THURBER ENGINEERING LTD.

PRELIMINARY
GEOTECHNICAL INVESTIGATION REPORT
CLASS EA STUDY FOR LANGSTAFF ROAD
FROM WESTON ROAD TO HIGHWAY 7
REGIONAL MUNICIPALITY OF YORK, ONTARIO

Report

to

WSP

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1. INTRODUCTION

This report presents the factual findings obtained from a preliminary geotechnical and pavement investigation conducted in support of the Class EA Study for Langstaff Road from Weston Road to Highway 7 in the Regional Municipality of York, Ontario.

The preliminary preferred plans (November 2018) call for the widening of Langstaff Road to six lanes from Weston Road to Dufferin Street, a connection overpass crossing the CN MacMIllan Yard between Creditstone Road and Keele Street, an overpass structure at the GO Transit Barrie Line, replacement of the West Don River Bridge, and improvements to the Highway 400 interchange.

The purpose of the investigation was to explore the subsurface conditions within the project limits and based on the data obtained, to provide borehole logs, borehole location plans, a written description of the subsurface conditions, and preliminary geotechnical recommendations regarding foundations for all crossing structures, roadway pavement design, fill embankments, the environmental quality of the soils, and other construction concerns.

Thurber Engineering Ltd. (Thurber) carried out the investigation as a sub-consultant to WSP who are conducting the EA Study for the Regional Municipality of York (York Region).

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 study area extends along Langstaff Road between Weston Road and Highway 7 in the City of Vaughan. The total length of the study corridor is approximately 6.7 km, of which an approximate 1.4 km long section between Creditstone Road and Keele Street crosses the CN MacMillan Yard and the remainder follows existing Langstaff Road.

Langstaff Road is an east-west arterial roadway with a posted speed limit of 60 km/h. The roadway presently comprises a four-lane urban cross section with curb-and-gutter between Weston Road and Creditstone Road, and a two-lane rural cross section with gravel shoulders between Keele Street and Dufferin Street. The two sections of roadway are separated by the CN MacMillan Yard and industrial/commercial properties.

Langstaff Road passes over Highway 400 approximately 660 m east of Weston Road. The interchange with Highway 400 provides access ramps from westbound and eastbound Langstaff Road to southbound Highway 400 and from northbound Highway 400 to eastbound and westbound Langstaff Road. Langstaff Road also crosses the West Don River about 180 m east of Keele Street, and the GO Transit Barrie Line at a level crossing approximately 730 m east of Keele Street.

The area surrounding the project corridor is largely developed for commercial and industrial purposes. The ground surface elevation generally exhibits a level to undulating topography, with grades typically lower towards the east. Typical photographs from the corridor are provided in Appendix A.

2.2 Existing Pavement Conditions

A visual examination of the roadway surface was carried out in February 2019 to obtain a general overview of the existing pavement conditions. In general, the existing roadway pavement is in good condition to the west of the CN Yard and in fair condition to the east. The following conditions were noted:

- The section between Weston Road and Highway 400 exhibits frequent slight transverse cracking, with areas of moderate map/alligator cracking and resurfacing in the westbound lanes approaching Weston Road, and intermittent moderate transverse and longitudinal joint cracking approaching Highway 400.

- From Highway 400 to Jane Street, frequent slight transverse and longitudinal joint cracking was observed, along with slight edge cracking along the curbs, as well as intermittent moderate transverse, longitudinal and wheel path cracking in the westbound lanes.

- Between Jane Street and the CN Yard, sealing of frequent slight cracks was evident, and intermittent edge/alligator cracking was observed in the outer wheel path.

- In the two lane section west of the CN Yard, moderate single and multiple transverse cracks were observed throughout, as were zones of moderate alligator cracking along wheel paths.

Representative photographs of the existing pavement are provided in Appendix A.

2.3 Geology

Based on the information in *The Physiography of Southern Ontario*[1] by Chapman and Putnam (1984), the site is located within the Peel Plain physiographic region. The Peel Plain is characterized by a level to undulating topography gradually sloping towards Lake Ontario with surficial soil comprising a thin lacustrine clay underlain by till. Based on *Surficial Geology of Southern Ontario*[2] and *Quaternary Geology Map P2204*[3], the surficial deposits in the vicinity of the site are generally clay or silt till with an overlay of shallow glaciolacustrine sediments consisting of silts and clays with pockets of sandy and gravelly flow till and rainout deposits. According to *Paleozoic Geology of Southern Ontario*[4], the bedrock geology consists of grey shale of the Georgian Bay Formation. The underlying bedrock is generally expected to be at depths of over 40 m.

2.4 Review of Existing Geotechnical Information

Existing geotechnical information was available in MTO GEOCRES files for the Highway 400 grade separation structure and the West Don River bridge. The subsurface information was reviewed and is summarized below.

2.4.1 Highway 400 Underpass

The MTO database provided the following information relevant to this structure:

- "Dynamic Monitoring of Piles – Langstaff Road Bridge over Highway 400, Town of Vaughan, Ontario", Geocres No. 30M13-89, by Golder Associates Ltd. (Golder) for McCormick Rankin & Associates Limited, dated April 25, 1991.
- Numerous correspondence memoranda regarding the foundation design between MTO and Golder and/or McCormick Rankin dated March 14, 1989 to August 15, 1991.

Based on a review of these files, the subsurface stratigraphy was reported to generally consist of "a complex succession of silty clay, sandy to clayey silt till, sand and silt deposits of variable consistency overlying hard clayey silt to silty clay till."

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[1] Chapman, L.J. and Putnam, D.F. 1984. The Physiography of Southern Ontario, Ontario Geological Survey Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

[2] Ontario Geological Survey, 2010: Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV

[3] Sharpe, D. R., 1980: Quaternary Geology of Toronto and Surrounding Area; Ontario Geological Survey Preliminary Map P. 2204, Geological Series. Scale 1:100 000. Compiled 1980

[4] Armstrong, D.K. and Dodge, J.E.P., 2007: Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219.

2.4.2 West Don River Bridge

The MTO GEOCRES database provided the following report for the existing bridge:

- "Proposed Bridge Structure – Langstaff Side Road, Vaughan Township", Geocres No. 30M13-46, by Donald Inspection Limited, dated February 25, 1964.

The subsurface conditions encountered in two boreholes completed during the investigation comprised 4.3 m of loose fill over a 1.5 m thick very stiff silt layer or a 1.4 m thick loose sand layer, underlain by compact sand to depths of 7.0 to 8.5 m. Very stiff to hard glacial till was encountered below the sands to the termination depths of 10.9 to 11.0 m.

3. INVESTIGATION PROCEDURES

The field investigation for this project was carried out between April 2 and 26, 2019 and comprised a total of sixteen boreholes (Boreholes 19-01 to 19-16) advanced to depths ranging from 3.7 m to 34.1 m. Borehole details are provided in Table 3.1 and in the Record of Borehole sheets included in Appendix B. The approximate locations of the boreholes are shown on the Borehole Location Plans, Drawings 13659-1 to 13659-6, provided in Appendix C.

Table 3.1 – Borehole Details

Facility	Borehole No.	Approx. Ground Elevation (m)	Borehole Termination Depth (m)	Approx. Borehole Termination Elevation (m)
Highway 400 Underpass	19-02	213.7	33.9	179.8
	19-03	213.9	34.1	179.8
CN MacMillan Yard	19-09	208.0	26.4	181.6
	19-10	205.6	24.4	181.2
West Don River Bridge	19-11	199.8	21.7	178.1
GO Transit Line	19-12	203.7	27.7	175.9
Pavement Structure, Municipal Services	19-01, 19-04 to 19-08,19-13 to 19-16	204.8 to 212.8	3.7	201.1 to 209.1

The borehole locations were established in the field by Thurber using a portable GPS receiver and verified relative to existing site features. The ground surface elevations at the borehole locations were provided by the client.

All borehole locations were cleared of utilities prior to commencement of drilling. The boreholes were repositioned as necessary in consideration of surface features, underground utilities, and restricted site access.

The boreholes were advanced using hollow stem augers and HW casing advancer powered by a truck mounted CME-75 drill rig supplied and operated by Geo-environmental Drilling Inc. 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). The field investigation was carried out under the full-time supervision of Thurber technical staff. All boreholes were logged in the field. Soil samples were identified, placed in labelled containers and transported back to Thurber's laboratory in Oakville for further examination and testing.

Groundwater conditions were observed in the open boreholes throughout the drilling operations. Monitoring wells were installed in Boreholes 19-02, 19-09, 19-10, 19-11 and 19-12 to permit monitoring of the groundwater levels at the site. The monitoring wells consisted of 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. The installation details are summarized in Table 3.2 below.

Table 3.2 – Monitoring Well Details

Borehole No.	Monitoring Well Tip		Slotted Screen Length (m)
	Depth (m)	Elevation (m)	
19-02	33.5	180.2	3.0 m
19-09	25.9	182.1	3.0 m
19-10	24.4	181.2	3.0 m
19-11	9.1	190.7	3.0 m
19-12	9.1	194.6	3.0 m

The boreholes in which no monitoring wells were installed were backfilled in general accordance with Ontario Regulation 903.

4. LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Representative soil samples were also subjected to grain size analysis and Atterberg Limits testing. Test results are shown on the individual borehole logs presented in Appendix B. The grain size distribution curves and Atterberg limit test results are plotted on the figures attached in Appendix D.

Selected soil samples were submitted to SGS Canada Inc. (SGS), an independent Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for analytical testing to assess the environmental quality of potential excavated materials. The results of the chemical laboratory testing are presented on the laboratory certificates of analysis in Appendix E.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

A generalized description of the subsurface conditions encountered in the boreholes is given in the following sections. Detailed descriptions of the soil conditions at the specific locations drilled are presented on the Record of Borehole sheets in Appendix B, and take precedence over the generalized description. It should be recognized and expected that soil conditions will vary between and beyond borehole locations.

The subsurface stratigraphy encountered in the boreholes generally comprises a surficial pavement structure overlying deposits of fill, localized alluvial sand and clay deposits, underlain by native deposits of silty clay till, clayey silt till, sand and silt. Further description of the individual strata are presented below.

5.1 Pavement Structure

The pavement structure encountered in the boreholes drilled on the roadway (Boreholes 19-01 to 19-11, 19-13 and 19-16) typically consisted of 125 to 200 mm of asphalt, typically 150 to 175 mm, overlying a granular base varying from sand and gravel to sand with trace gravel. The granular materials extended to depths ranging from 0.4 to 1.7 m, locally 1.9 and 2.3 m in Boreholes 19-02 and 19-03. Locally in Borehole 19-16, a buried 50 mm thick layer of asphalt was encountered at 0.5 m depth and underlain by 500 mm of sand fill.

In Boreholes 19-12, 19-14 and 19-15, drilled on the shoulder of the roadway, gravelly sand to sand and gravel granular was contacted from the ground surface to depths of 0.8 to 0.9 m (Elev. 202.8 to 204.0).

The results of grain size analyses conducted on samples of the granular material are presented on Figures D1 to D3 of Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	2 to 42
Sand	46 to 86
Silt + Clay	11 to 19

None of the samples tested meet the OPSS Granular B Type I or Granular A gradation specifications. The results may be impacted by the effects of compaction, auger sampling procedures, infiltration of fines with road runoff, or deterioration of the granular material over time.

5.2 Fill

A fill layer was encountered below the pavement structure in Boreholes 19-01 to 19-04, 19-09, 19-11, 19-12 and 19-16.

In Borehole 19-01, the fill layer consisted of sand, was 1.3 m thick, and was penetrated at a depth of 2.1 m (Elev. 205.0). SPT 'N' values of 14 and 24 blows per 0.3 m of penetration were recorded in the sand fill layer, indicating a compact condition. Moisture contents of 12% and 17% were measured.

In Boreholes 19-02 and 19-03, approach embankment fill consisting of silty clay over sand over silty clay were encountered below the pavement structure at depths of 1.9 and 2.3 m (Elev. 211.8 and 211.6) and penetrated at 5.6 and 8.6 m (Elev. 208.0 and 205.3). SPT 'N' values of 5 to 24 blows per 0.3 m of penetration were recorded, indicating a firm to very stiff/compact condition. Moisture contents ranged between 8 and 17%.

A silty clay fill layer was contacted below the pavement structure in Boreholes 19-04, 19-09, 19-11, 19-12 and 19-16 at depths of 0.9 to 1.7 m (Elev. 198.1 to 207.1) and was contacted to 1.7 to 4.1 m (Elev. 195.7 to 205.7). SPT 'N' values recorded in the fill layer varied from 4 to 20 blows per 0.3 m, indicating a firm to very stiff consistency. Measured moisture contents varied between 8% and 29%.

The results of grain size distribution analyses carried out on selected samples of the silty clay fill layer are shown on Figure D4 in Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	0 to 6
Sand	34 to 41
Silt	34 to 36
Clay	19 to 32

Atterberg limits testing was carried out on one sample of the clay fill. The measured plastic limit, liquid limit and plasticity index were 35, 17 and 18, respectively. These results, which are plotted on Figure D14 in Appendix D, indicate that the sample tested consists of low to medium plastic silty clay (CL to CI).

5.3 Alluvial Deposits

In Borehole 19-03, a 3.1 m thick layer of alluvial silty clay was contacted at a depth of 8.6 m (Elev. 205.3) and was penetrated at a depth of 11.7 m (Elev. 202.2). SPT 'N' values of 10 and 11 blows per 0.3 m of penetration were recorded in the alluvial clay layer, indicating a stiff consistency. Occasional organic inclusions and rootlets were noted in this stratum. Moisture contents of 13% and 21% were measured.

The results of a grain size distribution analysis carried out on a sample of the alluvial clay are presented on Figure D5 of Appendix D. The results indicated 4% gravel, 20% sand, 28% silt and 48% clay sized particles. Atterberg limits testing carried out on a sample measured a plastic limit, liquid limit and plasticity index of 30, 14 and 16, respectively. These results, which are plotted on Figure D15 in Appendix D, indicate that the sample tested consists of low plastic silty clay (CL).

In Borehole 19-11, alluvial sand was encountered below the fill at a depth of 4.1 m (Elev. 195.7) and penetrated at 5.6 m (Elev. 194.2). An SPT 'N' value of 5 blows per 0.3 m of penetration was recorded, indicating a loose relative density. Occasional decayed wood, shell fragments and organic inclusions were observed in this layer. A moisture content of 26% was measured.

5.4 Upper Silty Clay to Clayey Silt Till

An upper unit of silty clay to clayey silt till was encountered below the pavement structure, fill and alluvial deposits in all boreholes except Borehole 19-11.

Roadway Boreholes 19-01, 19-04, 19-08, and 19-13 to 19-16 were terminated in the clay till at 3.7 m depth (Elev. 201.1 to 209.1). In Boreholes 19-05 to 19-07, the till layer was 2.3 to 2.8 m thick and underlain by sand at depths of 3.1 to 3.2 (Elev. 204.4 to 209.7).

In Boreholes 19-02 and 19-03 drilled at the Highway 400 crossing, the upper till deposit was 11.3 to 11.4 m thick. The upper and lower boundaries of this layer varied within the boreholes however; the till was encountered between depths of 5.6 and 17.0 m (Elev. 208.0 and 196.7) in Borehole 19-02, and between depths of 11.7 and 23.0 m (Elev. 202.2 and 190.9) in Borehole 19-03.

In Boreholes 19-09, 19-10 and 19-12 drilled at the CN Yard and GO Transit crossings, the upper till layer varied in thickness from 1.7 to 7.6 m, with a lower boundary at depths of 1.5 to 9.9 m (Elev. 198.0 to 203.0).

SPT 'N' values recorded in the upper till deposits ranged from 7 blows per 0.3 m of penetration to 94 blows for 275 mm of penetration. In general, the 'N' values indicate a stiff to very stiff consistency, with localized hard zones. Measured moisture contents ranged from 8 to 28%, typically less than 20%.

The results of grain size distribution analyses carried out on selected samples of the upper silty clay to clayey silt till are shown on Figures D6 and D7 in Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	0 to 2
Sand	11 to 44
Silt	37 to 52
Clay	19 to 37

Atterberg limits testing was carried out on five samples of the upper till. The results indicate that the till samples tested consist of silty clay of low plasticity (CL) to clayey silt of slight plasticity (CL-ML). The results are plotted on Figure D16 in Appendix D and summarized below.

	Silty Clay	Clayey Silt
Liquid Limit	22 to 27	16
Plastic Limit	12 to 14	11
Plasticity Index	10 to 13	5

Till soils frequently contain cobbles and boulders, and these should be anticipated when excavating during construction.

5.5 Clayey Silt

A localized zone of clayey silt was encountered below the clay till in Boreholes 19-02 and 19-10. In Borehole 19-02, the clayey silt layer was 3.0 m thick with a lower boundary at 20.0 m depth (Elev. 193.7). In Borehole 19-10, it was 1.1 m thick with a lower boundary at 2.6 m depth (Elev. 203.0).

SPT 'N' values of 47 and 18 blows per 0.3 m of penetration were recorded in the clayey silt, indicating a consistency of hard and very stiff. Moisture contents of 16 to 20% were measured.

The results of grain size distribution analyses carried out on selected samples of the clayey silt are shown on Figure D8 in Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	0 to 1
Sand	2 to 16
Silt	64 to 85
Clay	13 to 19

Atterberg limits testing carried out on a sample of the clayey silt measured a plastic limit, liquid limit and plasticity index of 20, 14 and 6, respectively. These results, which are plotted on Figure D17 in Appendix D, indicate that the sample tested consists of clayey silt (CL-ML).

5.6 Sand to Silt

An upper sand layer was contacted below the clay till in roadway Boreholes 19-05 to 19-07 at depths of 3.1 to 3.2 m. These boreholes were terminated in the sand at 3.7 m depth (Elev. 203.8 to 209.1). It was not determined if this sand deposit is connected to the sand deposit contacted at greater depths in the deep boreholes.

A sand deposit was encountered below the upper till deposit, clayey silt layers, and alluvial sand in deep Boreholes 19-02 and 19-09 to 19-12. The sand layer was not identified in Borehole 19-03. The upper boundary of the sand deposit was encountered at depths of 2.6 to 20.0 m (Elev. 203.0 to 193.7), and the lower boundary was at depths of 9.5 to 23.0 m (Elev. 191.0 to 188.1). The thickness ranged from 3.0 to 14.2 m. The gradation of the deposit varied from silty to gravelly, with zones grading to sand and silt, and occasional interspersed layers of silt and silty clay.

SPT ‘N’ values ranging from 14 to 84 blows per 0.3 m of penetration and up to 50 blows for no penetration were recorded in the sand material, indicating a variable relative density of compact to very dense. Measured moisture contents ranged from 5 to 24%.

The results of grain size distribution tests carried out on samples of sand, silt and sand, and silt are shown on Figure D9 in Appendix D and summarized below:

Soil Particle	Sand	Silt and Sand	Silt
Gravel %	7	1	0
Sand %	77	37	6
Silt %	16	56	84
Clay %		6	10

5.7 Lower Silty Clay to Silty Clay Till

A lower unit of silty clay locally resembling a till deposit was encountered below the sand layer at depths of 9.5 to 23.0 m (Elev. 191.0 to 188.1) in Boreholes 19-02, 19-03, and 19-09 to 19-12. The clay/till was penetrated at depths of 20.6 to 26.2 m (Elev. 183.1 to 187.9) in Boreholes 19-02, 19-03 and 19-12. Boreholes 19-09 to 19-11 were terminated in the till at depths of 21.7 to 26.4 m (Elev. 178.1 to 181.6). A 2.0 m thick sand layer was encountered within the till at 14.8 m depth in Borehole 19-11, and the till graded to clayey silt and sand near 18.4 m depth in Borehole 19-12.

SPT ‘N’ values ranging from 26 to 85 blows per 0.3 m of penetration and up to 50 blows for 100 mm of penetration were recorded in the lower clay/till deposits, indicating a very stiff to hard consistency. Measured moisture contents ranged from 8 to 22%.

The results of grain size distribution analyses carried out on selected samples of the lower silty clay/till, as well as the localized clayey silt and sand zone, are shown on Figures D10 and D11 in Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Silty Clay	Silt & Sand
Gravel %	0 to 1	2
Sand %	0 to 13	49
Silt %	41 to 76	34
Clay %	24 to 45	15

Atterberg limits testing was carried out on one sample of the clay/till. The results indicate that the till sample tested consists of silty clay of low plasticity (CL). The results are plotted on Figure D18 in Appendix D and summarized below.

Liquid Limit	30
Plastic Limit	17
Plasticity Index	13

Till soils frequently contain cobbles and boulders, and these should be anticipated in any construction operations extending into this deposit.

5.8 Lower Sand

A lower sand deposit was contacted below the lower clay/till at depths of 20.6 to 26.2 m (Elev. 183.1 to 187.9) in Boreholes 19-02, 19-03 and 19-12. A 2.0 m thick sand layer was also encountered in Borehole 19-11, within the till at 14.8 m depth. The lower sand deposits were penetrated at 32.3 m depth (Elev. 181.4 and 181.6) in Boreholes 19-02 and 19-03; Borehole 19-12 was terminated in the sand at 27.7 m (Elev. 175.9). The sand typically contained some silt (to silty), locally becoming gravelly with depth in Borehole 19-12.

SPT ‘N’ values ranging from 17 to 72 blows per 0.3 m of penetration, locally up to 100 blows for 200 mm of penetration, were recorded in the sand material, indicating a variable relative density of compact to very dense. Measured moisture contents ranged from 10 to 23%.

The results of a grain size distribution analysis carried out on a sample of the sand are presented on Figure D12 of Appendix D. The results indicated 61% sand, and 39% silt and clay sized particles.

5.9 Silt

A silt layer was encountered below the lower sand at a depth of 32.3 m (Elev. 181.4 and 181.6) in Boreholes 19-02 and 19-03. These boreholes were terminated in the silt at depths of 33.9 and 34.1 (Elev. 179.8 and 179.8). SPT ‘N’ values of 86 blows per 0.3 m of penetration and 50 blows for 50 mm of penetration were recorded, indicating a very dense condition. Moisture contents of 17 and 21% were measured.

The results of a grain size distribution analysis carried out on one sample of the silt are presented on Figure D13 of Appendix D. The results indicated 0% gravel, 13% sand, 76% silt and 11% clay sized particles.

5.10 Groundwater Levels

During drilling, wet conditions were noted in the surficial fil materials in Boreholes 19-03, 19-04, 19-11, 19-12 and 19-16, at approximate depths ranging from 0.8 to 4.7 m. Wet conditions were also noted near 3.1 m depth in the sand layer in Boreholes 19-05 and 19-05, as well as in the clay till near 2.3 m depth in Borehole 19-13.

The groundwater depths and elevations measured in the monitoring wells installed in the boreholes are summarized in Table 5.1.

Table 5.1 – Summary of Groundwater Level Observations

Borehole	Date	Water Level (m)	
		Depth	Elevation
19-02	May 3, 2019	9.5	204.2
19-09	May 3, 2019	2.0	206.0
19-10	May 3, 2019	4.5	201.1
19-11	May 3, 2019	3.6	196.2
19-12	May 3, 2019	2.9	200.8

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. ENGINEERING DISCUSSION AND RECOMMENDATIONS

This section of the report provides preliminary geotechnical recommendations for design and construction of the roadway improvements and structure foundations. The recommendations are based on the subsurface soil and groundwater conditions encountered during the preliminary investigation. The soil conditions may vary between and beyond the borehole locations. Additional investigation will be required during the detailed design stage to supplement the subsurface information and confirm the preliminary recommendations.

6.1 Pavement Design and Construction

6.1.1 Design Analysis

Langstaff Road is a major arterial roadway carrying increasing traffic loads from major commercial and residential developments in the area, traffic passing through the study area, and transit service. Proposed improvements include widening of the road to a six-lane urban cross-section from the current four-lane urban section west of the CN MacMillan Yard and the two-lane rural section to the east.

The existing and projected traffic volumes along Langstaff Road, provided by WSP, are presented in Table 6.1. Construction of the section between Keele Street and Dufferin Street is expected to be completed in 2026, and between Weston Road and Keele Street in 2031.

Table 6.1 – Langstaff Road Traffic Information

Section	Existing ADT (2019)	Future ADT (2041, No Build)	Future ADT (2041, Build)	Truck Volume
Weston Road to Silmar/Terecar Drive	29716	25903	37223	6.7%
Highway 400 to Edgeley Blvd.	22944	24581	33827	7.4%
Millway Avenue to Jane Street	22886	24335	32203	6.9%
Creditstone Road to Keele Street	-	-	30466	-
Staffern/N.Rivermede Road to Dufferin Street	18125	22327	36121	5.6%

The traffic data was used to determine the pavement damage caused by the anticipated traffic volumes over the design life of the pavement. Using axle load equivalency factors, different axle loads and axle groups are converted to a standard axle load known as an Equivalent Single Axle

Loads (ESALs). The Design ESALs calculation was completed in accordance with the MTO *Procedures for Estimating Traffic Loads for Pavement Designs.* Assuming an average truck factor of 2.2, the number of ESALs during a 20-year design period was computed to be 14.0 million in the west section (Weston Road to Jane Street) and 12.4 million to the east of the CN yard.

The pavement design analysis was carried out using the methodology outlined in the 1993 AASHTO "*Guide for the Design of Pavement Structures*", as modified by the Ministry's "*Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions*", and the MTO "*Pavement Design and Rehabilitation Manual*". The AASHTO procedure 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.

- Design Period = 20 years
- Initial serviceability, (Pi) = 4.5
- Terminal serviceability (Pt) = 2.5
- Reliability level (R) = 90 percent
- Overall standard of deviation (So) = 0.44
- Mean soil resilient modulus (MR) = 30 MPa

The subgrade for the pavement structure is expected to consist primarily of firm to stiff silty clay fill or native silty clay till.

Based on the design input parameters and calculated ESALs, design structural numbers (SN_{Des}) of 149 and 147 mm are required for the west and east sections, respectively. The recommended pavement design thickness, based on the structural requirements, traffic projections, and subgrade conditions, is presented below.

6.1.2 Recommended Pavement Design

In general, the existing pavement structure on Langstaff Road between Weston Road and the CN Yard appears to be in relatively good condition exhibiting primarily slight transverse and longitudinal cracking. However, areas of moderate transverse, longitudinal, edge, map and/or alligator cracking are also present. The pavement structure encountered in the boreholes in this section comprised 150 to 200 mm of asphalt over a variable 230 to 730 mm, locally up to 2.1 m, of granular base.

The existing pavement structure is not considered to be structurally adequate to carry the 20-year design ESAL's calculated above, and strengthening by such means an overlay would be required.

However, the potential would exist for the observed cracks and other localized distresses to reflect up into the new pavement surface, as well as for differential performance between the existing pavement and new pavement in widening areas. To avoid the development of reflection cracks and provide a uniform pavement performance, it is recommended that the roadway pavement be fully reconstructed as part of the widening project.

Complete reconstruction would also facilitate alignment or grade revisions if required, allow subgrade reshaping to enhance drainage toward the pavement edges, and avoid joint cracks along pavement cuts such as for new utility installation or raised median removal.

The two lane section of Langstaff Road west of the CN Yard appears to be in fair condition with moderate transverse cracks and alligator cracking along wheel paths. This pavement is not considered to be suitable for strengthening in conjunction with widening, and therefore complete reconstruction is recommended.

Based on the borehole data, the anticipated traffic volumes, and assuming adequate subgrade drainage, the following preliminary pavement design is recommended for widening and reconstruction of Langstaff Road:

Component	**Thickness**
HL1	50 mm
HDBC (2 lifts)	140 mm
OPSS Granular A Base	150 mm
OPSS Granular B Type II Subbase	500 mm

A consistent pavement structure is recommended for the full study area as a significant increase in traffic is anticipated on the east leg immediately upon opening of the east-west connection. The pavement design thicknesses should be reviewed during detailed design.

The minimum PGAC grade of virgin asphalt cement in the surface and top binder course should be PG 64-28, and minimum PG 58-28 for the lower binder course. Consideration should be given to further upgrading of the PGAC grade to PG 70-28 if rutting has been experienced in other sections of this roadway due to truck traffic. Aggregates for the asphalt mixes should be in accordance with OPSS.MUNI 1003.

Should the Region consider using Superpave asphalt mixes for this project, the recommended HL1 material should be substituted with a Superpave 12.5 FC1 asphalt mix, and the HDBC asphalt material should be replaced with Superpave SP 19. As the 20-year design ESALs for Langstaff Road was estimated to be 14 million, a Traffic Category D designation should be used in preparing all Superpave asphalt mix designs.

