THURBER ENGINEERING LTD.

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
CLASS ENVIRONMENTAL ASSESSMENT STUDY
NINTH LINE FROM EGLINTON AVENUE WEST TO DERRY ROAD WEST
CITY OF MISSISSAUGA, ONTARIO

Report

to

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THURBER

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THURBER

1 INTRODUCTION

This report presents the results of a preliminary geotechnical investigation conducted in support of the Municipal Class Environmental Assessment (EA) for the proposed improvements of Ninth Line from Eglinton Avenue West to Derry Road West 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 HDR who are conducting the Class EA for the City of Mississauga. The investigation was conducted concurrently with a Phase One Environmental Site Assessment by Thurber, under separate cover.

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.

This report uses the International System of Units (SI Units).

2 SITE DESCRIPTION

The study area extends along Ninth Line from Eglinton Avenue West to Derry Road West, a distance of approximately 6.2 km. Ninth Line within the study area is an north-south arterial roadway presently comprising a two-lane road cross-section with a centre left-turn lane and a posted speed limit of up to 70 km/hr.

The area surrounding the project corridor is residential east of the centreline of Ninth Line. West of the centreline of Ninth Line, the property use is a mix of commercial and industrial with some open fields. Highway 407 runs parallel to Ninth Line, within 400 m west of the study area.

3 SITE INVESTIGATION AND FIELD TESTING

3.1 Field Investigation

The field work for this investigation was carried out on between August 5, 2020 and August 13, 2020 and comprised of 30 boreholes advanced at the approximate locations along Ninth Line, as

shown on the borehole location plan in Appendix A. The boreholes are designated as 20-01 to 20-30 and were generally advanced to depths from 4.7 to 5.2 m below the existing ground surface with the exception of Boreholes 20-05, 20-06, 20-26 and 20-29 which were terminated upon encountering shale or auger refusal at shallower depths between 3.0 and 4.0 m.

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 Trimble R10 GPS unit. During the utility locate process, the presence of an unlocatable 400 mm diameter watermain was identified in the boulevard on the east side of Ninth Line. As the exact location of the watermain was not confirmed for this preliminary investigation, no boreholes were drilled on the east lane or east shoulder of Ninth Line between Eglinton Avenue West and Britannia Road West.

The boreholes were drilled with solid stem augers by a specialized drilling subcontractor (DBW Drilling Limited) 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. Standpipe piezometers (25 mm diameter) were installed in seven (7) of the boreholes to allow for groundwater level measurements. The boreholes were backfilled with auger cuttings and the roadway surface was reinstated with asphalt cold patch. The piezometers were decommissioned following completion of the field investigation.

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

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 B. The grain size distribution curves and Atterberg Limits test results are plotted on figures attached in Appendix C.

To evaluate the requirements for management and/or disposal of soil excavated during construction, selected soil samples recovered from the boreholes were submitted to Bureau

Veritas Laboratories for analysis of selected parameters defined in the Request for Proposal for this project and in accordance with Ontario Regulation 153/04 (O.Reg. 153/04). The sample locations and material types are summarized in Table 3.1.

Table 3.1 – Samples Selected for Environmental Testing

Borehole	Sample No.	Depth (ft)	Soil Type	Analysis
BH20-01	SS6	15’ – 17’	Sand and Silt	O.Reg 153 PHCs, BTEX/F1-F4, EC, SAR
BH20-04	SS5	10’ – 12’	Silty Sand	
BH20-05	SS3	5’ – 7’	Sandy Silt Till	
BH20-09	SS4	7’6” – 9’6”	Silty Clay Till	
BH20-15	SS3	5’ – 7’	Silty Clay	
BH20-18	SS4	7’6” – 9’6”	Silty Clay Till	
BH20-19	SS5	10’ – 12’	Silty Clay Till	
BH20-23	SS6	10’ – 12’’	Silty Clay Till	
BH20-26	SS4	5’ – 7’	Silty Clay Till	
BH20-30	SS5	10’ – 12’	Silty Clay Till	

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

4 SUMMARY OF SITE CONDITIONS

4.1 Surface Conditions

Ninth Line is currently a two-lane arterial road with a centre left-turn lane between Foxwood Avenue and Eglinton Avenue West and with left turn lanes and an urban cross-section at select intersections between Foxwood Avenue and Derry Road West. The existing travel lanes are comprised of an asphalt pavement, with an unpaved gravel shoulder on the east road edge and a paved pedestrian sidewalk on the west road edge.

4.1.1 Geological Conditions

The study area is located within the Peel Plain physiographic region to the north and the South Slope physiographic region to the south of the alignment, as delineated in The Physiography of Southern Ontario by Chapman and Putnam (1984). The surficial geology consists of glaciolacustrine deposits of silt and clay with minor sand, as well as Halton till, a clayey silt to silty clay till that contains occasional sand layers. The underlying bedrock in the area consists of shale,

limestone, dolostone and siltstone of the Queenston Formation.

4.1.2 Surface Drainage

Drainage of surface water along the existing corridor is managed through open ditches on the east side of the roadway and catch basins on the west side of the road.

Major drainage features in the area comprise of tributaries of Sixteen Mile Creek that flow generally along Hwy 407 to the west of Ninth Line. One tributary crosses Ninth Line to the north of Britannia Road. Another tributary crosses Ninth Line to the north of Deepwood Heights.

4.1.3 Pavement Condition

The current condition of the pavement surface on Ninth Line is considered **Good**, with predominant pavement distresses consisting of extensive, slight to moderate severity longitudinal cracking, with intermittent, slight to moderate severity transverse cracking. In localized poorly performing areas, pavement distresses included severe wheelpath fatigue cracking and slight to moderate pavement rutting, with the cracks repaired with crack sealant.

4.1.4 Topsoil Thickness

At several borehole locations, hand dug test pits were carried out in order to measure the thickness of surficial topsoil beside the roadway, adjacent to the closest borehole. The measured topsoil thicknesses are summarized in Table 4.1 below.

Table 4.1 – Topsoil Thickness Summary

Borehole Location	Side of Ninth Line	Topsoil Thickness (mm)
20-02	West	100
20-05	East	25
20-12	West	150
20-17	West	75
20-26	West	25
20-29	West	75

4.2 Pavement Structure

The pavement structure encountered in the boreholes drilled on Ninth Line consisted of 150 mm to 250 mm of asphalt, overlying granular base fill varying from sand and gravel to gravelly sand

with some silt. The thickness of the granular fill under the asphalt pavement ranged from approximately 150 mm to 600 mm.

Moisture contents for the sand and gravel to gravelly sand fill ranged from 1 to 7 percent.

The results of grain size distribution analyses conducted on samples of the granular material are presented on Figures C1 to C3 of Appendix C. A summary of these results is presented below. In general, the gradation of the samples is finer than the requirements for OPSS Granular A and Granular B, Type I and Type II. Testing of bulk samples collected from open test pits would be required to confirm the gradation.

Soil Particle	Percentage (%)
Gravel	25 to 47
Sand	38 to 56
Silt & Clay	13 to 25

4.3 Fill

A layer of fill was encountered below the pavement structure in Boreholes 20-14, 20-16, 20-17, 20-20, and 20-26. The fill layer varied considerably from a sandy silt with some clay towards the north end of the alignment ranging to silty clay with trace to some sand and trace gravel moving south towards Eglinton Ave W. This layer was typically described as brown to black and contained organic material at some locations. The fill layers extended to depths between 1.1 m and 1.5 m (Elev. 191.9 m to 188.1 m).

An SPT N-value of 21 blows per 0.3 m of penetration was obtained in the sandy silt fill in Borehole 20-06, indicating a compact relative density. Moisture contents of the fill varied between 2 and 18 percent.

4.4 Silty Clay

A deposit consisting of silty clay with trace sand and trace gravel was encountered directly below the pavement structure or fill materials in Boreholes 20-11 to 20-17. This layer was encountered to depths ranging from 3.0 m to 4.1 m (Elev. 187.3 to 185.7 m) where fully penetrated, and to a borehole termination depth of 5.2 m in Borehole 20-12 (Elev. 185.4 m).

SPT N-values obtained in the silty clay deposit ranged from 6 to 26 blows per 0.3 m of penetration, indicating a firm to very stiff consistency. Moisture contents varied between 13 and 29 percent, typically between 21 and 26 percent.

The results of grain size distribution analyses conducted on samples of the silty clay are presented on Figure C4 of Appendix C. The results of the Atterberg Limits tests are presented on Figure C5. A summary of these results is presented below.

Soil Particle	Percentage (%)
Gravel	0
Sand	1 to 9
Silt	45 to 62
Clay	34 to 53

Soil Property	Percentage (%)
Liquid Limit	32 to 44
Plastic Limit	18 to 21
Plasticity Index	14 to 23

The Atterberg Limits test results indicate that the silty clay varies from low to intermediate plasticity, with group symbols of CL to CI.

4.5 Silty Clay Till

A till deposit consisting of silty clay was encountered either directly below the pavement structure or underlying the fill or silty clay layers in Boreholes 20-02, 20-07 to 20-11, and 20-13 to 20-30. The silty clay till generally contains some sand to sandy and trace gravel. These boreholes were all terminated within the till deposit at depths between 3.0 m and 5.2 m (Elev. 195.7 to 181.8 m) except for Borehole 20-07 where the deposit was 3.5 m thick and extended to a depth of 4.0 m (Elev. 188.9 m).

