THURBER ENGINEERING LTD.

PRELIMINARY GEOTECHNICAL DESIGN REPORT

CLASS ENVIRONMENTAL ASSESSMENT STUDY
BURNHAMTHORPE ROAD WEST
CITY OF MISSISSAUGA, ONTARIO

Report

to

CIMA+

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Date: September 26, 2019
File: 20337

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1 INTRODUCTION

This report presents the results of a preliminary geotechnical investigation conducted in support of the Class EA for the proposed improvements of Burnhamthorpe Road West (Burnhamthorpe Road) from Loyalist Drive to the west city limit (Ninth Line) in Mississauga, Ontario.

The purpose of this investigation was to explore the subsurface conditions within the project limits and based on the data obtained, to provide borehole logs, borehole location plans and written descriptions of the subsurface conditions. Preliminary geotechnical recommendations for road widening, pavement design, and management options for soil that may be removed during construction are also provided.

Thurber Engineering Ltd. (Thurber) carried out the investigation as a sub-consultant to CIMA+ who are conducting the EA Study for the City of Mississauga.

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 SITE DESCRIPTION

The study area extends along Burnhamthorpe Road from Loyalist Drive to the west city limit, a distance of approximately 1.5 km. Burnhamthorpe Road within the study area is an east-west arterial roadway presently comprising a two-lane road cross-section with ditches on both sides and a posted speed limit of 60 km/hr. Three intersections are included within the project area. From west to east the intersecting streets are Ninth Line, Ridgeway Drive and Colonial Drive. Burnhamthorpe Road crosses over Highway 403 east of Ninth Line.

The area surrounding the project corridor is residential east of Ridgeway Drive. West of Ridgeway Drive on the south side of Burnhamthorpe Road the property use is a mix of commercial and industrial. On the north side of Burnhamthorpe Road west of Ridgeway Drive there is a secondary school.

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3 SITE INVESTIGATION AND FIELD TESTING

3.1 Field Investigation

The field work for this investigation was carried out on April 9, 2018 and comprised 22 boreholes advanced at the approximate locations shown on the borehole location plan in Appendix A. A total of 16 boreholes were advanced along Burnhamthorpe Road, while a pair of boreholes were advanced in approach pavement at all crossroads. The boreholes are designated as 18-01 to 18-22 and were all advanced to a depth of 2.1 m below the existing ground surface with the exception of Borehole 18-08 which was terminated at a depth of 1.9 m.

Pavement cores of the existing asphalt pavement were recovered from eight of the borehole locations for visual examination and confirmation of pavement thickness. Photographs of the pavement cores are provided in Appendix B.

Prior to starting the site investigation, clearance was obtained from utilities having plant in the area through the Ontario One-Call system. The borehole locations were established in the field using a hand-help GPS receiver.

The boreholes were drilled with solid stem augers by a drilling subcontractor (Malone's Soil Samples Co. Ltd.) under the direction and supervision of Thurber personnel. Soil samples were obtained using a split spoon sampler in conjunction with the Standard Penetration Test (SPT). The soil stratigraphy was recorded in each borehole by Thurber personnel who processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

The groundwater conditions in the open boreholes were observed throughout the drilling operations. The boreholes were backfilled with auger cuttings and, where appropriate, the roadway surface was reinstated with asphalt cold-patch.

Results of the field drilling, sampling and testing are presented on the Record of Borehole sheets in Appendix C.

3.2 Laboratory Testing

All recovered soil samples were subjected to visual identification and to natural moisture content determination. Selected 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 C. The grain size distribution curves and Atterberg Limits test results are plotted on figures attached in Appendix D.

To evaluate the requirements for management and/or disposal of soil excavated during construction, soil samples recovered from the boreholes were submitted to SGS Canada for analysis of selected parameters outlined in Ontario Regulation 153/04 (O.Reg. 153/04). In addition, selected samples were also tested for Toxicity Characteristic Leaching Procedure (TCLP) analysis of inorganic parameters in accordance with O.Reg. 347 – General Waste Management as amended by O.Reg. 558/00. The sample locations and material types are summarized in Table 1.

Table 1. Samples Selected for Environmental Testing

Borehole	Sample No.	Depth (m)	Soil Type	Analysis
18-01	SS2	1.5 – 2.1	Silty Clay Fill	Metals & Inorganics
18-04	GS1	0 – 0.6	Granular Fill	Metals & Inorganics
18-06	GS1	0.2 – 0.6	Granular Fill	TCLP
18-06	SS1	0.8 – 1.4	Silty Clay Fill	Metals & Inorganics
18-10	SS2	1.5 – 2.1	Silty Clay Till	Metals & Inorganics
18-11	SS1	0.8 – 1.4	Silty Clay Till	Metals & Inorganics
18-13	GS1	0.2 – 0.6	Granular Fill	Metals & Inorganics
18-15	SS2	1.5 – 2.1	Silty Clay Fill	BTEX & PHCs
18-16	SS1	0.8 – 1.4	Silty Clay Fill	Metals & Inorganics
18-19	SS2	1.5 – 2.1	Silty Clay Till	Metals & Inorganics
18-20	SS1	0.8 – 1.4	Silty Clay Till	TCLP
18-22	GS1	0.2 – 0.6	Granular Fill	Metals & Inorganics

The results of the analyses are provided on the Certificates of Analysis in Appendix E.

4 SUMMARY OF SITE CONDITIONS

4.1 Surface Conditions

Burnhamthorpe Road is currently a two-lane rural platform, with left turn lanes and an urban cross-section at all intersections. The existing travel lanes comprise a flexible pavement, with unpaved gravel shoulders.

4.1.1 Geological Conditions

The study area is located within the South Slope physiographic region, as delineated in The

Physiography of Southern Ontario by Chapman and Putnam (1984). The surficial geology consists of Halton till, a clayey silt to silty clay till that contains occasional sand layers. The underlying bedrock is expected to consist of the Queenston Formation, a red shale with occasional harder interbeds.

4.1.2 Surface Drainage

Drainage of surface water along the existing corridor is managed through open ditches on both sides of the roadway, although in some areas the ditches appear relatively shallow.

Major drainage features in the area comprise Sixteen Mile Creek to the west and the Credit River to the east. Both features flow southerly into Lake Ontario.

4.1.3 Pavement Condition

The current condition of the pavement surface on Burnhamthorpe Road is considered **Fair**, with predominant pavement distresses consisting of extensive, moderate to severe severity transverse cracking; with intermittent slight to moderate severity longitudinal and centreline cracking. In localized poorly performing areas, pavement distresses included: severe wheelpath fatigue cracking; slight to moderate pavement rutting; and localized potholes repaired with manual patches.

4.2 Pavement Structure

The pavement structure encountered in the boreholes drilled on Burnhamthorpe Road consisted of 150 mm to 275 mm of asphalt, overlying granular base varying from sand some gravel to gravelly sand with trace to some silt. The thickness of the granular base under the asphalt pavement ranged from 360 mm to 620 mm. In boreholes drilled on the shoulders of Burnhamthorpe Road the granular fill material was encountered at surface and the thickness of the granular fill ranged from 560 mm to 910 mm.

The pavement structure encountered in the two boreholes drilled on 9th Line (18-02 and 18-03) consisted of 175 mm of asphalt, overlying 510 mm to 780 mm of granular base. The granular base consisted of sand some gravel to gravelly sand with trace to some silt.

The pavement structure encountered in the two boreholes drilled on Ridgeway Drive (18-10 and 18-11) consisted of 175 mm to 200 mm of asphalt, overlying 370 mm to 530 mm of granular base. The granular base consisted of gravelly sand with trace to some silt.

The pavement structure encountered in the two boreholes drilled on Colonial Drive (18-16 and 18-17) consisted of 125 mm to 150 mm of asphalt, overlying 460 mm to 660 mm of granular base. The granular base consisted of gravelly sand with trace silt.

The results of grain size distribution analyses conducted on four samples of the granular material are presented on Figure D1 of Appendix D. In general, the gradation of the samples is finer than the requirements for OPSS Granular A. Testing of bulk samples collected from open test pits would be required to confirm the gradation.

Moisture contents for the granular material ranged from 2 to 10 percent.

4.3 Fill

A layer of fill was encountered below the pavement structure in Boreholes 18-01 to 18-09 and 18-12 to 18-18. The fill layer typically consisted of silty clay with trace sand to sandy and trace to some gravel. This layer was typically described as brown to dark brown and contained organic material at some locations. The thickness of the silty clay fill layers varied from 0.7 m to 0.9 m, where fully penetrated. Boreholes 18-01 to 18-07, 18-15 and 18-17 were terminated in the silty clay fill at 2.1 m depth.

SPT N-values obtained in the silty clay fill ranged from 2 to 22 blows/0.3 m, indicating a soft to very stiff consistency. A localized value of 54 was recorded in Borehole 18-01 where the split spoon sampler hit an asphalt layer. A second localized value of 50 blows/0.1 m was recorded in Borehole 18-04. Moisture contents varied between 9 and 20 percent.

The results of grain size distribution analyses conducted on samples of the silty clay fill are presented on Figure D2 of Appendix D. The Atterberg Limits determined from three samples are plotted on Figure D4.

Silty sand fill with trace to some gravel and trace clay was found in two boreholes (Borehole 18-08 and 18-12) below the pavement structure. This layer was 0.6 m thick in Borehole 18-12, and Borehole 18-08 was terminated within this layer at a depth of 1.9 m.

SPT-N values obtained in the silty sand fill ranged from 8 blows/0.3 m in Borehole 18-12 (loose) to 50 blows/ 225 mm (very dense) in Borehole 18-08. Moisture contents varied from 5 to 18 percent.

The results of one grain size distribution analysis conducted on a sample of silty sand fill are presented on Figure D3 of Appendix D.

4.4 Silty Clay to Clayey Silt Till

A till deposit consisting of silty clay was encountered directly below the pavement structure in Boreholes 18-10, 18-11 and 18-19 to 18-22 and below the fill layer in Boreholes 18-09, 18-12 to 18-14, 18-16 and 18-18. The till generally contains some sand to sandy and trace gravel. The boreholes where the till deposit was encountered were terminated within the till deposit at a depth of 2.1 m.

SPT N-values obtained in the till deposit ranged from 12 blows/0.3 m to 38 blows/0.3 m, indicating a stiff to hard consistency, typically very stiff. Moisture contents ranged from 11% to 20%.

The results of grain size distribution analyses conducted on samples of the silty clay till are presented on Figure D5 of Appendix D. The Atterberg Limits determined from three samples are plotted on Figure D6

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

4.5 Groundwater

All boreholes were dry upon completion of drilling, except for Borehole 18-12 where a water level of 0.4 m (Elev. 180.2 m) was measured upon completion of the borehole drilling, and Borehole 18-17 where a water level at 1.4 m depth (Elev. 175.2 m) was measured. The water in Borehole 18-12 appears to be perched in the pavement granular and sand fill.

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring and following periods of sustained precipitation.

4.6 Chemical Analysis

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.

The analytical results were compared to the Table 3 Standards (Full Depth Generic Site Condition Standards in a Non-Potable Groundwater Condition) of O.Reg. 153/04, for industrial/commercial/community property use. The concentrations of all parameters measured in the samples are below Table 3 Standards, with the exception of Electrical Conductivity (EC) in five samples and Sodium Adsorption Ratio (SAR) in five samples. The concentrations of all

parameters measured in the TCLP analyses were below the leachate quality criteria specified in Schedule 4 of O.Reg. 347. A summary of samples where exceedances were detected is provided in Table 2.