All new granular subbase material should consist of OPSS Granular B Type II, while the granular base material should consist of OPSS Granular A. All new granular material should meet the requirements of OPSS 1010, and be compacted to 100 percent of the Standard Proctor Maximum Dry Density (SPMDD) within 2 percent of Optimum Moisture Content (OMC). All granular material should be compacted in accordance with the requirements of OPSS.MUNI 501, and should be carried the entire width of the roadway platform to maintain appropriate drainage.

6.1.3 Pavement Subgrade Preparation

Pavement subgrade preparation should include removal of the existing pavement structure and all surficial vegetation, topsoil, organic or compressible material. Grading to the new top of subgrade should match or exceed the thickness of the existing pavement to maintain lateral drainage at the top of subgrade. 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 shall be subexcavated and replaced with approved material within 2% of Optimum Moisture Content (OMC), and compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD).

Bulk fill used to raise the road grade should be constructed as engineered fill, consisting of approved inorganic material, placed in maximum 200 mm thick lifts, within 2% of optimum moisture content, and compacted to at least 98% of SPMDD. Standard side slopes of 2H:1V or flatter should be suitable for embankment construction. Exposed embankment surfaces should be provided with a vegetation cover or otherwise protected against erosion in accordance with OPSS 804.

The top of the compacted subgrade should be graded smooth with a minimum crossfall of 3% towards subdrains. Continuity of drainage should be maintained at transitions from existing pavement to new pavement.

6.2 Preliminary Foundation Design

6.2.1 Highway 400 Underpass

The proposed improvements to Langstaff Road at the Highway 400 interchange are expected to include widening of the existing underpass structure to accommodate two additional lanes of traffic. Preliminary design consultations are ongoing however, and replacement of the existing structure may also be considered.

The General Arrangement drawing for the existing Highway 400 Underpass was provided for review (Sheet No. 27, McCormick Rankin Consulting Engineers for the Town of Vaughan, dated May 1989). The drawing indicates that the overpass is a three span structure with spans of 28.1, 26.9 and 30.7 m, for a total length of approximately 85.7 m. The bridge deck widens from about 20.9 m at the east abutment to about 27.7 m at the west abutment to accommodate the beginning of the E-S ramp in addition to four lanes of through traffic.

The GA drawing indicates that the bridge abutments and piers are supported on battered HP 310x110 H-piles “to be driven in accordance with the special provisions of this contract”.

Prior to construction of the existing structure, dynamic monitoring of eighteen test piles was carried out to establish driving criteria for the design loads of HP 310x110 piles driven to support the structure (MTO Geocres File 30M13-89). Four piles at the east abutment, seven piles at the west pier, and seven piles at the west abutment were monitored during driving using a pile driving analyser (PDA) and assessed using Case Method Estimate (CMES) and Case Pile Wave Analysis Program (CAPWAP). Ultimate pile capacities ranging from 1065 to 2780 kN were reported for piles driven to depths of 21.9 to 33.0 m (Elev. 176.9 to 186.9). The maximum loadings for which the driving criteria were established varied from 557 to 1070 kN at ULS and 451 to 910 kN at SLS.

The subsurface stratigraphy encountered in Boreholes 19-02 and 19-03 drilled at the west and east abutments of the existing bridge, respectively, consisted of a pavement structure and embankment fill, underlain locally by alluvial deposits, overlying a stiff to hard deposit of silty clay till, underlain by variable deposits of very stiff to hard silty clay/clayey silt and compact to very dense silty sand, over very dense silt. Groundwater was measured in the monitoring well in Borehole 19-02 at a depth of 9.5 m below the road surface (Elev. 204.2).

Based on the borehole data and the results of the previous pile monitoring program, the preferred foundation system for support of the bridge widening or replacement consists of steel H-piles driven to adequate resistance in the native soils. Bedrock or a suitable stratum for support of high

capacity piles in end-bearing was not encountered within the exploration depth of about 34.0 m, and therefore the piles will obtain resistance primarily through friction along the pile shaft. For widening, selection of a foundation system similar to the existing foundations is recommended to maintain consistency of performance between the new and existing sections.

Review of the dynamic monitoring results from the test piles indicates that ultimate pile capacities of 1400 to 2400 kN are typically obtained for HP 310x110 piles driven to tip elevations of 178 to 183. Higher capacities were not confirmed by driving to greater depths, and a decrease in capacity may actually be experienced. Therefore for preliminary design purposes, it is recommended that a tip elevation of 178.0 be assumed and corresponding factored geotechnical resistances of 800 kN at ULS and 600 kN at SLS be employed for HP 310x110 piles.

Based on the borehole data, supporting a replacement bridge on spread footings constructed on the very stiff silty clay till encountered at 5.6 and 11.7 m depth (Elev. 208.0 and 202.2) at the west and east abutments, respectively, could be considered. It must be noted however that the elevation and geotechnical resistance of the native clay till is variable, and additional investigation will be required to confirm the feasibility of spread footings and determining design founding levels for each foundation unit. Factored geotechnical resistances of 300 kPa at ULS and 200 kPa at SLS are recommended for preliminary design of spread footings founded on the silty clay till.

Perching the footings on an engineered fill pad is also considered feasible for a replacement bridge structure. The engineered fill pad should founded at the same reference levels indicated for the footings on native soils and comprise Granular A material placed in maximum 200 mm thick lifts, compacted to 100% of the ASTM D698 (standard Proctor) maximum dry density. The pad should extend laterally to a line inclined downwards at 45° to the horizontal originating at least 1 m from the edge of the footing. Factored geotechnical resistances of 500 kPa at ULS and 350 kPa at SLS are recommended for preliminary design.

Augered caissons are not expected to be the preferred foundation type due to the layers of cohesionless sand deposits below the groundwater level, requiring the use of a steel liner and/or drilling slurry to maintain sidewall stability and enable caisson construction. Further, a very dense stratum suitable for support of high capacity caissons was not encountered within the depth of exploration.

6.2.2 CN MacMillan Yard

Construction of a new multi-span bridge is proposed to connect the west and east sections of Langstaff Road over the CN MacMillan Yard between Creditstone Road and Keele Street. The

linear distance of the crossing is approximately 1.4 km, however the structure will be offset approximately 300 m to the south of the direct line to achieve overhead clearance above the outer railway lines.

At present, the overall crossing design consists of two bridges separated by a high embankment. The main structure will comprise ten spans with a total length of about 930 m. A separate single span structure with a span of about 40 m will be constructed approximately 90 m to the west of the west abutment of the main structure. The east and west approach embankment as well as the embankment between the two structures will be constructed using reinforced soil system (RSS) walls with heights of up to 15 m.

Access to the CN yard was not permitted and therefore preliminary investigation for the crossing structure was limited to two boreholes, Boreholes 19-09 and 19-10, located to the west and east of the yard, respectively. The distance between the boreholes is approximately 1.4 km, and a dissimilar stratigraphy was encountered in the boreholes. Therefore the comments presented below regarding preliminary foundation design, based on the conditions encountered in the two widely spaced boreholes, do not necessarily reflect the actual conditions at the locations of the foundation units, and should be considered for their general implications. A detailed drilling program will be required to confirm conditions at each individual foundation unit.

The stratigraphy encountered in Borehole 19-09 drilled to the west of the CN yard consisted of a pavement structure overlying silty clay fill to a depth of 2.3 m (Elev. 205.7), underlain by a 7.6 m thick deposit of cohesive silty clay to clayey silt till with a lower boundary at 9.9 m depth (Elev. 198.1), over 7.1 m of compact to dense sand, then a lower silty clay till unit encountered at 17.0 m depth (Elev. 191.0) to the exploration depth of 26.4 m. The consistency of the cohesive till deposit was very stiff to a depth of approximately 4.1 m (Elev. 203.9), and then hard below this level.

The stratigraphy encountered in Borehole 19-10 drilled to the east of the CN yard consisted of a pavement structure overlying a 1.1 m thick layer of very stiff silty clay till and a 1.1 m thick layer of very stiff clayey silt, underlain by 14.2 m of sand to gravelly sand between depths of 2.6 and 16.8 m (Elev. 203.0 and 188.8), underlain by hard silty clay to the exploration depth of 24.4 m. The relative density of the sand deposit was typically compact to a depth of 7.2 m (Elev. 198.4), and very dense below this level.

Water was measured at depths of 2.0 and 4.5 m (Elev. 206.0 and 201.1) in the monitoring wells installed in Boreholes 19-09 and 19-10, respectively.

Based on the borehole data, consideration may be given to supporting the proposed structures on spread footings, driven pile foundations, or augered caissons. The preferred alternative for each foundation unit may depend upon the subsurface conditions specific to that foundation location, and will need to be determined/confirmed during detailed design. Comments regarding the foundation options at the borehole locations are presented below.

Spread Footings

Spread footings may be founded on the very stiff to hard silty clay till encountered in Borehole 19-09, and on the very stiff silty clay/clayey silt or compact to dense sand encountered in Borehole 19-10. The geotechnical resistances recommended for preliminary design of spread footings founded at or below the levels listed are as follows:

Table 6.2 – Preliminary Geotechnical Resistances for Spread Footing Design

Borehole No.	Founding Level	Founding Soil	Factored Resistance at ULS (kPa)	Factored Resistance at SLS (kPa)
19-09	205.7	Very stiff silty clay till	375	250
	203.5	Hard silty clay till	600	400
19-10	204.4	Very stiff silty clay till	330	225
	203.0	Compact to dense sand	500	300

Alternatively, the available geotechnical resistance could be increased and the founding level established by constructing the footings on a pad of compacted Granular A material. The granular pad should be constructed by subexcavation of the fill, very stiff silty clay till, and clayey silt down to the hard clay till and compact to dense sand (Elev. 203.9 in Borehole 19-09, and Elev. 203.0 in Borehole 19-10), and placement of Granular A compacted in thin lifts to 100% of standard Proctor maximum dry density to the design founding level. The pad should extend laterally beyond the footing a distance of 1.0 m plus the thickness of the pad. Footings constructed on a minimum 2.0 m thick pad of engineered fill may be designed using factored geotechnical resistances of 900 kPa at ULS and 350 kPa at SLS.

Driven H-Piles

The new bridge structures could be supported on driven steel H-piles. For preliminary design purposes, a factored geotechnical resistance of 1,200 kN at ULS and a factored geotechnical resistance of 1,000 kN at SLS are recommended for HP310x110 piles driven into the hard silty clay till or very dense sand.

The subsurface conditions at the site are variable, and as experienced during the pile driving operations at the Highway 400 underpass, prediction of the depth at which the piles will achieve the required resistance is particularly difficult in this area. For planning purposes, it may be assumed that the above noted resistances will be achieved for a pile tip at a depth of 24.0 m (Elev. 184.0) at Borehole 19-09 and 12.0 m (Elev. 193.6) at Borehole 19-10.

Considering the variability of the soils in the area and the large number of piles that may be required to support the multiple spans, a program of static pile load tests and/or dynamic monitoring of test piles is recommended to confirm the geotechnical resistances, pile lengths and required number of piles prior to construction.

Augered Caissons

The use of augered caissons may be advantageous in the CN Yard to minimize disruption to the rail facilities. However, installation of caissons may be particularly problematic due the presence of a thick cohesionless sand deposit and high groundwater levels. Construction will require use of a steel liner to maintain stability of the caisson sidewalls as well as techniques such as drilling slurry to prevent disturbance of the caisson base. As a result, the use of caissons is less preferred from a geotechnical viewpoint.

If employed, caissons should extend into the hard silty clay till in Borehole 19-09 and the very dense sand in Borehole 19-10. The geotechnical resistances recommended for preliminary design of caissons with base levels as listed are as follows:

Table 6.3 – Preliminary Geotechnical Resistances for Caissons

Borehole No.	Base Level	Caisson Diameter	Factored Axial Resistance at ULS (kN)	Factored Axial Resistance at SLS (kN)	
				10 mm	25 mm
19-09	184.0	0.9	2400	800	2000
		1.2	4000	1100	2600
		1.5	6000	1300	3300
19-10	193.5	0.9	3600	1200	2300
		1.2	6000	1600	3000
		1.5	9500	2100	3800

Note: Factored axial resistances at SLS are given for displacements of 10 mm and 25 mm.

The resistances provide in the above table are based on single boreholes drilled a considerable distance from the structure locations. The depth of caisson and axial resistances of caissons at each foundation unit will need to be determined by further investigation during detailed design.

6.2.3 West Don River Bridge

The existing Langstaff Road bridge over the West Don River will be replaced with a wider and longer bridge as part of the roadway reconstruction project.

The stratigraphy encountered in Borehole 19-11 drilled at the bridge location consisted of a pavement structure and embankment fill extending to a depth of 4.1 m (Elev. 195.7), underlain by loose alluvial sand, loose sand, and compact silt and sand to a depth of 9.5 m (Elev. 190.4), overlying very stiff to hard silty clay till. The upper clay till layer was underlain at 14.8 m depth (Elev. 185.0) by a 2.0 m thick layer of very dense sand, and then hard silty clay till contacted to the exploration depth of 21.7 m. Groundwater was measured in the monitoring well at a depth of 3.6 m (Elev. 196.2). This water level is expected to be near the water level in the West Don River.

Based on the borehole data, the preferred means of supporting the replacement bridge comprises steel H-piles driven into the very dense sand or hard clay till. For preliminary design purposes, a factored geotechnical resistance at ULS of 1,200 kN and a factored geotechnical resistance at SLS of 1,000 kN are recommended for HP310x110 piles. The piles are expected to achieve the recommended resistances at a pile tip depth in the order of 18 m (Elev. 182.0).

The use of H-piles at the abutments allows for the design of an integral abutment structure. To reduce resistance to lateral movement and provide a relatively flexible pile system, the top of each pile should be installed in a pre-augered hole supported by a CSP and filled with loose sand as per MTO Structural Office Report SO-96-01.

Suitable bearing strata for support of spread footings is not available until a depth of approximately 10.0 m (Elev. 189.8). Excavation for footing construction would need to extend through loose cohesionless deposits below the river water level, and cofferdam installation would be necessary to enable construction of footings in the dry. In view of these conditions, spread footings are not considered to be a practical foundation option to support this structure.

Augered caissons extended to the hard clay till below a depth of approximately 18.0 m could be considered at this site. However, installation of caissons may be problematic due the presence of cohesionless sand deposits and a high groundwater level. Construction will require use of a steel liner to maintain stability of the caisson sidewalls as well as techniques such as drilling slurry to prevent disturbance of the caisson base. As a result, the use of caissons does not appear to provide an advantage over driven piles, and is not recommended from a geotechnical viewpoint.

6.2.4 GO Transit Barrie Line Grade Separation

A grade separation at the GO Transit Barrie Line is planned. Current plans call for the construction of an overpass structure with road grades approximately 9.3 m above the existing tracks, near Elev. 213.3.

The stratigraphy encountered in Borehole 19-12 drilled at the GO Line crossing consisted of sand and gravel shoulder material over silty clay fill to 1.7 m depth (Elev. 202.0), underlain by successive deposits of very stiff to firm silty clay till, compact to very dense sand, hard silty clay till, and compact to very dense sand to gravelly sand to the exploration depth of 27.7 m. Groundwater was measured at a depth of 2.9 m (Elev. 200.8) in the monitoring well.

Based on the borehole data, the preferred means of supporting the replacement bridge comprises steel H-piles driven into the very dense sand deposits. For preliminary design purposes, a factored geotechnical resistance at ULS of 1,200 kN and a factored geotechnical resistance at SLS of 1,000 kN are recommended for HP310x110 piles driven to a tip depth in the order of 27 m (Elev. 177). Prediction of the depth at which the piles will achieve the required resistance is difficult at this site, and it is possible that the piles may encounter refusal in the very dense sand zone between depths of 10 to 15 m.

The use of H-piles at the abutments allows for the design of an integral abutment structure. To reduce resistance to lateral movement and provide a relatively flexible pile system, the top of each pile should be installed in a pre-augered hole supported by a CSP and filled with loose sand as per MTO Structural Office Report SO-96-01.

Consideration could be given to supporting the structure on spread footings founded on the very stiff clay till encountered at 1.7 m depth (Elev. 202.0). The presence of the firm zone between 4.1 and 5.6 m depth would require use of a relatively low geotechnical resistance however, and footing design is not expected to be practical. Extending the footings down to the compact to very dense sand below the clay till is also considered impractical. In view of these conditions, the use of spread footings is not recommended at this site.

Augered caissons extended to the very dense sand at a depth of approximately 12.0 m (Elev. 192.0) could be considered at this site. However, installation of caissons may be particularly problematic due the presence of the cohesionless sand deposit and high groundwater levels. Construction will require use of a steel liner to maintain stability of the caisson sidewalls as well as techniques such as drilling slurry to prevent disturbance of the caisson base. As a result, the

use of caissons is less preferred from a geotechnical viewpoint. The geotechnical resistances recommended for preliminary design of caissons, if employed, are as follows:

Table 6.4 – Preliminary Geotechnical Resistances for Caissons

Borehole No.	Base Level	Caisson Diameter	Factored Axial Resistance at ULS (kN)	Factored Axial Resistance at SLS (kN)	
				10 mm	25 mm
19-12	192.0	0.9	2400	800	2000
		1.2	4000	1100	2600
		1.5	6000	1300	3300

Note: Factored axial resistances at SLS are given for displacements of 10 mm and 25 mm.

6.2.5 Frost Cover

The depth of frost penetration at this site is approximately 1.2 m. All spread footings or pile caps should be provided with a minimum of 1.2 m of earth cover as protection against frost action.

6.3 Abutment Backfill and Lateral Earth Pressures

Backfill behind grade separation structure and bridge abutments should consist of non-frost susceptible, free-draining granular material conforming to OPS Granular A or Granular B Type II specifications.

The lateral earth pressures acting on the walls, assuming full drainage from behind the walls, may be calculated from the following expression:

$$p_h = K(\gamma h + q)$$

Where:

p_h = horizontal pressure on the wall at depth h (kPa)

K = earth pressure coefficient (see table below)

γ = unit weight of retained soil (see table below)

h = depth below top of fill where pressure is computed (m)

q = value of any surcharge (kPa)

Table 6.5 lists unfactored parameters for design purposes, assuming an essentially level ground surface behind and in front of the walls.

Table 6.5: Unfactored Earth Pressure Parameters

Retained Material	Unit Weight (kN/m^3)	Friction Angle (degrees)	Earth Pressure Coefficient		
			Active (K_a)	At-rest (k_o)	Passive (K_p)
Granular A or B Type II	22.8	35	0.27	0.43	3.7
Granular B Type I	21.2	32	0.31	0.47	3.3

If lateral movement is not permissible and/or the wall is restrained from lateral yielding, the at-rest earth pressure coefficient, K_o, should be used. If the wall design allows lateral yielding (non-rigid structure), the active earth pressure coefficient, K_a, may be used.

The earth pressure coefficients in the table above do not include potential compaction effects that must be included in the design. Compaction effects should be considered as per the CHBDC.

Design of the structures must incorporate measures such as weepholes to permit drainage of the backfill and avoid potential build-up of hydrostatic pressures behind the walls.

6.4 Embankments and Retaining Walls

Based on the preliminary profile drawings of the alignment provided by WSP, high fill embankments and/or retaining walls will be required in association with each of the grade separation structures. Preliminary details are as follows:

- The approach embankments to the Highway 400 grade separation structure will require widening to match the proposed widening of the structure. The approach embankments have a maximum height of approximately 7.0 m, and extend about 150 m west and 200 m east of the abutments.

- Extensive RSS walls are proposed for the approaches to the structure crossing the CN MacMillan Yard. The west approach to the single span structure will be up to 9 m high and extend approximately 200 m to the west of the west abutment, the approximate 90 m long section between the single span structure and the main multi-span structure will range from about 12 to 15 m in height, and the east approach will be up to 15 m in height and extend about 280 m east of the east abutment.

- The approach embankments for the proposed GO Barrie Line grade separation will be up to 9 m in height and extend approximately 250 and 150 west and east of the abutments, respectively.

Preliminary comments regarding the anticipated foundation conditions, stability and settlement of the high fill embankments and RSS walls are presented below.

Highway 400 Underpass

The foundation soils underlying the existing embankment fill generally consisted of very stiff to hard cohesive deposits and compact to very dense sands and silts at depth. In general, the stability of embankment slopes and settlement of the foundation soils under the new embankment loads are not expected to be a concern for embankment widening. Approximate 3.0 m thick zones of stiff material (clay till and clay alluvium) were identified in Boreholes 19-02 and 19-03, respectively; the prevalence and impact of these materials should be further assessed during detail design.

Embankments with standard side slope inclinations of 2H:1V are expected to be stable. Mid-height berms comprising 2 m wide benches must be incorporated along the length of embankments with heights exceeding 8 m. Where new embankment fill is placed against existing embankment slopes or on a sloping ground surface, the existing earth or fill slope must be benched in accordance with OPSD 208.010. Earth fill embankment slopes must be provided with erosion protection in accordance with OPSS.PROV 804.

CN MacMillan Yard

The native foundation soils underlying the pavement structure and fill in Borehole 19-09 drilled to the west of the CN yard generally consisted of very stiff to hard silty clay to clayey silt till underlain by compact to dense sand. In Borehole 19-10 drilled to the east of the CN yard, the foundation soils consisted of very stiff silty clay till and clayey silt underlain by compact to dense sand. In general, these soils are expected to be capable of supporting the proposed RSS walls. Settlement of the walls is expected to be within acceptable limits of the RSS and occur essentially as construction of the walls proceeds.

For sections where the wall height exceeds about 8 to 10 m, it may be necessary to improve the subgrade to increase the geotechnical resistance and factor safety against global instability. It is envisioned that this would entail subexcavating the upper very stiff silty clay till and clayey silt layer encountered in Boreholes 19-09 and 19-10 to depths of about 4.1 and 2.6 m, respectively, and re-establishing the design foundation level with Granular A material compacted to 100% of

standard Proctor maximum dry density. The need for and extent of subgrade improvement should be determined during detailed design following detailed investigation of the foundation conditions at the locations of the proposed wall alignments.

Design and construction of the RSS walls should be in accordance with the MTO RSS Design Guidelines, and Special Provisions SP599S22 and SP599S23. In general, the RSS walls should be specified as “High Performance” and “High Appearance”.

The RSS walls must also be designed against various modes of failure including sliding and overturning. Sliding resistance along the base of the wall on native clay till, sand or engineered fill may be estimated using ultimate friction coefficients of 0.45, 0.5 and 0.6, respectively. The internal stability of the RSS wall should be analysed by the supplier/designer of the proprietary product selected for this site.

GO Barrie Line

The foundation soils underlying the proposed approach embankments are expected to consist primarily of very stiff to hard clay till and compact to very dense sand. In general, the stability of embankment slopes and settlement of the foundation soils under the embankment loads are not expected to be a concern. An approximate 1.5 m thick zone of firm clay till was identified at 4.1 m depth in Borehole 19-12; the prevalence and impact of this zone should be further assessed during detail design.

Embankments with standard side slope inclinations of 2H:1V are expected to be stable. Mid-height berms comprising 2 m wide benches must be incorporated along the length of embankments with heights exceeding 8 m. Earth fill embankment slopes must be provided with erosion protection in accordance with OPSS.PROV 804.

6.5 Municipal Service Installation

In general, excavation for open cut installation of municipal services to an assumed maximum depth of 3.5 m will extend through the existing roadway pavement structure and fill materials, and into native silty clay till. Locally between Highway 400 and Jane Street, a sand deposit may be encountered in excavations extending below a depth of about 3.0 m. Sand may also be encountered in the vicinity of Keele Street and the West Don River. Use of a hydraulic excavator should be suitable for trench excavation within these materials.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. In general, the native soils are classified

as Type 3 soils above the groundwater level, and Type 4 soils if excavation extends below the water level without prior dewatering. Groundwater is not expected to pose construction issues during excavation of relatively shallow trenches.

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 York Region specifications.

Trench backfill materials should be placed in loose lift thicknesses not exceeding 200 mm and compacted to at least 98% of its SPMMD. Where utility trenches are located beneath the roadway, OPSS Granular A or B material, or unshrinkable fill should be employed as backfill.

For trenches located outside of the roadway, the portion of the trench above the pipe cover can be backfilled with excavated soil provided it is unfrozen and 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, and the till must be adequately broken down and compacted in the trench.

6.6 Soil Management

In general, visual and olfactory examination of the soil samples recovered from the field investigation program revealed no unusual staining or odours indicative of hydrocarbon impact or other contamination.

To evaluate the general environmental quality of the soils along the alignment, representative samples of the soils recovered from the boreholes were submitted to SGS for analysis of selected metals and inorganic parameters, petroleum hydrocarbons (PHC) fractions F1 to F4, including benzene, ethylbenzene, toluene and xylenes (BTEX) and volatile organic compounds (VOCs), as outlined in Ontario Regulation 153/04 (O.Reg. 153/04). Four samples were also tested in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) of O.Reg. 347 – General Waste Management as amended by O.Reg. 558/00.

The sample locations and material types are summarized in Table 6.6. The results of the analyses are provided on the Certificates of Analysis in Appendix E.

Table 6.6 – Samples Selected for Environmental Testing

Borehole	Sample ID	Depth (m)	Material	Analysis
19-02	BH19-02 SS7	6.1 – 6.7	Clay Till	Metals & Inorganics BTEX, PHCs F1 to F4 VOCs
19-03	BH19-03 SS8	7.6 – 8.2	Clay Fill	Metals & Inorganics BTEX, PHCs F1 to F4 VOCs
19-05	BH19-05 SS2	0.8 – 1.4	Clay Till	Metals & Inorganics
19-07	BH19-07 SS2	0.8 – 1.4	Clay Till	Metals & Inorganics
19-09	BH19-09 SS2B	0.9 – 1.4	Clay	Metals & Inorganics
19-09	BH19-09 SS4	2.3 – 2.9	Clay Till	BTEX, PHCs F1 to F4
19-10	BH19-10 SS6	4.6 – 5.2	Sand	Metals & Inorganics BTEX, PHCs F1 to F4
19-11	BH19-11 SS3B	1.7 – 2.1	Clay Fill	Metals & Inorganics BTEX, PHCs F1 to F4
19-11	BH19-11 SS6	4.6 – 5.2	Sand	Metals & Inorganics BTEX, PHCs F1 to F4
19-12	BH 19-12 SS2B	0.9 – 1.4	Clay Fill	Metals & Inorganics BTEX, PHCs F1 to F4
19-15	BH 19-15 SS2B	0.9 – 1.4	Clay Till	Metals & Inorganics
19-02	TCLP-1	6.1 – 8.2	Clay Till	TCLP
19-09	TCLP-2	0.9 – 2.1	Clay Fill	TCLP
19-11	TCLP-3	1.7 – 5.2	Clay Fill/Sand	TCLP
19-12	TCLP-4	0.9 – 2.1	Clay Fill/Till	TCLP

The analytical results were compared to the MECP Table 1 “Full Depth Background Site Condition Standards” for Property Uses other than Agricultural. The concentrations of all parameters measured in the samples meet the Table 1 Standards with the exception of electrical conductivity (EC) and sodium adsorption ratio (SAR) in multiple samples and F4 PHCs in one sample. The exceeding parameters are summarized in the following table:

Table 6.7 – Samples Exceeding Table 1 Background Standards

Borehole	Sample ID	Soil Type	Parameters	Table 1 Standard	Sample Result
19-02	BH19-02 SS7	Clay Till	PHC F4 (µg/g) PHC F4G (µg/g)	120 120	276 927
19-03	BH19-03 SS8	Clay Fill	EC (mS/cm) SAR	0.57 2.4	0.60 5.2
19-05	BH19-05 SS2	Clay Till	EC (mS/cm) SAR	0.57 2.4	2.2 20.3
19-07	BH19-07 SS2	Clay Till	EC (mS/cm) SAR	0.57 2.4	1.4 7.1
19-09	BH19-09 SS2B	Clay	EC (mS/cm) SAR	0.57 2.4	2.2 7.8
19-09	BH19-09 SS4	Clay Till	EC (mS/cm)	0.57	0.99
19-11	BH19-11 SS3B	Clay Fill	EC (mS/cm) SAR	0.57 2.4	3.2 20.6
19-11	BH19-11 SS6	Sand	EC (mS/cm) SAR	0.57 2.4	1.4 4.7
19-12	BH 19-12 SS2B	Clay Fill	EC (mS/cm) SAR	0.57 2.4	2.1 3.4
19-15	BH 19-15 SS2B	Clay Till	EC (mS/cm) SAR	0.57 2.4	1.6 9.4

The PHC Fraction F4 and F4G concentrations measured in the sample from Borehole 19-02 exceeded the Table 1 Standard but were below the standard of 6600 µg/g for Table 3 (“Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition”, Industrial/ Commercial/Community Property Use). If excavation is planned in this area, additional sampling and testing should be carried out to confirm and/or delineate the extent of soil containing PHC’s.