SPT N-values obtained in the till deposit ranged from 6 to 78 blows per 0.3 m of penetration, typically between 15 and 38 blows, indicating a fir to hard consistency, typically very stiff to hard. Moisture contents varied between 8 and 38 percent, typically between 9 and 23 percent.

The results of grain size distribution analyses conducted on samples of the silty clay till are presented on Figures C6 to C8 of Appendix D. The results of the Atterberg Limits tests are presented on Figures C9 and C10. A summary of these results is presented below.

Soil Particle	Percentage (%)
Gravel	1 to 10
Sand	20 to 37
Silt	38 to 48
Clay	17 to 37

Soil Property	Percentage (%)
Liquid Limit	21 to 28
Plastic Limit	13 to 16
Plasticity Index	6 to 12

The Atterberg Limits test results indicate that the silty clay till has low plasticity, with a group symbol of CL.

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

4.6 Silty Sand to Sandy Silt Till

A deposit of native silty sand to sandy silt till with trace to some clay and trace gravel was encountered directly below the granular fill in Boreholes 20-04 to 20-06. The till deposit ranged in thickness from 1.8 m to 3.3 m and extended to depths of 2.2 to 3.8 m (Elev. 194.5 to 190.2 m).

SPT ‘N’ values measured in the silty sand to sandy silt till deposit ranged from 21 to 78 blows per 0.3 m of penetration, indicating that the deposit is compact to very dense. The measured moisture contents in the deposit ranged between 9 and 18 percent.

The results of grain size analyses conducted on samples of the silty sand to silty silt till deposit are presented on Figure C11 in Appendix C. The results of an Atterberg Limits test are presented on Figure C12. The results for the silt and sand to silt and sand till are summarized as follows:

Soil Particle	Percentage (%)
Gravel	1 to 8
Sand	21 to 46
Silt	41 to 62
Clay	5 to 16

Soil Property	Percentage (%)
Liquid Limit	22
Plastic Limit	16
Plasticity Index	6

The Atterberg Limits test result indicates that the silty sand to sandy silt till has low plasticity to non-plastic, with a group symbol of CL-ML.

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

4.7 Sand to Sand and Silt

A deposit of native sand to sand and silt with trace clay and trace to some gravel was encountered either directly below the granular fill or below the silty clay till or silty sand to sandy silt till in Boreholes 20-01 to 20-04 and 20-07. The sand to sand and silt deposit ranged in thickness from 0.8 m to 2.4 m and extended to depths of 4.0 to 4.6 m (Elev. 196.5 to 192.1 m) where fully penetrated in Boreholes 20-02 and 20-04. Boreholes 20-01, 20-03 and 20-07 were terminated within this deposit at depths of 4.9 to 5.2 m (Elev. 196.2 to 187.7 m).

SPT ‘N’ values measured in this deposit ranged from 11 to greater than 50 blows per 0.3 m of penetration, indicating that the deposit is compact to very dense. The measured moisture contents in the deposit ranged between 8 and 18 percent.

The results of grain size analyses conducted on samples of the sand to sand and silt deposit are presented on Figure C13 in Appendix C. The results are summarized as follows:

Soil Particle	Percentage (%)
Gravel	1 to 8
Sand	43 to 85
Silt	12 to 47
Clay	2 to 6

4.8 Shale

Boreholes 20-04 and 20-05 were terminated within highly weathered shale, and Borehole 20-06 was terminated upon auger refusal on probably bedrock. The boreholes were terminated at depths ranging from 3.4 m to 4.7 m (Elev. 192.0 to 190.2 m).

4.9 Groundwater

The groundwater level was measured upon completion in the majority of the open boreholes and in the standpipe piezometers installed in Boreholes 20-04, 20-09, 20-13, 20-17, 20-18, 20-21 and 20-28. The summary of measured water levels is provided in Table 4.2 below:

Table 4.2 – Summary of Groundwater Level Measurements

Borehole ID	Water Level (m)	Elevation (m)	Measurement type
20-01	3.66	197.8	open borehole
20-02	Dry	-	open borehole
20-03	1.83	196.5	open borehole
20-04	1.66	195.0	standpipe piezometer
20-07	4.10	188.8	open borehole
20-08	3.96	187.8	open borehole
20-09	2.25	189.0	standpipe piezometer
20-11	Dry	-	open borehole
20-12	Dry	-	open borehole
20-13	2.95	187.3	standpipe piezometer
20-16	Dry	-	open borehole
20-17	3.09	187.2	standpipe piezometer
20-18	2.50	187.0	standpipe piezometer
20-19	Dry	-	open borehole
20-21	2.24	187.0	standpipe piezometer
20-22	Dry	-	open borehole
20-23	Dry	-	open borehole

Borehole ID	Water Level (m)	Elevation (m)	Measurement type
20-24	Dry	-	open borehole
20-25	Dry	-	open borehole
20-27	Dry	-	open borehole
20-28	1.67	186.3	standpipe piezometer
20-30	Dry	-	open borehole

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.

4.10 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 2 Standards of O.Reg. 153/04, for Residential, Parkland and Institutional property use. The concentrations of all parameters measured in the samples are below Table 2 Standards, with the exception of Electrical Conductivity (EC) in four samples and Sodium Adsorption Ratio (SAR) in three samples. A summary of samples where exceedances were detected is provided in Table 4.3 below. The laboratory Certificate of Analysis is provided in Appendix D.

Table 4.3 – Summary of Analytical Test Exceedances

Sample	Soil Type	Parameter	Guideline Value*	Test Result
20-05 SS3 1.5 – 2.1m	Sandy Silt Till	Conductivity	0.7	1.9
		Sodium Adsorption Ratio	5	5.3
20-15 SS3 1.5 – 2.1m	Silty Clay	Conductivity	0.7	2.7
20-18 SS4 2.3 – 2.9m	Silty Clay Till	Conductivity	0.7	2.2
		Sodium Adsorption Ratio	5	18
20-23 SS5 3.0 – 3.7m	Silty Clay Till	Conductivity	0.7	0.88

*Note: Results compared to Table 2 Standards (“Full Depth Generic Site Condition Standards in a Potable Ground Water Condition” for Residential/Park/Institutional Property Use with coarse textured soils)

5 PAVEMENT EVALUATION AND DESIGN

5.1 General

This section of the report presents the design analysis for the rehabilitation and potential widening of Ninth Line based on our interpretation of the borehole information and projected traffic volumes.

5.2 Traffic Analysis

Traffic information for Ninth Line was provided by HDR and included the 2018 Annual Average Daily Traffic (AADT) volumes for Ninth Line and the percentage of heavy trucks for the three roadway segment within the project limits. The highest traffic volume was used in the design process. It is assumed that the provided AADT includes two-way traffic volumes. Forecasted volumes were also provided for the year 2041, which were used to estimate future growth rate. A summary of the provided traffic information is provided in Table 5.1 below.

Table 5.1 – Traffic Summary

Year	AADT	Percentage Trucks
2018	18,500	2.15 %
2041	40,000	2.15 %

Based on the forecasted traffic volumes, a growth rate of 3.4 percent was back-calculated between the years 2018 and 2041. For pavement design purposes, an estimated 2021 (the assumed construction year) AADT of 20,452 will be assumed for Ninth Line, with 2.15 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 Ninth Line is estimated to be some 4.5 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

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 Ninth Line 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 Ninth Line within the project limits is considered to be in Good condition, with pavement distresses such as transverse and longitudinal cracking. Most of the transverse cracks vary from slight to moderate severity, with the majority of the cracks being moderate severity, which negatively affects 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 Ninth Line 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 Ninth Line 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 Ninth Line 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 Ninth Line may not be completed for several years, the existing pavement will continue to deteriorate. Therefore, any rehabilitation treatment considered for the existing portion of Ninth Line should include structural strengthening as part of the roadway improvements.

5.4.3 Full Depth Asphalt Replacement

Based on the AASHTO pavement design analysis and the analysis of the field investigation, the existing pavement on Ninth Line is considered to be approaching the end of the service life, and in need of 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 full-depth removal of the existing asphalt and placement of a new granular base and HMA layers. The existing granular 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.

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.

5.4.4 Pavement Resurfacing with Base Repairs

It is understood that the City would also like to consider a resurfacing strategy for the rehabilitation of the existing travel lanes. However, in consideration of the severity and extent of the distresses observed in the existing pavement, a resurfacing strategy would not be considered a viable long-term pavement rehabilitation option.

Although suitable as a short-term holding strategy, resurfacing the existing pavement would results in reflective cracking of underlying structural distresses within a few years following construction. To reduce the rate of reflection cracking through an asphalt overlay, the 'mill and overlay' strategy would need to be combined with repairs to the base asphalt to address moderate to severe distresses prior to the placement of the asphalt overlay. Areas exhibiting extensive localized cracking would require additional asphalt removal and patching, while areas with severe fatigue cracking and rutting would require full-depth asphalt removal and replacement. Based on a review of existing conditions, it is estimated that as much as 20 percent of the paving area would require base asphalt repairs prior to the placement of the asphalt overlay. Due to the estimated quantity of base repairs, this option is not considered as a viable rehabilitation strategy for this roadway, and was not considered further in the design analysis.