Table 2. Summary of Test Exceedances

Sample	Soil Type	Guideline	Analysis	Parameter	Guide Value	Result
18-4 GS1 0 – 0.6	Granular Fill	Table 3	O. Reg. 153 Metals & Inorganics	Sodium Adsorption Ratio	12	13.8
18-6 SS1 0.8 – 1.4	Silty Clay Fill	Table 3	O. Reg. 153 Metals & Inorganics	Conductivity	1.4	4.9
				Sodium Adsorption Ratio	12	69.2
18-10 SS2 1.5 – 2.1	Silty Clay Till	Table 3	O. Reg. 153 Metals & Inorganics	Conductivity	1.4	2.3
18-11 SS1 0.8 – 1.4	Silty Clay Till	Table 3	O. Reg. 153 Metals & Inorganics	Conductivity	1.4	2.0
				Sodium Adsorption Ratio	12	30.5
18-16 SS1 0.8 – 1.4	Silty Clay Fill	Table 3	O. Reg. 153 Metals & Inorganics	Conductivity	1.4	2.2
				Sodium Adsorption Ratio	12	32.0
18-19 SS2 1.5 – 2.1	Silty Clay Till	Table 3	O. Reg. 153 Metals & Inorganics	Conductivity	1.4	2.1
				Sodium Adsorption Ratio	12	20.6

Note: Results compared to Table 3 Standards ("Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition" for Industrial/Commercial/Community Property Use with coarse textured soils)

5 PAVEMENT DESIGN ANALYSIS

5.1 General

This section of the report presents the design analysis for the widening and rehabilitation of Burnhamthorpe Road based on our interpretation of the borehole information and projected traffic volumes. Readers of this report are reminded that the subsurface conditions may vary between and beyond the borehole locations.

5.2 Traffic Analysis

Traffic information for Burnhamthorpe Road was provided by CIMA+ and included the 2015 Annual Average Daily Traffic (AADT) volumes for Burnhamthorpe Road for the roadway segment

between Ridgeway Drive and Ninth Line. It is assumed that the provided AADT includes two-way traffic volumes. Forecasted volumes were also provided for years 2031 and 2041, which were used to estimate future growth rate. A summary of the provided traffic information is provided in Table 3.

Table 3. Peak Hour Traffic Summary

Year	AADT
2015	15,560
2031	22,924
2041	23,150

Based on the forecasted traffic volumes, a growth rate of 2.45 percent was back-calculated between the years 2015 and 2031, while a growth rate of 0.1 percent was forecasted between years 2031 and 2041. Furthermore, it is understood that the truck traffic on Burnhamthorpe Road is between 1 (PM) to 2 (AM) percent. For pavement design purposes, an estimated 2021 AADT of 17,014 will be assumed for Burnhamthorpe Road, with 2.0 percent truck traffic.

The traffic data was used to determine the amount of pavement damage caused by the anticipated traffic volumes. Using an average truck factor of 2.5, the pavement damage caused by different vehicle classes are converted to a standard axle load known as an Equivalent Single Axle Load (ESAL). The 20-year design ESALs (commencing in year 2021) for Burnhamthorpe Road is estimated to be some 3.3 million ESALs.

5.3 New Pavement Design Analysis

5.3.1 AASHTO Design Procedure

Flexible pavement designs were developed using the AASHTO procedure as outlined in the 1993 Guide for Design of Pavement Structures, as modified by the MTO publication MI-183. The following inputs were used in developing the required pavement designs.

- Initial serviceability, (P_i) = 4.5
- Terminal serviceability (P_t) = 2.5
- Reliability level (R) = 90 percent
- Overall standard of deviation (S_o) = 0.44
- Mean soil resilient modulus (M_R) = 30 MPa

Based on the above structural requirements, site considerations, and input from the design team, the following pavement structure is required in new pavement areas.

140 mm	Hot Mix Asphalt
200 mm	Granular Base Material
400 mm	Granular Subbase Material

The total thickness of the new pavement should be adequate to maintain subsurface drainage across the pavement widening area; however, localized thickening of the granular subbase layer will be required.

5.3.2 City of Mississauga Design Requirements

The results of the AASHTO pavement design analysis were compared to the City of Mississauga Standard Pavement and Road Base Design Requirements (Standard No. 2220.010). The new pavement design developed for pavement widening areas matches the design standard for an Arterial roadway, when constructed on a subgrade soil (or fill material) containing less than 55 percent silt content.

However, it is noted that the thickness of the granular subbase is to be increased by 150 mm when roadways are constructed within 15 m of intersections.

5.4 Pavement Rehabilitation

The rehabilitation of Burnhamthorpe Road will need to address the functional and structural requirements to extend the service life of this roadway. The understanding of these requirements is critical for the development of the most practical and cost-effective rehabilitation treatment.

5.4.1 Functional Requirements

The functional capacity of a roadway is a measure of how well the pavement serves the user. This serviceability index is often referred to as ‘Ride Comfort’ and is reflective of the pavement condition at a particular time during the service life of the pavement. Pavement distresses that impact a pavement’s functional ability to serve the travelling public include: transverse cracking; potholes; ravelling; as well as heave and swells.

The segment of Burnhamthorpe Road within the project limits is considered to be in **Fair** condition, with pavement distresses such as transverse, wheelpath, and longitudinal cracking, as well as localized areas of ravelling and pothole patches that affect the ride comfort. Most of the transverse

cracks vary from moderate to severe severity, and significantly affect the ride quality. Furthermore, based on the observed severity, these cracks are expected to have propagated through the full asphalt thickness. Any rehabilitation treatments considered for Burnhamthorpe Road will need to improve the observed functional distresses.

5.4.2 Structural Requirements

The structural capacity of a pavement is the physical condition of the roadway that adversely affects the load-carrying capability of the pavement structure. The structural assessment of Burnhamthorpe Road was completed by identifying pavement distresses that indicate structural failure (such as alligator/fatigue cracking and pavement rutting), as well as considering the existing pavement layer thicknesses.

Although the asphalt thickness on Burnhamthorpe Road appears to be of adequate thickness, the pavement surface shows localized structural distresses that are an early indication of structurally deficiency. As the proposed improvements to Burnhamthorpe Road will not be completed for several years, the existing pavement will continue to deteriorate. Therefore, any rehabilitation treatment considered for the existing portion of Burnhamthorpe Road should include structural strengthening as part of the roadway improvements.

5.4.3 Rehabilitation Alternatives

Based on the AASHTO pavement design analysis and the analysis of the field investigation, the existing pavement on Burnhamthorpe Road is considered to be approaching the end of the service life, and in need of considerable functional and structural improvement. Based on the expected pavement condition at the time of the proposed widening, the most practical and cost-effective rehabilitation strategy to address the functional and structural pavement capacity includes the removal of the existing asphalt, with the underlying granular base/subbase graded (as required) into the widening area for the placement of the new Granular Base and Asphalt material.

An alternative to the removal of the existing asphalt would be to consider Full-Depth Reclamation (FDR), which would pulverize the existing asphalt and blend the material with the underlying granular base/subbase. Completing FDR of the existing pavement will reduce the removal of existing materials from site and increase the quantity of granular material available to use as granular subbase in the pavement widening area. The processed material should be graded to permit the placement of the new granular base and asphalt layers. The thickness of the new pavement layers should match the design in the pavement widening area and include:

140 mm	Hot Mix Asphalt
200 mm	Granular Base

It is noteworthy that the FDR process may be complicated by the presence of manholes observed in the EB lane. The practicality of proceeding with the FDR process should be reviewed during detailed design.

This rehabilitation strategy will provide a uniform granular base and asphalt thickness across the entire new pavement platform, which is expected to maintain a consistent performance over the pavement service life.

6 PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

6.1 Burnhamthorpe Road Rehabilitation

Preliminary recommendations for the pavement rehabilitation of Burnhamthorpe Road should consist of full depth reclamation (pulverizing) of the existing asphalt with the underlying granular material, followed by grading and compacting the pulverized material, and placement of new Granular Base and Hot Mix Asphalt (HMA). Due to the thickness of the existing asphalt and limitations on the maximum depth of pulverization (400 mm), milling of the existing asphalt in advance of pulverization is recommended. After milling, the remaining pavement should be pulverized to a depth of 400 mm so that the blended material contains a maximum of 50 percent of asphalt coated aggregate, as permitted by OPSS.MUNI 330.

The pulverized material should be graded and compacted (as required), prior to the placement of new granular base material. The recommended asphalt lift types and thicknesses shall consist of:

40 mm	HL1
50 mm	HDBC
50 mm	HDBC
200 mm	Granular ‘A’ Base

Consideration should be given to grading the pulverized material into the pavement widening area and utilizing the blended material as granular subbase material. Should this option be selected, it is recommended that a maximum of 340 mm of the processed material be removed from the existing lanes, with this material replacing the need for new Granular B, Type I subbase material in the widening area.

This strategy would permit the placement of a consistent granular base and asphalt layer thickness across the entire pavement platform.

6.2 Pavement Widening

It is understood that roadway improvements within the project limits include pavement widening to Burnhamthorpe Road for the construction of a 4-lane platform. In all pavement widening areas (beyond existing shoulder rounding or curb and gutters), the surficial topsoil should be removed with the underlying subgrade graded as required.

The preliminary recommended pavement structure for widening of Burnhamthorpe Road shall consist of:

40 mm	HL1
50 mm	HDBC
50 mm	HDBC
200 mm	Granular ‘A’ Base
400 mm	Granular ‘B’ Type I Subbase

As per City of Mississauga standards (Standard No. 2220.010), the thickness of the granular subbase layer should be increased by 150 mm when placed within 15 m of an intersection.

Final grades in all pavement widening areas will need to match the expected elevation of the new curb and gutters. The grading of the top of subgrade in pavement widening areas must match, or exceed, the thickness of the adjacent existing pavement to maintain lateral drainage at the top of subgrade. The total thickness of the new pavement should be sufficient to maintain subsurface drainage across the widening for most of the project limits; however, localized thickening of the granular subbase will be required.

6.3 Subgrade Preparation

In all pavement widening areas, any surficial topsoil should be stripped to expose the underlying soils. The underlying subgrade soils should be removed and graded as required to accommodate the new pavement platform. The exposed top of subgrade should be graded to a 3 percent crossfall toward the subdrains installed at the outer pavement edge.

As per City of Mississauga standards, the top 1.0 m of the subgrade shall be compacted to a minimum of 98 percent of Standard Proctor Maximum Dry Density (SPMDD), within 2 percent of optimum moisture content (OMC). The exposed subgrade should be compacted and proof-rolled

with a heavy roller and examined to identify areas of unstable subgrade. Any soft/wet areas identified should be sub-excavated and replaced with approved material.

6.4 Pavement Drainage

Proper drainage of the pavement structure must be provided by way of curb and gutter and use of subdrains to ensure optimal pavement performance. Pavement design thicknesses in widening areas are based on the pavement structure thicknesses recorded in the boreholes. It is cautioned that actual existing pavement thicknesses may fluctuate between borehole locations. The actual thickness of the new granular subbase layer may need to be increased during construction to ensure that the total thickness of the pavement in the widening area match, or exceed, the thickness of the existing pavement.

All new subdrains should be constructed as per City of Mississauga standard No. 2220.040.

6.5 Management of Excess Materials

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, the excavated materials may be managed for reuse in engineering applications on site (i.e. site grading fill or backfill) pending geotechnical approval. 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 benefical use, pending approval of receiving site authorities. The use of the excess material at other sites must meet the site’s analytical requirements and MECP standards for imported material. The EC and SAR concentrations may have potential implications if a Record of Site Condition is required for that site at this time or in the future.