The EC and SAR values likely result from de-icing salt applied to the roadway for safety purposes. Currently, salt-related impacts are exempt where salt has been applied on a “highway” by a government or municipal authority, and the applicable site conditions standard is deemed not to be exceeded under O. Reg. 153/04. Therefore excavated materials may be managed by reuse in engineering applications on site (i.e. site grading fill or backfill). The material should not be used in landscaped areas with sensitive vegetation and plant species.

Considering that the parameter exceedances are non-health related, the soils may also be suitable for reuse at industrial/commercial/community sites that require fill for a beneficial use, pending approval of receiving site authorities. Alternatively, excess soils may be disposed of off-site as waste at a licensed facility (i.e. landfill and/or treatment facilities) with an Environmental

Compliance Approval (ECA) to receive this material, pending approval of receiving site authorities. The results of the leachate analyses met the respective Schedule 4 criteria provided under O. Reg. 347, and therefore, the materials may be disposed of as non-hazardous.

Additional analytical testing of excavated soils will be required during detailed design to further evaluate the environmental quality of the soil and confirm reuse and disposal requirements. It must be noted that samples were not recovered from within the CN MacMillan Yard, and particular attention should be given to establishing the characteristics of materials to be excavated for foundation construction in this area.

6.7 Detailed Geotechnical Investigation

The information presented in this report is provided for preliminary design and planning purposes only. Detailed geotechnical investigation will be required to confirm the subsurface conditions and recommendations. This work should incorporate:

- A detailed pavement investigation including additional boreholes within the existing roadway pavement and widening areas to further define the subgrade conditions and confirm the pavement design recommendations;
- Boreholes within the envelope of all foundation units to confirm the subsurface conditions at the structure locations and develop detailed geotechnical recommendations for design and construction of the new grade separation structures, structure widening, and bridge foundations;
- Additional investigation along the proposed RSS walls, high fill embankments, and temporary track and roadway protection locations;
- Further assessment of dewatering requirements and the need for a PTTW; and
- Supplemental chemical testing to confirm the requirements for reuse or disposal of excavated material.

7. CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this report, please do not hesitate to contact us.

Yours truly,

Thurber Engineering Ltd.

Karel Furbacher, P.Eng.
Geotechnical Engineer

Murray R. Anderson, M.Eng., P.Eng.
Senior Geotechnical Engineer

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STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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Appendix A

Site Photographs

Langstaff Road Class EA Study
Weston Road to Highway 7
Site Photographs

Photograph 1 – Langstaff Road eastbound looking from Weston Road

Photograph 2 – Looking west from the west abutment of the Highway 400 bridge

Langstaff Road Class EA Study
Weston Road to Highway 7
Site Photographs

Photograph 3 – Highway 400 bridge looking west from east abutment

Photograph 4 – Westbound lanes looking west from east of Edgeley Boulevard

Photograph 5 – Eastbound lanes looking east from Millway Avenue

Photograph 6 – Langstaff Road at CN Property

Langstaff Road Class EA Study
Weston Road to Highway 7
Site Photographs

Photograph 7 – Don River Bridge looking west towards Keele Street

Photograph 8 – Langstaff Road at Barrie Go Line

Photograph 9 – View of eastbound lanes of Langstaff Rd. between Spinnaker Way and Staffern Drive

Photograph 10 – Langstaff Road at Dufferin Street intersection

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Appendix B

Record of Borehole Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT[(1)] 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

1) Laboratory Triaxial Testing
2) Field Insitu Vane Testing
3) Laboratory Vane Testing
4) SPT value
5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample		TP Thin Wall Piston Sample
	PH Sampler Advanced by Hydraulic Pressure		PM Sampler Advanced by Manual Pressure
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

▼ Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

(1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.

(2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

RECORD OF BOREHOLE 19-01

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 2, 2019
COMPLETED : April 2, 2019

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

N 4 851 599.0 E 616 682.0

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		207.10				
	Hollow Stem Augers CME-75	**ASPHALT**: (175mm)		0.00				
		SAND, some gravel, trace silt and clay, compact, brown, moist: (FILL)		0.18	1	SS	14	Grain Size Analysis: Gr 13%/Sa 74%/ Si & Cl 13%
				206.31				
1		**SAND**, some clay, trace to some silt, compact, brownish grey, moist: (FILL)		0.79	2	SS	14	
					3	SS	24	
2				204.97				
		CLAY, silty, trace sand and gravel, very stiff, grey, moist: (TILL)		2.13	4	SS	22	
3					5	SS	26	
				203.44				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE AND ASPHALT AT SURFACE		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

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THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-02

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 5, 2019
COMPLETED : April 9, 2019
N 4 851 713.0 E 617 073.0

Project No. 13659
SHEET 1 OF 4
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		213.66				
		ASPHALT: (175mm)		0.00				Grain Size Analysis: Gr 24%/ Sa 58%/ Si & Cl 18%
		SAND, some gravel, compact to very dense, brown, moist: (FILL)		0.18	1	SS	67	
1	Hollow Stem Augers				2	SS	54	
					3	SS	19	
2		**CLAY**, silty, sandy, trace gravel, very stiff, grey to dark grey, moist: (FILL)		211.78 1.88				Grain Size Analysis: Gr 1%/ Sa 41%/ Si 36%/ Cl 22%
		SAND, some clay, compact, grey, moist, occasional wood fragments: (FILL)		211.12 2.54	4	SS	19	
3		**CLAY**, silty, some sand, trace gravel, stiff, grey, moist		210.61 3.05	5	SS	12	
4								
	CME-75				6	SS	15	
5								
		CLAY, silty, some sand to sandy, trace gravel, stiff to very stiff, grey to brownish grey, moist: (TILL)		208.02 5.64				
6					7	SS	27	
7	HW Casing Advancer							
					8	SS	19	Grain Size Analysis: Gr 1%/ Sa 31%/ Si 39%/ Cl 29%
8								
9					9	SS	12	

DEPTH SCALE (metres)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
			Flushmount Well Protector Set in Concrete

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-02

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 5, 2019
COMPLETED : April 9, 2019
N 4 851 713.0 E 617 073.0

Project No. 13659
SHEET 2 OF 4
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		CLAY, silty, some sand to sandy, trace gravel, stiff to hard, grey to brownish grey, moist: (TILL)									
11	Hollow Stem Augers CME-75				10	SS	8				
12					11	SS	41				
13											
14					12	SS	27				
15											Bentonite Grout
					13	SS	27				
16											
17				196.66							
		SILT, clayey, some sand, trace gravel, hard, grey, moist		17.00							
18											
					14	SS	47	Grain Size Analysis: Gr 1%/ Sa 16%/ Si 64%/ Cl 19%			
19				193.66							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-02

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 5, 2019
COMPLETED : April 9, 2019
N 4 851 713.0 E 617 073.0

Project No. 13659
SHEET 3 OF 4
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
21	Hollow Stem Augers CME-75	**SAND**, silty, trace clay, compact, grey, wet		19.99							
22					15	SS	27		○		
23		**CLAY**, silty, some sand, trace gravel, hard, grey, moist		190.66 23.00							
24											
25					16	SS	68	Grain Size Analysis: Gr 1%/ Sa 13%/ Si 41%/ Cl 45%	○		
26											
27		**SAND**, silty, compact to very dense, grey, wet		187.46 26.20							
28					17	SS	72		○		
29											Bentonite Pellets

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-02

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 5, 2019
COMPLETED : April 9, 2019
N 4 851 713.0 E 617 073.0

Project No. 13659
SHEET 4 OF 4
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp w wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		SAND, silty, compact to very dense, grey, wet									Filter Sand
31	Hollow Stem Augers CME-75				18	SS	25		○		
32				181.35							Slotted Screen
		SILT, some sand and clay, very dense, grey, wet		32.31							
33											
					19	SS	50/ 0.050	Grain Size Analysis: Gr 0%/ Sa 13%/ Si 76%/ Cl 11%	○		
34		END OF BOREHOLE AT 33.88m. Monitoring well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.		179.78 33.88							
		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) May 03/19 9.49 204.17									
35											
36											
37											
38											
39											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-03

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 2, 2019
COMPLETED : April 4, 2019
N 4 851 730.0 E 617 179.0

Project No. 13659
SHEET 1 OF 4
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		213.93				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
		ASPHALT: (150mm)		0.00							
	Hollow Stem Augers	**SAND** and **GRAVEL**, compact to dense, brown, moist: (FILL)		0.15	1	SS	39	Grain Size Analysis: Gr 37%/ Sa 49%/ Si & Cl 14%	○		
1					2	SS	32		○		
					3	SS	19		○		
2				211.64							
		CLAY, silty, some sand to sandy, firm to stiff, grey to brownish grey, moist: (FILL)		2.29	4	SS	5		○		
3					5	SS	8	Grain Size Analysis: Gr 6%/ Sa 41%/ Si 34%/ Cl 19%	○		
4				209.82							
		SAND, some clay, trace gravel, compact, brown, wet: (FILL)		4.11	6	SS	24		○		
5	CME-75										
6											
	HW Casing Advancer	**CLAY**, some sand, trace silt, trace gravel, firm to stiff, grey, wet; occasional organics inclusions: (FILL)		207.55 6.38	7	SS	15		○		
7											
					8	SS	7		○		
8				205.33							
		CLAY, silty, trace to some sand, trace gravel, stiff, grey, wet; occasional organic inclusions, rootlets: (ALLUVIAL)		8.60							
9					9	SS	10		○		

GROUNDWATER ELEVATIONS

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

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-03

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 2, 2019
COMPLETED : April 4, 2019

Project No. 13659
SHEET 2 OF 4
DATUM Geodetic

N 4 851 730.0 E 617 179.0

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 ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
11	Hollow Stem Augers CME-75	**CLAY**, silty, trace to some sand, trace gravel, stiff, grey, wet; occasional organic inclusions, rootlets: (ALLUVIAL)			10	SS	11	Grain Size Analysis: Gr 4%/ Sa 20%/ Si 28%/ Cl 48%			
12		**CLAY**, silty, trace to some sand, trace gravel, very stiff to hard, grey, wet: (TILL)		202.20 11.73	11	SS	34				
13											
14					12	SS	30				
15											
16					13	SS	23	Grain Size Analysis: Gr 0%/ Sa 19%/ Si 47%/ Cl 34%			
17											
18					14	SS	18				
19				193.94							

GROUNDWATER ELEVATIONS

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

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-03

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 2, 2019
COMPLETED : April 4, 2019
N 4 851 730.0 E 617 179.0

Project No. 13659
SHEET 3 OF 4
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 ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
21	Hollow Stem Augers CME-75	**SILT**, clayey, trace to some sand, hard, grey, wet: (TILL)		19.99							
22					15	SS	67		○		
23		**CLAY**, silty, trace sand and gravel, very stiff, grey, wet		190.93 23.00							
24											
25					16	SS	26	Grain Size Analysis: Gr 0%/ Sa 0%/ Si 76%/ Cl 24%	○		
26		**SAND**, some silt to silty, compact to very dense, grey, wet		187.93 26.00							
27											
28					17	SS	22		○		
29											

GROUNDWATER ELEVATIONS

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

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-03

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 2, 2019
COMPLETED : April 4, 2019
N 4 851 730.0 E 617 179.0

Project No. 13659
SHEET 4 OF 4
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 ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
31	Hollow Stem Augers CME-75				18	SS	61	Grain Size Analysis: Gr 0%/ Sa 61%/ Si & Cl 39%	○		
32		**SILT**, some sand and clay, very dense, grey, moist		181.62 32.31							
33											
34					19	SS	86		○		
		END OF BOREHOLE AT 34.09m. BOREHOLE BACKFILLED WITH BENTONITE GROUT; ASPHALT AT SURFACE.		179.84 34.09							
35											
36											
37											
38											
39											

GROUNDWATER ELEVATIONS

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

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-04

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 26, 2019
COMPLETED : April 26, 2019
N 4 851 800.0 E 617 413.0

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		208.00				
		ASPHALT: (150mm)		0.00				
		SAND, gravelly, trace silt and clay, very dense, brown, moist: (FILL)		0.15	1	SS	62	Grain Size Analysis: Gr 26%/Sa 55%/ Si & Cl 19%
1					2	SS	73	
	Hollow Stem Augers			206.47				
		CLAY, silty, some sand, trace gravel, firm to stiff, brown, moist to wet: (FILL)		1.52	3	SS	10	
2					4	SS	5	
				205.03				
3		**CLAY**, silty, trace sand, trace organics, stiff, brownish grey, moist: (TILL)		2.97	5	SS	12	
				204.34				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE.		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-05

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 26, 2019
COMPLETED : April 26, 2019
N 4 851 901.0 E 617 703.0

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		207.49				
		ASPHALT: (150mm)		0.00				
		SAND and **GRAVEL**, trace silt and clay, compact, brown, moist: (FILL)		0.15	1	SS	16	
				206.73				
1	Hollow Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, stiff to very stiff, brownish grey, moist: (TILL)		0.76	2	SS	20	
2					3	SS	23	
					4	SS	14	
3				204.44				
		SAND, some silt, trace clay, trace gravel, compact, grey, wet		3.05	5	SS	14	Grain Size Analysis: Gr 7%/ Sa 77%/ Si & Cl 16%
				203.83				
4		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE GROUT, ASPHALT AT SURFACE.		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-06

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 9, 2019
COMPLETED : April 9, 2019
N 4 851 989.0 E 618 055.0

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		210.14				
	Hollow Stem Augers CME-75	**ASPHALT**: (175mm)		0.00				
		SANDand **GRAVEL**, trace silt and clay, loose, brown, moist: (FILL)		0.18				
		CLAY, silty, trace to some sand, trace gravel, trace organics, very stiff, brownish grey, moist: (TILL)		0.41	1	SS	8	Grain Size Analysis: Gr 36%/ Sa 49%/ Si & Cl 15%
1					2	SS	16	
2					3	SS	19	
					4	SS	19	
3				206.92				
		SAND, some silt and gravel, trace clay, dense, brown to grey, moist		3.22	5	SS	44	
				206.48				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE.		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-07

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 12, 2019
COMPLETED : April 12, 2019

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

N 4 852 089.0 E 618 288.0

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		212.77				
		ASPHALT: (150mm)		0.00				
		SAND and **GRAVEL**, trace silt and clay, compact, brown, moist: (FILL)		0.15				
				212.31	1	SS	17	Grain Size Analysis: Gr 63%/ Sa 26%/ Si & Cl 11%
		CLAY, silty, trace to some sand, trace gravel, stiff to hard, brownish grey with orange oxidized staining, moist: (TILL)		0.46				
1	Hollow Stem Augers CME-75				2	SS	12	
2					3	SS	21	
					4	SS	36	
3				209.72				
		SAND, some silt, trace gravel, dense, brown, wet		3.05	5	SS	40	
				209.11				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE.		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-08

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 12, 2019
COMPLETED : April 12, 2019

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

N 4 852 190.0 E 618 604.0

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		212.30				
	Hollow Stem Augers CME-75	**ASPHALT**: (200mm)		0.00				Grain Size Analysis: Gr 36%/Sa 46%/ Si & Cl 18%
		SAND and **GRAVEL**, trace silt and clay, compact, brown. moist: (FILL)		0.20				
		CLAY, silty, trace to some sand, trace gravel, orange iron-oxide staining, stiff to hard, brownish grey, moist: (TILL)		211.79 0.51	1	SS	18	
1					2	SS	10	
2					3	SS	18	
3					4	SS	24	
					5	SS	32	
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE.		208.64 3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-09

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 10, 2019
COMPLETED : April 11, 2019
N 4 852 328.0 E 619 019.0

Project No. 13659
SHEET 1 OF 3
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		208.03				DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (40 80 120 160) / WATER CONTENT, PERCENT (wp w wl; 10 20 30 40)		
		ASPHALT: (175mm)		0.00							
		SAND and **GRAVEL**, trace silt and clay, compact, brown, moist: (FILL)		0.18	1	SS	24	Grain Size Analysis: Gr 42%/ Sa 46%/ Si & Cl 12%			Flushmount Well Protector Set in Concrete
1	Hollow Stem Augers	**CLAY**, silty, trace sand, firm, brownish grey, moist; with occasional black staining: (FILL)		207.11 0.91	2	SS	4				
2					3	SS	6				
		CLAY, silty, trace sand and gravel, very stiff to hard, brownish grey to dark brown, moist: (TILL)		205.74 2.29	4	SS	20				
3					5	SS	22				
4											
5	CME-75				6	SS	90/ 0.275	Grain Size Analysis: Gr 2%/ Sa 34%/ Si 45%/ Cl 19%			
		SILT, clayey, some sand to sandy, trace gravel, hard, grey, moist: (TILL)		202.48 5.55							
6					7	SS	94/ 0.275				
7	HW Casing Advancer										
8					8	SS	61				
9					9	SS	82	Grain Size Analysis: Gr 1%/ Sa 30%/ Si 50%/ Cl 19%			
				198.12							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-09

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 10, 2019
COMPLETED : April 11, 2019
N 4 852 328.0 E 619 019.0

Project No. 13659
SHEET 2 OF 3
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		SAND, trace silt, compact to dense, grey, wet		9.91							
11	Hollow Stem Augers CME-75				10	SS	20		○		Bentonite Grout
12					11	SS	23		○		
13											
14					12	SS	36		○		
15											
16					13	SS	23		○		
17		**CLAY**, silty, trace sand, trace gravel, hard, grey, moist: (TILL)		191.03 17.00							
18											
19					14	SS	34		○		

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-09

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 10, 2019
COMPLETED : April 11, 2019
N 4 852 328.0 E 619 019.0

Project No. 13659
SHEET 3 OF 3
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
21	Hollow Stem Augers CME-75	**CLAY**, silty, trace sand, trace gravel, hard, grey, moist: (TILL)			15	SS	80/ 0.200		○		
22											Bentonite Pellets
23					16	SS	78/ 0.275		○		Filter Sand
24		with occasional pockets of sand		184.19 23.84	17	SS	50/ 0.125		○		Slotted Screen
25											
26					18	SS	85		○		
27		END OF BOREHOLE AT 26.39m. Monitoring well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.		181.64 26.39							
28		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) May 03/19 2.00 206.03									
29											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-10

PROJECT : Langstaff Road Class EA
LOCATION : Keele Street, Vaughan, Ontario
STARTED : April 12, 2019
COMPLETED : April 16, 2019
N 4 852 562.0 E 620 350.0

Project No. 13659
SHEET 1 OF 3
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		205.59				DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: 40 80 120 160 / WATER CONTENT: wp w wl 10 20 30 40		
		ASPHALT: (175mm)		0.00							
		SAND, some gravel, trace silt and clay, compact, brown, moist: (FILL)		0.18				Grain Size Analysis: Gr 19%/ Sa 70%/ Si & Cl 11%			
		CLAY, silty, trace sand, trace gravel, orange iron-oxide staining, stiff to very stiff, grey, moist: (TILL)		0.38	1	SS	13		○		Flushmount Well Protector Set in Concrete
1	Hollow Stem Augers				2	SS	17		○		
				204.07							
		SILT, clayey, trace sand, orange iron-oxide staining, very stiff, brown, moist		1.52	3	SS	18	Grain Size Analysis: Gr 0%/ Sa 2%/ Si 85%/ Cl 13%	○		
2											
				202.98	4	SS	29		○		
		SAND, trace silt, compact to very dense, brown, moist to wet		2.62							
3					5	SS	57		○		
4											▼
					6	SS	29		○		
5	CME-75										
6					7	SS	28		○		
7	HW Casing Advancer										
					8	SS	67/ 0.250		○		
8											
9					9	SS	50/ 0.00				
				195.59							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-10

PROJECT : Langstaff Road Class EA
LOCATION : Keele Street, Vaughan, Ontario
STARTED : April 12, 2019
COMPLETED : April 16, 2019
N 4 852 562.0 E 620 350.0

Project No. 13659
SHEET 2 OF 3
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 ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	NW Casing CME-75	**SAND**, some gravel to gravelly, trace to some silt, very dense, grey, wet		10.00							Bentonite Grout
					10	SS	50/ 0.025				
11											
					11	SS	50/ 0.00				
12											
13											
					12	SS	50/ 0.025				
14											
15											
					13	SS	50/ 0.125				
16											
		CLAY, silty, trace sand, hard, grey, moist		188.76 16.83							
17											
18											
					14	SS	50/ 0.100	Grain Size Analysis: Gr 0%/ Sa 3%/ Si 60%/ Cl 37%			
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-10

PROJECT : Langstaff Road Class EA
LOCATION : Keele Street, Vaughan, Ontario
STARTED : April 12, 2019
COMPLETED : April 16, 2019
N 4 852 562.0 E 620 350.0

Project No. 13659
SHEET 3 OF 3
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 ▲) 40 80 120 160; WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
21	NQ Coring CME-75	**CLAY**, silty, trace sand, hard, grey, moist									Bentonite Pellets
					15	SS	80				Filter Sand
22											
23											Slotted Screen
24				181.21							
		END OF BOREHOLE AT 24.38m. Monitoring well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.		24.38							
25		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) — May 03/19 / 4.54 / 201.05									
26											
27											
28											
29											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-11

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 17, 2019
COMPLETED : April 17, 2019
N 4 852 876.0 E 620 512.0

Project No. 13659
SHEET 1 OF 3
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		199.80				DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	40 80 120 160 / wp 10 20 30 40 wl		
		ASPHALT: (175mm)		0.00							
		SAND, trace clay, trace gravel, dense to compact, brown, moist to wet: (FILL)		0.18	1	SS	33				Flushmount Well Protector Set in Concrete
1	Hollow Stem Augers				2	SS	16				
								Grain Size Analysis: Gr 4%/ Sa 79%/ Si & Cl 17%			
		CLAY, silty, trace sand, trace gravel, trace organics, firm to very stiff, grey, moist to wet: (FILL)		198.07 1.73	3	SS	5				
2											
					4	SS	12				
3											Bentonite
					5	SS	16				
4				195.68							
		SAND, some silt, trace gravel, loose, grey, wet; with occasional decayed wood and shell fragments, organics (ALLUVIAL)		4.11							
					6	SS	5				
5											
				194.20							
		SAND, some gravel, trace silt, loose to compact, grey wet		5.60							
6											Filter Sand
					7	SS	8				
7	NW Casing										
								Grain Size Analysis: Gr 1%/ Sa 37%/ Si 56%/ Cl 6%			
8		becoming silt and sand, trace gravel			8	SS	16				Slotted Screen
9											
				190.35	9	SS	11				
		CLAY, silty, trace sand, trace gravel, very stiff to hard, grey, wet to moist: (TILL)		9.45							

GROUNDWATER ELEVATIONS

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

May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-11

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 17, 2019
COMPLETED : April 17, 2019
N 4 852 876.0 E 620 512.0

Project No. 13659
SHEET 2 OF 3
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 ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
11	NW Casing				10	SS	26		○		
12					11	SS	36				
13											
14					12	SS	26		○		
15		**SAND**, some silt, trace clay, trace gravel, very dense, grey, wet		185.02 14.78	13	SS	50/ 0.100		○		Bentonite
16											
17		**CLAY**, silty, trace to some gravel, trace to some sand, hard, grey, moist to wet: (TILL)		183.04 16.76							
18					14	SS	50/ 0.100		○		
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-11

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 17, 2019
COMPLETED : April 17, 2019
N 4 852 876.0 E 620 512.0

Project No. 13659
SHEET 3 OF 3
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp ○w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
21		**CLAY**, silty, trace to some gravel, trace to some sand, hard, grey, moist to wet: (TILL)									
					15	SS	91/ 0.250		○		
				178.06							
22		END OF BOREHOLE AT 21.74m. Monitoring well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.		21.74							
		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) May 03/19 3.64 196.16									
23											
24											
25											
26											
27											
28											
29											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-12

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 22, 2019
COMPLETED : April 23, 2019
N 4 853 032.0 E 620 993.0

Project No. 13659
SHEET 1 OF 3
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		203.65				
	Hollow Stem Augers	**SAND** and **GRAVEL**, trace silt and clay, compact, brown, moist to wet: (FILL)		0.00	1	SS	17	
1		**CLAY**, silty, trace sand, trace gravel, trace organics, firm, grey, wet: (FILL)		202.76 0.89	2	SS	4	
		CLAY, silty, trace to some sand, trace gravel, very stiff, brownish grey, moist to wet: (TILL)		201.97 1.68	3	SS	20	
2					4	SS	20	Grain Size Analysis: Gr 0%/ Sa 11%/ Si 52%/ Cl 37%
3					5	SS	22	
4		becoming firm.		199.53 4.11	6	SS	7	
5				198.01				
	HW Casing Advancer	**SAND**, trace to some silt, trace clay, compact to very dense, grey, wet		5.64	7	SS	22	
6								
7					8	SS	78	
8		with occasional layers of silt						
9					9	SS	84	

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Flushmount Well Protector Set in Concrete
Bentonite
Filter Sand
Slotted Screen

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-12

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 22, 2019
COMPLETED : April 23, 2019
N 4 853 032.0 E 620 993.0

Project No. 13659
SHEET 2 OF 3
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 ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
11	Casing Advance	with occasional layers of silty clay			10	SS	69/ 0.225				
12					11	SS	95/ 0.250				
13											
14		with occasional layers of silt			12	SS	97/ 0.225	Grain Size Analysis: Gr 0%/ Sa 6%/ Si 84%/ Cl 10%			
15											
		CLAY, silty, trace sand, trace gravel, hard, grey, wet: (TILL)		188.08 15.57	13	SS	59				
16											
17											
18											
		grading to clayey silt and sand			14	SS	47	Grain Size Analysis: Gr 2%/ Sa 49%/ Si 34%/ Cl 15%			Bentonite
19				183.65							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-12

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 22, 2019
COMPLETED : April 23, 2019
N 4 853 032.0 E 620 993.0

Project No. 13659
SHEET 3 OF 3
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160); WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		CLAY, silty, trace sand, trace gravel, hard, grey, wet: (TILL)		19.99							
				183.05							
		SAND, some clay, some silt, trace gravel, very dense, grey, wet		20.60							
21					15	SS	100/ 0.200				
22											
23											
24	Casing Advance										
		becoming compact to very dense, gravelly		179.27 24.38	16	SS	17				
25											
26											
27					17	SS	70/ 0.275				
		END OF BOREHOLE AT 27.71m UPON PRACTICAL REFUSAL TO ADVANCE. Monitoring well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.		175.94 27.71							
28											
29		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) May 03/19 2.90 200.75									

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 3, 2019

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-13

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 22, 2019
COMPLETED : April 22, 2019

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

N 4 853 116.0 E 621 277.0

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		205.10				
		ASPHALT: (125mm)						
		SAND, gravelly, trace silt and clay, compact to dense, brown, moist: (FILL)		0.13	1	SS	57	Grain Size Analysis: Gr 25%/Sa 61%/ Si & Cl 14%
				204.16				
1	Hollow Stem Augers	**CLAY**, silty, trace sand and gravel, stiff to very stiff, grey to dark grey, moist to wet: (TILL)		0.94	2	SS	11	
2					3	SS	18	
					4	SS	8	
3					5	SS	15	
				201.44				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-14

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 18, 2019
COMPLETED : April 18, 2019
N 4 853 217.0 E 621 612.0

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		204.76				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
	Hollow Stem Augers CME-75	**SAND**, gravelly, trace silt and clay, compact, brown, moist: (FILL)		0.00	1	SS	10	Grain Size Analysis: Gr 22%/ Sa 65%/ Si & Cl 13%	○		
				204.00							
1		**CLAY**, silty, some sand to sandy, trace gravel, stiff to very stiff, brown to brownish grey, moist: (TILL)		0.76	2	SS	10		○		
2					3	SS	21		○		
					4	SS	27	Grain Size Analysis: Gr 1%/ Sa 34%/ Si 37%/ Cl 28%	◑———		
3					5	SS	24		○ ○		
				201.10							
4		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE		3.66							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-15

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 22, 2019
COMPLETED : April 22, 2019

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

N 4 853 338.0 E 621 951.0

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		204.86				
	Hollow Stem Augers	**SAND**, gravelly, trace silt and clay, compact, brown, moist: (FILL)		0.00	1	SS	12	
				203.97				
1		**CLAY**, silty to **SILT**, clayey, some sand to sandy, trace gravel, stiff to hard, grey, moist: (TILL)		0.89	2	SS	10	
		with pockets of sand			3	SS	23	Grain Size Analysis: Gr 0%/ Sa 44%/ Si 37%/ Cl 19%
2					4	SS	38	
3					5	SS	21	
				201.20				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

THURBER

THURBER2S TEL-13659.GPJ 8/29/19

RECORD OF BOREHOLE 19-16

PROJECT : Langstaff Road Class EA
LOCATION : Langstaff Road, Vaughan, Ontario
STARTED : April 16, 2019
COMPLETED : April 16, 2019
N 4 853 438.0 E 622 277.0

Project No. 13659
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		206.06				
		ASPHALT: (150mm)		0.00				
		SAND, trace gravel, dense, brown, moist: (FILL)		0.15	1	SS	50/ 0.125	
				205.53				
		ASPHALT: (50mm)		0.53				
		SAND, trace gravel silt and clay, compact, brown, moist: (FILL)		0.59	2	SS	20	Grain Size Analysis: Gr 2%/ Sa 86%/ Si & Cl 12%
1	Hollow Stem Augers CME-75			204.97				
		CLAY, silty, some sand to sandy, trace gravel, trace organics, orange oxide staining, firm to stiff, grey, wet (FILL)		1.09	3	SS	5	
2					4	SS	9	Grain Size Analysis: Gr 0%/ Sa 34%/ Si 34%/ Cl 32%
3				203.01				
		CLAY, silty, some sand, trace gravel, very stiff, brown, moist: (TILL)		3.05	5	SS	21	
				202.40				
		END OF BOREHOLE AT 3.66m. BOREHOLE BACKFILLED WITH BENTONITE, ASPHALT AT SURFACE		3.66				
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 ▲
40 80 120 160

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 : BRM
CHECKED : KF

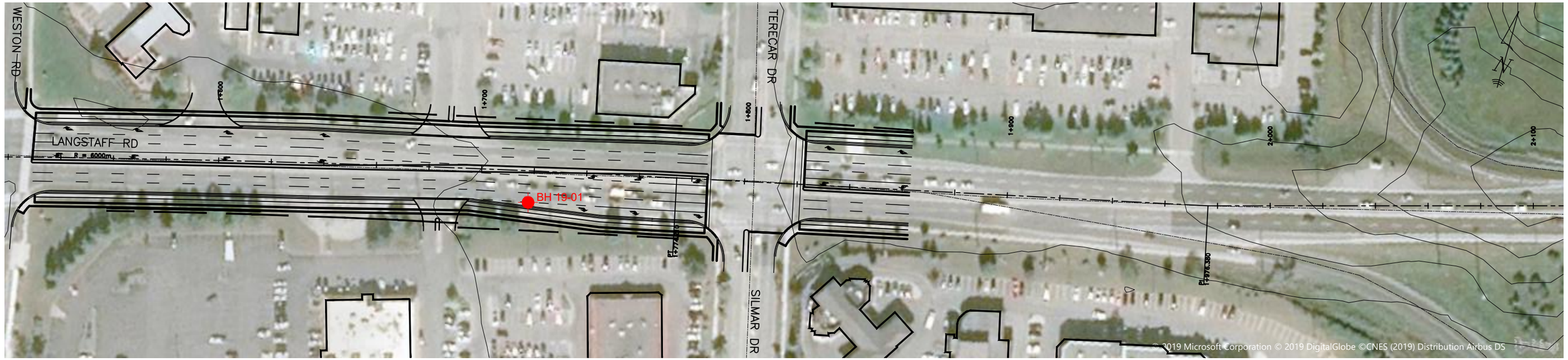
THURBER

THURBER2S TEL-13659.GPJ 8/29/19

THURBER

Appendix C

Borehole Location Plans



LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE MONITORING WELL (BH/MW) LOCATION

30 0 30 60m

SCALE 1:1500

PLAN PROVIDED BY WSP CANADA GROUP LTD. DRAWING FILE 3216079-400-XN1- Overpass Design EA

WSP Canada Group Ltd.