6 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

6.1 Ninth Line Rehabilitation

Preliminary recommendations for the pavement rehabilitation of Ninth Line consist of full depth removal of the existing asphalt, with the exposed granular material graded as required for the placement of new Granular Base and Hot Mix Asphalt (HMA). The recommended pavement lift types and thicknesses shall consist of:

40 mm	HL1
50 mm	HDBC
50 mm	HDBC
50 mm	HDBC
150 mm	Granular 'A' Base

It is noted that the recommended rehabilitation strategy for the existing travel lanes permits the placement of a consistent granular base and asphalt layer thickness across the entire new pavement platform.

6.1.1 Pavement Widening Areas

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. As shown in Table 4.2, topsoil thickness ranges from 25 to 150 mm.

The preliminary recommended pavement structure for widening of Ninth Line shall consist of:

40 mm	HL1
50 mm	HDBC 50 mm HDBC
50 mm	HDBC
150 mm	Granular 'A' Base
300 mm	Granular 'B' Type II 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 top of subgrade in pavement widening areas must be no higher than the top of subgrade in 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.

6.2 Pavement Materials

6.2.1 New Hot Mix Asphalt

All HMA materials should meet the requirements of OPSS.MUNI 310 and OPSS.MUNI 1150, as amended by the City of Mississauga Special Provisions. All new HMA should be compacted to at least 92 percent of the Maximum Relative Density (MRD) for HL 1 material and 91 percent of the MRD for the HDBC material. An asphalt cement binder grade of PG 64-28 is required for the asphalt mix. A tack coat shall be utilized between the asphalt lifts, all vertical faces, and at all tie-in to existing locations. Recycled Asphalt Pavement (RAP) material may not be used in HL 1 or HDBC asphalt mixes.

6.2.2 New Granular Material

New granular material will be required for the pavement widening, grade raises, and full pavement reconstruction sections, as well as for grading of the new gravel shoulders and shoulder rounding. All granular base material should consist of new Granular A, while new granular subbase material should consist on Granular B, Type II, consistent with OPSS.MUNI 1010 requirements.

Placement of the granular material should be completed in accordance with OPSS.MUNI 314 and should be compacted to 100 percent of the Standard Proctor Maximum Dry Density (SPMDD) within 2 percent of Optimum Moisture Content (OMC) in accordance with the requirements of OPSS.MUNI 501.

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 towards 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 Culvert Structures

If the proposed rehabilitation works include widening of Ninth Line, it is anticipated that four structural culverts may require extension. The culvert locations are shown on the Borehole Location Plan in Appendix A. Details on the following existing structures were obtained from previous drawings and 2019 inspection reports that were provided for review by HDR:

- Culvert 1 (City of Mississauga Asset ID: 056005): Existing 3-cell concrete box culvert crossing Sixteen Mile Creek, located approximately 50 m north of Parkgate Drive. Referred to as Sixteen Mile Creek bridge in 2019 inspection report. Total structure span length of approximately 44 m along Ninth Line, including approach slabs and retaining walls. Approximate invert Elev. 187.25 to 187.35 m, with base level at approximate Elev. 186.7 m;

- Culvert 2 (City of Mississauga Asset ID: 057005): Existing 2.4 m wide concrete box culvert, located approximately 20 m north of McDowell Drive . Approximate invert Elev. 189.20 to 188.91 m, with base level at approximate Elev. 188.3 m;

- Culvert 3 (City of Mississauga Asset ID: 057003): Existing twin 2.4 m wide cell concrete box culvert, located approximately 50 m south of Lacman Trail. Approximate invert Elev. 186.8 to 186.6 m, with base level at approximate Elev. 186.3 m; and,

- Culvert 4 (City of Mississauga Asset ID: 057004): Existing twin 2.4 m wide cell concrete box culvert, located at approximately 100 m north of Deepwood Heights. Approximate invert Elev. 186.5 to 186.4 m, with base level at approximate Elev. 186.3 m.

At Culvert 1, the stratigraphy based on Boreholes 20-13 and 20-14 consisted of asphalt and granular fill to a depth between 0.5 and 1 m, overlying native firm to very stiff silty clay to a depth of 4.1 m, underlain by firm to stiff silty clay till to at least 5.2 m depth. The groundwater level was measured at approximate Elev. 187.3 m.

At Culvert 2, the stratigraphy based on Borehole 20-17 consisted of asphalt, granular fill and sand fill to a depth of 1.5 m, underlain by firm to stiff silty clay to 3.0 m and very stiff to stiff silty clay till to at least 5.2 m depth. The groundwater level was measured at approximate Elev. 187.2 m.

At Culvert 3, the stratigraphy based on Borehole 20-18 consisted of asphalt and granular fill to a depth of 0.5 m, underlain by stiff to very stiff silty clay till to a depth of at least 5.2 m. The groundwater level was measured at approximate Elev. 187.0 m.

At Culvert 4 the stratigraphy based on Borehole 20-21 consisted of asphalt and granular fill to a depth of 0.4 m, underlain by firm to hard silty clay till to a depth of at least 5.2 m. The groundwater level was measured at approximate Elev. 187.0 m.

6.5.1 Foundation Design, Bedding and Subgrade Preparation

The bases of any culvert extensions should be placed at the same level or lower than the existing culvert bases and founded on native stiff to hard or compact to very dense soil.

The base of the culvert at Culvert 1 is at approximate Elev. 186.7 m, which corresponds to firm to stiff silty clay till in Boreholes 20-13 and 20-14. However, due to the size of this culvert, if the ultimate design of the project includes extension of this culvert, additional deeper boreholes should be advanced during detailed design to confirm the founding soil conditions.

All existing fill, topsoil, organic/streambed deposits and soft / loose soils should be removed from the culvert subgrade prior to placement of the culvert bedding material. Inspection and approval of the exposed base by a geotechnical engineer is recommended. To minimize the potential for differential settlement on the subgrade silty clay or silty clay till, it is recommended that the subgrade below any culvert extensions on the firm silty clay be sub-excavated down to the underlying stiff to very stiff silty clay till and replaced with compacted Granular A or Granular B Type II material to the appropriate subgrade level. Furthermore, if necessary to maintain the culvert extensions at the same or lower elevation as the existing culverts, the grade may be raised using Granular A backfill, compacted to 100% of SPMDD.

In order to provide a uniform foundation subgrade, a minimum 300 mm thick layer of bedding material conforming to OPSS.MUNI 1010 Granular A or Granular B Type II requirements should be provided under the base of the box culvert extensions, as per OPSD 803.010. The bedding material should be placed on the prepared subgrade as soon as practicable following its inspection and approval.

The subgrade preparation and placement and compaction of the bedding material should be carried out in the dry. The subgrade surface prepared to support the box units should have a 75 mm minimum thick top levelling course consisting of uncompacted Granular A as per OPSS 422. Construction equipment should not be allowed to travel on the bedding or the prepared subgrade, which should be protected from disturbance during construction.

The anticipated culvert subgrade conditions and recommended design bearing resistances at the concrete culverts at Culvert 1 to Culvert 4 are presented in Table 6.1 below.

Table 6.1 – Recommended Culvert Bearing Resistances

Culvert	Reference Boreholes	Approximate Base Elevation (m)	Anticipated Subgrade	Factored Bearing Resistance at ULS (kPa)	Bearing Resistance at SLS (for up to 25 mm settlement) (kPa)
Culvert 1	20-13, 20-14	186.7	Firm to Stiff Silty Clay Till	225	150
Culvert 2	20-17	188.3	Firm to Stiff Silty Clay	225	150
Culvert 3	20-18	186.3	Very Stiff Silty Clay Till	225	150
Culvert 4	20-21	186.3	Stiff to Very Stiff Silty Clay Till	225	150

A consequence factor of 1.0 was utilized in this design adopting the typical consequence level. The geotechnical resistance factor of 0.5 for bearing and 0.8 for settlement, both adopted for typical degree of understanding, were used to obtain the above values, as per Canadian Highway Bridge Design Code (CHBDC) 2019, Section 6.9.

The above geotechnical resistances are for vertical, concentric loads. Where eccentric or inclined loads are applied, the resistance values used in design must be reduced in accordance with the CHBDC 2019, Clause 6.10.3 and Clause 6.10.4.

Resistance to sliding between the concrete and the underlying Granular A or B Type II bedding material should be calculated assuming an ultimate coefficient of friction of 0.45.

The culvert extensions should be designed to resist external loadings including frost forces, lateral earth pressures, hydrostatic pressure, weight of embankment fill, traffic loadings and surcharge due to construction equipment.

Applicable comments regarding excavation and groundwater control during culvert installation are presented in Section 6.5.

6.5.2 Frost Cover

The depth of frost penetration at this site is approximately 1.2 m. Any concrete box culvert extensions to be constructed within the frost penetration depth should include frost treatment as per OPSD 803.010.

6.5.3 Backfill and Lateral Earth Pressures

Backfill to the culvert extensions and any headwalls should consist of free-draining, non-frost susceptible granular materials conforming to OPSS Granular A or Granular B Type II requirements. Reference should be made to the backfill arrangements stipulated in OPSD 802 series, 803.010, 3121.150 and 3190.100, as appropriate.