Alternatively, excess soil 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 testing will be required during the detailed design investigation to confirm these preliminary recommendations regarding management of excess excavated soils.

6.6 Construction Inspection and Testing

The successful performance of the pavement and roadwork will depend largely on good workmanship and quality control during construction. It is therefore recommended that materials testing and inspection by qualified personnel be provided during construction. The inspection and testing should include observation and inspection of asphalt paving and sampling as well as onsite recommendation and coordination.

Thurber should be retained to review the preliminary pavement recommendations during detailed design and have an opportunity to review the construction tender package for the proposed works to ensure that the recommendations in this report have been adequately interpreted.

7 CLOSURE

Overall supervision of the field program was carried out by Mr. Matthew Boucher, P.Eng. Interpretation of the field data, and report preparation was conducted by Mr. Mark Popik P.Eng. A technical review of this report was completed by Mr. Murray Anderson, P.Eng.

The preliminary recommendations made in this report are in accordance with our present understanding of the project requirements. Additional field, laboratory, and analytic work will be required to advance the project beyond the preliminary stage.

We trust that this report satisfies the requirements of CIMA+, and the City of Mississauga. Please do not hesitate to contact our office if you have any questions.

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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.

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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.

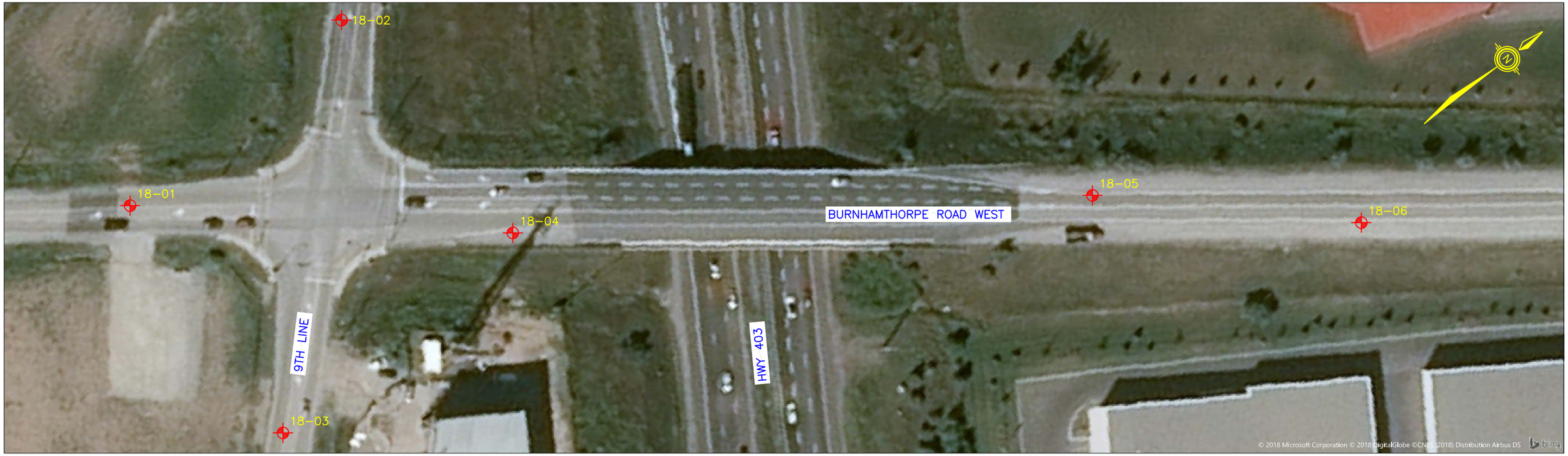
7. INDEPENDENT JUDGEMENTS OF CLIENT

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.

THURBER

Appendix A

Borehole Location Plan



LEGEND:

APPROX. BOREHOLE LOCATION

BURNHAMTHORPE ROAD WEST
CLASS EA STUDY
MISSISSAUGA, ONTARIO

BOREHOLE LOCATIONS PLAN

JOB# 20337

THURBER ENGINEERING LTD.

ENGINEER:	DRAWN:	APPROVED:
CR	AN	MTB
DATE:	SCALE:	DRAWING No.
MAY 2019	1:1000	20337-1

FILENAME: H:\Drafting\20000\20337\xref\Boreholes.dwg
PLOTDATE: May 13, 2019 - 2:42 PM

LEGEND:

APPROX. BOREHOLE LOCATION

BURNHAMTHORPE ROAD WEST
CLASS EA STUDY
MISSISSAUGA, ONTARIO

BOREHOLE LOCATIONS PLAN

JOB# 20337

THURBER ENGINEERING LTD.

ENGINEER:	DRAWN:	APPROVED:
CR	AN	MTB
DATE:	SCALE:	DRAWING No.
MAY 2019	1:1000	20337-2

FILENAME: H:\Drafting\20000\20337\xref\Boreholes.dwg
PLOTDATE: May 13, 2019 - 2:44 PM

THURBER

Appendix B

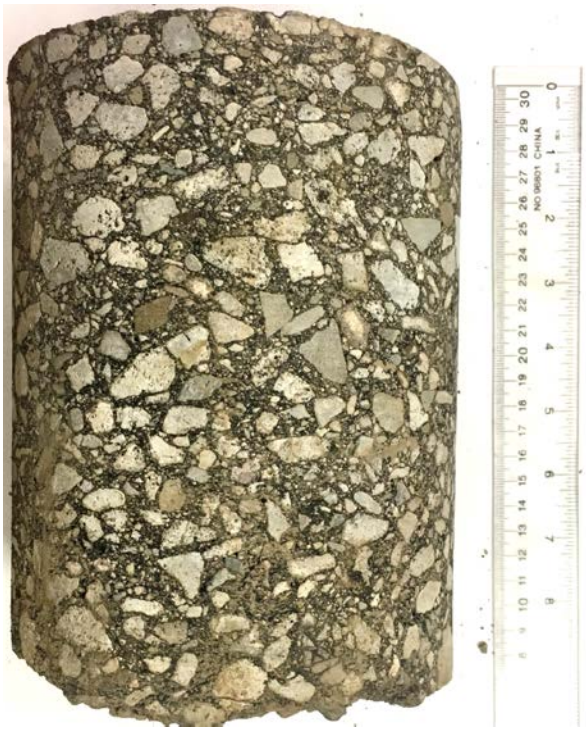
Pavement Core Photographs

THURBER

Burnhamthorpe Road West
Pavement Core Photographs

Borehole 18-01

Borehole 18-05

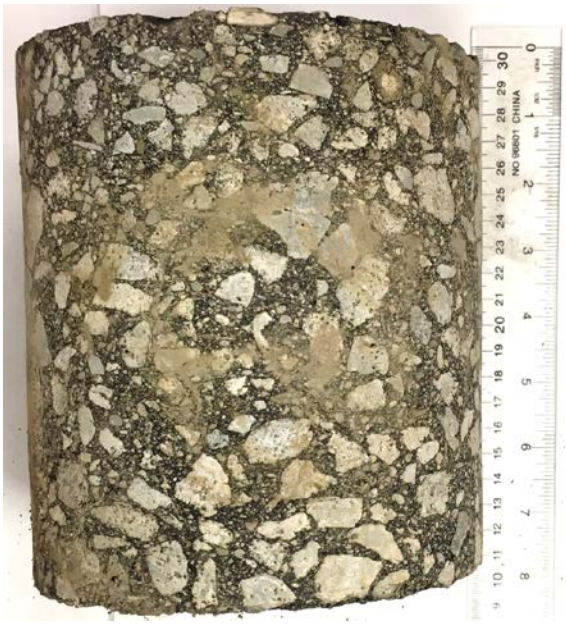


THURBER

Burnhamthorpe Road West
Pavement Core Photographs

Borehole 18-09

Borehole 18-13



THURBER

Burnhamthorpe Road West
Pavement Core Photographs

Borehole 18-18

Borehole 18-19

THURBER

Burnhamthorpe Road West
Pavement Core Photographs

Borehole 18-21

Borehole 18-22

THURBER

Appendix C

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.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

RECORD OF BOREHOLE 18-01

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 552.0 E 603 738.0

Project No. 20337
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		182.48				
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (150mm)		0.00				
		SAND, gravelly, some silt, brown, wet: (FILL)		0.15	1	GS		
				181.89				
		CLAY, silty, sandy, trace gravel, hard to very stiff, dark brown, moist: (FILL)		0.59				
1					1	SS	54	Grain Size Analysis: Gr 0%/ Sa 28%/ Si 42%/ Cl 30%
		0.15m of asphalt at 1.2m						
					2	SS	16	
2				180.34				
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13				
3								
4								

COMMENTS: 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 : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-02

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 624.0 E 603 734.0

Project No. 20337
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: 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
		GROUND SURFACE		183.44							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (175mm)		0.00							
		SAND, gravelly, trace to some silt, dark brown, moist: (FILL)		0.18	1	GS			○		
		CLAY, silty, some sand to sandy, trace gravel, very stiff to stiff, dark brown, moist: (FILL)		182.75 0.69							
1					1	SS	16		○		
					2	SS	9		○		
2				181.30							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-03

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

N 4 819 547.0 E 603 808.0

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
		GROUND SURFACE		183.44							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (175mm)		0.00							
		SAND, some gravel, trace to some silt, brown, moist: (FILL)		0.18	1	GS			w		
1		**CLAY**, silty, sandy, some gravel, some cobbles, very stiff, brown, moist: (FILL)		182.48 0.96	1	SS	21		w		
2					2	SS	18		w		
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		181.30 2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-04

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 625.0 E 603 804.0

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (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
		GROUND SURFACE		185.20							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**SAND**, some gravel, trace to some silt, brown, moist: (FILL)		0.00	1	GS			○		
				184.59							
1		**CLAY**, silty, sandy to some sand, trace gravel, hard to stiff, dark brown, moist: (FILL)		0.61	1	SS	50/ 0.100		○		
					2	SS	11		○		
2				183.06							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-05

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 748.0 E 603 888.0

Project No. 20337
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		188.11				
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (225mm)		0.00				
		SAND, some silt, some gravel, trace clay, brown, moist: (FILL)		0.23	1	GS		Grain Size Analysis: Gr 17%/Sa 56%/ Si 20%/ Cl 7%
				187.52				
		CLAY, silty, some sand to sandy, trace gravel, stiff, brown, moist: (FILL)		0.59				
1					1	SS	11	
2					2	SS	14	
				185.97				
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13				
3								
4								

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 : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-06

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 798.0 E 603 936.0

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		188.19							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (200mm)		0.00							
		SAND, some gravel, some silt, brown, moist: (FILL)		0.20	1	GS			○		
				187.51							
		CLAY, silty, trace sand, trace gravel, stiff, dark brown, moist: (FILL)		0.69	1	SS	11		○		
1											
					2	SS	10		○		
2				186.06							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-07

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 869.0 E 603 981.0

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		186.78							
1	Solid Stem Augers / Truck Mounted Hydraulic Drill	**SAND**, some gravel, trace to some silt, brown, dry: (FILL)		0.00	1	GS			○		
		CLAY, silty, some sand, trace gravel, some organics, firm, dark brown, moist: (FILL)		186.23 0.56	1	SS	7		○		
2					2	SS	4		○		
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		184.65 2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-08