Langstaff Road Class EA
Langstaff Road from Weston Road to Dufferin Street
Vaughan, Ontario

BOREHOLE LOCATION PLAN

JOB# 13659

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
MAY 2019	1:1500	13659-1

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PLOTDATE: Jun 26, 2019 - 2:09 PM

LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE MONITORING WELL (BH/MW) LOCATION

30 0 30 60m

SCALE 1:1500

PLAN PROVIDED BY WSP CANADA GROUP LTD. DRAWING FILE 3216079-400-XN1- Overpass Design EA

WSP Canada Group Ltd.

Langstaff Road Class EA
Langstaff Road from Weston Road to Dufferin Street
Vaughan, Ontario

BOREHOLE LOCATION PLAN

JOB# 13659

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
MAY 2019	1:1500	13659-2

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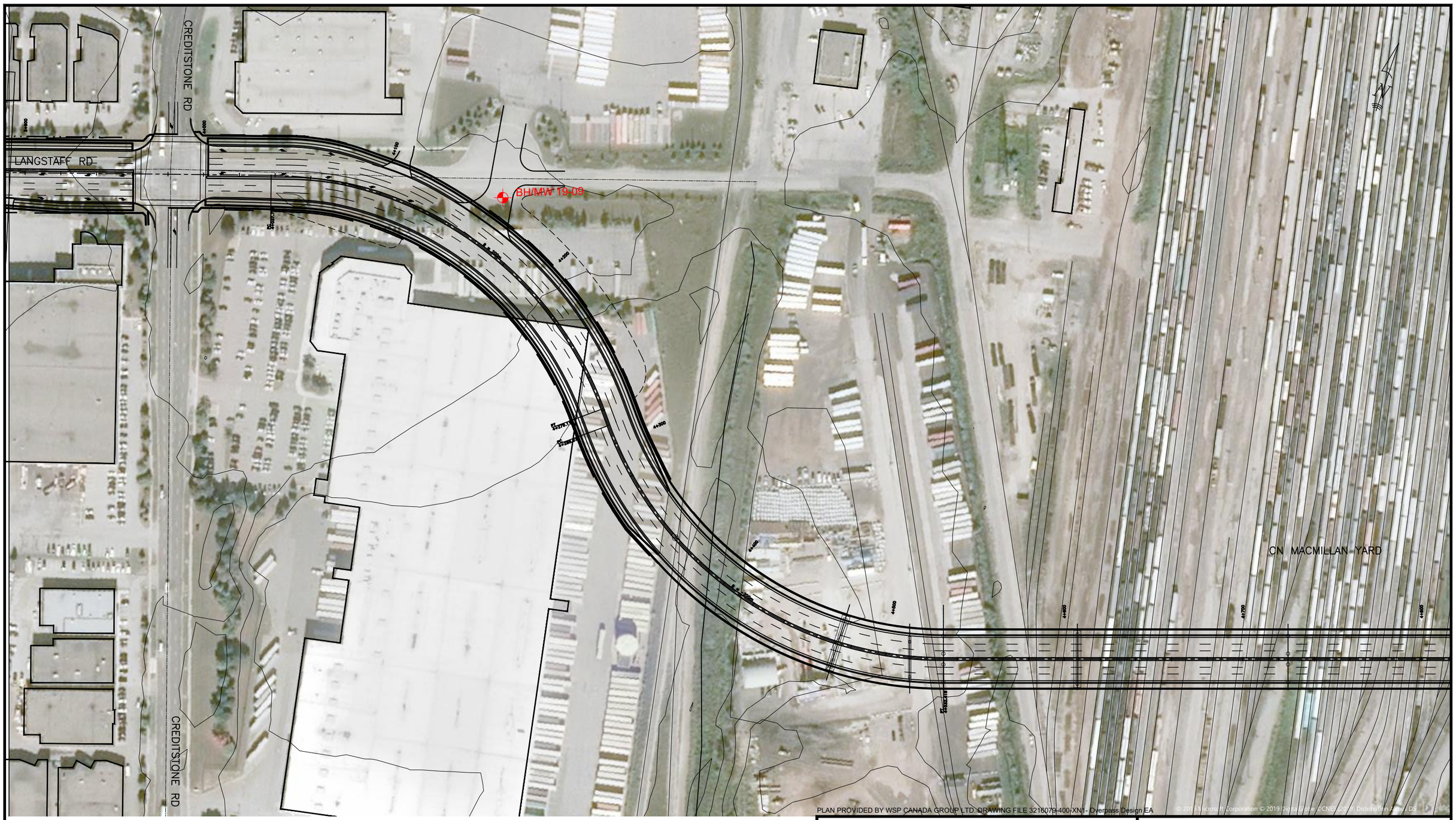
PLOTDATE: Jun 26, 2019 - 2:09 PM



LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE MONITORING WELL (BH/MW) LOCATION

40 0 40 80m

SCALE 1:2000

WSP Canada Group Ltd.

Langstaff Road Class EA
Langstaff Road from Weston Road to Dufferin Street
Vaughan, Ontario

BOREHOLE LOCATION PLAN

JOB# 13659

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
MAY 2019	1:2000	13659-3

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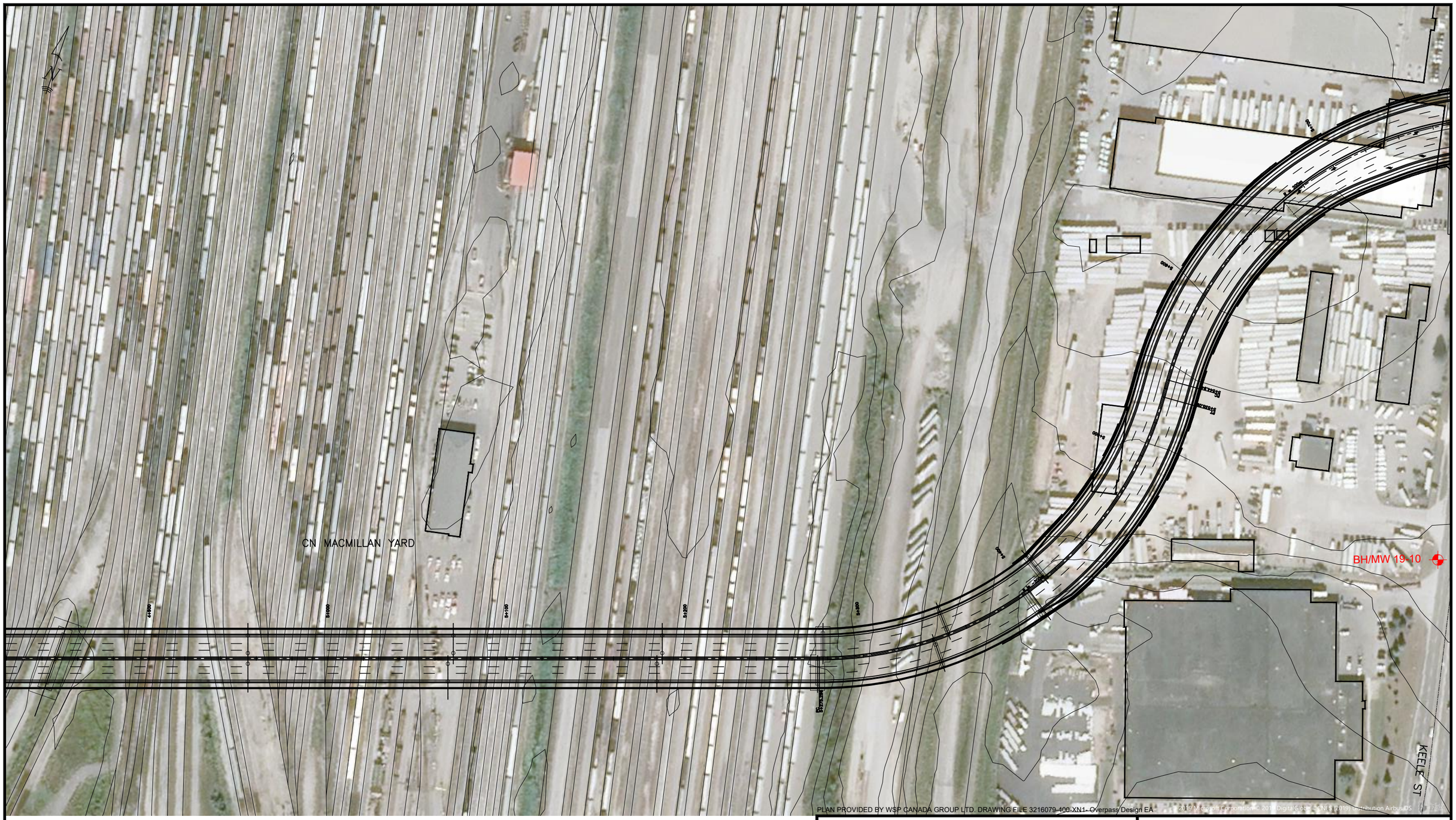
PLOTDATE: Jun 26, 2019 - 2:09 PM



LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE MONITORING WELL (BH/MW) LOCATION

40 0 40 80m

SCALE 1:2000

WSP Canada Group Ltd.

Langstaff Road Class EA
Langstaff Road from Weston Road to Dufferin Street
Vaughan, Ontario

BOREHOLE LOCATION PLAN

JOB# 13659

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
MAY 2019	1:2000	13659-4

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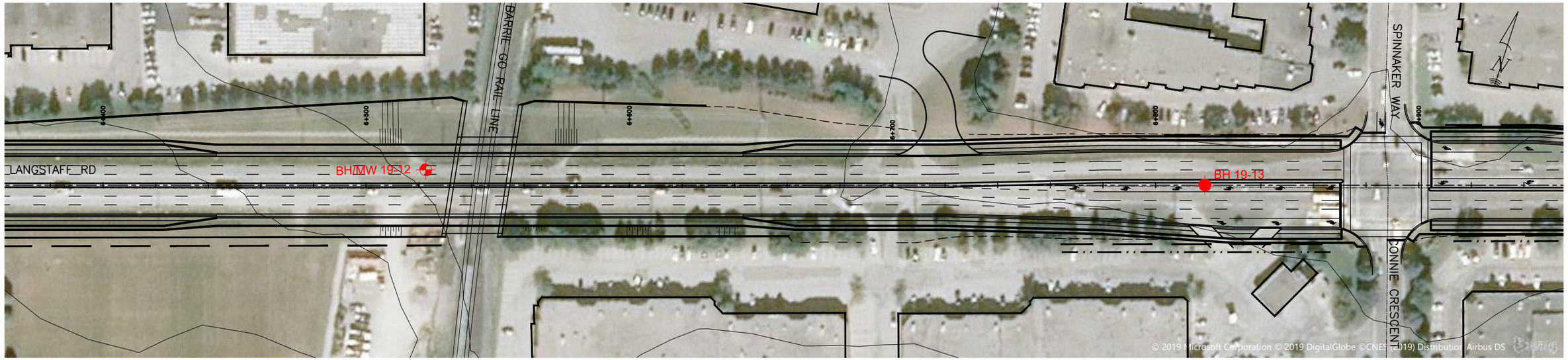
PLOTDATE: Jun 26, 2019 - 2:09 PM



LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE MONITORING WELL (BH/MW) LOCATION

30 0 30 60m

SCALE 1:1500

PLAN PROVIDED BY WSP CANADA GROUP LTD. DRAWING FILE 3216079-400-XN1- Overpass Design EA

WSP Canada Group Ltd.

Langstaff Road Class EA
Langstaff Road from Weston Road to Dufferin Street
Vaughan, Ontario

BOREHOLE LOCATION PLAN

JOB# 13659

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
MAY 2019	1:1500	13659-5

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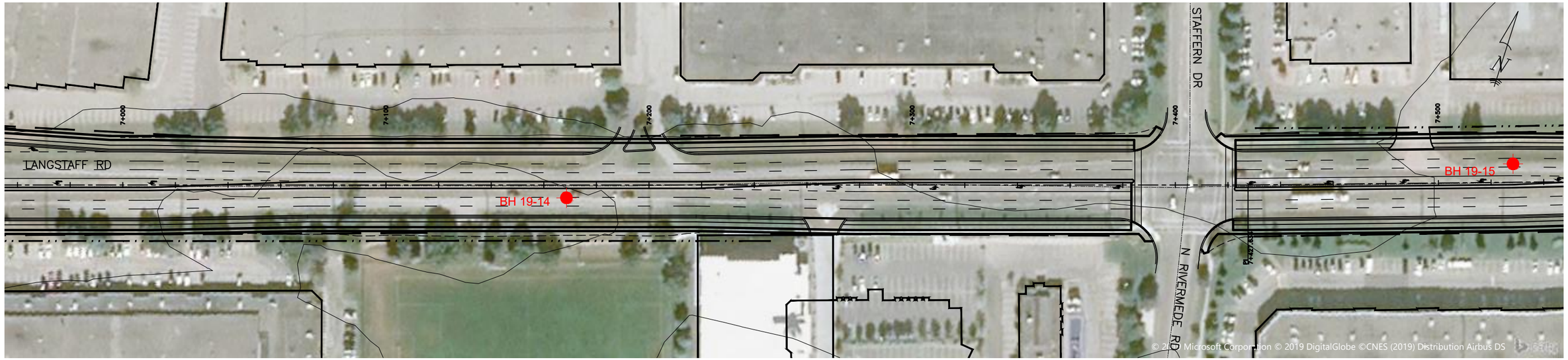
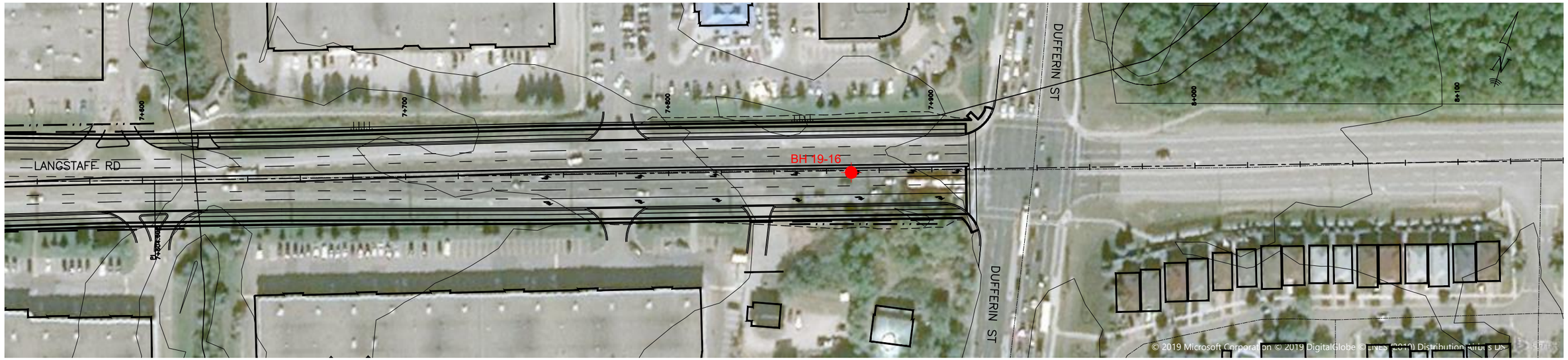




LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE MONITORING WELL (BH/MW) LOCATION

30 0 30 60m

SCALE 1:1500

PLAN PROVIDED BY WSP CANADA GROUP LTD. DRAWING FILE 3216079-400-XN1- Overpass Design EA

WSP Canada Group Ltd.

Langstaff Road Class EA
Langstaff Road from Weston Road to Dufferin Street
Vaughan, Ontario

BOREHOLE LOCATION PLAN

JOB# 13659

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
MAY 2019	1:1500	13659-6

FILENAME: H:\Drafting\13000\13659\TED-13659-BHPL.dwg
PLOTDATE: Jun 26, 2019 - 2:09 PM

THURBER

Appendix D

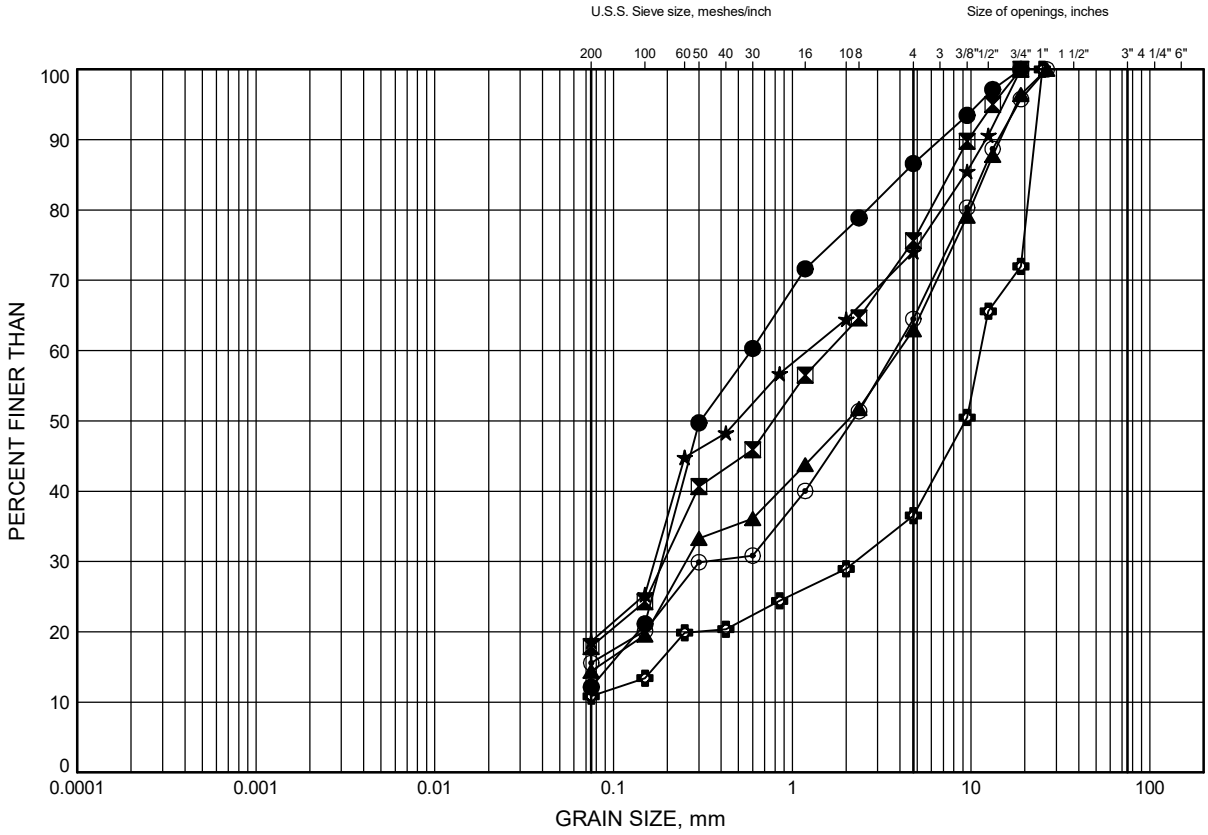
Geotechnical Laboratory Soil Test Results

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D1

Granular FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-01	0.39	206.71
⊠	19-02	0.24	213.42
▲	19-03	0.46	213.47
★	19-04	0.46	207.54
⊙	19-06	0.48	209.66
✿	19-07	0.38	212.39

Date August 2019

Project 13659

THURBER

Prep'd BH

Chkd. MRA

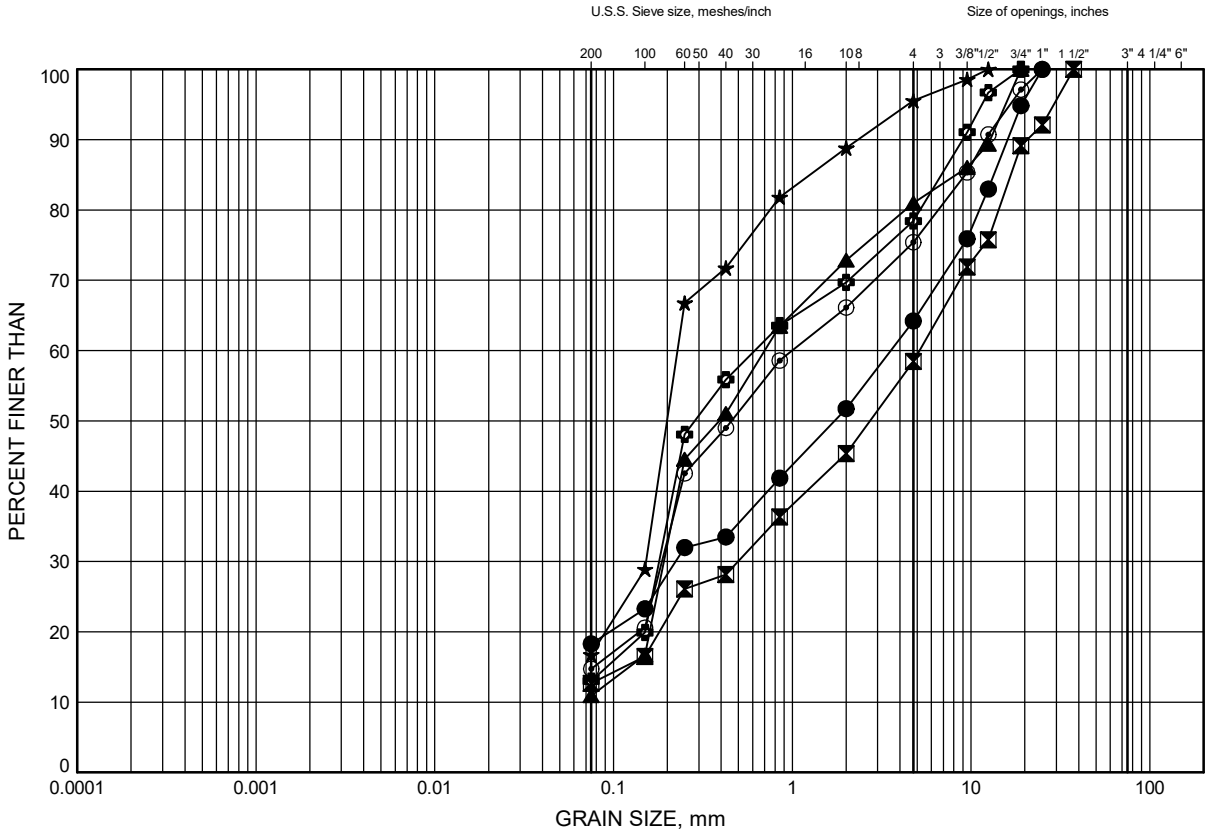
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D2

Granular FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-08	0.25	212.05
⊠	19-09	0.63	207.40
▲	19-10	0.30	205.29
★	19-11	1.62	198.17
⊙	19-13	0.30	204.80
✿	19-14	0.30	204.45

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Project 13659

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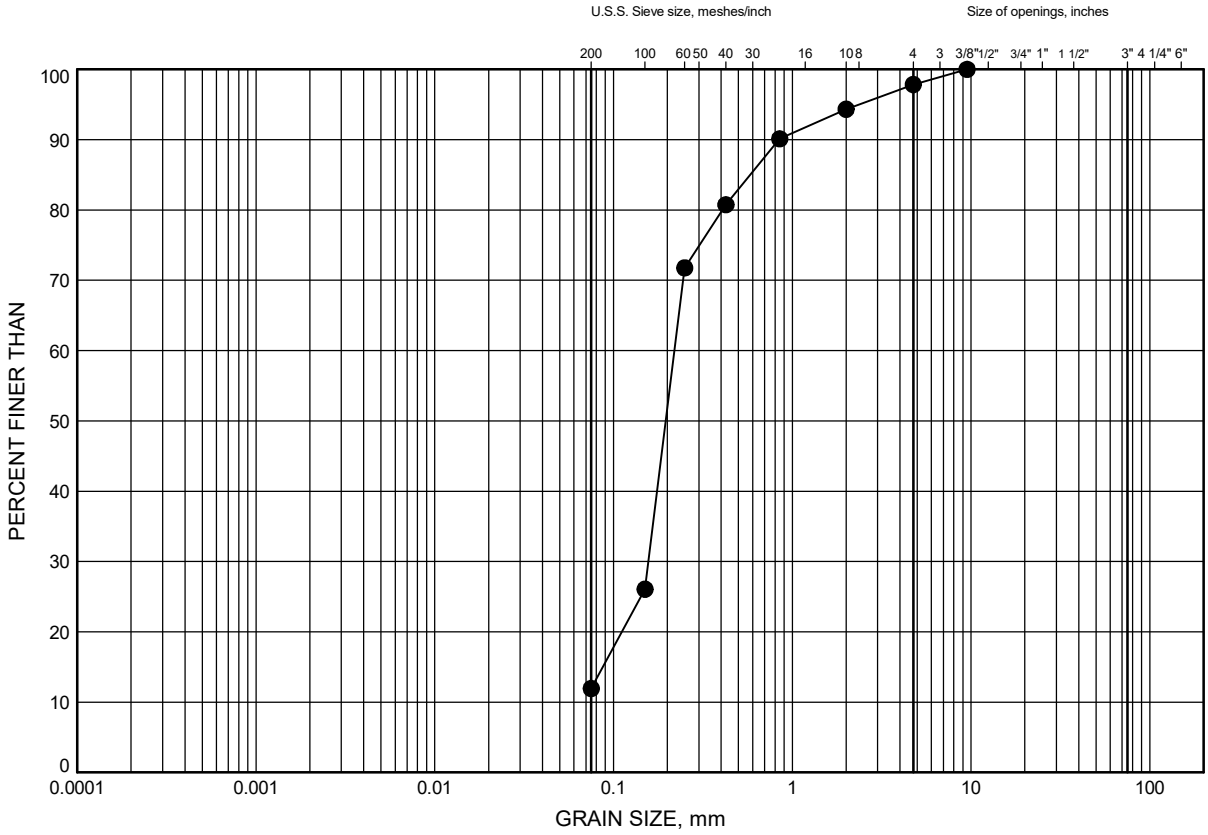
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D3