Widened embankment slopes beyond the culverts should be constructed at the same slope inclination as the existing embankment, but not steeper than 2H:1V.

The lateral earth pressures acting on the culvert (and any headwalls), assuming full drainage from behind the walls, may be computed using the following pressure distribution:

$$p = K(\gamma H + q)$$

where p = lateral earth pressure acting at depth H, kPa

K = earth pressure coefficient (see Table 6.2 below)

γ = unit weight of retained soil or backfill, kN/m^3 (see Table 6.2 below)

H = depth below top of wall where pressure is computed, m

q = surcharge pressure including traffic loads, kPa

Table 6.2 lists the unfactored parameters recommended for design, for an essentially level ground surface or for sloping backfill (2H:1V) behind and in front of the culvert and walls:

Table 6.2 – Earth Pressure Parameters

Parameter	Retained Material			
	OPSS Granular A or Granular B Type II		OPSS Granular B Type I	
	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)
Unit Weight, kN/m^3	22.8	22.8	21.2	21.2
Friction Angle, degrees	35	35	32	32
Active Pressure Coefficient, K_a	0.27	0.38	0.31	0.46
At-Rest Pressure Coefficient, K_0	0.43	-	0.47	-
Passive Pressure Coefficient, K_p	3.7	-	3.3	-

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

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

Wall backfill should be placed in maximum 200 mm loose lifts and compacted to 95% of the material's SPMDD. The backfill should be placed and compacted in simultaneous equal lifts on both sides of the culvert, and the top of the backfill elevation should be the same on both sides of the culvert at all times. Heavy compaction equipment should not be used adjacent to the walls and roof of the culvert or headwalls.

Design of the culvert headwalls must incorporate measures such as weepholes as per OPSD 3190.100 to permit drainage of the backfill and avoid potential build-up of hydrostatic pressures behind the walls.

6.5.4 Erosion and Scour Protection

Erosion protection should be provided at the culvert extension inlet and outlet areas. Vegetation cover, riprap or other protective measures should be established on the creek banks to protect against surficial erosion and seepage-induced material loss. Design of the scour and erosion protection measures must consider hydrologic/hydraulic factors.

A concrete/steel cut-off wall or clay seal should be installed at the culvert inlet to minimize the potential for seepage through the granular bedding and backfill material and avoid consequent erosion of these materials. The clay seal should have a minimum thickness of 0.5 m, completely surround the culvert, extend laterally the width of the granular backfill material, and extend above the high water level. The material used for the clay seal should conform to the requirements of OPSS 1205.

6.6 Excavation and Groundwater Control

Excavations for culvert extension foundations and open cut installation of sewers will primarily extend through the existing roadway pavement structure and into native sand and silt, silty clay, silty clay till, and silty sand to sandy silt till deposits. Use of a hydraulic excavator should be suitable for excavation within these materials. Provision should be made for handling and removal of possible obstructions in the fill and cobbles or boulders in the till soils.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. In general, the pavement structure, fill materials, sand and soils are classified as Type 3 soils above the observed water table and Type 4 at depths below the observed water table. The native silty clay to silty clay till soils can be classified as Type 3 soils.

Where space restrictions preclude excavation of inclined slopes, sewer installation may be carried out using a trench box or temporary shoring. If the trench depth exceeds 6 m, the support system must be designed specifically for this project.

The design of all members of the support system should include the effects of surcharge loads such as those imposed by construction equipment and highway traffic. Soil should not be stockpiled within a horizontal distance from the excavation wall equal to the depth of excavation.

Groundwater was measured in the piezometers at depths of 1.7 to 3.1 m below the ground surface. Considering the observations during drilling and the consistency of the soils on site, dewatering of shallow excavations will be required. Concentrated seepage and instability of the trench walls and base may be experienced where cohesionless layers are encountered below the groundwater level. Further, localized zones of perched water may be encountered in the fill. Sumps and pumps or suitable well point systems may be required dependent on the conditions at a particular location. Boreholes 20-01 to 20-07 encountered cohesionless soils below the water level, and therefore excavations in these locations may require additional groundwater control

measures, such as carrying out excavations within a water-tight, sheetpile enclosure, or utilizing well point systems for dewatering.

Temporary stream diversion measures such as impervious dykes and/or sandbagging should be provided to divert surface water runoff and stream flow away from the culvert extension excavations at all times during construction.

6.7 Storm Sewer Installation – Trenching/Pipe Bedding

New storm sewers may be installed along Ninth Line as part of the roadway improvements. Excavations and control of groundwater for sewer installations should follow the recommendations provided in Section 6.5.

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

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

Trench backfill materials should be placed and compacted as per OPSS 401. Where the sewer trench is located beneath the roadway, OPSS Granular A or B material, or unshrinkable fill should be employed as backfill.

6.8 Management of Excess Materials

Selected soil samples were submitted for analytical laboratory testing as outlined in Section 3.2. The test results are provided in Appendix D, with the parameters exceeding the O.Reg. 153/04 criteria summarized on Table 4.2 in Section 4.10.

The concentrations of all parameters measured in the samples are below the Table 2 Residential, Parkland and Institutional Standards, with the exception of Electrical Conductivity (EC) in four samples and Sodium Adsorption Ratio (SAR) in three samples.

The EC and SAR values likely result from de-icing salt applied to the roadway for safety purposes. The presence of EC and SAR does not impose a risk to human health, but rather may only impact

the physical composition of the soil which could affect the growth of vegetation. Further, where salt has been applied by a government or municipal authority, salt-related impacts are exempt, and the applicable site condition standard is deemed not to be exceeded under Section 48 (3) of O. Reg. 153/04. Therefore, based on the preliminary test results, the excavated materials are anticipated to be acceptable 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. The gradation tests on samples of the granular fill soils indicate that the soils contain too much fine material to meet OPSS Granular A or Granular B Type I or Type II specifications, however testing of bulk samples collected from open test pits would be required to confirm the gradation.

Excess excavated soils are also anticipated to be acceptable for disposal off-site at suitable fill receiver sites or waste disposal facilities, subject to additional Toxicity Characteristic Leaching Procedures (TCLP) analysis in accordance with O. Reg. 558/00, as appropriate.

Please note that additional testing will be required during the detailed design stage to confirm these preliminary recommendations regarding management of excess excavated soils. In particular, additional testing and preparation of additional planning documents may be necessary to meet the new O. Reg. 406/19 “Excess Soil Regulation” requirements.

6.9 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 sewer trench, culvert and pavement subgrade conditions, compaction testing of backfill and pavement materials as well as concrete and asphalt testing.

7 CLOSURE

Overall supervision of the field program was carried out by Ms. Cecile Ritchie, EIT and Mr. Mark Farrant, P.Eng. Interpretation of the field data, and report preparation was conducted by Ms. Cecile Ritchie, EIT, Mr. Mark Farrant, P.Eng and Ms. Amelia Jewison, P.Eng. A technical review of this report was completed by Mr. Weiss Mehdawi, P.Eng.

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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 HDR, and the City of Mississauga. Please do not hesitate to contact our office if you have any questions.

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

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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.

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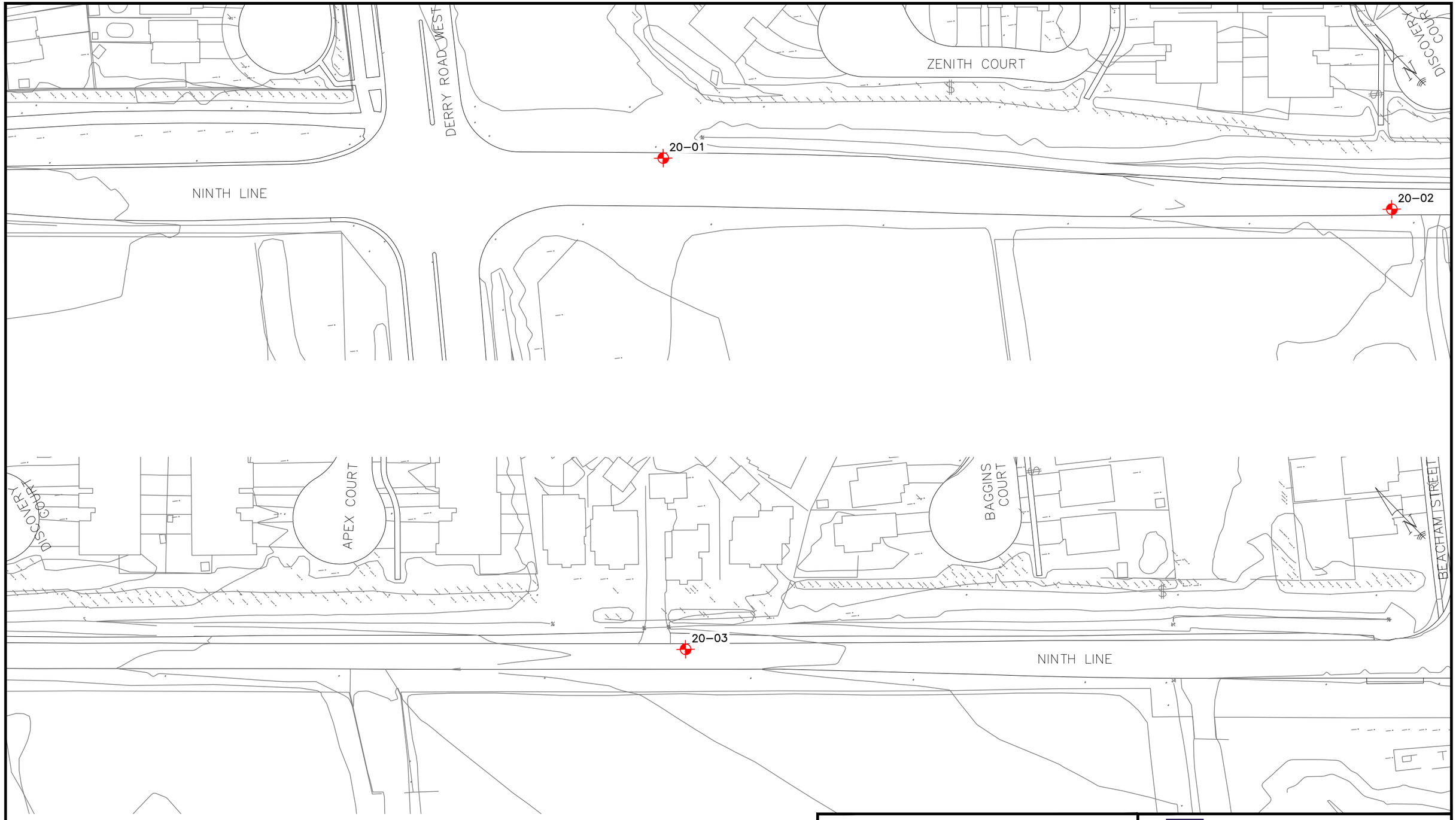
Appendix A