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 819 942.2 E 604 040.0

Project No. 20337
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: 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
		GROUND SURFACE		185.05							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (225mm)		0.00							
		SAND, some gravel, trace to some silt, brown, moist: (FILL)		0.23	1	GS			○		
				184.43							
		SAND, silty, trace gravel, trace clay, very dense, brown, moist: (FILL)		0.62							
1					1	SS	60	Grain Size Analysis: Gr 6%/ Sa 62%/ Si 28%/ Cl 4%	○		
					2	SS	50/ 0.225		○		
				183.15							
2		END OF BOREHOLE AT 1.91m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		1.91							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-09

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018

Project No. 20337
SHEET 1 OF 1
N 4 820 017.3 E 604 107.4
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		183.11				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (235mm)		0.00							
		SAND, gravelly, trace to some silt, brown, wet: (FILL)		0.24	1	GS					
				182.35							
1		**CLAY**, silty, sandy, trace gravel and cobbles, very stiff, brown, moist: (FILL)		0.76	1	SS	22	Grain Size Analysis: Gr 0%/ Sa 26%/ Si 46%/ Cl 28%			
				181.59							
		CLAY, silty, some sand, trace gravel, oxidized, very stiff, brown, moist: (TILL)		1.52	2	SS	29				
2				180.98							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-10

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 066.0 E 604 090.0

Project No. 20337
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: 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
		GROUND SURFACE		182.30							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (200mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (FILL)		0.20	1	GS		Grain Size Analysis: Gr 28%/Sa 57%/ Si & Cl 15%	○		
		CLAY, silty, some sand to sandy, trace gravel, very stiff, brown, moist: (TILL)		181.73 0.57	1	SS	20		○		
					2	SS	26		○		
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		180.16 2.13							

1
2
3
4

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-11

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 027.0 E 604 165.0

Project No. 20337
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: 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
		GROUND SURFACE		181.99							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (175mm)		0.00							
		SAND, gravelly, trace to some silt, brown, moist: (FILL)		0.18	1	GS			○		
				181.28							
1		**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		0.71	1	SS	21		○		
					2	SS	38		○		
2				179.86							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-12

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 113.9 E 604 185.8

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		180.64							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**SAND**, gravelly, trace to some silt, brown, wet: (FILL)		0.00	1	GS			○		▽
1		**SAND**, silty, some gravel, trace clay, loose, brown, wet: (FILL)		179.73 0.91	1	SS	8		○		
		CLAY, silty, trace to some sand, trace gravel, hard, brown, wet: (TILL)		179.12 1.52	2	SS	32		○		
2											
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN TO 0.6m AND WATER LEVEL AT 0.45m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		178.51 2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-13

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 196.1 E 604 238.6

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		179.38							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (185mm)		0.00							
		SAND, gravelly, trace silt, brown, wet: (FILL)		0.19	1	GS			○		
				178.57							
1		**CLAY**, silty, some sand to sandy, trace gravel, very stiff, dark brown, moist to wet: (FILL)		0.81	1	SS	19		○		
				177.86							
		CLAY, silty, some sand to sandy, trace gravel, very stiff, brown to grey, moist: (TILL)		1.52	2	SS	24		○		
2				177.25							
		END OF BOREHOLE AT 2.13m. BOREHOLE CAVED TO 1.47m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-14

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 278.0 E 604 302.0

Project No. 20337
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: 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
		GROUND SURFACE		178.41							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (200mm)		0.00							
		SAND, some gravel to gravelly, trace silt, brown, moist: (FILL)		0.20	1	GS			○		
		CLAY, silty, some sand to sandy, trace gravel, stiff, dark brown, moist to wet: (FILL)		177.77 0.63	1	SS	13	Grain Size Analysis: Gr 0%/ Sa 21%/ Si 45%/ Cl 34%	⊢○⊣		
1				176.89							
		CLAY, silty, some sand to sandy, trace gravel, very stiff, brown to grey, moist: (TILL)		1.52	2	SS	23		○		
2				176.27							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-15

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 350.7 E 604 353.1

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		177.43							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**SAND**, gravelly, some silt, brown, wet: (FILL)		0.00	1	GS		Grain Size Analysis: Gr 34%/Sa 52%/ Si & Cl 14%	○		
				176.72							
1		**CLAY**, silty, some sand to sandy, trace gravel, firm to soft, dark brown, moist to wet: (FILL)		0.71	1	SS	7		○		
		some organics material			2	SS	2		○		
2				175.30							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-16

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

N 4 820 421.0 E 604 375.2

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
		GROUND SURFACE		176.66							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (150mm)		0.00							
		SAND, gravelly, trace silt, brown, moist: (FILL)		0.15	1	GS			○		
				175.85							
1		**CLAY**, silty, some sand, trace gravel, stiff, brown, moist: (FILL)		0.81	1	SS	10		○		
				175.14							
		CLAY, silty, some sand, trace gravel, oxidized lenses, very stiff, brown, moist: (TILL)		1.52	2	SS	29		○		
2				174.53							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-17

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 380.7 E 604 438.4

Project No. 20337
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: 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
		GROUND SURFACE		176.60							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (125mm)		0.13							
		SAND, gravelly, trace silt, brown, moist: (FILL)			1	GS			○		
				176.02							
		CLAY, silty, some sand, trace gravel, stiff, grey to brown, moist: (FILL)		0.59							
1					1	SS	13		○		▽
2					2	SS	14		○		
				174.47							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND WATER LEVEL AT 1.42m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-18

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 443.1 E 604 430.0

Project No. 20337
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: 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
		GROUND SURFACE		176.20							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (235mm)		0.00							
		SAND, gravelly, trace silt, brown, wet: (FILL)		0.24	1	GS			w		
				175.49							
1		**CLAY**, silty, some sand, trace gravel, very stiff, brown, moist: (FILL)		0.71	1	SS	19		w		
				174.68							
		CLAY, silty, some sand to sandy, trace gravel, very stiff, brown, moist: (TILL)		1.52	2	SS	22		w		
2				174.07							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN TO 1.37m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-19

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 497.4 E 604 482.0

Project No. 20337
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		175.38							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (235mm)		0.00							
		SAND, gravelly, trace silt, brown, wet: (FILL)		0.24	1	GS			○		
		CLAY, silty, some sand to sandy, trace gravel, stiff to very stiff, grey to brown, moist: (TILL)		174.52 0.86	1	SS	12	Grain Size Analysis: Gr 2%/ Sa 22%/ Si 47%/ Cl 29%	○⊢		
1											
					2	SS	19		○		
2				173.25							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-20

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 589.1 E 604 542.6

Project No. 20337
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		174.71				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**SAND**, gravelly, trace silt, brown, moist: (FILL)		0.00	1	GS			○		
				174.10							
1		**CLAY**, silty, some sand to sandy, trace gravel, stiff to very stiff, brown, moist: (TILL)		0.61	1	SS	15		○		
					2	SS	19	Grain Size Analysis: Gr 0%/ Sa 31%/ Si 40%/ Cl 29%	○—|		
2				172.57							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-21

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 664.7 E 604 608.2

Project No. 20337
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: 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
		GROUND SURFACE		175.18							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (225mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (FILL)		0.23	1	GS		Grain Size Analysis: Gr 24%/Sa 62%/ Si & Cl 14%	○		
				174.47							
1		**CLAY**, silty, some sand to sandy, trace gravel, very stiff, grey to brown, moist: (TILL)		0.71	1	SS	16		○		
2					2	SS	23		○		
				173.05							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN TO 1.44m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

RECORD OF BOREHOLE 18-22

PROJECT : Burnhamthorpe Road West Class EA
LOCATION : Mississauga, ON
STARTED : April 9, 2018
COMPLETED : April 9, 2018
N 4 820 733.9 E 604 669.5

Project No. 20337
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: 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
		GROUND SURFACE		175.63							
	Solid Stem Augers / Truck Mounted Hydraulic Drill	**ASPHALT:** (275mm)		175.35							
		SAND, gravelly, trace silt, brown, wet: (FILL)		0.28	1	GS			w		
				174.79							
1		**CLAY**, silty, some sand to sandy, trace gravel, stiff to very stiff, brown to grey, moist: (TILL)		0.84	1	SS	14		w		
					2	SS	22	Grain Size Analysis: Gr 0%/ Sa 32%/ Si 41%/ Cl 27%	w		
2				173.50							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS AND ASPHALT TO SURFACE.		2.13							
3											
4											

GROUNDWATER ELEVATIONS

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

LOGGED : CAR
CHECKED : MTB

THURBER

THURBER2S TEL-20337.GPJ 5/17/19

THURBER

Appendix D

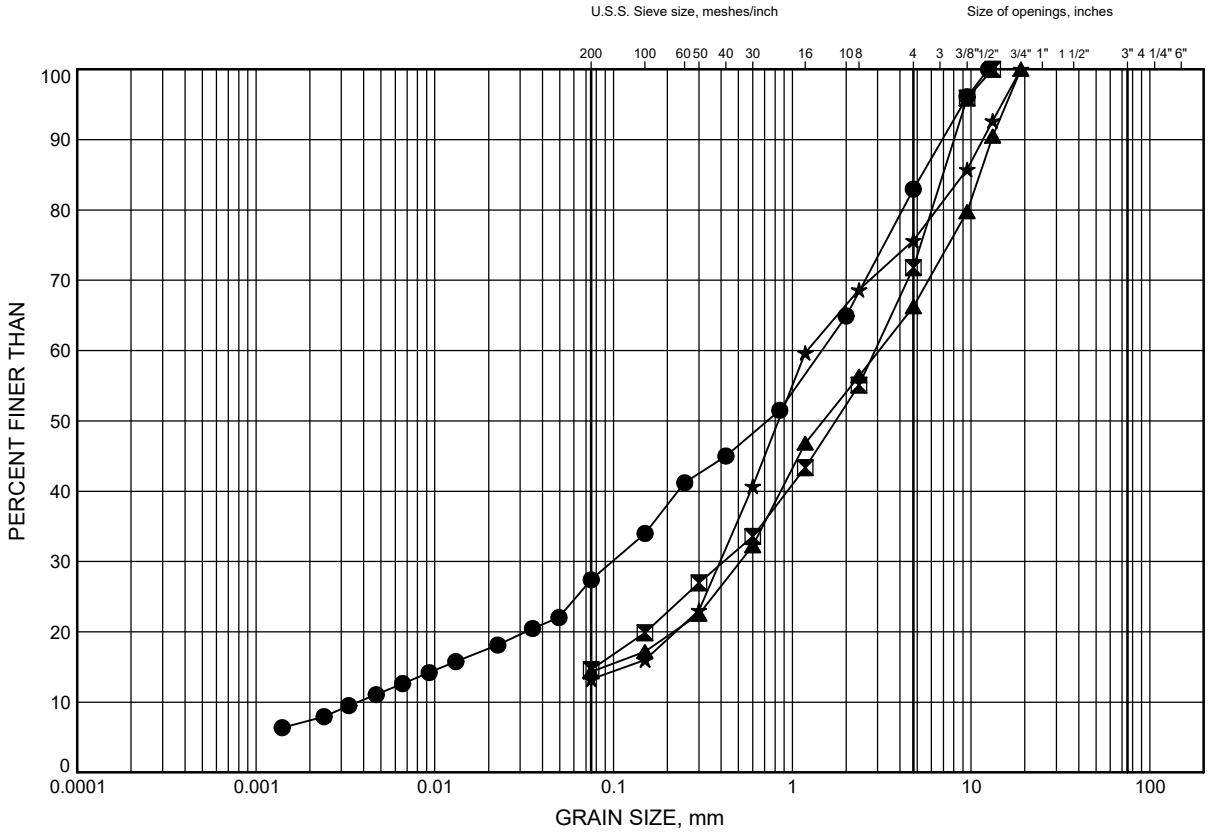
Geotechnical Laboratory Test Results

Burnhamthorpe Road West 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)
●	18-05	0.42	187.69
⊠	18-10	0.41	181.89
▲	18-15	0.30	177.13
★	18-21	0.42	174.76