Granular FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-16	0.93	205.13

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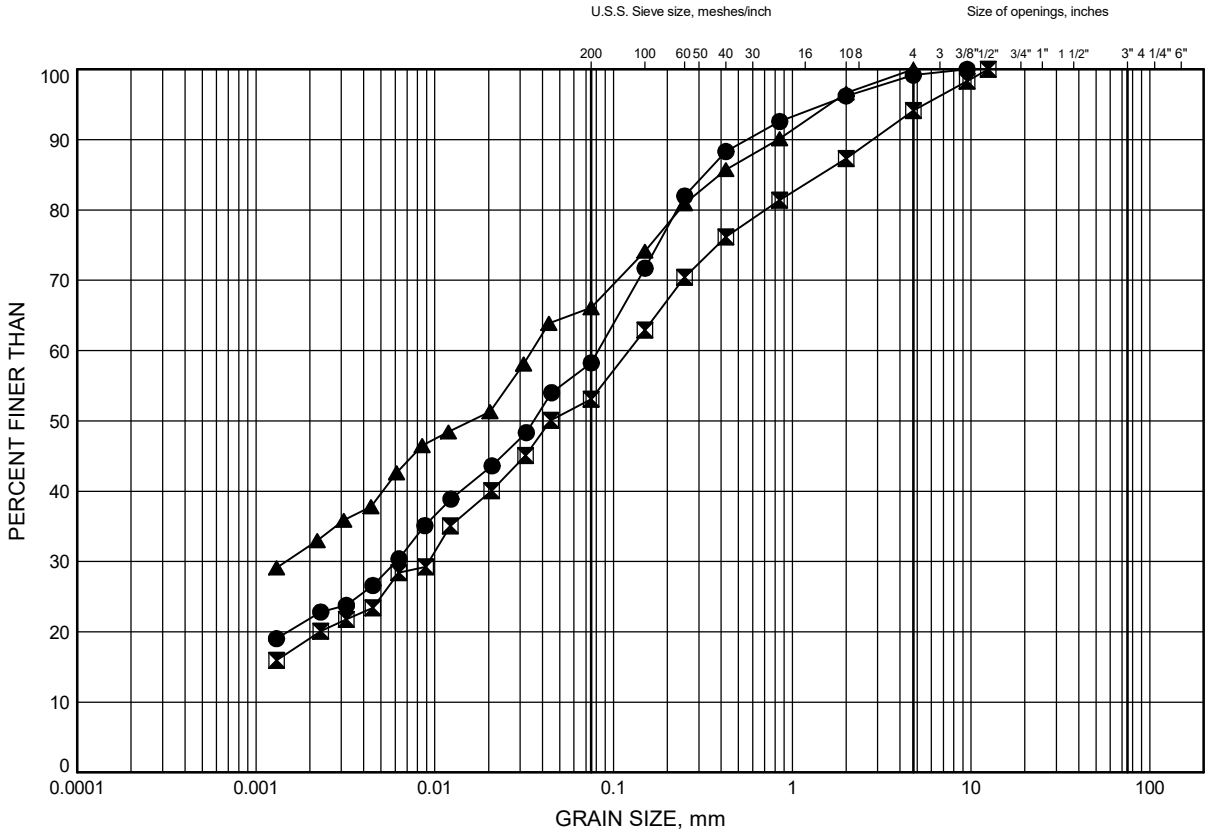
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D4

Silty CLAY FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	2.41	211.24
⊠	19-03	3.35	210.58
▲	19-16	2.59	203.47

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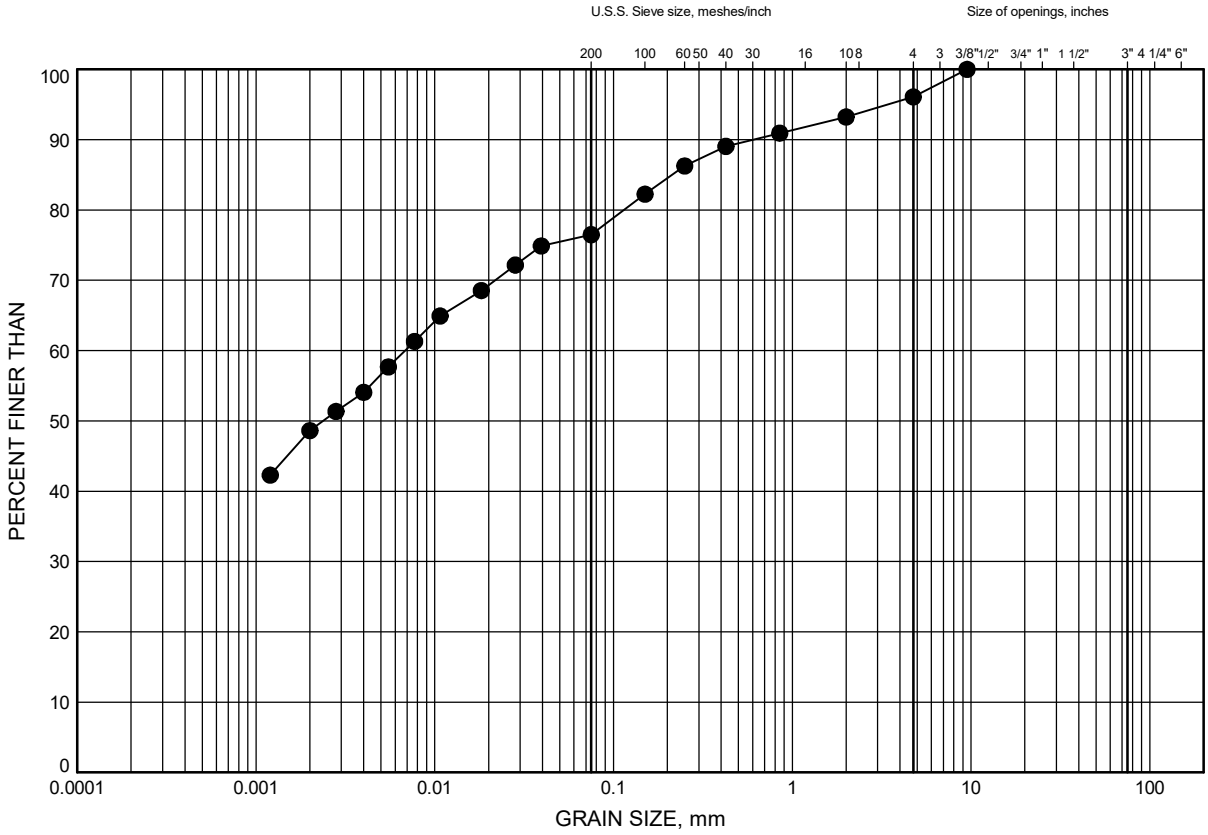
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D5

Alluvial Silty CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-03	10.97	202.96

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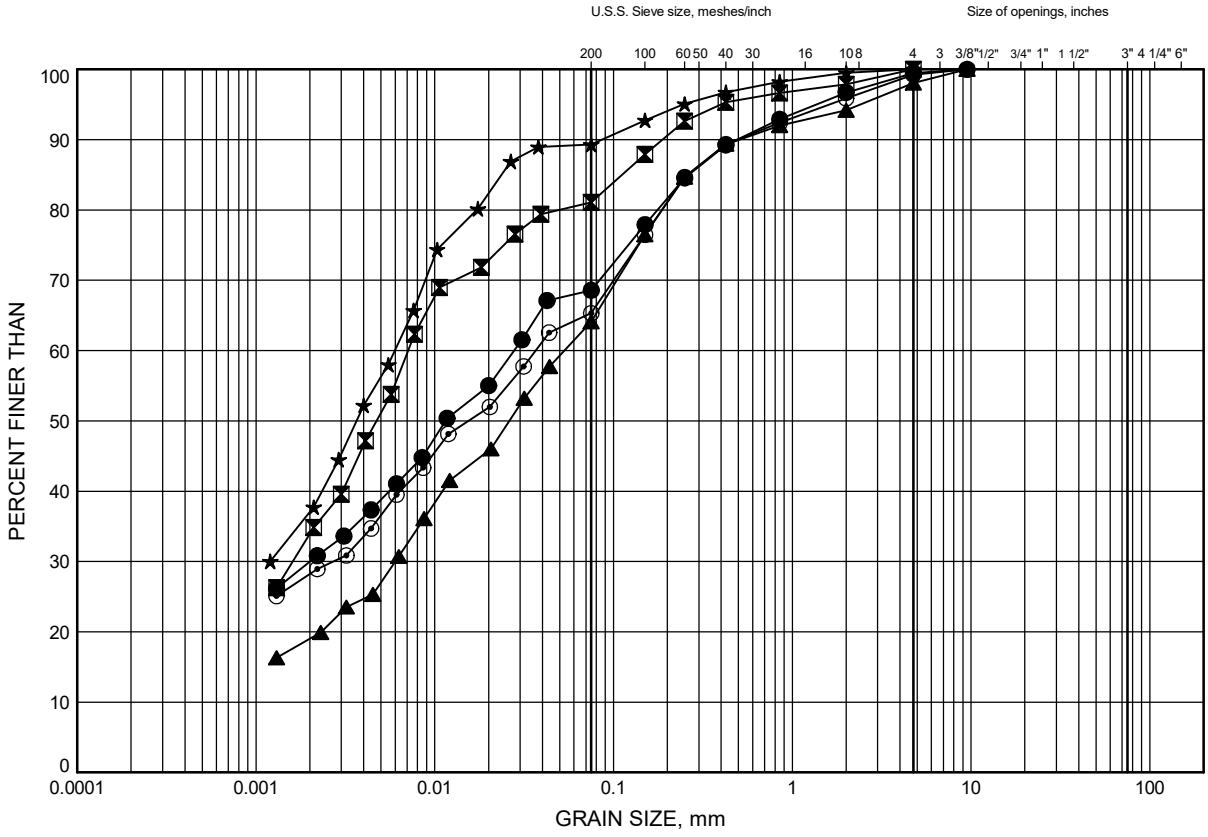
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D6

Upper Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	7.92	205.73
⊠	19-03	15.54	198.39
▲	19-09	4.80	203.23
★	19-12	2.59	201.06
⊙	19-14	2.59	202.17

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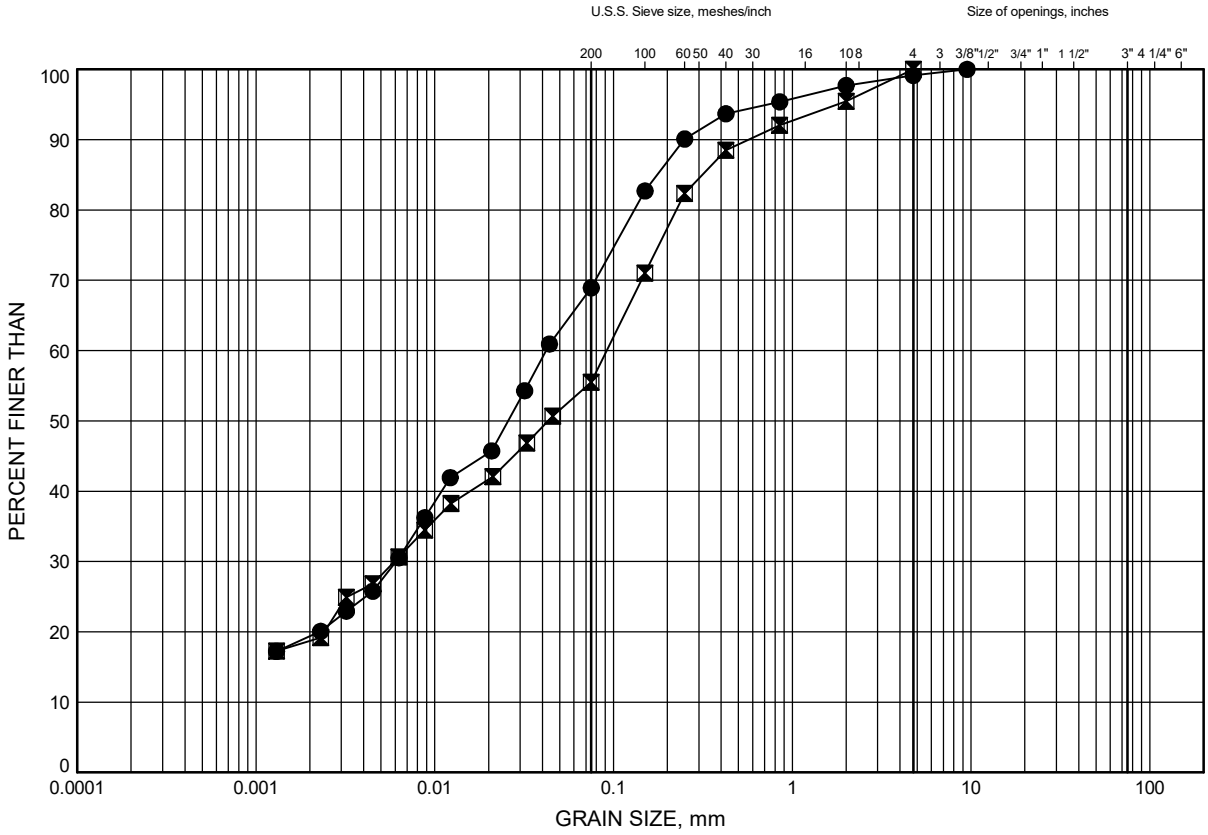
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D7

Upper Clayey SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-09	9.45	198.58
⊠	19-15	1.83	203.03

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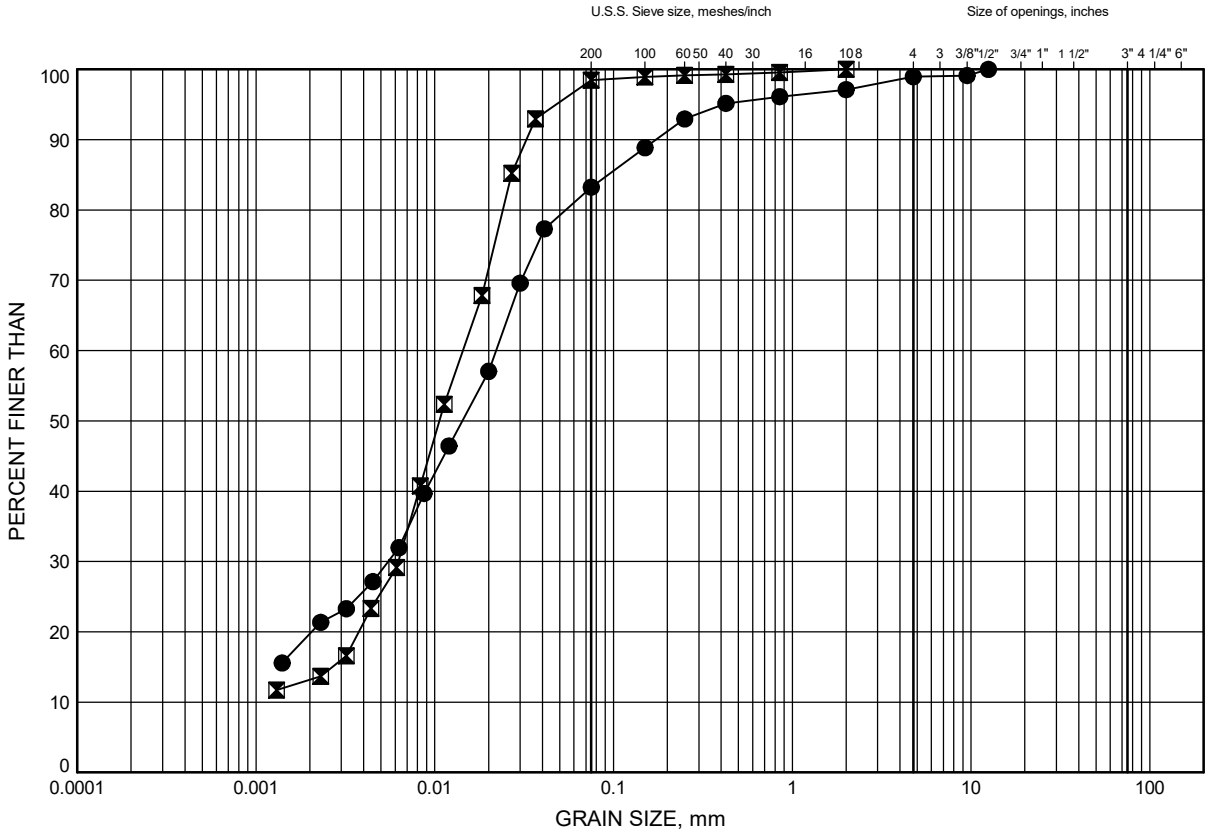
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D8

Clayey SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	18.59	195.07
⊠	19-10	1.83	203.76

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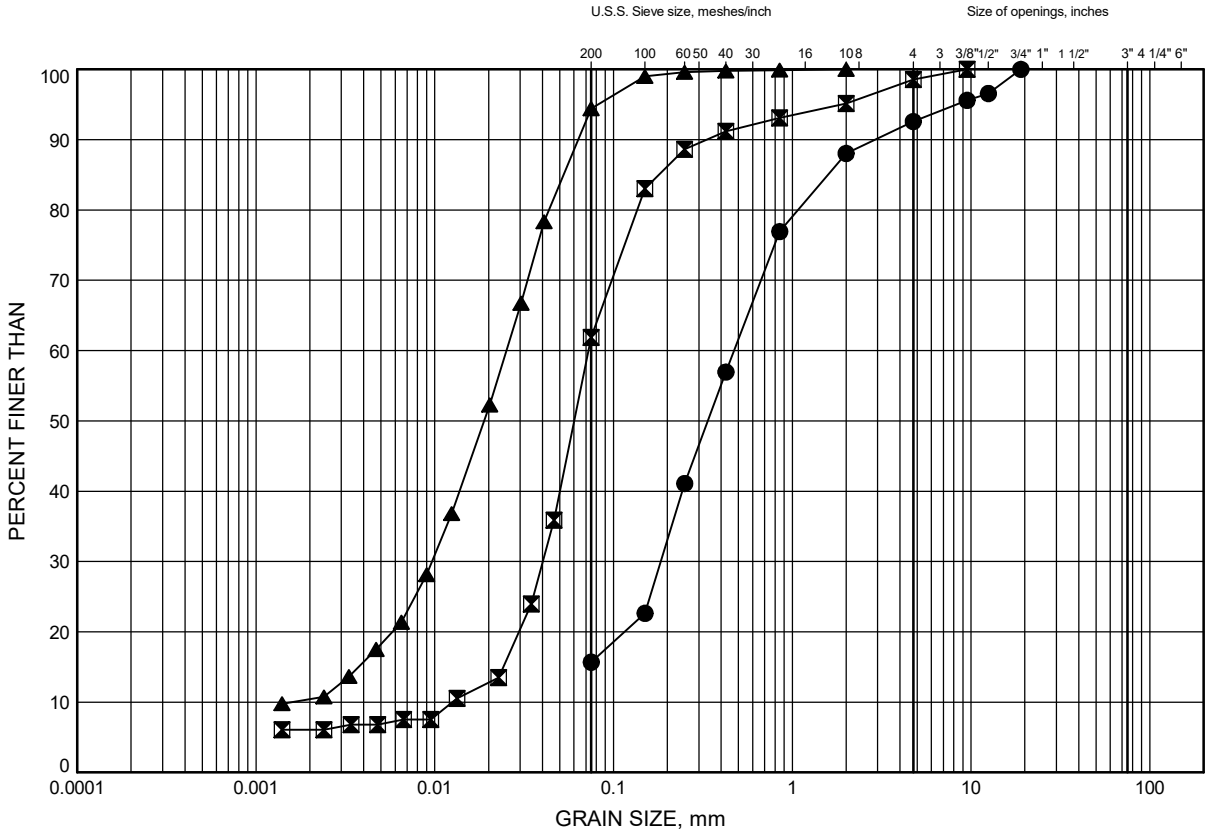
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D9

SAND to SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-05	3.35	204.14
⊠	19-11	7.92	191.87
▲	19-12	13.91	189.74

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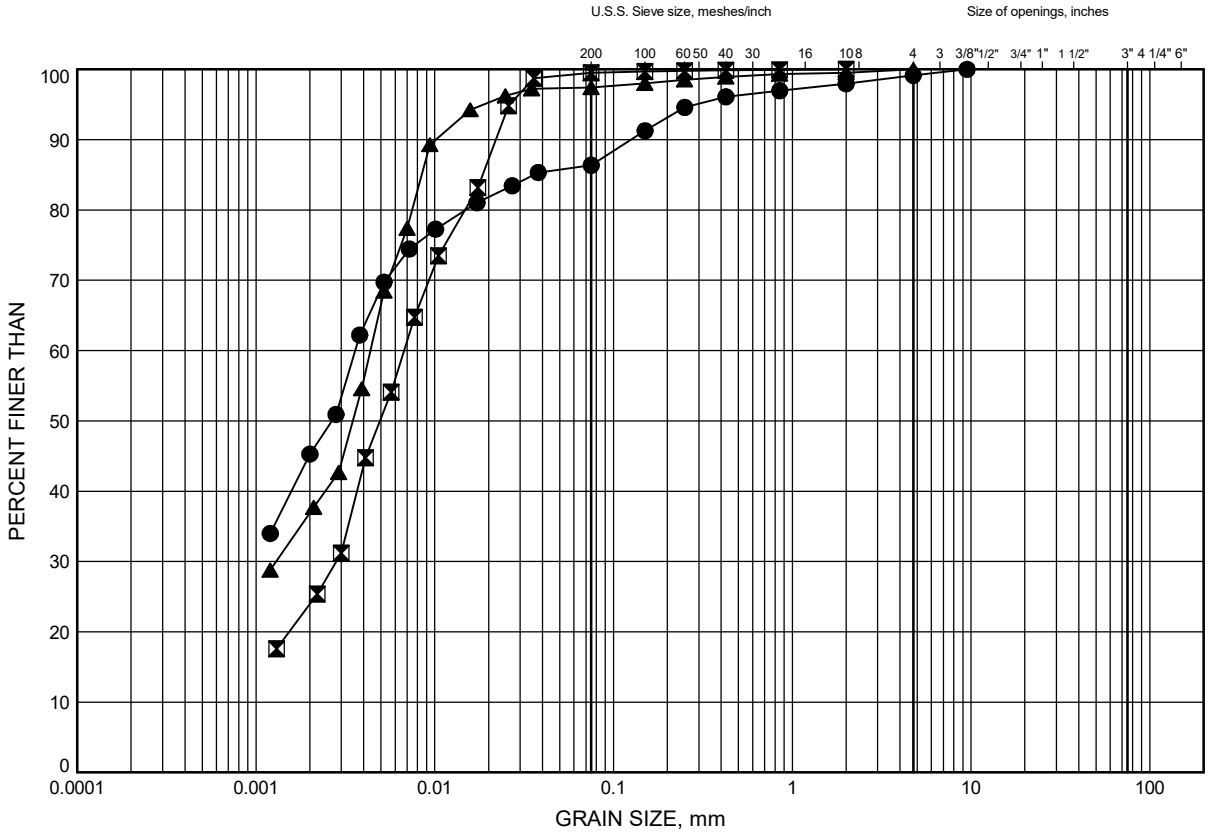
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D10

Lower Silty CLAY to Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	24.69	188.97
⊠	19-03	24.69	189.24
▲	19-10	18.49	187.10

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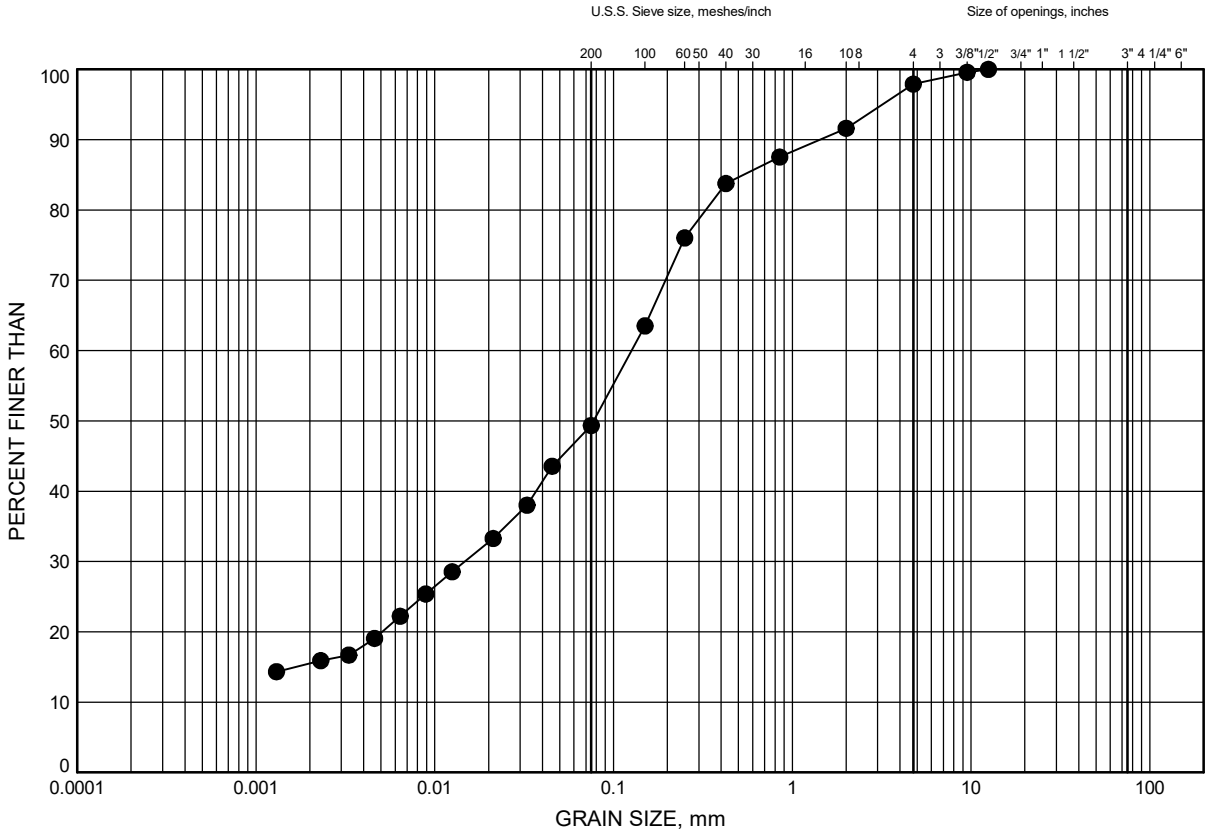
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D11

SILT and SAND TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-12	18.59	185.06