Borehole Location Plan



LEGEND

- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

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SCALE 1:1000

HDR CORPORATION

9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

JOB# 27269

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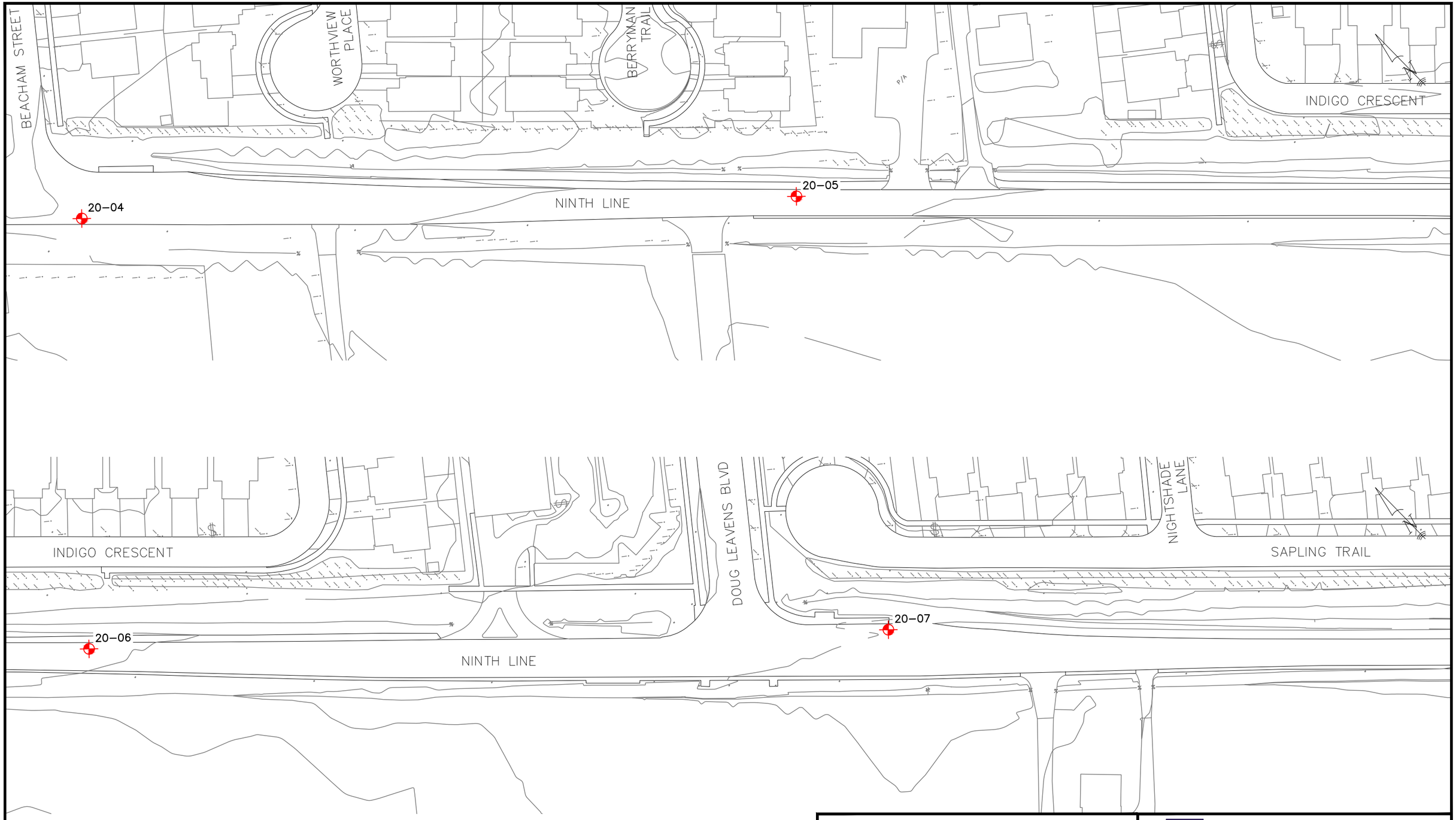

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- APPROXIMATE CULVERT LOCATION

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SCALE 1:1000

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9TH LINE
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PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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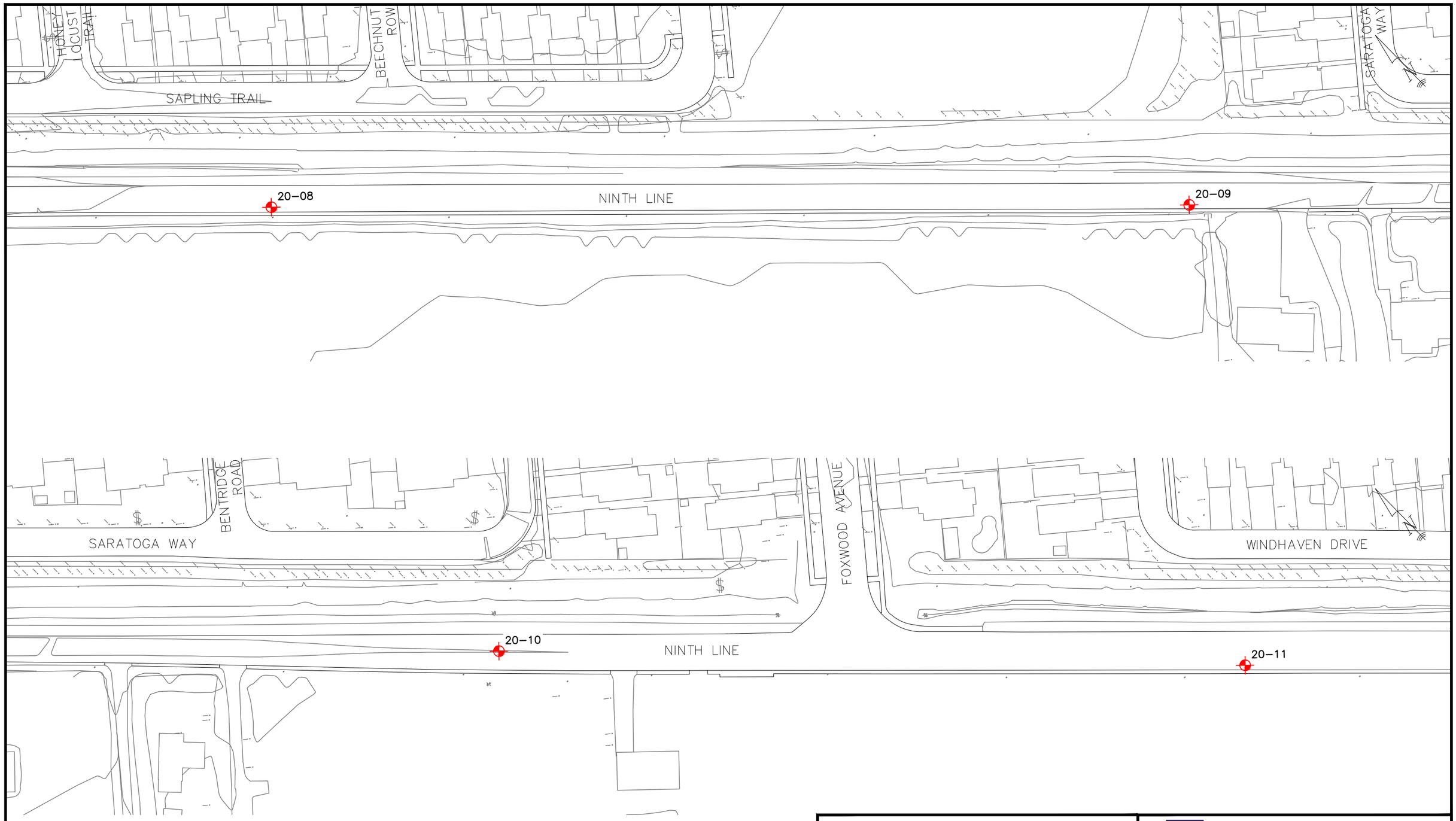