Date May 2019

Project 20337

THURBER

Prep'd AN

Chkd. MTB

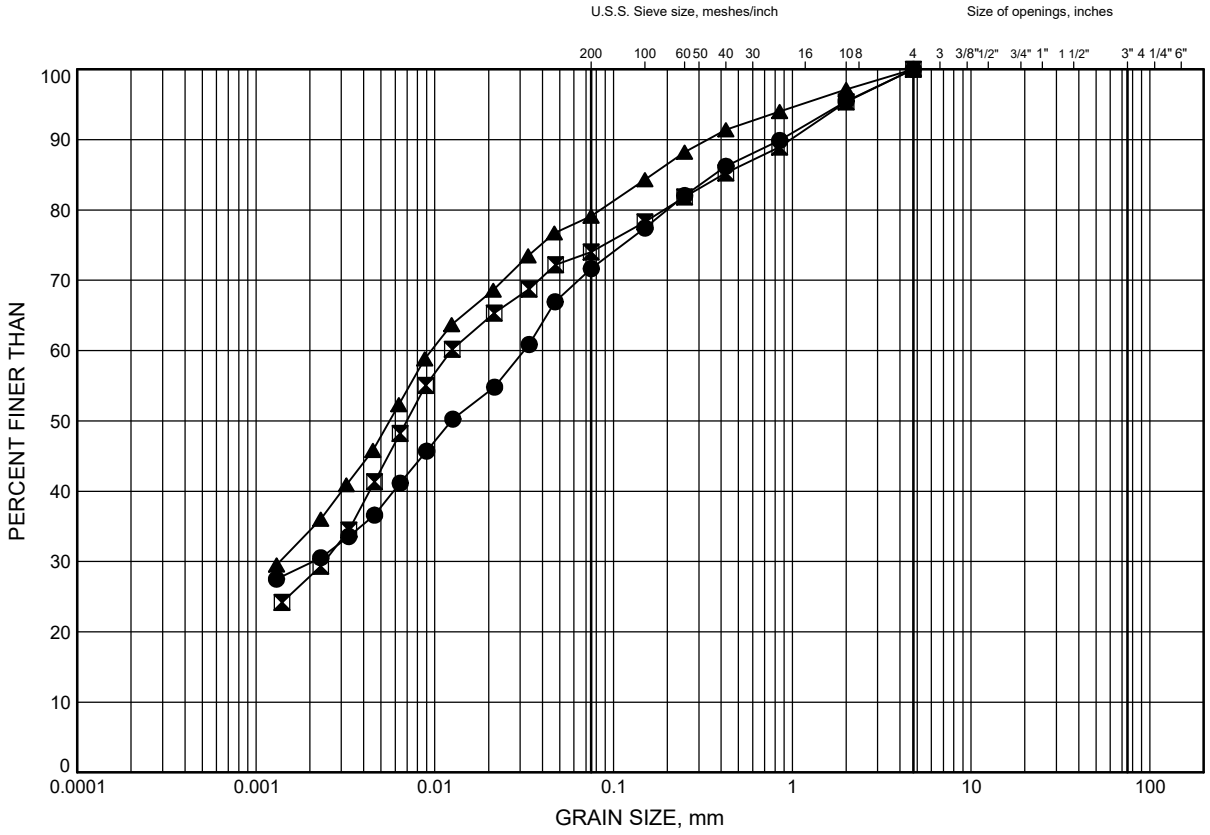
GRAIN SIZE DISTRIBUTION - THURBER TEL-20337.GPJ 5/17/19

Burnhamthorpe Road West Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D2

Silty CLAY FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	18-01	1.07	181.41
⊠	18-09	1.07	182.05
▲	18-14	1.07	177.34

Date May 2019

Project 20337

THURBER

Prep'd AN

Chkd. MTB

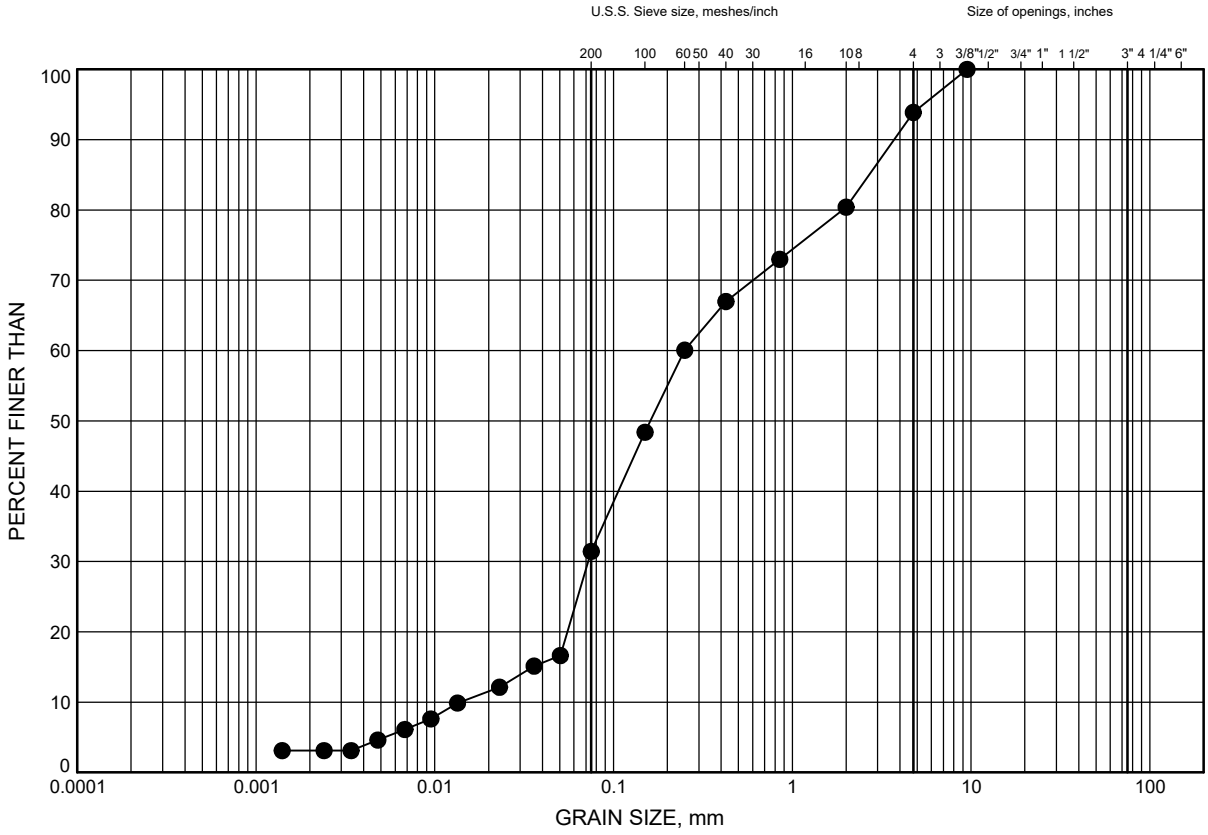
GRAIN SIZE DISTRIBUTION - THURBER TEL-20337.GPJ 5/17/19

Burnhamthorpe Road West Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D3

Silty SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	18-08	1.07	183.98

Date May 2019

Project 20337

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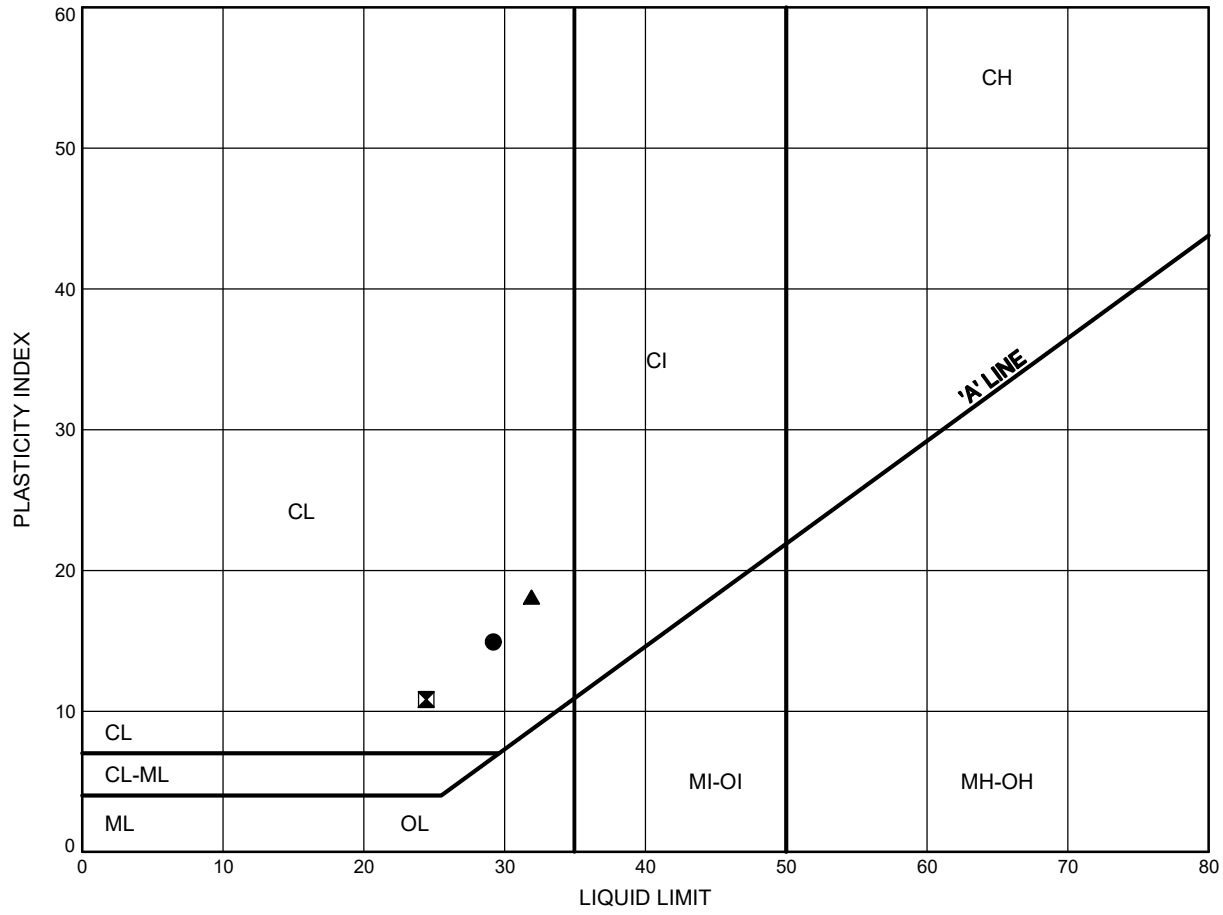
GRAIN SIZE DISTRIBUTION - THURBER TEL-20337.GPJ 5/17/19

Burnhamthorpe Road West Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D4

Silty CLAY FILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	18-01	1.07	181.41
⊠	18-09	1.07	182.05
▲	18-14	1.07	177.34