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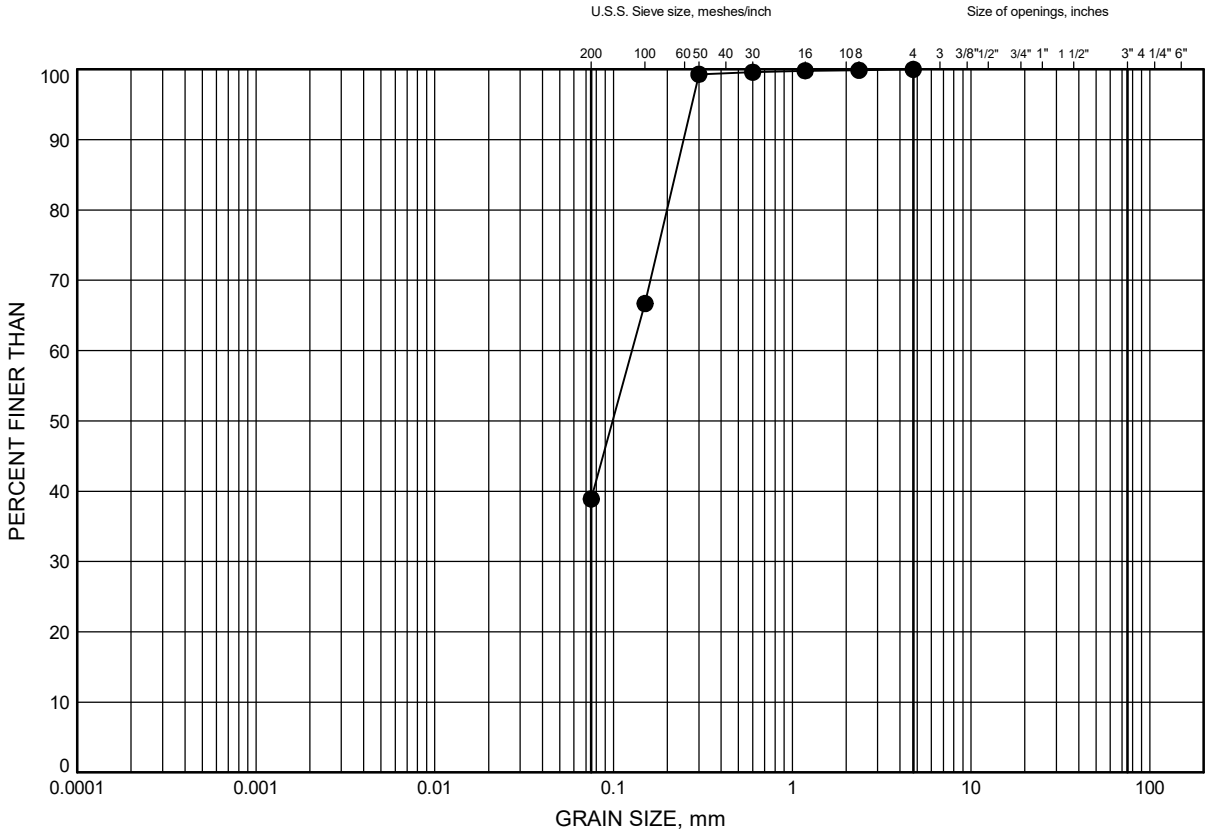
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D12

Lower Silty SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-03	30.78	183.15

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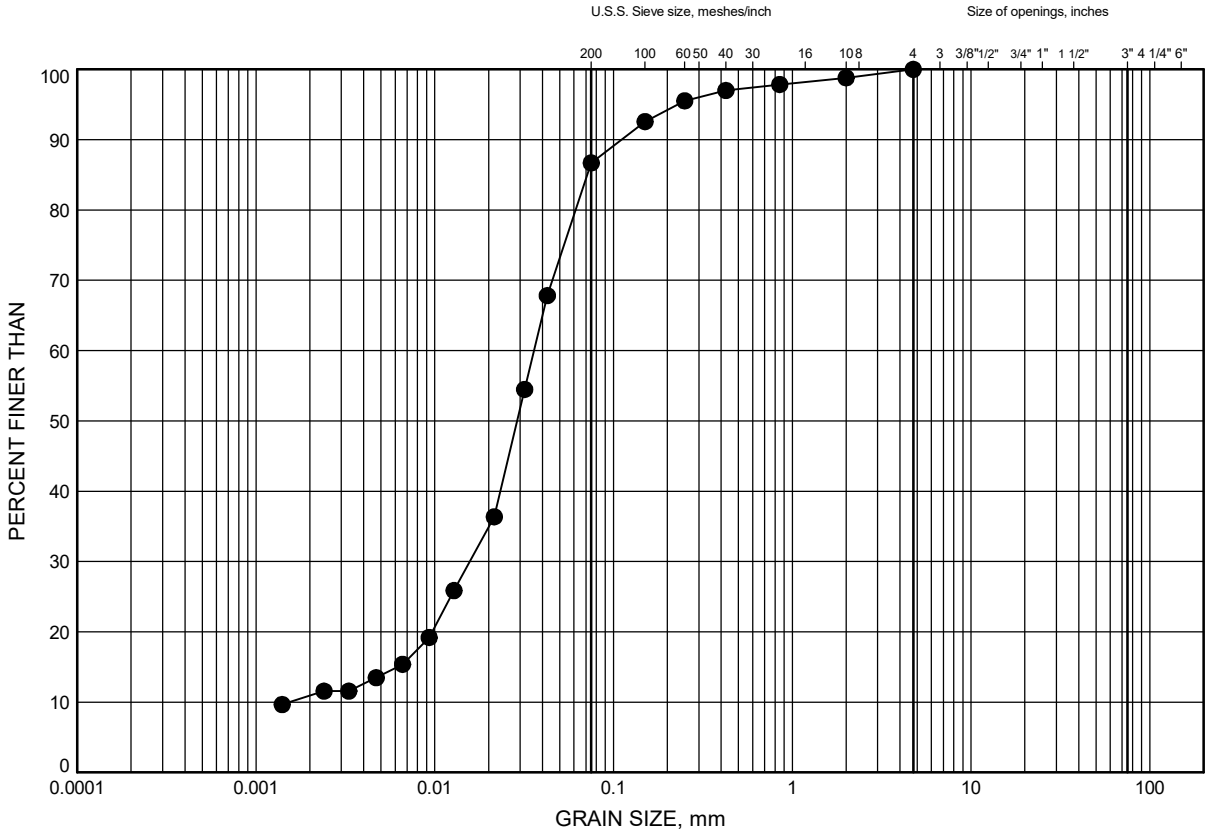
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D13

SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	33.83	179.83

Date August 2019

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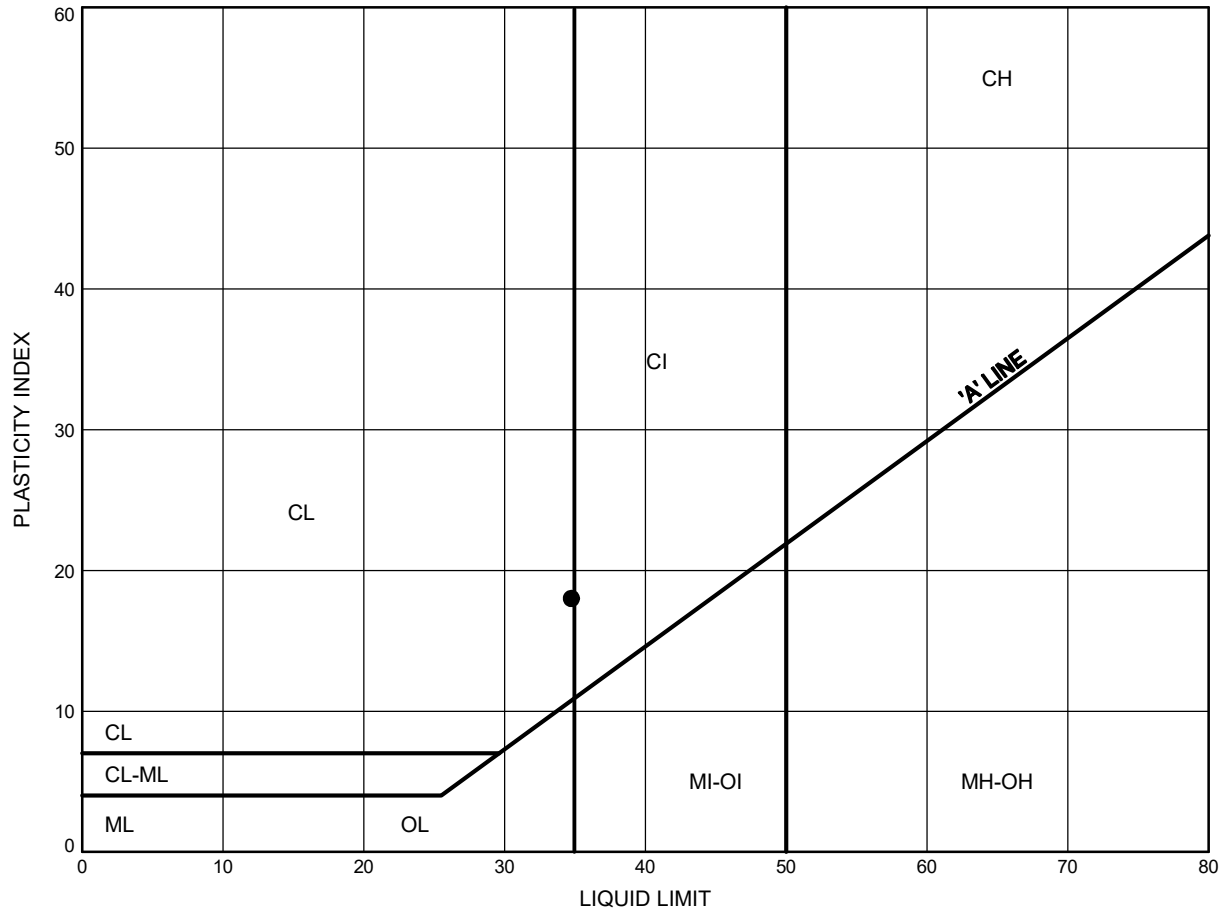
GRAIN SIZE DISTRIBUTION - THURBER TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D14

Silty CLAY FILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-16	2.59	203.47

Date August 2019

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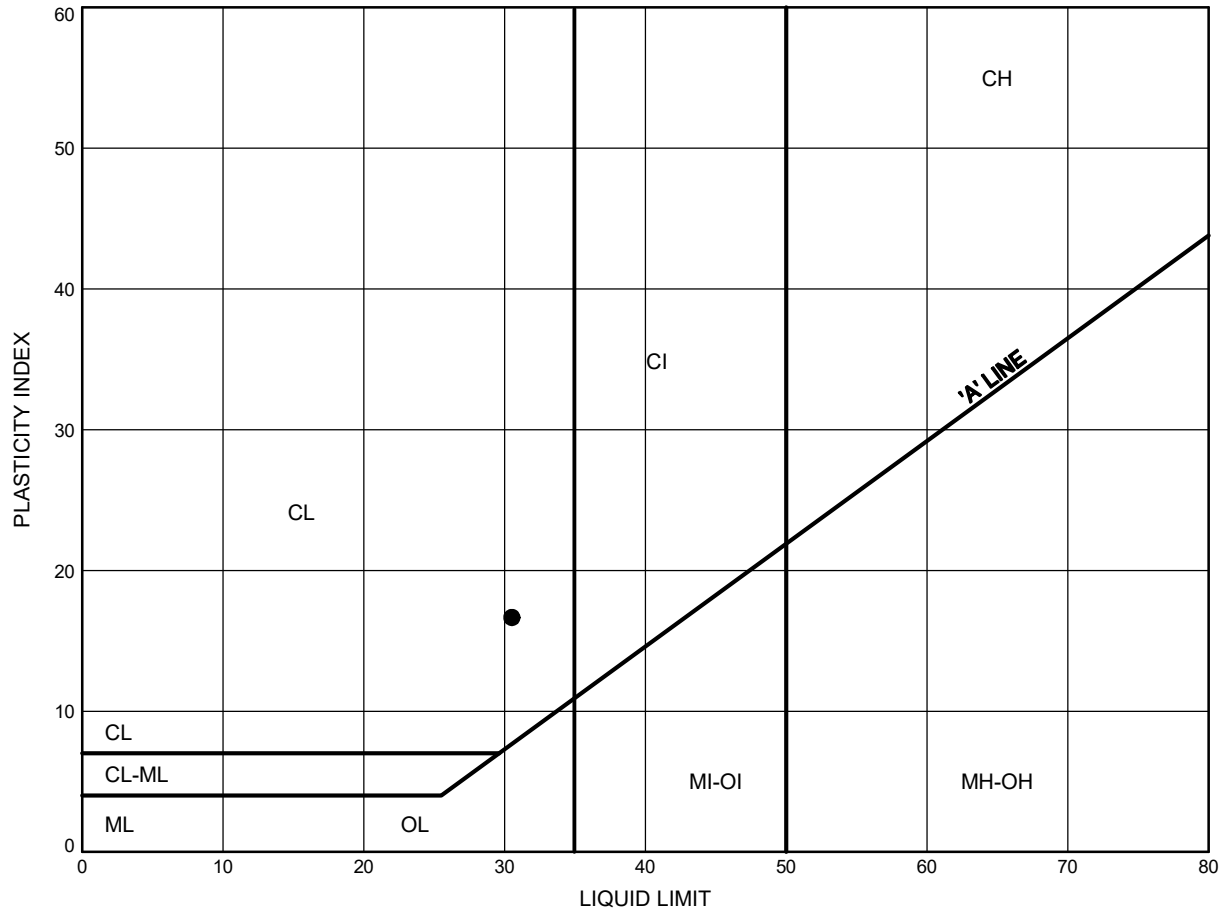
THURBALT TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D15

Alluvial Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-03	10.97	202.96

Date August 2019

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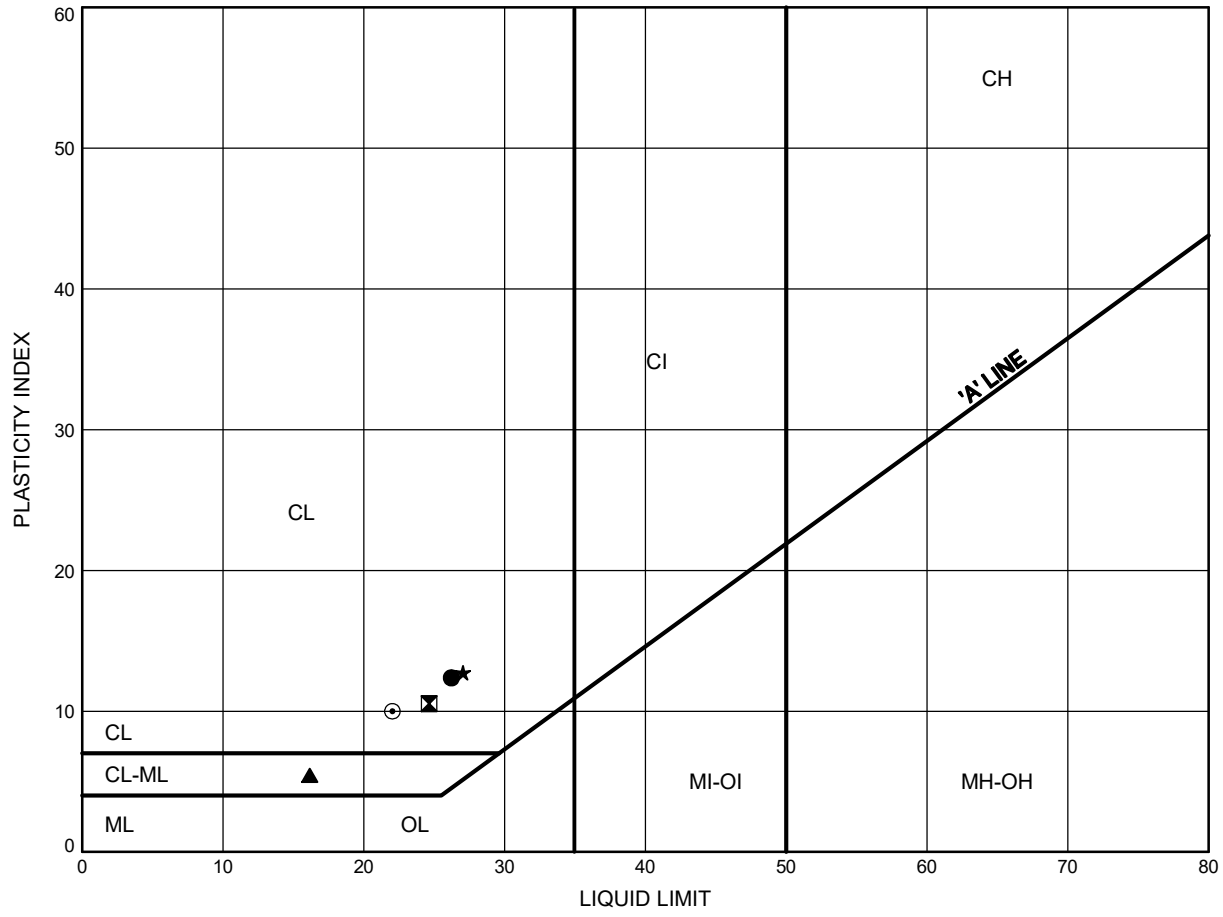
THURBALT TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D16

Upper SIlty CLAY to Clayey SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	7.92	205.73
⊠	19-03	15.54	198.39
▲	19-09	9.45	198.58
★	19-12	2.59	201.06
⊙	19-14	2.59	202.17

Date August 2019

Project 13659

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Chkd. MRA

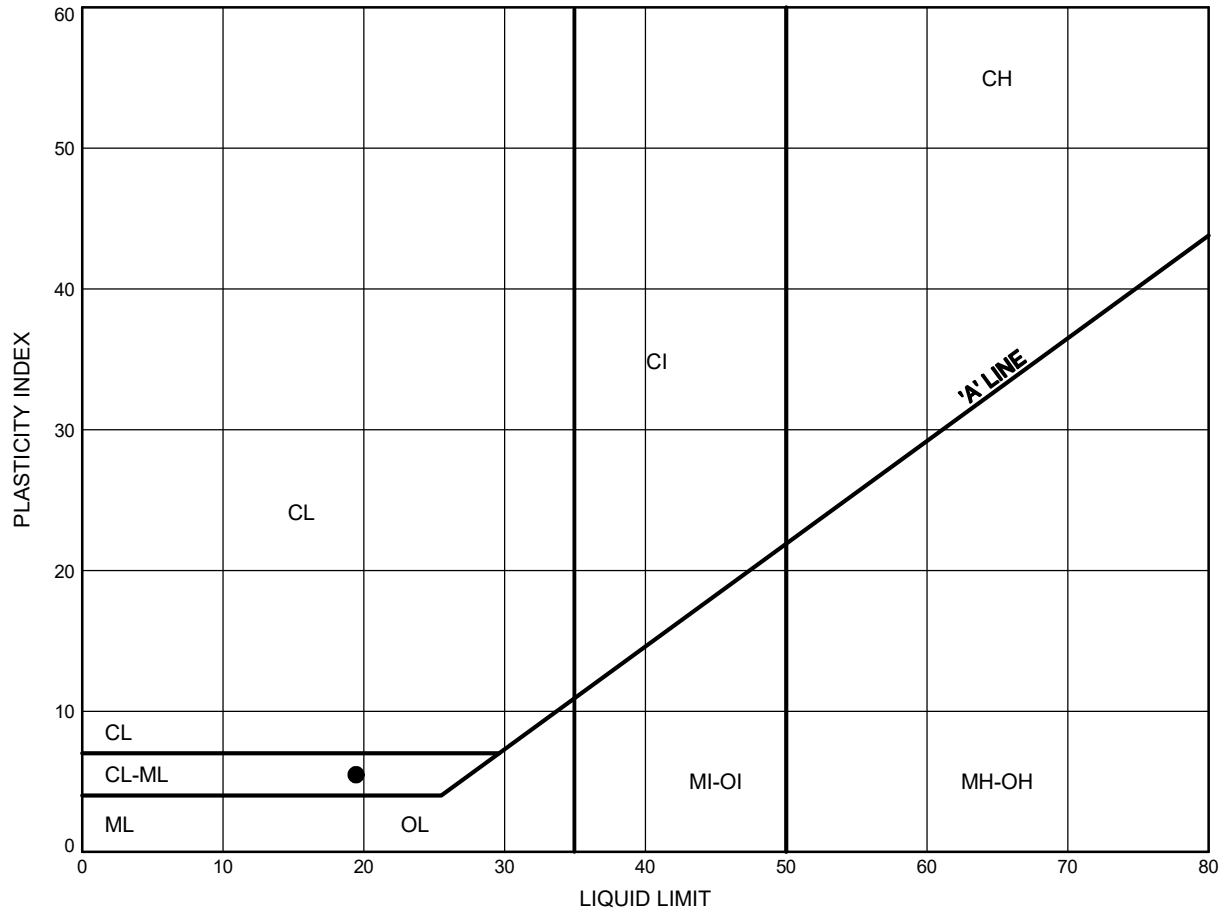
THURBALT TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D17

Clayey SILT



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-02	18.59	195.07

Date August 2019

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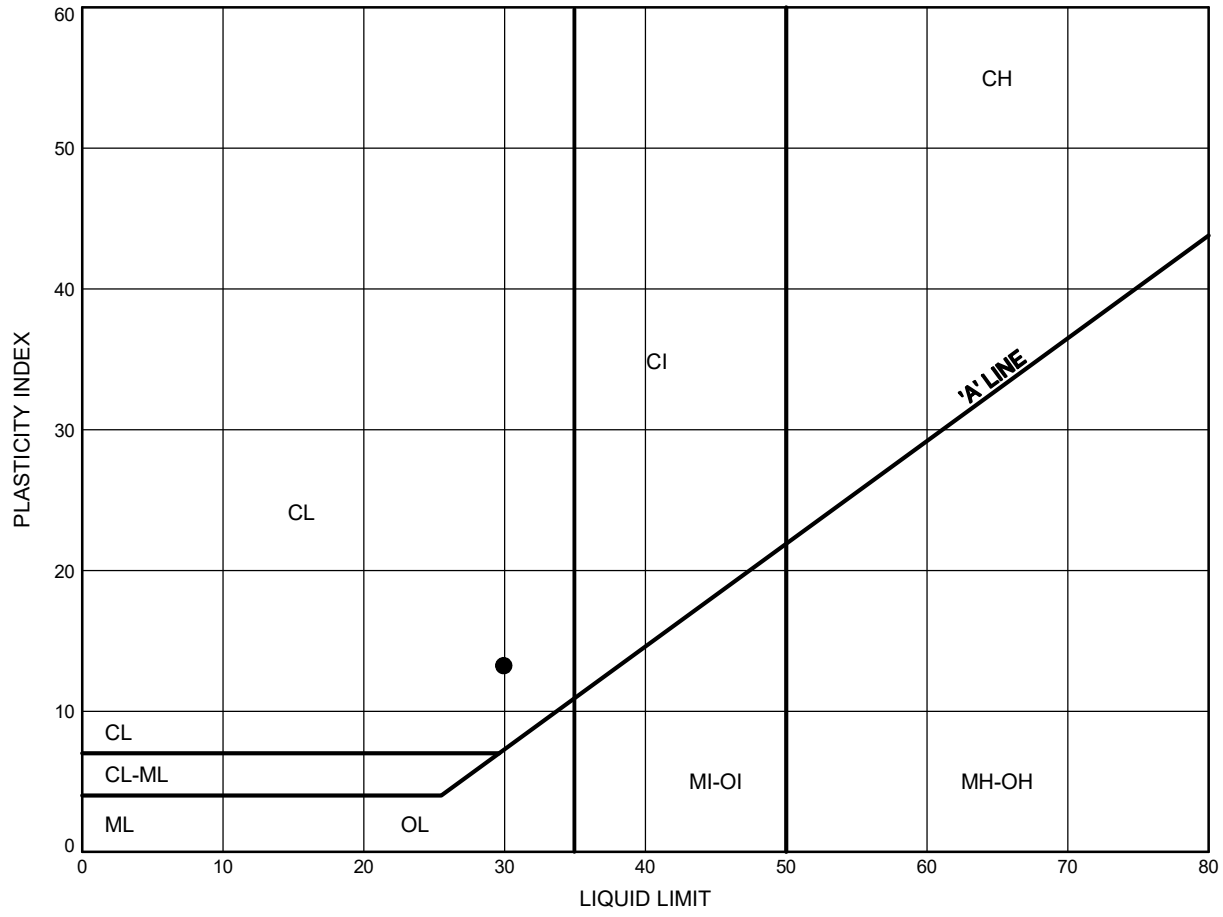
THURBALT TEL-13659.GPJ 8/28/19

Langstaff Road Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D18

Lower Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	19-10	18.49	187.10

Date August 2019

Project 13659

THURBER

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THURBALT TEL-13659.GPJ 8/28/19

THURBER

Appendix E

Laboratory Certificates of Analysis – Soil Management

FINAL REPORT

CA14541-APR19 R

13659 Langstaff Road

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14541-APR19 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	705-652-2000
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	
Email	kfurbacher@thurber.ca	SGS Reference	CA14541-APR19
Project	13659 Langstaff Road	Received	04/15/2019
Order Number		Approved	04/23/2019
Samples	Soil (2)	Report Number	CA14541-APR19 R
		Date Reported	04/23/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES

nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES

C50 response factors within 70% of nC10 + nC16 + nC34 average: YES

Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

SIGNATORIES

Brad Moore Hon. B.Sc

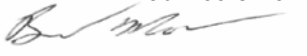

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11
				Sample Name	BH19-03 SS8	BH19-02 SS7
				Sample Matrix	Soil	Soil
				Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
BTEX						
Benzene	µg/g	0.02	0.02	0.32	< 0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	9.5	< 0.05	< 0.05
Toluene	µg/g	0.05	0.2	68	< 0.05	< 0.05
Xylene (total)	µg/g	0.05	0.05	26	< 0.05	< 0.05
m/p-xylene	µg/g	0.05			< 0.05	< 0.05
o-xylene	µg/g	0.05			< 0.05	< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11
				Sample Name	BH19-03 SS8	BH19-02 SS7
				Sample Matrix	Soil	Soil
				Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Hydrides						
Antimony	µg/g	0.8	1.3	40	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	18	2.7	3.3
Selenium	µg/g	0.7	1.5	5.5	< 0.7	< 0.7

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-03 SS8	BH19-02 SS7
					Sample Matrix	Soil	Soil
					Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Moisture Content	%	-			14.4	12.5
Barium	µg/g	0.1	220	670	66	56
Beryllium	µg/g	0.02	2.5	8	0.34	0.40
Boron	µg/g	1	36	120	2	7
Cadmium	µg/g	0.02	1.2	1.9	0.11	0.10
Chromium	µg/g	0.5	70	160	13	18
Cobalt	µg/g	0.01	21	80	5.6	8.8
Copper	µg/g	0.1	92	230	16	30
Lead	µg/g	0.1	120	120	17	12
Molybdenum	µg/g	0.1	2	40	0.2	0.4
Nickel	µg/g	0.5	82	270	13	19
Silver	µg/g	0.05	0.5	40	< 0.05	< 0.05
Thallium	µg/g	0.02	1	3.3	0.10	0.17
Uranium	µg/g	0.002	2.5	33	0.42	0.52
Vanadium	µg/g	3	86	86	21	23
Zinc	µg/g	0.7	290	340	49	80
Water Soluble Boron	µg/g	0.5		2	< 0.5	< 0.5

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-03 SS8	BH19-02 SS7
					Sample Matrix	Soil	Soil
					Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Other (ORP)						
Mercury	µg/g	0.05	0.27	3.9	0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	2.4	12	5.2	2.4
SAR Calcium	mg/L	0.09			20.1	21.4
SAR Magnesium	mg/L	0.02			2.9	2.2
SAR Sodium	mg/L	0.15			84.3	44.1
Conductivity	mS/cm	0.002	0.57	1.4	0.60	0.34
pH	pH Units	0.05			7.76	7.98
Chromium VI	µg/g	0.2	0.66	8	0.3	0.2
Free Cyanide	µg/g	0.05	0.051	0.051	< 0.05	< 0.05

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11
				Sample Name	BH19-03 SS8	BH19-02 SS7
				Sample Matrix	Soil	Soil
				Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
PHCs						
F1 (C6-C10)	µg/g	10	25	55	< 10	< 10
F1-BTEX (C6-C10)	µg/g	10			< 10	< 10
F2 (C10-C16)	µg/g	10	10	230	< 10	< 10
F3 (C16-C34)	µg/g	50	240	1700	< 50	114
F4 (C34-C50)	µg/g	50	120	3300	< 50	**276**
F4G-sg (GHH)	µg/g	200	120	3300		**927**
Chromatogram returned to baseline at nC50	Yes / No	-			YES	NO