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- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

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SCALE 1:1000

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9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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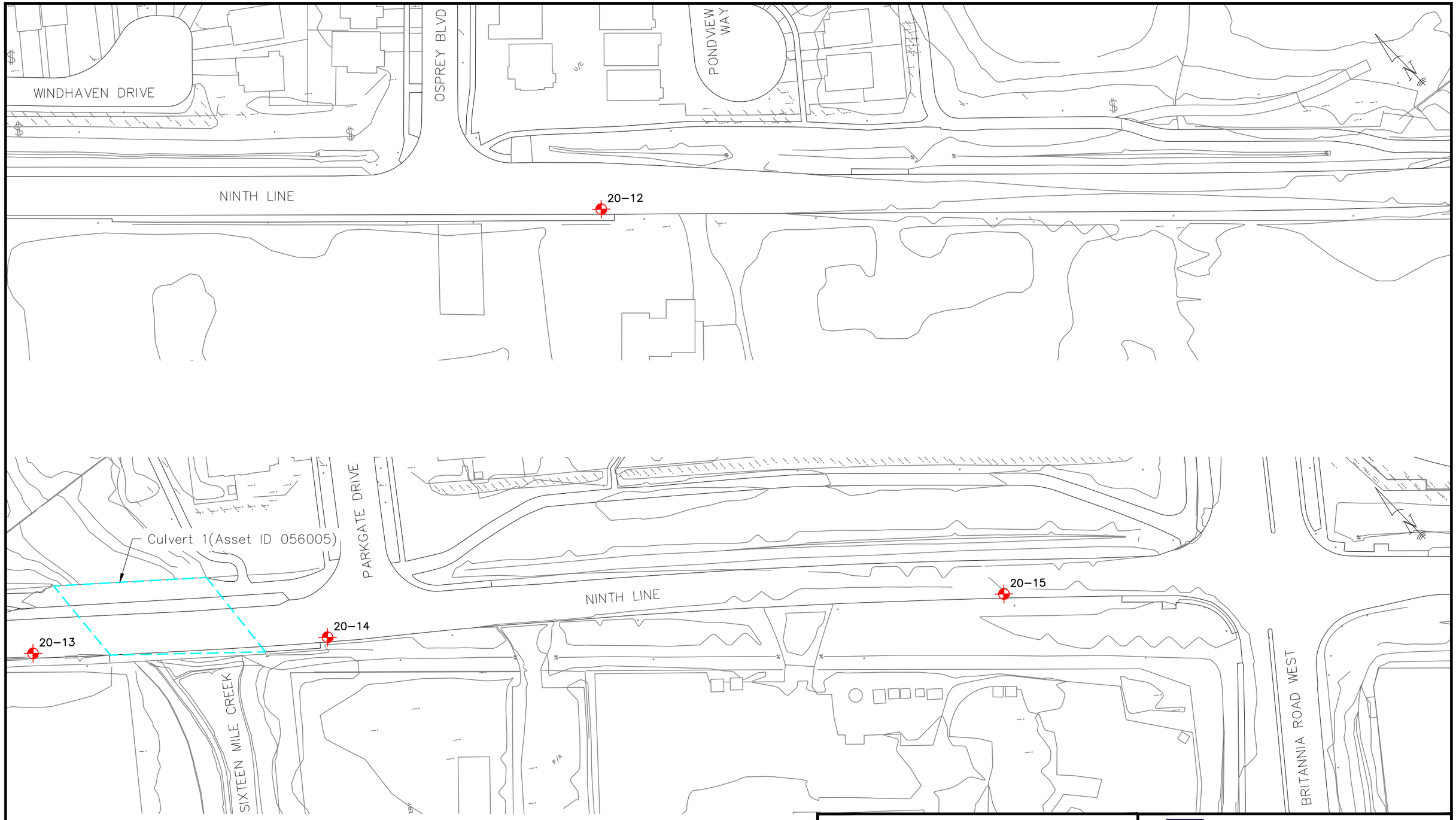

LEGEND

- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

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9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

20 0 20 40m

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9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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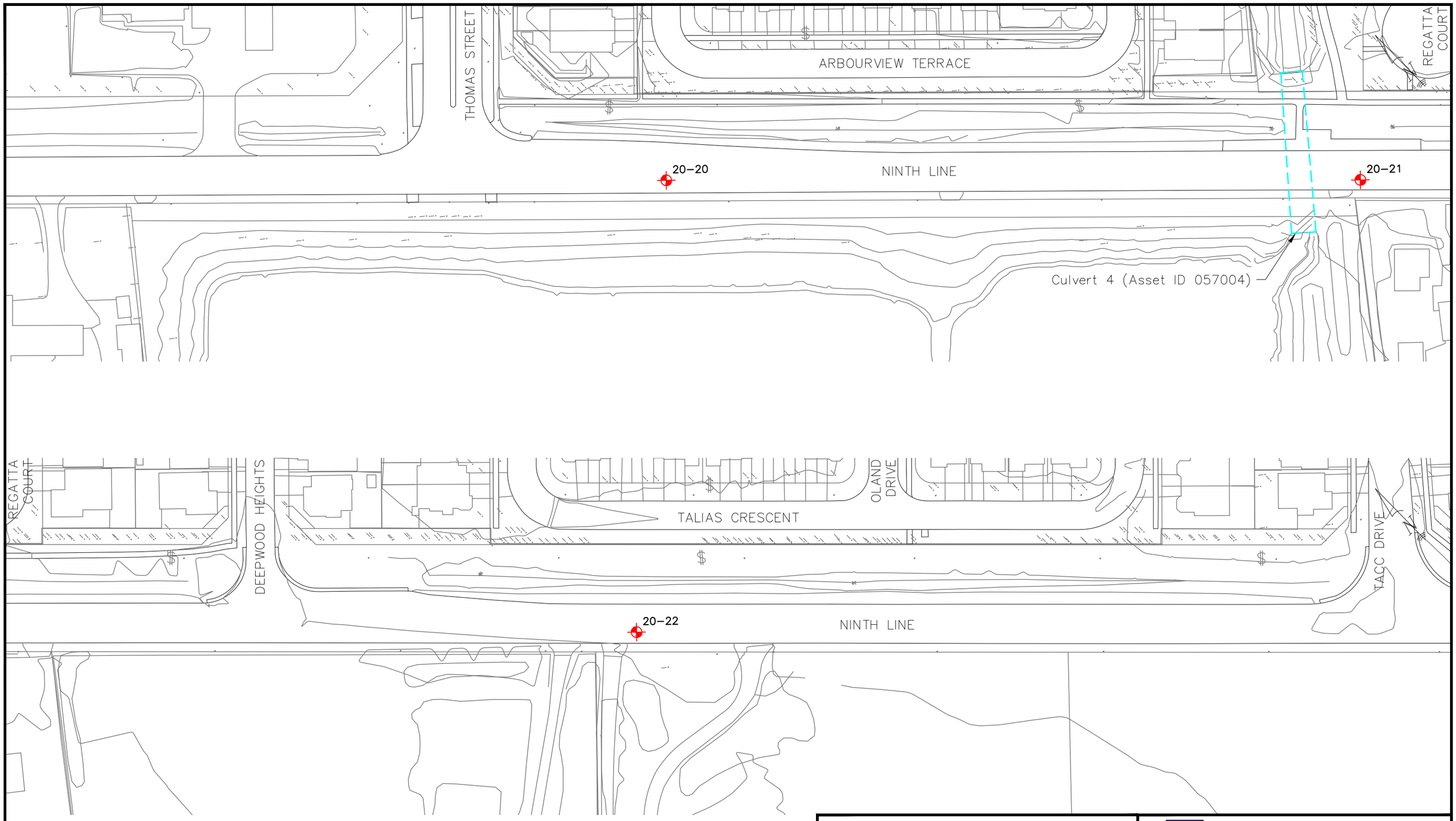