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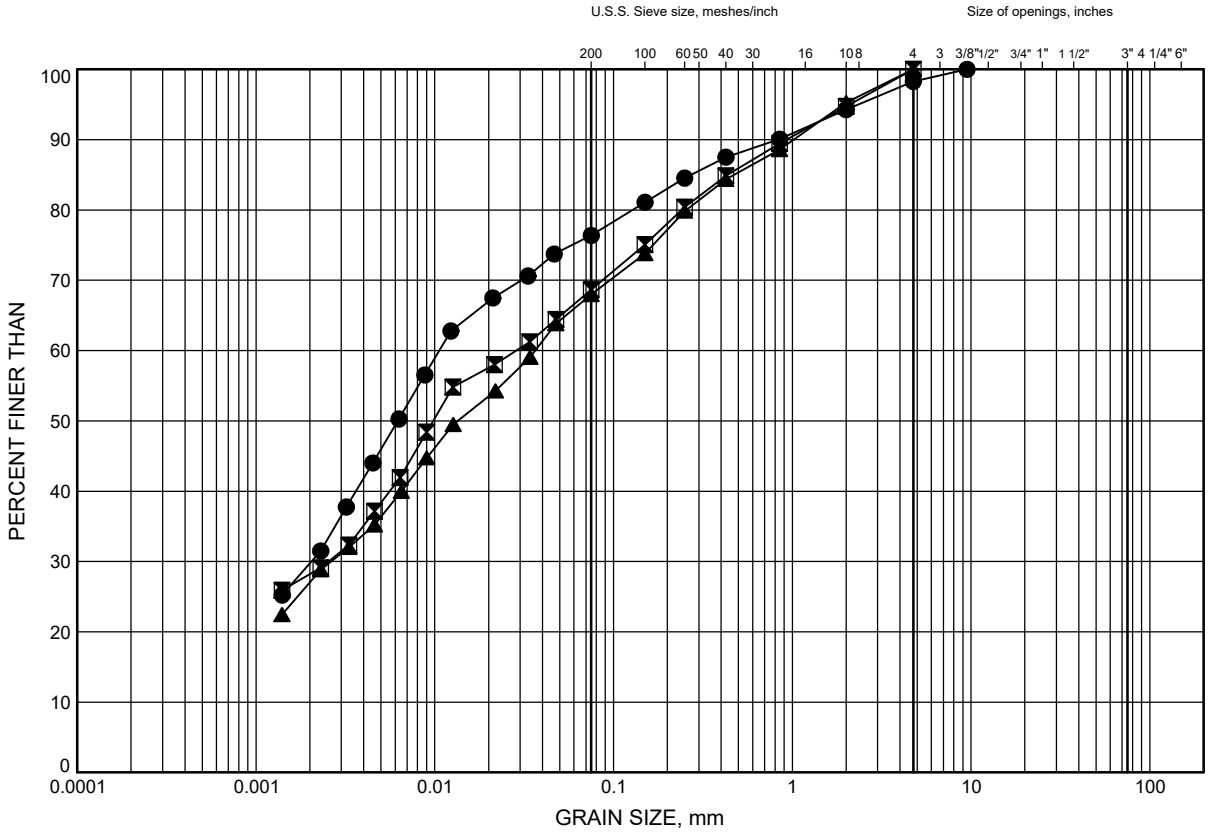
THURBALT TEL-20337.GPJ 5/17/19

Burnhamthorpe Road West Class EA

GRAIN SIZE DISTRIBUTION

FIGURE D5

Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	18-19	1.07	174.31
⊠	18-20	1.83	172.88
▲	18-22	1.83	173.80

Date May 2019

Project 20337

THURBER

Prep'd AN

Chkd. MTB

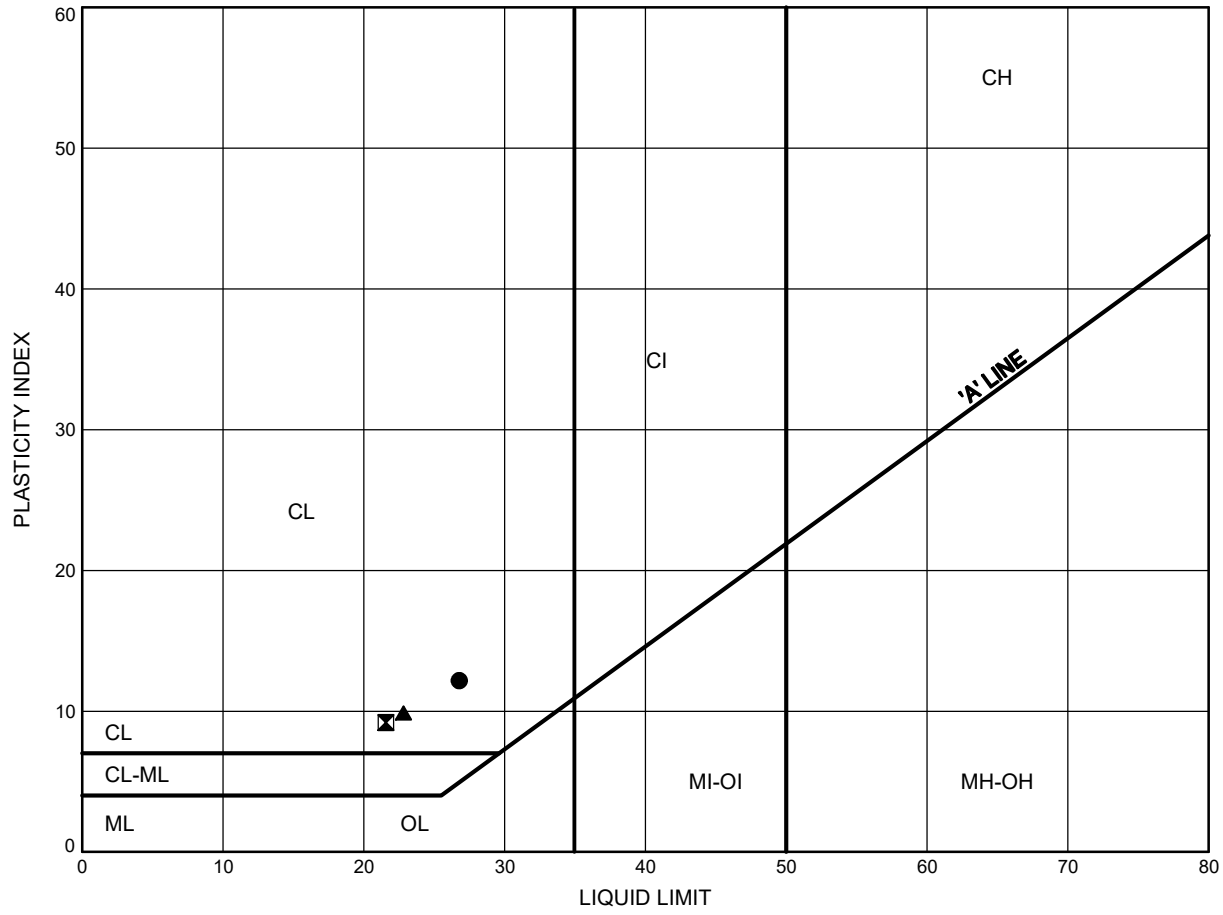
GRAIN SIZE DISTRIBUTION - THURBER TEL-20337.GPJ 5/17/19

Burnhamthorpe Road West Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE D6

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	18-19	1.07	174.31
⊠	18-20	1.83	172.88
▲	18-22	1.83	173.80

Date May 2019

Project 20337

THURBER

Prep'd AN

Chkd. MTB

THURBALT TEL-20337.GPJ 5/17/19

THURBER

Appendix E

Analytical Laboratory Certificates of Analysis

FINAL REPORT

CA14274-APR18 R1

PO# 20337

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

First Page

CLIENT DETAILS

Client	Thurber Engineering Ltd.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7.
Contact	Cecile Ritchie
Telephone	905-829-8666
Facsimile	
Email	critchie@thurber.ca
Project	PO# 20337
Order Number	
Samples	Soil (10)

LABORATORY DETAILS

Project Specialist	Deanna Edwards, B.Sc, C.Chem
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2000
Facsimile	705-652-6365
Email	deanna.edwards@sgs.com
SGS Reference	CA14274-APR18
Received	04/12/2018
Approved	04/19/2018
Report Number	CA14274-APR18 R1
Date Reported	05/13/2019

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: 7.2 degrees C

Cooling Agent Present: Yes

Custody Seal Present: No

SIGNATORIES

Deanna Edwards, B.Sc, C.Chem

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: PO# 20337
Project Manager: Cecile Ritchie
Samplers: Cecile R

PACKAGE: **BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	18-15 SS2 5-7'
Sample Matrix	Soil
Sample Date	10/04/2018

Parameter	Units	RL	L1	L2	Result
BTEX					
Benzene	µg/g	0.02	0.32	0.21	< 0.02
Ethylbenzene	µg/g	0.05	9.5	2	< 0.05
Toluene	µg/g	0.05	68	2.3	< 0.05
Xylene (total)	µg/g	0.05	26	3.1	< 0.05
m/p-xylene	µg/g	0.05			< 0.05
o-xylene	µg/g	0.05			< 0.05
Hydrides					
Antimony	µg/g	0.8	40	7.5	< 0.8
Arsenic	µg/g	0.5	18	18	4.9
Selenium	µg/g	0.7	5.5	2.4	< 0.7
Metals and Inorganics					
Moisture Content	%	-			15.0
Barium	µg/g	0.01	670	390	88
Beryllium	µg/g	0.02	8	4	0.54
Boron	µg/g	1	120	120	6
Cadmium	µg/g	0.02	1.9	1.2	0.09
Chromium	µg/g	0.5	160	160	20
Cobalt	µg/g	0.01	80	22	11
Copper	µg/g	0.1	230	140	27
Lead	µg/g	0.1	120	120	8.5
Molybdenum	µg/g	0.1	40	6.9	0.5
Nickel	µg/g	0.1	270	100	23
Silver	µg/g	0.01	40	20	0.03

Result							
< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
4.9	4.1	4.7	4.6	4.9	10	4.3	6.3
< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
15.0	10.9	17.6	11.1	11.1	5.4	12.3	8.9
88	69	78	64	94	37	88	60
0.54	0.55	0.71	0.51	0.48	0.21	0.56	0.28
6	6	2	6	5	8	6	7
0.09	0.06	0.15	0.08	0.09	0.10	0.09	0.15
20	18	22	18	17	12	19	15
11	12	13	12	11	6.9	11	17
27	30	19	28	28	93	28	49
8.5	8.5	14	8.3	8.9	20	8.8	10
0.5	0.4	0.6	0.4	0.5	1.4	0.5	0.6
23	23	20	26	24	11	24	13
0.03	0.03	0.03	0.02	0.01	0.08	0.03	0.22

Client: Thurber Engineering Ltd.
Project: PO# 20337
Project Manager: Cecile Ritchie
Samplers: Cecile R