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11
				Sample Name	BH19-03 SS8	BH19-02 SS7
				Sample Matrix	Soil	Soil
				Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
THMs (VOC)						
Bromodichloromethane	µg/g	0.05	0.05	18	< 0.05	< 0.05
Bromoform	µg/g	0.05	0.05	0.61	< 0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	13	< 0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11
				Sample Name	BH19-03 SS8	BH19-02 SS7
				Sample Matrix	Soil	Soil
				Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
VOC Surrogates						
Surr 1,2-Dichloroethane-d4	Surr Rec %	-			106	106
Surr 4-Bromofluorobenzene	Surr Rec %	-			96	93
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-			92	93

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11
				Sample Name	BH19-03 SS8	BH19-02 SS7
				Sample Matrix	Soil	Soil
				Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
VOCs						
Acetone	µg/g	0.5	0.5	16	< 0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	0.05	< 0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	0.21	< 0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	2.4	< 0.05	< 0.05
Chloroform	µg/g	0.05	0.05	0.47	< 0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	6.8	< 0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	9.6	< 0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	0.2	< 0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	16	< 0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	17	< 0.05	< 0.05
1,2-Dichloroethane	µg/g	0.05	0.05	0.05	< 0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	0.064	< 0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	1.3	< 0.05	< 0.05

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-03 SS8	BH19-02 SS7
					Sample Matrix	Soil	Soil
					Sample Date	02/04/2019	05/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
VOCs (continued)						
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	55	< 0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	0.16	< 0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03			< 0.03	< 0.03
trans-1,3-dichloropropene	µg/g	0.03			< 0.03	< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	0.18	< 0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	0.05	< 0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	46	< 0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	70	< 0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	31	< 0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	11	< 0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	1.6	< 0.05	< 0.05
Styrene	µg/g	0.05	0.05	34	< 0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	4.5	< 0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	0.087	< 0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	0.05	< 0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	6.1	< 0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	0.05	< 0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	0.91	< 0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.25	4	< 0.05	< 0.05
Vinyl Chloride	µg/g	0.02	0.02	0.032	< 0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L1	REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED L2
BH19-03 SS8					
Conductivity	EPA 6010/SM 2510	µg/g	0.60	0.57	
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	5.2	2.4	
BH19-02 SS7					
F4 (C34 to C50)	CCME Tier 1	µg/g	276	120	
Gravimetric Heavy Hydrocarbons	CCME Tier 1	µg/g	927	120	

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0329-APR19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5044-APR19	µg/g	0.05	<0.05	ND	20	97	80	120	97	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVIIC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0308-APR19	µg/g	0.2	<0.2	ND	20	97	80	120	96	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0102-APR19	µg/g	0.05	<0.05	ND	20	90	80	120	104	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0059-APR19	mg/L	0.09	<0.09	2	20	107	80	120	112	70	130
SAR Magnesium	ESG0059-APR19	mg/L	0.02	<0.02	ND	20	106	80	120	114	70	130
SAR Sodium	ESG0059-APR19	mg/L	0.15	<0.15	6	20	103	80	120	107	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0102-APR19	ug/g	0.05	<0.05	ND	20	94	70	130	103	70	130
Arsenic	EMS0102-APR19	µg/g	0.5	<0.5	4	20	94	70	130	102	70	130
Barium	EMS0102-APR19	ug/g	0.1	<0.1	2	20	101	70	130	108	70	130
Beryllium	EMS0102-APR19	µg/g	0.02	<0.02	4	20	100	70	130	99	70	130
Boron	EMS0102-APR19	µg/g	1	<1	9	20	106	70	130	98	70	130
Cadmium	EMS0102-APR19	µg/g	0.02	<0.02	ND	20	97	70	130	108	70	130
Cobalt	EMS0102-APR19	µg/g	0.01	<0.01	0	20	104	70	130	118	70	130
Chromium	EMS0102-APR19	µg/g	0.5	<0.5	1	20	105	70	130	117	70	130
Copper	EMS0102-APR19	µg/g	0.1	<0.1	11	20	104	70	130	111	70	130
Molybdenum	EMS0102-APR19	µg/g	0.1	<0.1	0	20	107	70	130	103	70	130
Nickel	EMS0102-APR19	ug/g	0.5	<0.5	3	20	106	70	130	117	70	130
Lead	EMS0102-APR19	ug/g	0.1	<0.1	1	20	97	70	130	106	70	130
Antimony	EMS0102-APR19	µg/g	0.8	<0.8	ND	20	104	70	130	111	70	130
Selenium	EMS0102-APR19	µg/g	0.7	<0.7	ND	20	99	70	130	103	70	130
Thallium	EMS0102-APR19	µg/g	0.02	<0.02	ND	20	96	70	130	105	70	130
Uranium	EMS0102-APR19	µg/g	0.002	<0.002	5	20	93	70	130	107	70	130
Vanadium	EMS0102-APR19	µg/g	3	<3	2	20	105	70	130	114	70	130
Zinc	EMS0102-APR19	µg/g	0.7	<0.7	7	20	100	70	130	109	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0266-APR19	µg/g	10	<10	ND	30	103	80	120	107	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0303-APR19	µg/g	10	<10	ND	30	112	80	120	110	60	140
F3 (C16-C34)	GCM0303-APR19	µg/g	50	<50	ND	30	112	80	120	110	60	140
F4 (C34-C50)	GCM0303-APR19	µg/g	50	<50	ND	30	112	80	120	110	60	140

QC SUMMARY

Petroleum Hydrocarbons (F4G)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F4G-sg (GHH)	GCM0357-APR19	µg/g	200	<200	NA	30	99	80	120	NA	60	140

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0070-APR19	pH Units	0.05		1	20	100	80	120			

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	86	50	140
1,1,1-Trichloroethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	86	50	140
1,1,2,2-Tetrachloroethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	88	50	140
1,1,2-Trichloroethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	88	50	140
1,1-Dichloroethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	85	50	140
1,1-Dichloroethylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	82	60	130	105	50	140
1,2-Dichlorobenzene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	88	50	140
1,2-Dichloroethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	78	60	130	87	50	140
1,2-Dichloropropane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	86	50	140
1,3-Dichlorobenzene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	87	50	140
1,4-Dichlorobenzene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	87	50	140
Acetone	GCM0265-APR19	µg/g	0.5	< 0.5	ND	50	80	50	140	108	50	140
Benzene	GCM0265-APR19	µg/g	0.02	< 0.02	ND	50	79	60	130	87	50	140
Bromodichloromethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	85	50	140
Bromoform	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	78	60	130	81	50	140
Bromomethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	84	50	140	88	50	140
Carbon tetrachloride	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	87	50	140
Chlorobenzene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	88	50	140
Chloroform	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	89	50	140
cis-1,2-Dichloroethylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	84	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0265-APR19	µg/g	0.03	< 0.03	ND	50	80	60	130	84	50	140
Dibromochloromethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	85	50	140
Dichlorodifluoromethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	82	50	140	67	50	140
Ethylbenzene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	90	50	140
Ethylenedibromide	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	87	50	140
n-Hexane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	78	50	140
m/p-xylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	88	50	140
Methyl ethyl ketone	GCM0265-APR19	µg/g	0.5	< 0.5	ND	50	82	50	140	88	50	140
Methyl isobutyl ketone	GCM0265-APR19	µg/g	0.5	< 0.5	ND	50	84	50	140	93	50	140
Methyl-t-butyl Ether	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	82	60	130	87	50	140
Methylene Chloride	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	89	50	140
o-xylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	87	50	140
Styrene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	88	50	140
Tetrachloroethylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	86	50	140
Toluene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	79	60	130	87	50	140
trans-1,2-Dichloroethylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	81	60	130	85	50	140
trans-1,3-dichloropropene	GCM0265-APR19	µg/g	0.03	< 0.03	ND	50	79	60	130	81	50	140
Trichloroethylene	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	80	60	130	89	50	140
Trichlorofluoromethane	GCM0265-APR19	µg/g	0.05	< 0.05	ND	50	82	50	140	101	50	140
Vinyl Chloride	GCM0265-APR19	µg/g	0.02	< 0.02	ND	50	80	50	140	89	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-IENVI SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0052-APR19	µg/g	0.5	<0.5	ND	20	98	80	120	103	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhiw
Received Date (mm/dd/yy): 04/15/2019
Received Time: 11:45
Received By (signature):
Custody Seal Present: ☐ NO
Custody Seal Intact: ☐ NO
Cooling Agent Present: ☑ ice applied by driver
Temperature Upon Receipt (°C) 8°, 8°, 8° 7.3
LAB LIMS #: CA14541-Apr19

REPORT INFORMATION	INVOICE INFORMATION	PROJECT INFORMATION
Company: Thurber Engineering Ltd.	☑ (same as Report Information)	Quotation #: P.O. #:
Contact: Karel Furbacher	Company:	Project #: 13659 Site Location/ID: Langstaff Road
Address: 103-2010 Winston Park Drive, Oakville, Ontario	Contact:	
Phone: 289-455-7296	Address:	
Email: kfurbacher@thurber.ca	Phone:	
Email: manderson@thurber.ca	Email:	

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153/04: ☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____ ☐ R/P/I ☒ I/C/C ☐ A/O — Soil Texture: ☐ Coarse ☐ Medium ☐ Fine

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☑ BTEX ☑ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	BH19-03 SS8	4/2/19	12:00 p.m.	2	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2	BH19-02 SS7	4/5/19	12:00 p.m.	2	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	**Signature:**	Date: 04/12/19 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	**Signature:**	Date: 04/12/19 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

FINAL REPORT

CA14705-APR19 R

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14705-APR19 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Rob Irwin B.Sc., C.Chem
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	2361
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	rob.irwin@sgs.com
Email	kfurbacher@thurber.ca	SGS Reference	CA14705-APR19
Project		Received	04/18/2019
Order Number		Approved	04/26/2019
Samples	Soil (2)	Report Number	CA14705-APR19 R
		Date Reported	04/26/2019

COMMENTS

Temperature of Sample upon Receipt: 3 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

SIGNATORIES

Rob Irwin B.Sc., C.Chem

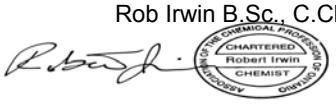

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project:
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-07 SS2	BH19-09 SS2B
					Sample Matrix	Soil	Soil
					Sample Date	12/04/2019	10/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Hydrides						
Antimony	µg/g	0.8	1.3	50	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	18	2.4	2.6
Selenium	µg/g	0.7	1.5	5.5	< 0.7	< 0.7

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-07 SS2	BH19-09 SS2B
					Sample Matrix	Soil	Soil
					Sample Date	12/04/2019	10/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**
Metals and Inorganics						
Moisture Content	%	-			16.8	17.0
Barium	µg/g	0.1	220	670	100	68
Beryllium	µg/g	0.02	2.5	10	0.49	0.40
Boron	µg/g	1	36	120	7	6
Cadmium	µg/g	0.02	1.2	1.9	0.10	0.26
Chromium	µg/g	0.5	70	160	20	17
Cobalt	µg/g	0.01	21	100	9.3	6.4
Copper	µg/g	0.1	92	300	17	19
Lead	µg/g	0.1	120	120	7.7	36
Molybdenum	µg/g	0.1	2	40	0.3	0.4
Nickel	µg/g	0.5	82	340	20	15
Silver	µg/g	0.05	0.5	50	< 0.05	< 0.05
Thallium	µg/g	0.02	1	3.3	0.18	0.13

Client: Thurber Engineering Ltd.
Project:
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED
L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-07 SS2	BH19-09 SS2B
					Sample Matrix	Soil	Soil
					Sample Date	12/04/2019	10/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**		**Result**	**Result**
Metals and Inorganics (continued)							
Uranium	µg/g	0.002	2.5	33		0.54	0.49
Vanadium	µg/g	3	86	86		29	23
Zinc	µg/g	0.7	290	340		45	140
Water Soluble Boron	µg/g	0.5		2		< 0.5	< 0.5

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED
L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11
					Sample Name	BH19-07 SS2	BH19-09 SS2B
					Sample Matrix	Soil	Soil
					Sample Date	12/04/2019	10/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**		**Result**	**Result**
Other (ORP)							
Mercury	µg/g	0.05	0.27	20		< 0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	2.4	12		7.1	7.8
SAR Calcium	mg/L	0.09				51.7	33.9
SAR Magnesium	mg/L	0.02				4.0	57.4
SAR Sodium	mg/L	0.15				193	385
Conductivity	mS/cm	0.002	0.57	1.4		1.4	2.0
pH	pH Units	0.05				7.75	NSS
Chromium VI	µg/g	0.2	0.66	10		0.2	< 0.2
Free Cyanide	µg/g	0.05				< 0.05	< 0.05

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L1	REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED L2
BH19-07 SS2					
Conductivity	EPA 6010/SM 2510	µg/g	1.4	0.57	
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	7.1	2.4	
BH19-09 SS2B					
Conductivity	EPA 6010/SM 2510	µg/g	2.0	0.57	1.4
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	7.8	2.4	

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0380-APR19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA0147-APR19	µg/g	0.05	<0.05	ND	20	89	80	120	99	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVIIC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0338-APR19	µg/g	0.2	<0.2	ND	20	96	80	120	87	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0130-APR19	µg/g	0.05	<0.05	ND	20	NV	80	120	95	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0070-APR19	mg/L	0.09	<0.09	3	20	99	80	120	106	70	130
SAR Magnesium	ESG0070-APR19	mg/L	0.02	<0.02	1	20	99	80	120	109	70	130
SAR Sodium	ESG0070-APR19	mg/L	0.15	<0.15	ND	20	99	80	120	105	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0130-APR19	ug/g	0.05	<0.05	ND	20	96	70	130	98	70	130
Arsenic	EMS0130-APR19	µg/g	0.5	<0.5	3	20	101	70	130	104	70	130
Barium	EMS0130-APR19	ug/g	0.1	<0.1	3	20	106	70	130	103	70	130
Beryllium	EMS0130-APR19	µg/g	0.02	<0.02	8	20	103	70	130	94	70	130
Boron	EMS0130-APR19	µg/g	1	<1	6	20	108	70	130	100	70	130
Cadmium	EMS0130-APR19	µg/g	0.02	<0.02	17	20	100	70	130	108	70	130
Cobalt	EMS0130-APR19	µg/g	0.01	<0.01	2	20	104	70	130	119	70	130
Chromium	EMS0130-APR19	µg/g	0.5	<0.5	7	20	103	70	130	113	70	130
Copper	EMS0130-APR19	µg/g	0.1	<0.1	0	20	104	70	130	113	70	130
Molybdenum	EMS0130-APR19	µg/g	0.1	<0.1	2	20	101	70	130	107	70	130
Nickel	EMS0130-APR19	ug/g	0.5	<0.5	2	20	105	70	130	118	70	130
Lead	EMS0130-APR19	ug/g	0.1	<0.1	3	20	102	70	130	103	70	130
Antimony	EMS0130-APR19	µg/g	0.8	<0.8	ND	20	99	70	130	118	70	130
Selenium	EMS0130-APR19	µg/g	0.7	<0.7	ND	20	101	70	130	101	70	130
Thallium	EMS0130-APR19	µg/g	0.02	<0.02	8	20	102	70	130	105	70	130
Uranium	EMS0130-APR19	µg/g	0.002	<0.002	4	20	97	70	130	104	70	130
Vanadium	EMS0130-APR19	µg/g	3	<3	3	20	105	70	130	116	70	130
Zinc	EMS0130-APR19	µg/g	0.7	<0.7	0	20	99	70	130	106	70	130

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0093-APR19	pH Units	0.05		0	20	100	80	120			

Water Soluble Boron

Method: O.Reg. 153/04 I Internal ref.: ME-CA-IENVI SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0069-APR19	µg/g	0.5	<0.5	ND	20	101	80	120	109	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

SGS Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhiw
Received Date (mm/dd/yy): 04/18/2019
Received Time: 14:00
Received By (signature):
Custody Seal Present: ☑ no
Custody Seal Intact: ☑ no
Cooling Agent Present: ☑ Ice applied by driver
Temperature Upon Receipt (°C): 4°, 4°, 4° 3.3
LAB LIMS #: CA14705-Apr19

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Karel Furbacher
Address: 103-2010 Winston Park Drive, Oakville, Ontario
Phone: 289-455-7296
Email: kfurbacher@thurber.ca
Email: manderson@thurber.ca

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #:
P.O. #:
Project #: 13659
Site Location/ID: Langstaff Road

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:
Rush Confirmation ID:

REGULATIONS

Regulation 153/04:
☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____
☐ R/P/I ☑ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☑ Fine

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☑ BTEX ☑ VOC ☐ F2-F4 ☐	THM ☐ BTEX ☐ VOC ☑	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	BH19-07 SS2	4/12/19	10:30 a.m.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2	BH19-09 SS2B	4/10/19	10:00 a.m.	2	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	**Signature:**	Date: 04/17/19	(mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	**Signature:**	Date: 04/17/19	(mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

FINAL REPORT

CA14798-APR19 R

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14798-APR19 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Catharine Arnold, B.Sc., C.Chem
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	705-652-2618
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	catharine.arnold@sgs.com
Email	kfurbacher@thurber.ca	SGS Reference	CA14798-APR19
Project		Received	04/23/2019
Order Number		Approved	04/30/2019
Samples	Soil (4)	Report Number	CA14798-APR19 R
		Date Reported	04/30/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES

nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES

C50 response factors within 70% of nC10 + nC16 + nC34 average: YES

Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

Method deviation: VOC and/or F1 sample vials for all samples contained a ratio of ~1:1 sample wet weight:methanol, whereas the method requires a ratio of 1:2 sample wet weight:methanol.

SIGNATORIES

Catharine Arnold, B.Sc., C.Chem

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project:
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11	12	13
				Sample Name	BH19-09 SS4	BH19-10 SS6	BH19-11 SS3B	BH19-11 SS6
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Date	10/04/2019	12/04/2019	17/04/2019	17/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
BTEX								
Benzene	µg/g	0.02	0.02	0.4	< 0.02	< 0.02	< 0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	19	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	µg/g	0.05	0.2	78	< 0.05	< 0.05	< 0.05	< 0.05
Xylene (total)	µg/g	0.05	0.05	30	< 0.05	< 0.05	< 0.05	< 0.05
m/p-xylene	µg/g	0.05			< 0.05	< 0.05	< 0.05	< 0.05
o-xylene	µg/g	0.05			< 0.05	< 0.05	< 0.05	< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	11	12	13
				Sample Name	BH19-10 SS6	BH19-11 SS3B	BH19-11 SS6
				Sample Matrix	Soil	Soil	Soil
				Sample Date	12/04/2019	17/04/2019	17/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
Hydrides							
Antimony	µg/g	0.8	1.3	50	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	18	0.7	2.1	0.6
Selenium	µg/g	0.7	1.5	5.5	< 0.7	< 0.7	< 0.7

Client: Thurber Engineering Ltd.
Project:
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11	12	13
					Sample Name	BH19-09 SS4	BH19-10 SS6	BH19-11 SS3B	BH19-11 SS6
					Sample Matrix	Soil	Soil	Soil	Soil
					Sample Date	10/04/2019	12/04/2019	17/04/2019	17/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics								
Moisture Content	%	-			11.2	13.6	13.5	25.0
Barium	µg/g	0.1	220	670		7.2	59	14
Beryllium	µg/g	0.02	2.5	10		0.09	0.39	0.10
Boron	µg/g	1	36	120		2	5	1
Cadmium	µg/g	0.02	1.2	1.9		0.05	0.10	0.07
Chromium	µg/g	0.5	70	160		5.1	16	5.0
Cobalt	µg/g	0.01	21	100		2.4	6.9	2.0
Copper	µg/g	0.1	92	300		3.8	14	3.6
Lead	µg/g	0.1	120	120		1.7	6.9	1.8
Molybdenum	µg/g	0.1	2	40		0.2	0.2	0.1
Nickel	µg/g	0.5	82	340		2.9	12	2.9
Silver	µg/g	0.05	0.5	50		< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	1	3.3		0.03	0.12	0.03
Uranium	µg/g	0.002	2.5	33		0.27	0.41	0.26
Vanadium	µg/g	3	86	86		11	24	8
Zinc	µg/g	0.7	290	340		8.8	35	11
Water Soluble Boron	µg/g	0.5		2		< 0.5	< 0.5	< 0.5

Client: Thurber Engineering Ltd.
Project:
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11	12	13
					Sample Name	BH19-09 SS4	BH19-10 SS6	BH19-11 SS3B	BH19-11 SS6
					Sample Matrix	Soil	Soil	Soil	Soil
					Sample Date	10/04/2019	12/04/2019	17/04/2019	17/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Other (ORP)								
Mercury	µg/g	0.05	0.27	20		< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	2.4	12		1.8	20.6	4.7
SAR Calcium	mg/L	0.09				12.2	16.6	68.2
SAR Magnesium	mg/L	0.02				1.4	14.1	5.1
SAR Sodium	mg/L	0.15				24.6	755	133
Conductivity	mS/cm	0.002	0.57	1.4	0.99	0.22	3.2	1.4
pH	pH Units	0.05				8.12	7.96	7.65
Chromium VI	µg/g	0.2	0.66	10		< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05			< 0.05	< 0.05	< 0.05	< 0.05

Client: Thurber Engineering Ltd.
Project:
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11	12	13
					Sample Name	BH19-09 SS4	BH19-10 SS6	BH19-11 SS3B	BH19-11 SS6
					Sample Matrix	Soil	Soil	Soil	Soil
					Sample Date	10/04/2019	12/04/2019	17/04/2019	17/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
PHCs								
F1 (C6-C10)	µg/g	10	25	65	< 10	< 10	< 10	< 10
F1-BTEX (C6-C10)	µg/g	10			< 10	< 10	< 10	< 10
F2 (C10-C16)	µg/g	10	10	250	< 10	< 10	< 10	< 10
F3 (C16-C34)	µg/g	50	240	2500	< 50	< 50	< 50	< 50
F4 (C34-C50)	µg/g	50	120	6600	< 50	< 50	< 50	< 50
Chromatogram returned to baseline at nC50	Yes / No	-			YES	YES	YES	YES

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L1	REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED L2
BH19-09 SS4					
Conductivity	EPA 6010/SM 2510	mS/cm	0.99	0.57	
BH19-11 SS3B					
Conductivity	EPA 6010/SM 2510	mS/cm	3.2	0.57	1.4
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	20.6	2.4	12
BH19-11 SS6					
Conductivity	EPA 6010/SM 2510	mS/cm	1.4	0.57	
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	4.7	2.4	

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0467-APR19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		
Conductivity	EWL0515-APR19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5066-APR19	µg/g	0.05	<0.05	ND	20	98	80	120	84	75	125
Free Cyanide	SKA5078-APR19	µg/g	0.05	<0.05	ND	20	100	80	120	90	75	125

QC SUMMARY

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0398-APR19	µg/g	0.2	<0.2	ND	20	98	80	120	106	75	125

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0146-APR19	µg/g	0.05	<0.05	ND	20	NV	80	120	100	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0080-APR19	mg/L	0.09	<0.09	0	20	100	80	120	93	70	130
SAR Magnesium	ESG0080-APR19	mg/L	0.02	<0.02	ND	20	100	80	120	95	70	130
SAR Sodium	ESG0080-APR19	mg/L	0.15	<0.15	ND	20	97	80	120	94	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0146-APR19	ug/g	0.05	<0.05	19	20	92	70	130	95	70	130
Arsenic	EMS0146-APR19	µg/g	0.5	<0.5	1	20	100	70	130	96	70	130
Barium	EMS0146-APR19	ug/g	0.1	<0.1	2	20	108	70	130	93	70	130
Beryllium	EMS0146-APR19	µg/g	0.02	<0.02	3	20	103	70	130	90	70	130
Boron	EMS0146-APR19	µg/g	1	<1	2	20	98	70	130	107	70	130
Cadmium	EMS0146-APR19	µg/g	0.02	<0.02	20	20	105	70	130	110	70	130
Cobalt	EMS0146-APR19	µg/g	0.01	<0.01	3	20	106	70	130	112	70	130
Chromium	EMS0146-APR19	µg/g	0.5	<0.5	0	20	107	70	130	112	70	130
Copper	EMS0146-APR19	µg/g	0.1	<0.1	0	20	107	70	130	106	70	130
Molybdenum	EMS0146-APR19	µg/g	0.1	<0.1	12	20	96	70	130	109	70	130
Nickel	EMS0146-APR19	ug/g	0.5	<0.5	0	20	109	70	130	95	70	130
Lead	EMS0146-APR19	ug/g	0.1	<0.1	2	20	103	70	130	97	70	130
Antimony	EMS0146-APR19	µg/g	0.8	<0.8	ND	20	105	70	130	117	70	130
Selenium	EMS0146-APR19	µg/g	0.7	<0.7	ND	20	103	70	130	102	70	130
Thallium	EMS0146-APR19	µg/g	0.02	<0.02	ND	20	104	70	130	99	70	130
Uranium	EMS0146-APR19	µg/g	0.002	<0.002	2	20	99	70	130	97	70	130
Vanadium	EMS0146-APR19	µg/g	3	<3	1	20	108	70	130	112	70	130
Zinc	EMS0146-APR19	µg/g	0.7	<0.7	5	20	102	70	130	98	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0403-APR19	µg/g	10	<10	ND	30	111	80	120	111	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0404-APR19	µg/g	10	<10	7	30	117	80	120	116	60	140
F3 (C16-C34)	GCM0404-APR19	µg/g	50	<50	8	30	117	80	120	116	60	140
F4 (C34-C50)	GCM0404-APR19	µg/g	50	<50	ND	30	117	80	120	116	60	140

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0093-APR19	pH Units	0.05		0	20	100	80	120			

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzene	GCM0402-APR19	µg/g	0.02	< 0.02	ND	50	94	60	130	108	50	140
Ethylbenzene	GCM0402-APR19	µg/g	0.05	< 0.05	ND	50	96	60	130	109	50	140
m/p-xylene	GCM0402-APR19	µg/g	0.05	< 0.05	ND	50	97	60	130	110	50	140
o-xylene	GCM0402-APR19	µg/g	0.05	< 0.05	ND	50	96	60	130	110	50	140
Toluene	GCM0402-APR19	µg/g	0.05	< 0.05	ND	50	94	60	130	107	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-IENVI SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0076-APR19	µg/g	0.5	<0.5	14	20	99	80	120	104	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhin
Received Date (mm/dd/yy): 04/23/2019
Received Time: 13:25
Received By (signature):
Custody Seal Present: ☑ N/A
Custody Seal Intact: ☐ N/A
Cooling Agent Present: ☑ Ice applied by driver
Temperature Upon Receipt (°C): 9.0 9.0 9.0 T x 3
LAB LIMS #: CH14798-APR19

REPORT INFORMATION	INVOICE INFORMATION	PROJECT INFORMATION
Company: Thurber Engineering Ltd.	☑ (same as Report Information)	Quotation #: P.O. #:
Contact: Karel Furbacher	Company:	Project #: 13659 Site Location/ID: Langstaff Road
Address: 103-2010 Winston Park Drive, Oakville, Ontario	Contact:	
Phone: 289-455-7296	Address:	
Email: kfurbacher@thurber.ca	Phone:	
Email: manderson@thurber.ca	Email:	

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153/04: ☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____ ☐ R/P/I ☑ I/C/C ☐ A/O — Soil Texture: ☐ Coarse ☐ Medium ☑ Fine

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☑ NO

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☑ BTEX ☑ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity	COMMENTS:
1	BH19-09 SS4	4/10/19	10:00 a.m.	2	SOIL		☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	
2	BH19-10 SS6	4/12/19	10:00 a.m.	2	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	
3	BH19-11 SS3B	4/17/19	11:00 a.m.	2	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	
4	BH19-11 SS6	4/17/19	1:00 p.m.	2	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	Signature: RM	Date: 04/23/19	(mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature:	Date: 04/23/19	(mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhik
Received Date (mm/dd/yy): 04/26/2019
Received Time: 13:35
Received By (signature):
Custody Seal Present: ☑
Custody Seal Intact: ☑
Cooling Agent Present: ☑ ice applied by driver
Temperature Upon Receipt (°C): 8.9 8.8 8.3
LAB LIMS #: OA14798-AK19.