LEGEND

- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

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SCALE 1:1000

HDR CORPORATION

9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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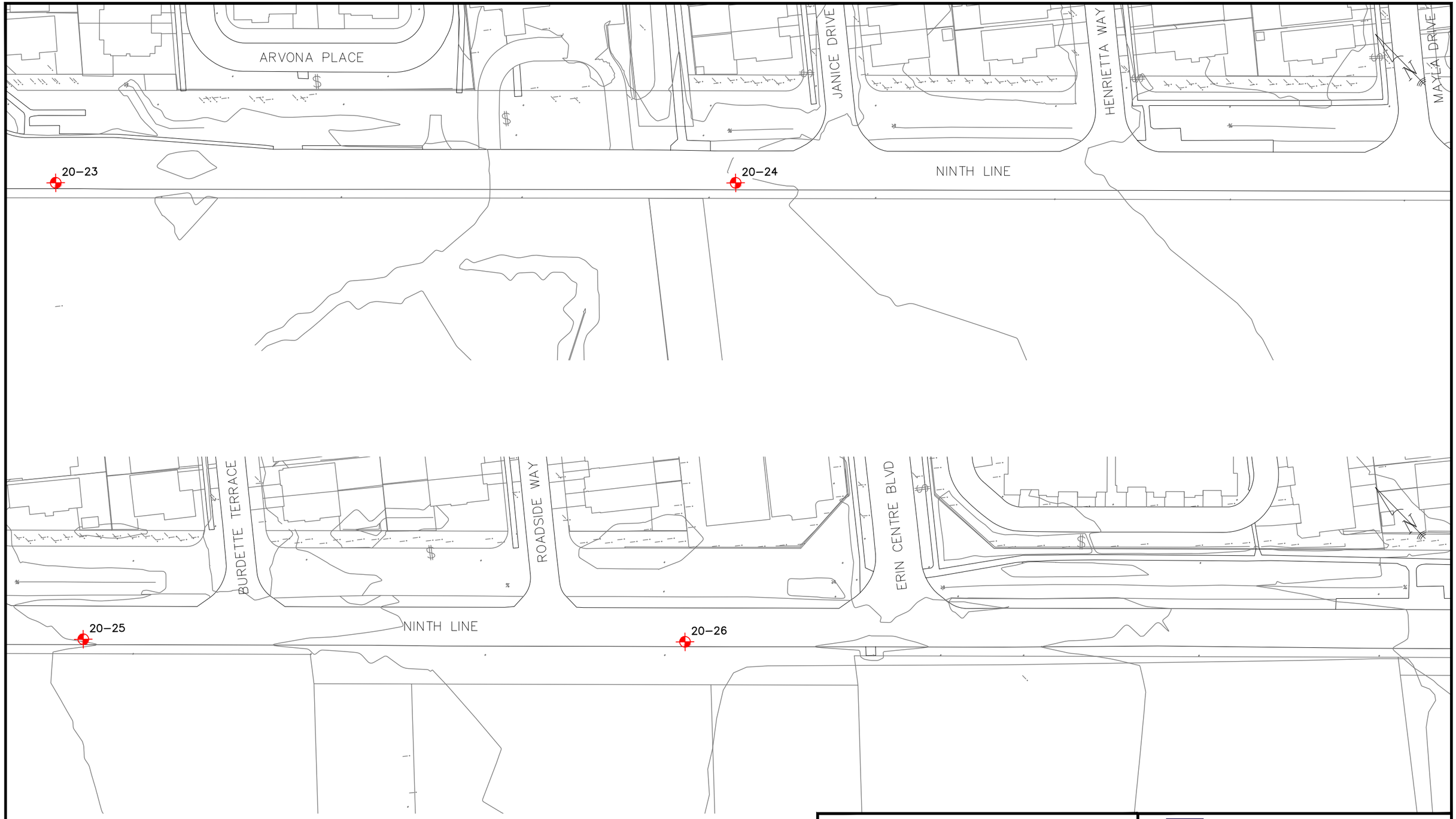

LEGEND

- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

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SCALE 1:1000

HDR CORPORATION

9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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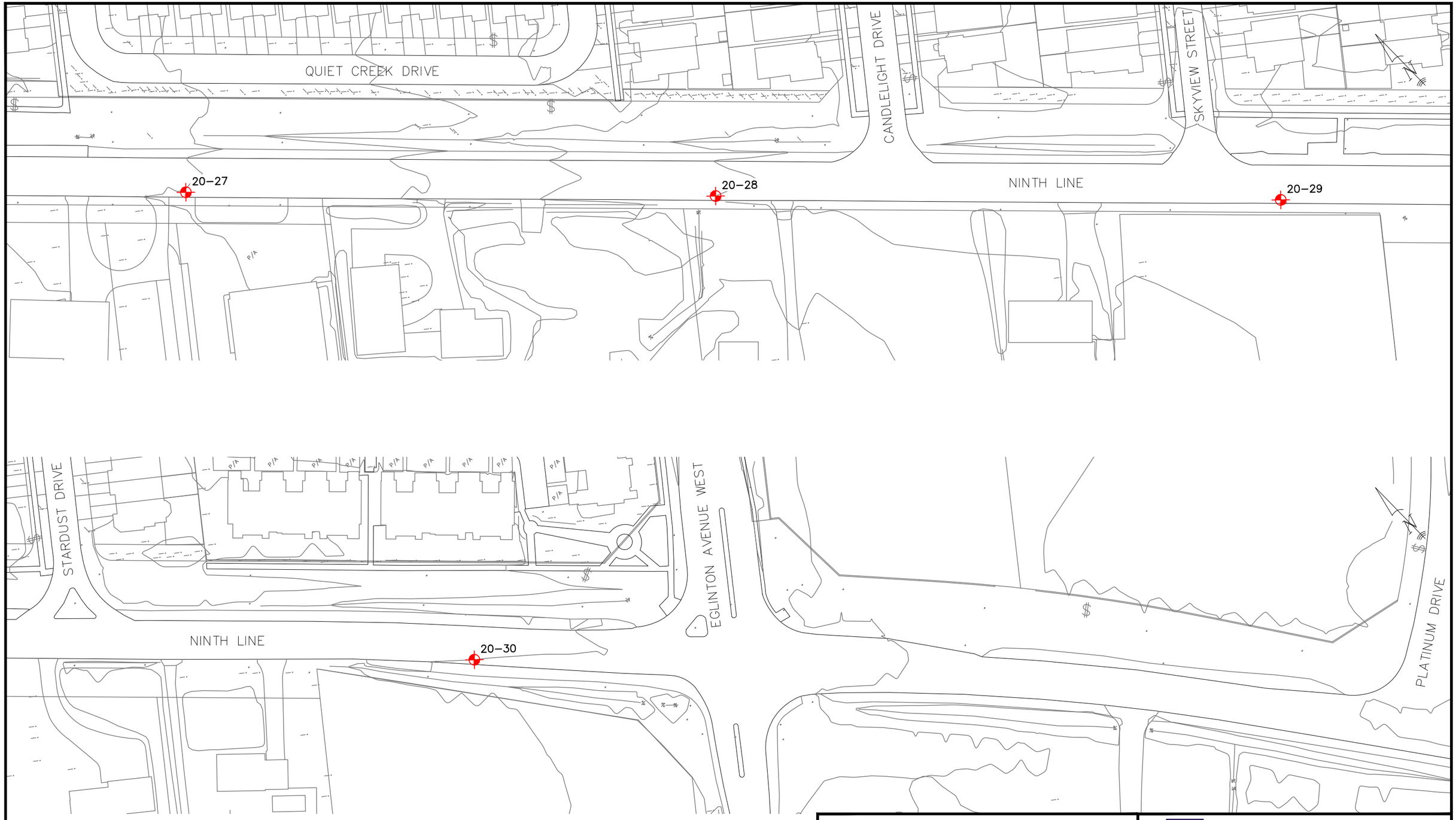

LEGEND

- BOREHOLE LOCATION
- APPROXIMATE CULVERT LOCATION

HDR CORPORATION

9TH LINE
CLASS EA
PRELIMINARY GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

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Appendix B

Record of Borehole Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

5. LEGEND FOR RECORDS OF BOREHOLES

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

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

▼ Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

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

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

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 20-01

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 10, 2020
COMPLETED : August 10, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 825 266.9 E 598 005.6

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		201.41							
		ASPHALT (150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS		Grain Size Analysis:	○		
				200.95	2	GS		Gr 39%/ Sa 46%/ Si & Cl 15%	○		
		SAND, silty to **SAND** and **SILT**, trace clay, trace gravel, dense to very dense, brown, moist		0.46							
1	Solid Stem Augers / Rotary Drill										
2					3	SS	36		○		
					4	SS	67		○		
3					5	SS	64	Grain Size Analysis: Gr 8%/ Sa 43%/ Si 47%/ Cl 2%	○		▽
4											
					6	SS	-		○		
5				196.22							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.0m AND WATER LEVEL AT 3.66m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-02

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 12, 2020
COMPLETED : August 12, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 825 114.2 E 598 141.7

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		200.44							
		ASPHALT(150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS			○		
					2	GS			○		
				199.67							
		CLAY, silty, sandy, trace gravel, hard, brown, moist: (TILL) (CL)		0.76							
1					3	GS			○		
					4	SS	37	Grain Size Analysis: Gr 7%/ Sa 20%/ Si 47%/ Cl 26%	○ ⊢		
2	Solid Stem Augers / Rotary Drill				5	SS	61		○		
3				197.24							
		SILT, sandy, trace clay, hard, brown, moist		3.20	6	SS	81/ 0.200		○ ○		
4		**CLAY**, silty, trace gravel, sandy, hard, red, moist: (TILL)		196.47 3.96							
				195.71	7	SS	60/ 0.150		○		
5		END OF BOREHOLE AT 4.72m. BOREHOLE OPEN TO 4.26m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		4.72							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-03

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 7, 2020
COMPLETED : August 7, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 972.2 E 598 292.7