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

L1 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Parameter	Units	RL	L1	L2	Sample Number 8	9	10	11	12	13	14	15
					Sample Name 18-16 SS1 2.5'-4.5'	18-10 SS2 5-7'	18-1 SS2 5-7	18-19 SS2 5-7	18-11 SS1 2.5-4.5	18-4 GS1 0-2'	18-6 SS1 2.5-4.5	18-22 GS1 0-2'
					Sample Matrix Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
					Sample Date 10/04/2018	10/04/2018	10/04/2018	10/04/2018	10/04/2018	10/04/2018	10/04/2018	10/04/2018
					Result	Result	Result	Result	Result	Result	Result	Result
Metals and Inorganics (continued)												
Thallium	µg/g	0.02	3.3	1	0.14	0.14	0.14	0.14	0.12	0.11	0.13	0.11
Uranium	µg/g	0.002	33	23	0.63	0.98	0.54	0.68	0.56	0.29	0.57	0.34
Vanadium	µg/g	3	86	86	27	23	33	25	23	12	26	20
Zinc	µg/g	0.7	340	340	61	55	59	55	54	47	55	54
Water Soluble Boron	µg/g	0.5	2	1.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Other (ORP)												
Mercury	µg/g	0.05	3.9	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	12	5	32.0	4.8	1.5	20.6	30.5	13.8	69.2	6.8
Conductivity	mS/cm	0.002	1.4	0.7	2.2	2.3	0.96	2.1	2.0	1.4	4.9	0.62
Chromium VI	µg/g	0.2	8	8	< 0.2	< 0.2	0.4	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
PHCs												
F1 (C6-C10)	µg/g	10	55	55	< 10							
F1-BTEX (C6-C10)	µg/g	10			< 10							
F2 (C10-C16)	µg/g	10	230	98	< 10							
F3 (C16-C34)	µg/g	50	1700	300	< 50							
F4 (C34-C50)	µg/g	50	3300	2800	< 50							
Chromatogram returned to baseline at nC50	Yes / No	-			YES							

Client: Thurber Engineering Ltd.
Project: PO# 20337
Project Manager: Cecile Ritchie
Samplers: Cecile R

PACKAGE: **Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	16
Sample Name	18-13 GS1 0-2'
Sample Matrix	Soil
Sample Date	10/04/2018

Parameter	Units	RL	L1	L2	Result	
Hydrides						
Antimony	µg/g	0.8	40	7.5	< 0.8	
Arsenic	µg/g	0.5	18	18	6.9	
Selenium	µg/g	0.7	5.5	2.4	< 0.7	
Metals and Inorganics						
Moisture Content	%	-			7.7	15.5
Barium	µg/g	0.01	670	390	79	
Beryllium	µg/g	0.02	8	4	0.24	
Boron	µg/g	1	120	120	6	
Cadmium	µg/g	0.02	1.9	1.2	0.10	
Chromium	µg/g	0.5	160	160	9.8	
Cobalt	µg/g	0.01	80	22	33	
Copper	µg/g	0.1	230	140	66	
Lead	µg/g	0.1	120	120	8.9	
Molybdenum	µg/g	0.1	40	6.9	0.6	
Nickel	µg/g	0.1	270	100	11	
Silver	µg/g	0.01	40	20	3.9	
Thallium	µg/g	0.02	3.3	1	0.12	
Uranium	µg/g	0.002	33	23	0.33	
Vanadium	µg/g	3	86	86	17	
Zinc	µg/g	0.7	340	340	45	
Water Soluble Boron	µg/g	0.5	2	1.5	< 0.5	

Client: Thurber Engineering Ltd.
Project: PO# 20337
Project Manager: Cecile Ritchie
Samplers: Cecile R

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

L1 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	16
Sample Name	18-13 GS1 0-2'
Sample Matrix	Soil
Sample Date	10/04/2018

Parameter	Units	RL	L1	L2	Result
Other (ORP)					
Mercury	µg/g	0.05	3.9	0.27	< 0.05
Sodium Adsorption Ratio	---	0.2	12	5	4.5
Conductivity	mS/cm	0.002	1.4	0.7	0.40
Chromium VI	µg/g	0.2	8	8	< 0.2
Free Cyanide	µg/g	0.05			< 0.05

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED L1	REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED L2
18-16 SS1 2.5'-4.5'					
Conductivity	EPA 6010/SM 2510	mS/cm	2.2	1.4	0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	32.0	12	5
18-10 SS2 5-7'					
Conductivity	EPA 6010/SM 2510	mS/cm	2.3	1.4	0.7
18-1 SS2 5-7					
Conductivity	EPA 6010/SM 2510	mS/cm	0.96		0.7
18-19 SS2 5-7					
Conductivity	EPA 6010/SM 2510	mS/cm	2.1	1.4	0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	20.6	12	5
18-11 SS1 2.5-4.5					
Conductivity	EPA 6010/SM 2510	mS/cm	2.0	1.4	0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	30.5	12	5
18-4 GS1 0-2'					
Conductivity	EPA 6010/SM 2510	mS/cm	1.4		0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	13.8	12	5
18-6 SS1 2.5-4.5					
Conductivity	EPA 6010/SM 2510	mS/cm	4.9	1.4	0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	69.2	12	5
18-22 GS1 0-2'					
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	---	6.8		5
18-13 GS1 0-2'					
Cobalt	EPA 3050/EPA 200.8	µg/g	33		22

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	EWL0267-APR18	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	SKA5037-APR18	µg/g	0.05	<0.05	ND	20	103	80	120	98	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	DIO0262-APR18	µg/g	0.2	<0.2	ND	20	101	80	120	99	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	EMS0082-APR18	µg/g	0.05	<0.05	ND	20	97	80	120	116	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	EMS0082-APR18	µg/g	0.01	<0.01	ND	20	103	70	130	106	70	130
Arsenic	EMS0082-APR18	µg/g	0.5	<0.5	18	20	96	70	130	113	70	130
Barium	EMS0082-APR18	µg/g	0.01	<0.01	4	20	101	70	130	104	70	130
Beryllium	EMS0082-APR18	µg/g	0.02	<0.02	4	20	100	70	130	87	70	130
Boron	EMS0082-APR18	µg/g	1	<1	ND	20	105	70	130	NV	70	130
Cadmium	EMS0082-APR18	µg/g	0.02	<0.02	ND	20	95	70	130	98	70	130
Cobalt	EMS0082-APR18	µg/g	0.01	<0.01	7	20	96	70	130	102	70	130
Chromium	EMS0082-APR18	µg/g	0.5	<0.5	3	20	96	70	130	118	70	130
Copper	EMS0082-APR18	µg/g	0.1	<0.1	5	20	96	70	130	109	70	130
Molybdenum	EMS0082-APR18	µg/g	0.1	<0.1	ND	20	101	70	130	76	70	130
Nickel	EMS0082-APR18	µg/g	0.1	<0.1	2	20	94	70	130	108	70	130
Lead	EMS0082-APR18	µg/g	0.1	<0.1	2	20	95	70	130	112	70	130
Antimony	EMS0082-APR18	µg/g	0.8	<0.8	ND	20	80	70	130	74	70	130
Selenium	EMS0082-APR18	µg/g	0.7	<0.7	ND	20	104	70	130	NV	70	130
Thallium	EMS0082-APR18	µg/g	0.02	<0.02	20	20	95	70	130	107	70	130
Uranium	EMS0082-APR18	µg/g	0.002	<0.002	1	20	92	70	130	83	70	130
Vanadium	EMS0082-APR18	µg/g	3	<3	1	20	98	70	130	99	70	130
Zinc	EMS0082-APR18	µg/g	0.7	<0.7	5	20	96	70	130	111	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)	GCM0203-APR18	µg/g	10	<10	ND	30	104	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)	GCM0176-APR18	µg/g	10	< 10	ND	30	113	80	120	99	60	140
F3 (C16-C34)	GCM0176-APR18	µg/g	50	< 50	ND	30	113	80	120	99	60	140
F4 (C34-C50)	GCM0176-APR18	µg/g	50	< 50	ND	30	113	80	120	99	60	140

QC SUMMARY

Sodium adsorption ratio (SAR)

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVIARD-LAK-AN-021

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
Sodium Adsorption Ratio	ESG0041-APR18	---	0.2				0.16	80	120			

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
Benzene	GCM0202-APR18	µg/g	0.02	< 0.02	ND	50	94	60	130	106	50	140
Ethylbenzene	GCM0202-APR18	µg/g	0.05	< 0.05	ND	50	95	60	130	107	50	140
m/p-xylene	GCM0202-APR18	µg/g	0.05	< 0.05	ND	50	94	60	130	105	50	140
o-xylene	GCM0202-APR18	µg/g	0.05	< 0.05	ND	50	95	60	130	106	50	140
Toluene	GCM0202-APR18	µg/g	0.05	< 0.05	ND	50	95	60	130	106	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	ESG0038-APR18	µg/g	0.5	<0.5	ND	20	99	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.

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

No: CN14274-Apr18

Page ___ of ___

SGS Environment, Health and Safety
- Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361 Web: www.ca.sgs.com

Laboratory Information Section - Lab use only

Received By: Enak-Adjei
Received Date: 04/12/2018 (mm/dd/yy)
Received Time: 10:30 (am) / pm (circle)

Received By (signature): [signature]
Custody Seal Present: Y / N (circle)
Custody Seal Intact: Y / N

Cooling Agent Present: (Y) / N Type: ICE
Temperature Upon Receipt (°C): 7-1, 7-2, 7-3
LAB LIMS #: ___

REPORT INFORMATION

Company: Thurber Engineering
Contact: Cecile Ritchie
Address: 2010 Winston Park Drive Suite 103
Phone: (905) 829 8666
Fax: ___
Email: critchie@thurber.ca

INVOICE INFORMATION

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

PROJECT INFORMATION

Quotation #: ___
P.O. #: 20337
Project #: 20337
Site Location/ID: ___

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 3pm or on weekends : TAT begins the next business day

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

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: ___ Rush Confirmation ID: ___

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

REGULATIONS

Regulation 153 (2011):
☒ Table 1 ☐ Res/Park ☐ Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium
☐ Table 3 ☐ Agri/Other ☐ Fine
☐ Table ___

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	Metals & Inorg.	PHC F1 - F4	COMMENTS: Field Filtered (F) Preserved (P)
1	18-16 SS1 2.5'-4.5'	April 10/18		1	S	/		
2	18-10 SS2 5-7'	"		1	S	/		
3	18-1 SS2 5-7	"		1	S	/		
4	18-19 SS2 5-7	"		1	S	/		
5	18-11 SS1 2.5-4.5	"		1	S	/		
6	18-4 ~~SS~~ GS1 0-2'	"		1	S	/		
7	18-6 SS1 2.5-4.5	"		1	S	/		
8	18-22 GS1 0-2'	"		1	S	/		
9	18-13 GS1 0-2'	"		1	S	/		
10	18-15 SS2 5-7'	"		2 ~~1~~	S		/	

Observations/Comments/Special Instructions

Sampled By (NAME): Cecile Ritchie Signature: [signature] Date: 04/10/18 (mm/dd/yy)
Relinquished by (NAME): Cecile Ritchie Signature: [signature] Date: 04/12/18 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

SGS

SAMPLE INTEGRITY REPORT

Project Number: 20337

SGS Sample ID CA14274-Apr18

Date / Time Sampled Apr 10/18

Client Sample ID See CoC

ONTARIO REGULATION 153/04

	ALL
Sample Submission General Sample Integrity Violations	
Temperature >10 C upon receipt if not sampled same day	☐
No evidence of cooling trend initiated if sampled same day	☐
Chain of Custody not submitted	☐
Chain of Custody incomplete	☐
Chain of Custody not signed / dated	☐
Chain of Custody not a current version	☐
Bottles / Samples listed on CoC but not received	☐
Bottles / Samples received but not listed on the CoC	☐
Sample container received empty	☐

Sample Specific Sample Integrity Violations							
Sample received past hold time	☐	☐	☐	☐	☐	☐	☐
Incorrect preservation (including no preservation where required)	☐	☐	☐	☐	☐	☐	☐
Headspace present in VOC vial (aqueous)	☐	☐	☐	☐	☐	☐	☐
Sample(s) received frozen	☐	☐	☐	☐	☐	☐	☐
Bottle(s) broken or damaged in transport	☐	☐	☐	☐	☐	☐	☐
Discrepancy between sample label and chain of custody	☐	☐	☐	☐	☐	☐	☐
Analysis requirements absent / unclear	☐	☐	☐	☐	☐	☐	☐
Missing or incorrect sample label(s)	☐	☐	☐	☐	☐	☐	☐
Inappropriate sample container used	☐	☐	☐	☐	☐	☐	☐
Insufficient number of bottles received	☐	☐	☐	☐	☐	☐	☐
Limited sample volume	☐	☐	☐	☐	☐	☐	☐
Insufficient sample volume	☐	☐	☐	☐	☐	☐	☐
Sample contains multiple phases	☐	☐	☐	☐	☐	☐	☐