REPORT INFORMATION	INVOICE INFORMATION	PROJECT INFORMATION
Company: Thurber Engineering Ltd.	☑ (same as Report Information)	Quotation #:
Contact: Karel Furbacher	Company:	P.O. #:
Address: 103-2010 Winston Park Drive, Oakville, Ontario	Contact:	Project #: 13659
Phone: 289-455-7296	Address:	Site Location/ID: Langstaff Road
Email: kfurbacher@thurber.ca	Phone:	
Email: manderson@thurber.ca	Email:	

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153/04: ☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____ ☐ R/P/I ☑ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☑ Fine

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☑ NO

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☑ BTEX ☑ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg	Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	BH19-09 SS4	4/10/19	10:00 a.m.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Supplemental Sample
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	**Signature:** BKM	Date: 04/26/19	(mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	**Signature:**	Date: 04/26/19	(mm/dd/yy)	Yellow & White Copy - SGS

FINAL REPORT

CA14077-MAY19 R

13659 Langstaff Road

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14077-MAY19 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	705-652-2000
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	
Email	kfurbacher@thurber.ca	SGS Reference	CA14077-MAY19
Project	13659 Langstaff Road	Received	05/02/2019
Order Number		Approved	05/08/2019
Samples	Soil (3)	Report Number	CA14077-MAY19 R
		Date Reported	05/08/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES

nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES

C50 response factors within 70% of nC10 + nC16 + nC34 average: YES

Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

Sample Number					11
Sample Name					BH19-12 SS2B
Sample Matrix					Soil
Sample Date					22/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**
BTEX					
Benzene	µg/g	0.02	0.02	0.4	< 0.02
Ethylbenzene	µg/g	0.05	0.05	19	< 0.05
Toluene	µg/g	0.05	0.2	78	< 0.05
Xylene (total)	µg/g	0.05	0.05	30	< 0.05
m/p-xylene	µg/g	0.05			< 0.05
o-xylene	µg/g	0.05			< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

Sample Number					10	11	12
Sample Name					BH19-05 SS2	BH19-12 SS2B	BH19-15 SS2B
Sample Matrix					Soil	Soil	Soil
Sample Date					26/04/2019	22/04/2019	22/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
Hydrides							
Antimony	µg/g	0.8	1.3	50	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	18	2.5	2.9	2.2
Selenium	µg/g	0.7	1.5	5.5	< 0.7	< 0.7	< 0.7

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11	12
					Sample Name	BH19-05 SS2	BH19-12 SS2B	BH19-15 SS2B
					Sample Matrix	Soil	Soil	Soil
					Sample Date	26/04/2019	22/04/2019	22/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
Metals and Inorganics							
Moisture Content	%	-			9.2	22.8	14.9
Barium	µg/g	0.1	220	670	46	92	74
Beryllium	µg/g	0.02	2.5	10	0.25	0.57	0.34
Boron	µg/g	1	36	120	4	5	4
Cadmium	µg/g	0.02	1.2	1.9	0.06	0.18	0.08
Chromium	µg/g	0.5	70	160	11	23	16
Cobalt	µg/g	0.01	21	100	4.9	8.8	7.9
Copper	µg/g	0.1	92	300	12	20	17
Lead	µg/g	0.1	120	120	5.0	9.9	8.6
Molybdenum	µg/g	0.1	2	40	0.3	0.3	0.2
Nickel	µg/g	0.5	82	340	10	20	16
Silver	µg/g	0.05	0.5	50	< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	1	3.3	0.08	0.16	0.13
Uranium	µg/g	0.002	2.5	33	0.38	0.54	0.40
Vanadium	µg/g	3	86	86	19	32	24
Zinc	µg/g	0.7	290	340	26	45	32
Water Soluble Boron	µg/g	0.5		2	< 0.5	< 0.5	< 0.5

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

					Sample Number	10	11	12
					Sample Name	BH19-05 SS2	BH19-12 SS2B	BH19-15 SS2B
					Sample Matrix	Soil	Soil	Soil
					Sample Date	26/04/2019	22/04/2019	22/04/2019
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
Other (ORP)							
Mercury	µg/g	0.05	0.27	20	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	2.4	12	20.3	3.4	9.4
SAR Calcium	mg/L	0.09			18.9	49.5	13.4
SAR Magnesium	mg/L	0.02			3.7	93.4	4.9
SAR Sodium	mg/L	0.15			354	388	214
Conductivity	mS/cm	0.002	0.57	1.4	2.2	2.1	1.6
pH	pH Units	0.05			8.05	7.86	8.27
Chromium VI	µg/g	0.2	0.66	10	< 0.2	0.3	< 0.2
Free Cyanide	µg/g	0.05			< 0.05	< 0.05	< 0.05

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED

Sample Number	11
Sample Name	BH19-12 SS2B
Sample Matrix	Soil
Sample Date	22/04/2019

Parameter	Units	RL	L1	L2	Result
PHCs					
F1 (C6-C10)	µg/g	10	25	65	< 10
F1-BTEX (C6-C10)	µg/g	10			< 10
F2 (C10-C16)	µg/g	10	10	250	< 10
F3 (C16-C34)	µg/g	50	240	2500	< 50
F4 (C34-C50)	µg/g	50	120	6600	< 50
Chromatogram returned to baseline at nC50	Yes / No	-			YES

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / FINE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L1	REG153 / SOIL / FINE - TABLE 3 - Industrial/Commercial - UNDEFINED L2
BH19-05 SS2					
Conductivity	EPA 6010/SM 2510	µg/g	2.2	0.57	1.4
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	20.3	2.4	12
BH19-12 SS2B					
Conductivity	EPA 6010/SM 2510	µg/g	2.1	0.57	1.4
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	3.4	2.4	
BH19-15 SS2B					
Conductivity	EPA 6010/SM 2510	µg/g	1.6	0.57	1.4
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	9.4	2.4	

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0114-MAY19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5016-MAY19	µg/g	0.05	<0.05	ND	20	100	80	120	95	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVIIC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0058-MAY19	µg/g	0.2	<0.2	ND	20	100	80	120	102	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0020-MAY19	µg/g	0.05	<0.05	ND	20	101	80	120	103	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0017-MAY19	mg/L	0.09	<0.09	1	20	102	80	120	110	70	130
SAR Magnesium	ESG0017-MAY19	mg/L	0.02	<0.02	0	20	101	80	120	113	70	130
SAR Sodium	ESG0017-MAY19	mg/L	0.15	<0.15	0	20	99	80	120	108	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0020-MAY19	ug/g	0.05	<0.05	ND	20	93	70	130	94	70	130
Arsenic	EMS0020-MAY19	µg/g	0.5	<0.5	2	20	106	70	130	103	70	130
Barium	EMS0020-MAY19	ug/g	0.1	<0.1	4	20	109	70	130	98	70	130
Beryllium	EMS0020-MAY19	µg/g	0.02	<0.02	3	20	100	70	130	91	70	130
Boron	EMS0020-MAY19	µg/g	1	<1	10	20	105	70	130	105	70	130
Cadmium	EMS0020-MAY19	µg/g	0.02	<0.02	3	20	106	70	130	110	70	130
Cobalt	EMS0020-MAY19	µg/g	0.01	<0.01	1	20	107	70	130	113	70	130
Chromium	EMS0020-MAY19	µg/g	0.5	<0.5	2	20	104	70	130	111	70	130
Copper	EMS0020-MAY19	µg/g	0.1	<0.1	0	20	107	70	130	106	70	130
Molybdenum	EMS0020-MAY19	µg/g	0.1	<0.1	ND	20	93	70	130	104	70	130
Nickel	EMS0020-MAY19	ug/g	0.5	<0.5	0	20	107	70	130	114	70	130
Lead	EMS0020-MAY19	ug/g	0.1	<0.1	5	20	109	70	130	104	70	130
Antimony	EMS0020-MAY19	µg/g	0.8	<0.8	ND	20	100	70	130	102	70	130
Selenium	EMS0020-MAY19	µg/g	0.7	<0.7	ND	20	107	70	130	100	70	130
Thallium	EMS0020-MAY19	µg/g	0.02	<0.02	ND	20	106	70	130	102	70	130
Uranium	EMS0020-MAY19	µg/g	0.002	<0.002	7	20	104	70	130	103	70	130
Vanadium	EMS0020-MAY19	µg/g	3	<3	1	20	107	70	130	110	70	130
Zinc	EMS0020-MAY19	µg/g	0.7	<0.7	6	20	99	70	130	99	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0060-MAY19	µg/g	10	<10	ND	30	86	80	120	105	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0064-MAY19	µg/g	10	<10	ND	30	111	80	120	113	60	140
F3 (C16-C34)	GCM0064-MAY19	µg/g	50	<50	ND	30	111	80	120	113	60	140
F4 (C34-C50)	GCM0064-MAY19	µg/g	50	<50	ND	30	111	80	120	113	60	140

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0017-MAY19	pH Units	0.05		0	20	100	80	120			

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzene	GCM0059-MAY19	µg/g	0.02	< 0.02	ND	50	89	60	130	91	50	140
Ethylbenzene	GCM0059-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	92	50	140
m/p-xylene	GCM0059-MAY19	µg/g	0.05	< 0.05	ND	50	90	60	130	92	50	140
o-xylene	GCM0059-MAY19	µg/g	0.05	< 0.05	ND	50	90	60	130	92	50	140
Toluene	GCM0059-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-IENVI SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0014-MAY19	µg/g	0.5	<0.5	ND	20	97	80	120	107	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

SGS Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhiy
Received Date (mm/dd/yy): 05/2/2019
Received Time: 10:45
Received By (signature):
Custody Seal Present: ☐ no
Custody Seal Intact: ☐ no
Cooling Agent Present: ☑ ice packs 9x3
Temperature Upon Receipt (°C) 6°, 6°, 6°
LAB LIMS #: CA14077-May19

REPORT INFORMATION	INVOICE INFORMATION	PROJECT INFORMATION
Company: Thurber Engineering Ltd.	☑ (same as Report Information)	Quotation #: P.O. #:
Contact: Karel Furbacher	Company:	Project #: 13659 Site Location/ID: Langstaff Road
Address: 103-2010 Winston Park Drive, Oakville, Ontario	Contact:	**TURNAROUND TIME (TAT) REQUIRED**
Phone: 289-455-7296	Address:	☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day
Email: kfurbacher@thurber.ca	Phone:	**RUSH TAT (Additional Charges May Apply):** ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
Email: manderson@thurber.ca	Email:	**PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION**
		Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153/04: ☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____ ☐ R/P/I ☑ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☑ Fine

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

RECORD OF SITE CONDITION (RSC) ☐ YES ☑ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☐ BTEX ☐ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☐ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	BH19-05 SS2	4/26/19	10:00 a.m.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2	BH19-12 SS2B	4/22/19	10:00 a.m.	4	SOIL		☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3	BH19-15 SS2B	4/22/19	11:00 a.m.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	Signature: RM	Date: 04/30/19	(mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature:	Date: 04/30/19	(mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

FINAL REPORT

CA14542-APR19 R

13659

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14542-APR19 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	705-652-2000
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	
Email	kfurbacher@thurber.ca	SGS Reference	CA14542-APR19
Project	13659	Received	04/15/2019
Order Number		Approved	04/22/2019
Samples	Leachate (1)	Report Number	CA14542-APR19 R
		Date Reported	04/22/2019

COMMENTS

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

Raise RL for NO2/NO3 due to matrix interference

SIGNATORIES

Brad Moore Hon. B.Sc

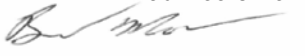

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 13659
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Acid rock Drainage**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-1
Sample Matrix	Leachate
Sample Date	05/04/2019

Parameter	Units	RL	L1	Result
Acid rock Drainage				
Final pH	no unit	0.01		6.00

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-1
Sample Matrix	Leachate
Sample Date	05/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		2
^ Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑
Fluoride	mg/L	0.06	150	0.22
Cyanide (total)	mg/L	0.01	20	< 0.01
Mercury	mg/L	0.00001	0.1	< 0.00001
Arsenic	mg/L	0.01	2.5	< 0.01
Silver	mg/L	0.08	5	< 0.08
Barium	mg/L	0.0009	100	0.499
Boron	mg/L	0.005	500	0.056

Client: Thurber Engineering Ltd.
Project: 13659
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-1
Sample Matrix	Leachate
Sample Date	05/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics (continued)				
Cadmium	mg/L	0.001	0.5	0.004
Chromium	mg/L	0.001	5	0.004
Lead	mg/L	0.007	5	0.012
Selenium	mg/L	0.01	1	< 0.01
Uranium	mg/L	0.1	10	< 0.1

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0285-APR19	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0285-APR19	mg/L	0.03	<0.03	ND	20	97	80	120	95	75	125
Nitrate (as N)	DIO0285-APR19	mg/L	0.06	<0.06	1	20	100	80	120	102	75	125

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0129-APR19	mg/L	0.01	<0.01	ND	10	102	90	110	NV	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0323-APR19	mg/L	0.06	<0.06	ND	10	97	90	110	NV	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0019-APR19	mg/L	0.00001	< 0.00001	ND	20	89	80	120	NV	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.7 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	ESG0060-APR19	mg/L	0.08	< 0.08	ND	20	98	90	110	90	70	130
Arsenic	ESG0060-APR19	mg/L	0.01	< 0.01	ND	20	91	90	110	85	70	130
Barium	ESG0060-APR19	mg/L	0.0009	< 0.0009	2	20	91	90	110	117	70	130
Boron	ESG0060-APR19	mg/L	0.005	< 0.005	1	20	93	90	110	90	70	130
Cadmium	ESG0060-APR19	mg/L	0.001	< 0.001	0	20	91	90	110	85	70	130
Chromium	ESG0060-APR19	mg/L	0.001	< 0.002	ND	20	92	90	110	87	70	130
Lead	ESG0060-APR19	mg/L	0.007	< 0.007	ND	20	93	90	110	84	70	130
Selenium	ESG0060-APR19	mg/L	0.01	< 0.01	ND	20	100	90	110	120	70	130
Uranium	ESG0060-APR19	mg/L	0.1	< 0.1	ND	20	92	90	110	91	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhiv
Received Date (mm/dd/yy): 04/15/2019
Received Time: 11:45
Received By (signature):
Custody Seal Present: ☐ no
Custody Seal Intact: ☐ no
Cooling Agent Present: ☑ ice applied by driver
Temperature Upon Receipt (°C): 8°, 8°, 8° 7x3
LAB LIMS #: CA14542-Apr19

REPORT INFORMATION	INVOICE INFORMATION	PROJECT INFORMATION
Company: Thurber Engineering Ltd.	☑ (same as Report Information)	Quotation #: P.O. #:
Contact: Karel Furbacher	Company:	Project #: 13659 Site Location/ID: Langstaff Road
Address: 103-2010 Winston Park Drive, Oakville, Ontario	Contact:	**TURNAROUND TIME (TAT) REQUIRED**
Phone: 289-455-7296	Address:	☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day
Email: kfurbacher@thurber.ca	Phone:	**RUSH TAT (Additional Charges May Apply):** ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
Email: manderson@thurber.ca	Email:	**PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION**
		Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153/04: ☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____ ☐ R/P/I ☒ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☐ Fine
Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA
Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☐ BTEX ☐ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☑ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	TCLP-1	4/5/19	12:00 p.m.	2	SOIL		☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	Signature:	Date: 04/12/19	(mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature:	Date: 04/12/19	(mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

FINAL REPORT

CA14707-APR19 R1

13659 Langstaff Road

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14707-APR19 R1

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	705-652-2143
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	brad.moore@sgs.com
Email	kfurbacher@thurber.ca	SGS Reference	CA14707-APR19
Project	13659 Langstaff Road	Received	04/18/2019
Order Number		Approved	04/25/2019
Samples	Leachate (1)	Report Number	CA14707-APR19 R1
		Date Reported	05/31/2019

COMMENTS

Temperature of Sample upon Receipt: 3 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

RL raised for Nitrates due to sample matrix

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Acid rock Drainage**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-2
Sample Matrix	Leachate
Sample Date	10/04/2019

Parameter	Units	RL	L1	Result
Acid rock Drainage				
Final pH	no unit	0.01		6.08

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-2
Sample Matrix	Leachate
Sample Date	10/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		2
^ Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑
Fluoride	mg/L	0.06	150	0.16
Cyanide (total)	mg/L	0.01	20	< 0.01
Mercury	mg/L	0.00001	0.1	0.00002
Arsenic	mg/L	0.01	2.5	0.02
Silver	mg/L	0.08	5	< 0.08
Barium	mg/L	0.0009	100	0.557
Boron	mg/L	0.005	500	0.065

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-2
Sample Matrix	Leachate
Sample Date	10/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics (continued)				
Cadmium	mg/L	0.001	0.5	< 0.001
Chromium	mg/L	0.001	5	< 0.001
Lead	mg/L	0.007	5	< 0.007
Selenium	mg/L	0.01	1	< 0.01
Uranium	mg/L	0.1	10	< 0.1

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0379-APR19	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0379-APR19	mg/L	0.03	<0.03	ND	20	98	80	120	102	75	125
Nitrate (as N)	DIO0379-APR19	mg/L	0.06	<0.06	ND	20	98	80	120	102	75	125

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0170-APR19	mg/L	0.01	<0.01	ND	10	99	90	110	91	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0401-APR19	mg/L	0.06	<0.06	ND	10	100	90	110	93	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0024-APR19	mg/L	0.00001	< 0.00001	ND	20	95	80	120	98	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.7 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	ESG0071-APR19	mg/L	0.08	< 0.08	ND	20	96	90	110	99	70	130
Arsenic	ESG0071-APR19	mg/L	0.01	< 0.01	ND	20	92	90	110	91	70	130
Barium	ESG0071-APR19	mg/L	0.0009	< 0.0009	5	20	95	90	110	100	70	130
Boron	ESG0071-APR19	mg/L	0.005	< 0.005	ND	20	94	90	110	101	70	130
Cadmium	ESG0071-APR19	mg/L	0.001	< 0.001	ND	20	94	90	110	100	70	130
Chromium	ESG0071-APR19	mg/L	0.001	< 0.002	ND	20	95	90	110	101	70	130
Lead	ESG0071-APR19	mg/L	0.007	< 0.007	ND	20	94	90	110	106	70	130
Selenium	ESG0071-APR19	mg/L	0.01	< 0.01	ND	20	93	90	110	85	70	130
Uranium	ESG0071-APR19	mg/L	0.1	< 0.1	ND	20	97	90	110	91	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

SGS Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhin
Received Date (mm/dd/yy): 04/18/2019
Received Time: 14:00
Received By (signature):
Custody Seal Present: ☐ no
Custody Seal Intact: ☐ no
Cooling Agent Present: ☑ Ice applied by drivek
Temperature Upon Receipt (°C): 4 4 4 3.3
LAB LIMS #: CA14707-Apr19

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Karel Furbacher
Address: 103-2010 Winston Park Drive, Oakville, Ontario
Phone: 289-455-7296
Email: kfurbacher@thurber.ca
Email: manderson@thurber.ca

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #:
P.O. #:
Project #: 13659
Site Location/ID: Langstaff Road

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION
Specify Due Date:
Rush Confirmation ID:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04: ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table ____ ☐ R/P/I ☐ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☐ Fine

Other Regulations: ☑ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☐ VOC ☐ BTEX ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☑ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	TCLP-2	4/10/19	10:00 a.m.	2	SOIL		☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	Signature: RM	Date: 04/17/19 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature:	Date: 04/17/19 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

FINAL REPORT

CA14797-APR19 R

13659, Langstaff Road

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14797-APR19 R

First Page

CLIENT DETAILS

Client	Thurber Engineering Ltd.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada
Contact	Karel Furbacher
Telephone	289-455-7296
Facsimile	
Email	kfurbacher@thurber.ca
Project	13659, Langstaff Road
Order Number	
Samples	Leachate (1)

LABORATORY DETAILS

Project Specialist	Rob Irwin B.Sc., C.Chem
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	2361
Facsimile	705-652-6365
Email	rob.irwin@sgs.com
SGS Reference	CA14797-APR19
Received	04/23/2019
Approved	04/30/2019
Report Number	CA14797-APR19 R
Date Reported	04/30/2019

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

SIGNATORIES

Rob Irwin B.Sc., C.Chem

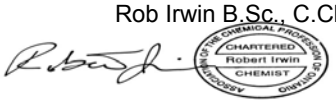

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 13659, Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Acid rock Drainage**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-3
Sample Matrix	Leachate
Sample Date	17/04/2019

Parameter	Units	RL	L1	Result
Acid rock Drainage				
Final pH	no unit	0.01		4.62

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-3
Sample Matrix	Leachate
Sample Date	17/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		2
^ Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑
Fluoride	mg/L	0.06	150	0.26
Cyanide (total)	mg/L	0.01	20	< 0.01
Mercury	mg/L	0.00001	0.1	< 0.00001
Arsenic	mg/L	0.01	2.5	< 0.01
Silver	mg/L	0.08	5	< 0.08
Barium	mg/L	0.0009	100	0.449
Boron	mg/L	0.005	500	0.075

Client: Thurber Engineering Ltd.
Project: 13659, Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-3
Sample Matrix	Leachate
Sample Date	17/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics (continued)				
Cadmium	mg/L	0.001	0.5	0.001
Chromium	mg/L	0.001	5	0.002
Lead	mg/L	0.007	5	0.008
Selenium	mg/L	0.01	1	0.02
Uranium	mg/L	0.1	10	< 0.1

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0426-APR19	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0426-APR19	mg/L	0.03	<0.03	ND	20	98	80	120	90	75	125
Nitrate (as N)	DIO0426-APR19	mg/L	0.06	<0.06	0	20	99	80	120	104	75	125

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0214-APR19	mg/L	0.01	<0.01	ND	10	97	90	110	97	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0481-APR19	mg/L	0.06	<0.06	2	10	97	90	110	91	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0027-APR19	mg/L	0.00001	< 0.00001	ND	20	116	80	120	114	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.7 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	ESG0081-APR19	mg/L	0.08	< 0.08	ND	20	95	90	110	96	70	130
Arsenic	ESG0081-APR19	mg/L	0.01	< 0.01	ND	20	103	90	110	92	70	130
Barium	ESG0081-APR19	mg/L	0.0009	< 0.0009	5	20	105	90	110	NV	70	130
Boron	ESG0081-APR19	mg/L	0.005	< 0.005	5	20	104	90	110	112	70	130
Cadmium	ESG0081-APR19	mg/L	0.001	< 0.001	ND	20	105	90	110	105	70	130
Chromium	ESG0081-APR19	mg/L	0.001	< 0.002	ND	20	107	90	110	103	70	130
Lead	ESG0081-APR19	mg/L	0.007	< 0.007	2	20	104	90	110	109	70	130
Selenium	ESG0081-APR19	mg/L	0.01	< 0.01	ND	20	103	90	110	101	70	130
Uranium	ESG0081-APR19	mg/L	0.1	< 0.1	ND	20	107	90	110	118	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

SGS Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhin
Received Date (mm/dd/yy): 04/23/2019
Received Time: 13:25
Received By (signature):
Custody Seal Present: ☑ no
Custody Seal Intact: ☑ no
Cooling Agent Present: ☑ ice applied by drver
Temperature Upon Receipt (°C) 9.9.9 9.0 9 x3
LAB LIMS #: CA14797-APR19

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Karel Furbacher
Address: 103-2010 Winston Park Drive, Oakville, Ontario
Phone: 289-455-7296
Email: kfurbacher@thurber.ca
Email: manderson@thurber.ca

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #: P.O. #:
Project #: 13659
Site Location/ID: Langstaff Road

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION
Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153/04: ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table ____ ☐ R/P/I ☐ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☐ Fine

Other Regulations: ☑ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm
Municipality:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

RECORD OF SITE CONDITION (RSC) ☐ YES ☑ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☐ BTEX ☐ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☑ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	TCLP-3	4/17/19	10:00 a.m.	2	SOIL		☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	Signature: RMcC	Date: 04/23/19 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature:	Date: 04/23/19 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018

FINAL REPORT

CA14078-MAY19 R

13659 Langstaff Road

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14078-MAY19 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	705-652-2000
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	
Email	kfurbacher@thurber.ca	SGS Reference	CA14078-MAY19
Project	13659 Langstaff Road	Received	05/02/2019
Order Number		Approved	05/08/2019
Samples	Leachate (1)	Report Number	CA14078-MAY19 R
		Date Reported	05/08/2019

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:NA

RL raised for Nitrates due to sample matrix

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Acid rock Drainage**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-4
Sample Matrix	Leachate
Sample Date	22/04/2019

Parameter	Units	RL	L1	Result
Acid rock Drainage				
Final pH	no unit	0.01		6.20

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-4
Sample Matrix	Leachate
Sample Date	22/04/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		2
^ Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑
Fluoride	mg/L	0.06	150	0.21
Cyanide (total)	mg/L	0.01	20	< 0.01
Mercury	mg/L	0.00001	0.1	< 0.00001
Arsenic	mg/L	0.01	2.5	0.02
Silver	mg/L	0.08	5	< 0.08
Barium	mg/L	0.0009	100	0.546
Boron	mg/L	0.005	500	0.073

Client: Thurber Engineering Ltd.
Project: 13659 Langstaff Road
Project Manager: Karel Furbacher
Samplers: Ryan McCourt

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	TCLP-4
Sample Matrix	Leachate
Sample Date	22/04/2019

Metals and Inorganics (continued)

Parameter	Units	RL	L1	Result
Cadmium	mg/L	0.001	0.5	< 0.001
Chromium	mg/L	0.001	5	0.002
Lead	mg/L	0.007	5	< 0.007
Selenium	mg/L	0.01	1	0.02
Uranium	mg/L	0.1	10	< 0.1

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Nitrate + Nitrite (as N)	DIO0079-MAY19	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0079-MAY19	mg/L	0.03	<0.03	17	20	97	80	120	96	75	125
Nitrate (as N)	DIO0079-MAY19	mg/L	0.06	<0.06	0	20	99	80	120	99	75	125

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Cyanide (total)	SKA0046-MAY19	mg/L	0.01	<0.01	ND	10	100	90	110	83	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0109-MAY19	mg/L	0.06	<0.06	ND	10	94	90	110	101	75	125
Fluoride	EWL0118-MAY19	mg/L	0.06	<0.06	1	10	96	90	110	103	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0005-MAY19	mg/L	0.00001	< 0.00001	ND	20	116	80	120	126	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.7 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	ESG0015-MAY19	mg/L	0.08	< 0.08	ND	20	93	90	110	92	70	130
Arsenic	ESG0015-MAY19	mg/L	0.01	< 0.01	ND	20	94	90	110	97	70	130
Barium	ESG0015-MAY19	mg/L	0.0009	< 0.0009	3	20	95	90	110	99	70	130
Boron	ESG0015-MAY19	mg/L	0.005	< 0.005	1	20	98	90	110	98	70	130
Cadmium	ESG0015-MAY19	mg/L	0.001	< 0.001	ND	20	95	90	110	98	70	130
Chromium	ESG0015-MAY19	mg/L	0.001	< 0.002	ND	20	96	90	110	94	70	130
Lead	ESG0015-MAY19	mg/L	0.007	< 0.007	ND	20	95	90	110	94	70	130
Selenium	ESG0015-MAY19	mg/L	0.01	< 0.01	ND	20	95	90	110	102	70	130
Uranium	ESG0015-MAY19	mg/L	0.1	< 0.1	ND	20	97	90	110	120	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

SGS Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No:

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Oleg Mozhiv
Received Date (mm/dd/yy): 05/2/2019
Received Time: 10:45
Received By (signature):
Custody Seal Present: ☐ no
Custody Seal Intact: ☐ no
Cooling Agent Present: ☑ ice packs
Temperature Upon Receipt (°C): 6°, 6°, 6°
LAB LIMS #: CA-14078-may19

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Karel Furbacher
Address: 103-2010 Winston Park Drive, Oakville, Ontario
Phone: 289-455-7296
Email: kfurbacher@thurber.ca
Email: manderson@thurber.ca

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #:
P.O. #:
Project #: 13659
Site Location/ID: Langstaff Road

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:
Rush Confirmation ID:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04: ☐ Table 1 ☐ Table 2 ☐ Table 3 ☐ Table ____ ☐ R/P/I ☐ I/C/C ☐ A/O
Soil Texture: ☐ Coarse ☐ Medium ☐ Fine

Other Regulations: ☑ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ CCME ☐ MISA ☐ MMER ☐ Other:

Sewer By-Law: ☐ Sanitary ☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☑ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☐ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☐ BTEX ☐ VOC ☐ BTEX/F1 ☐ F2-F4 ☐	VOC ☑ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☑ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	TCLP-4	4/22/19	10:00 a.m.	2	SOIL		☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Ryan McCourt	**Signature:** RM	Date: 04/30/19 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	**Signature:**	Date: 04/30/19 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
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