Sediment Log							
Groundwater samples contain visible sediment / particulate	☐	☐	☐	☐	☐	☐	☐
Groundwater contains greater than 1cm of sediment / particulate matter in bottle	☐	☐	☐	☐	☐	☐	☐

Additional Comments/Remarks:

No issues upon receipt ☑ Initials: BC

FINAL REPORT

CA14273-APR18 R

PO# 20337

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14273-APR18 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Deanna Edwards, B.Sc, C.Chem
		Laboratory	SGS Canada Inc.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7.	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Cecile Ritchie	Telephone	705-652-2000
Telephone	905-829-8666	Facsimile	705-652-6365
Facsimile		Email	deanna.edwards@sgs.com
Email	critchie@thurber.ca	SGS Reference	CA14273-APR18
Project	PO# 20337	Received	04/12/2018
Order Number		Approved	04/23/2018
Samples	Leachate (2)	Report Number	CA14273-APR18 R
		Date Reported	04/23/2018

COMMENTS

Temperature of Sample upon Receipt: 7.2 degrees C
Cooling Agent Present: Yes
Custody Seal Present: No

SIGNATORIES

Deanna Edwards, B.Sc, C.Chem

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: PO# 20337
Project Manager: Cecile Ritchie
Samplers: Cecile R

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

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

				Sample Number	6	7
				Sample Name	18-20 SS1 2.5-4.5	18-6 GS1 0-2
				Sample Matrix	Leachate	Leachate
				Sample Date	10/04/2018	10/04/2018
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
Acid rock Drainage						
Final pH	-	0.01			6.24	6.00

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

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

				Sample Number	6	7
				Sample Name	18-20 SS1 2.5-4.5	18-6 GS1 0-2
				Sample Matrix	Leachate	Leachate
				Sample Date	10/04/2018	10/04/2018
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
Metals and Inorganics						
Sample weight	g	0.001			100	100
Ext Fluid	#1 or #2	0.01			2	2
^ Ext Volume	mL	0.01			2000	2000
Nitrite (as N)	as N mg/L	0.03			< 0.3↑	< 0.3↑
Nitrate (as N)	as N mg/L	0.06			< 0.6↑	< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000		< 0.6↑	< 0.6↑
Fluoride	mg/L	0.06	150		0.43	0.45
Cyanide (total)	mg/L	0.01	20		< 0.01	< 0.01
Mercury	mg/L	0.00001	0.1		0.00001	< 0.00001
Arsenic	mg/L	0.01	2.5		0.01	< 0.01
Silver	mg/L	0.08	5		< 0.08	< 0.08
Barium	mg/L	0.0009	100		0.615	0.342
Boron	mg/L	0.005	500		0.136	0.077

Client: Thurber Engineering Ltd.
Project: PO# 20337
Project Manager: Cecile Ritchie
Samplers: Cecile R

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

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

Sample Number	6	7
Sample Name	18-20 SS1 2.5-4.5	18-6 GS1 0-2
Sample Matrix	Leachate	Leachate
Sample Date	10/04/2018	10/04/2018

Parameter	Units	RL	L1	Result	Result
Metals and Inorganics (continued)					
Cadmium	mg/L	0.001	0.5	0.001	0.002
Chromium	mg/L	0.001	5	0.003	< 0.001
Lead	mg/L	0.007	5	< 0.007	< 0.007
Selenium	mg/L	0.01	1	< 0.01	< 0.01
Uranium	mg/L	0.1	10	< 0.1	< 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)	DIO0267-APR18	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0267-APR18	mg/L	0.03	<0.03	ND	20	98	80	120	102	75	125
Nitrate (as N)	DIO0267-APR18	mg/L	0.06	<0.06	1	20	103	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)	SKA0121-APR18	mg/L	0.01	<0.01	ND	10	102	90	110	78	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	EWL0284-APR18	mg/L	0.06	<0.06	8	10	104	90	110	84	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	EHG0020-APR18	mg/L	0.00001	< 0.00001	ND	20	84	80	120	104	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	ESG0045-APR18	mg/L	0.08	< 0.08	ND	20	95	90	110	104	70	130
Arsenic	ESG0045-APR18	mg/L	0.01	< 0.01	11	20	106	90	110	94	70	130
Barium	ESG0045-APR18	mg/L	0.0009	< 0.0009	5	20	103	90	110	83	70	130
Boron	ESG0045-APR18	mg/L	0.005	< 0.005	6	20	101	90	110	78	70	130
Cadmium	ESG0045-APR18	mg/L	0.001	< 0.001	6	20	104	90	110	94	70	130
Chromium	ESG0045-APR18	mg/L	0.001	< 0.002	2	20	104	90	110	NV	70	130
Lead	ESG0045-APR18	mg/L	0.007	< 0.007	ND	20	105	90	110	81	70	130
Selenium	ESG0045-APR18	mg/L	0.01	< 0.01	ND	20	102	90	110	129	70	130
Uranium	ESG0045-APR18	mg/L	0.1	< 0.1	ND	20	102	90	110	120	70	130

Metals Prep

|

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
Total Recov.Metals	ESG0045-APR18	Prep	-		Error!							

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.

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RPD: Relative percent difference

AC: Acceptance criteria

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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.

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-- End of Analytical Report --

SGS

Request for Laboratory Services and CHAIN OF CUSTODY

No:

Page ___ of ___

SGS Environment, Health and Safety
- Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361 Web: www.ca.sgs.com

CA 14273-APR18

Laboratory Information Section - Lab use only

Received By: ERICK - ADJ#1
Received Date: 04/12/2018 (mm/dd/yy)
Received Time: 10:32 am / pm (circle)

Received By (signature): [signature]
Custody Seal Present: Y / N (circle)
Custody Seal Intact: Y / N

Cooling Agent Present: Y / N Type: ICE
Temperature Upon Receipt (°C): 7.1, 7.2, 7.3

LAB LIMS #:

REPORT INFORMATION

Company: Thurber Engineering
Contact: Cecile Ritchie
Address: 2010 Winston Park Drive Suite 103
Phone: (905) - 829 8666
Fax:
Email: critchie@thurber.ca

INVOICE INFORMATION

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

PROJECT INFORMATION

Quotation #:
P.O. #: 20337
Project #: 20337
Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 3pm or on weekends : TAT begins the next business day

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

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153 (2011):
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium
☐ Table ___ ☐ Fine

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

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

DRINKING WATER SAMPLES (POTABLE WATER 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
1	18-20 SS1 2.5-4.5	April 10/18			S
2	18-6 GS1 0-2	April 10/18			S
3					
4					
5					
6					
7					
8					
9					
10					

We test 4 inorganics

COMMENTS:
Field Filtered (F)
Preserved (P)

Observations/Comments/Special Instructions

Sampled By (NAME): Cecile Ritchie **Signature:** [signature] Date: 04/10/18 (mm/dd/yy) — Pink Copy - Client

Relinquished by (NAME): Cecile Ritchie **Signature:** [signature] Date: 04/12/18 (mm/dd/yy) — Yellow & White Copy - SGS

SGS

SAMPLE INTEGRITY REPORT

Project Number: 20337

SGS Sample ID CA14273-Apr18

Date / Time Sampled Apr 10 18

Client Sample ID See COC

ONTARIO REGULATION 153/04

	ALL
Sample Submission General Sample Integrity Violations	
Temperature >10 C upon receipt if not sampled same day	☐
No evidence of cooling trend initiated if sampled same day	☐
Chain of Custody not submitted	☐
Chain of Custody incomplete	☐
Chain of Custody not signed / dated	☐
Chain of Custody not a current version	☐
Bottles / Samples listed on CoC but not received	☐
Bottles / Samples received but not listed on the CoC	☐
Sample container received empty	☐

Sample Specific Sample Integrity Violations							
Sample received past hold time	☐	☐	☐	☐	☐	☐	☐
Incorrect preservation (including no preservation where required)	☐	☐	☐	☐	☐	☐	☐
Headspace present in VOC vial (aqueous)	☐	☐	☐	☐	☐	☐	☐
Sample(s) received frozen	☐	☐	☐	☐	☐	☐	☐
Bottle(s) broken or damaged in transport	☐	☐	☐	☐	☐	☐	☐
Discrepancy between sample label and chain of custody	☐	☐	☐	☐	☐	☐	☐
Analysis requirements absent / unclear	☐	☐	☐	☐	☐	☐	☐
Missing or incorrect sample label(s)	☐	☐	☐	☐	☐	☐	☐
Inappropriate sample container used	☐	☐	☐	☐	☐	☐	☐
Insufficient number of bottles received	☐	☐	☐	☐	☐	☐	☐
Limited sample volume	☐	☐	☐	☐	☐	☐	☐
Insufficient sample volume	☐	☐	☐	☐	☐	☐	☐
Sample contains multiple phases	☐	☐	☐	☐	☐	☐	☐
Sediment Log							
Groundwater samples contain visible sediment / particulate	☐	☐	☐	☐	☐	☐	☐
Groundwater contains greater than 1cm of sediment / particulate matter in bottle	☐	☐	☐	☐	☐	☐	☐

Additional Comments/Remarks:

No issues upon receipt ☐ Initials:

# of Bottles not checked.

THURBER

Appendix F

Pavement Design Analysis

1997 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
Thurber Engineering Ltd.

Flexible Structural Design Module

Burnhamthorpe Road Class EA Study
Burnhamthorpe Road Widening
Flexible Pavement Design

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	3,233,225
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	90 %
Overall Standard Deviation	0.44
Roadbed Soil Resilient Modulus	30,000 kPa
Stage Construction	1
Calculated Design Structural Number	122 mm

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	17,014
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %
Percent Trucks in Design Direction	50 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	2 %
Average Initial Truck Factor (ESALs/truck)	2.5
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	1.5 %
Growth	Compound
Total Calculated Cumulative ESALs	3,233,225

Rigorous ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	17,014
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	90 %
Percent Trucks in Design Direction	50 %

Vehicle Class	Percent of ADT	Annual % Growth	Average Initial Truck Factor (ESALs/ Truck)	Annual % Growth in Truck Factor	Accumulated 80-kN ESALs over Performance Period
Total	-	-	-	-	-

Growth	Simple
Total Calculated Cumulative ESALs	- *

*Note: This value is not represented by the inputs or an error occurred in calculation.

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(mm)	Width (m)	Calculated SN (mm)
1	HMA	0.42	1	140	3.75	59
2	Granular Base	0.14	1	200	3.75	28
3	Granular Subbase	0.09	1	400	3.75	36
Total	-	-	-	740	-	123

Layered Thickness Design

Thickness precision: Actual

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Spec Thickness (Di)(mm)	Min Thickness (Di)(mm)	Elastic Modulus (kPa)	Width (m)	Calculated Thickness (mm)	Calculated SN (mm)
1	HMA	0.42	1	-	20	2,750,000	3.75	137	57
2	Granular Base	0.14	1	200	-	250,000	3.75	200	28
3	Granular Subbase	0.09	1	-	100	150,000	3.75	406	37
Total	-	-	-	-	-	-	-	742	122