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		198.31							
		ASPHALT (175mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.18	1	GS			○		
				197.83	2	GS		Grain Size Analysis: Gr 35%/ Sa 45%/ Si & Cl 20%	○		
		SAND, some silt, trace to some gravel, compact, brown to grey, moist		0.48							
1											
					3	SS	11		○		▽
2	Solid Stem Augers / Rotary Drill										
					4	SS	22	Grain Size Analysis: Gr 1%/ Sa 85%/ Si 12%/ Cl 2%	○		
3											
					5	SS	20		○		
4											
		grey		193.44	6	SS	50/ 0.000		○		
5		END OF BOREHOLE AT 4.88m. BOREHOLE OPEN TO 2.44m AND WATER LEVEL AT 1.83m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		4.88							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-04

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 10, 2020
COMPLETED : August 10, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 802.8 E 598 457.2

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		196.66							
		ASPHALT (150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS			○		
				196.23	2	GS			○		
		SILT, sandy, some clay, trace gravel, very stiff, mottled brown, moist: (TILL)		0.43							
1											Bentonite
					3	SS	25	Grain Size Analysis: Gr 2%/ Sa 32%/ Si 53%/ Cl 13%	○		
2				194.45							
		SAND, silty, frequent shale fragments, compact to dense, brown, moist		2.21							
					4	SS	25		○		
3											Filter Sand
					5	SS	37		○		
4				192.09							Slotted Screen
		Highly weathered **SHALE**, hard, red, moist		4.57	6	SS	50/ 0.075		○		
		END OF BOREHOLE AT 4.67m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.70							
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 09/20 1.66 195.00									
6											
7											
8											
9											

Solid Stem Augers
Rotary Drill

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-05

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 5, 2020
COMPLETED : August 5, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 667.6 E 598 604.8

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		195.39				
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00				
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS		
					2	GS		
		SILT, sandy, some clay, trace gravel, very stiff to hard, brown, moist: (TILL) (CL-ML)		0.36				
					3	SS	27	Grain Size Analysis: Gr 1%/ Sa 21%/ Si 62%/ Cl 16%
					4	SS	51	
		Highly weathered, **SHALE**, hard, red, moist		192.34 3.05	5	SS	45/ 0.150	
		END OF BOREHOLE AT 3.35m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		192.04 3.35				

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 : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-06

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 7, 2020
COMPLETED : August 7, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 523.2 E 598 753.1

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		194.02				
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00				Grain Size Analysis: Gr 35%/ Sa 44%/ Si & Cl 21%
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS		
				193.51	2	GS		
		SAND and **SILT**, trace clay, trace gravel, occasional cobbles, compact to very dense, brown, moist: (TILL)		0.51				
1					3	SS	21	
2					4	SS	78	Grain Size Analysis: Gr 8%/ Sa 46%/ Si 41%/ Cl 5%
3					5	SS	82	
				190.21	6	GS	-	
4		END OF BOREHOLE AT 3.81m UPON AUGER REFUSAL UPON PROBABLE BEDROCK. BOREHOLE OPEN TO 4.27m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		3.81				
5								
6								
7								
8								
9								

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

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-07

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 10, 2020
COMPLETED : August 10, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 370.8 E 598 917.0

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		192.85							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS			○		
				192.41	2	GS		Grain Size Analysis: Gr 47%/ Sa 38%/ Si & Cl 15%	○		
		CLAY, silty, some sand to sandy, trace gravel, stiff to hard, mottled brown to brown, moist: (TILL)		0.43							
1											
					3	SS	9		○		
2											
					4	SS	24		○		
3											
					5	SS	56		○		
				188.88							
4		**SAND** and **SILT**, trace gravel, trace clay, occasional cobbles, dense, brown, wet		3.96							▽
					6	SS	45	Grain Size Analysis: Gr 4%/ Sa 46%/ Si 44%/ Cl 6%	○		
5				187.74							
		END OF BOREHOLE AT 5.11m. BOREHOLE OPEN TO 4.27m AND WATER LEVEL AT 4.10m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.11							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-08

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 7, 2020
COMPLETED : August 7, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 202.8 E 599 077.4

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	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		191.81							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (250mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.25	1	GS					
				0.41	2	GS					
		CLAY, silty, some sand to sandy, trace gravel, stiff to hard, brown to grey, moist: (TILL) (CL)									
1											
					3	SS	9				
2											
					4	SS	15				
3		occasional cobbles									
					5	SS	32	Grain Size Analysis: Gr 3%/ Sa 27%/ Si 47%/ Cl 23%			
4											
					6	SS	78				
5		grey									
				186.63							▽
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 3.96m AND WATER LEVEL AT 3.96m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-09

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 7, 2020
COMPLETED : August 7, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 824 023.7 E 599 261.8

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		191.23				
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00				Grain Size Analysis: Gr 39%/ Sa 47%/ Si & Cl 14%
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS		
		CLAY, silty, some sand to sandy, trace gravel, stiff to very stiff, brown to grey, moist: (TILL)		0.46	2	GS		
1								
2					3	SS	12	
					4	SS	20	Grain Size Analysis: Gr 3%/ Sa 29%/ Si 46%/ Cl 22%
3		becoming grey			5	SS	25	
4								
5		hard			6	SS	55	
				186.05				
		END OF BOREHOLE AT 5.18m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18				
6		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) Sep 09/20 / 2.25 / 188.98						
7								
8								
9								

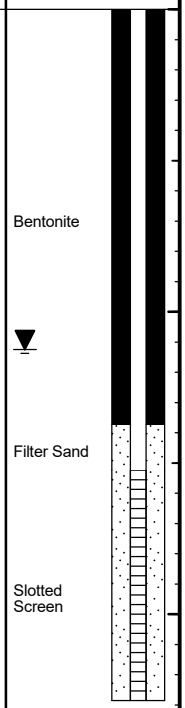
SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲)
40 80 120 160

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-10

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 6, 2020
COMPLETED : August 6, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 877.4 E 599 414.7

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		190.77							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS			○		
					2	GS			○		
				190.22							
		CLAY, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL) (CL)		0.56							
1											
2					3	SS	18		○		
					4	SS	24		○		
3					5	SS	31		○		
4											
		occasional cobbles, becoming grey			6	SS	27	Grain Size Analysis: Gr 4%/ Sa 32%/ Si 45%/ Cl 19%	○ —		
5				185.59							
		END OF BOREHOLE AT 5.18m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-11

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 6, 2020
COMPLETED : August 6, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 728.6 E 599 561.6

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		190.58							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS			○		
					2	GS			○		
				189.97							
		CLAY, silty, trace sand, varved, firm to stiff, brown, moist (CL)		0.61							
1											
					3	SS	6	Grain Size Analysis: Gr 0%/ Sa 4%/ Si 62%/ Cl 34%	○ (w)		
2											
					4	SS	14		○		
3		mottled									
					5	SS	13		○		
4				186.46							
		CLAY, silty, some sand, hard, grey, moist: (TILL)		4.11							
					6	SS	31		○		
5				185.40							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-12

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 11, 2020
COMPLETED : August 11, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 572.1 E 599 722.7

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		190.60							
		ASPHALT (150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS					
		CLAY,silty ,trace sand, stiff to firm, grey, moist (Cl)		0.36	2	GS		Grain Size Analysis: Gr 42%/ Sa 43%/ Si & Cl 15%			
1					3	GS					
2	Solid Stem Augers / Rotary Drill				4	SS	11				
					5	SS	12				
3		very stiff			6	SS	18	Grain Size Analysis: Gr 0%/ Sa 1%/ Si 54%/ Cl 45%			
4											
5					7	SS	6				
				185.42							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-13

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 6, 2020
COMPLETED : August 6, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 402.2 E 599 900.5

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		190.24							
		ASPHALT (175mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.18	1	GS					
				189.79	2	GS					
		CLAY, silty, trace sand, occasional gravel, firm to stiff, mottled to brown, moist (CI)		0.46							
1	Solid Stem Augers / Rotary Drill										Bentonite
2					3	SS	7				
					4	SS	14	Grain Size Analysis: Gr 0%/ Sa 1%/ Si 52%/ Cl 47%			
3											Filter Sand
					5	SS	14				
4											Slotted Screen
		CLAY, silty, some sand, trace gravel, firm, grey, moist: (TILL)		186.13 4.11							
5					6	SS	7				
				185.06							
		END OF BOREHOLE AT 5.18m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18							
6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 09/20 2.95 187.29									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-14

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 11, 2020
COMPLETED : August 11, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 347.9 E 599 962.7

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	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		190.56							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (225mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.23	1	GS					
		SAND, silty, some gravel: (FILL)		0.43							
1				189.50	2	GS					
		CLAY, silty, trace sand, occasional gravel, stiff to very stiff, brown, wet		1.07							
2					3	SS	10				
					4	SS	17				
3					5	SS	18	Grain Size Analysis: Gr 0%/ Sa 2%/ Si 45%/ Cl 53%			
4				186.45							
		CLAY, silty, some sand, trace gravel, occasional cobbles, stiff, grey, wet: (TILL)		4.11							
5					6	SS	10				
				185.38							
		END OF BOREHOLE AT 5.18m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-15

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 6, 2020
COMPLETED : August 6, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 224.3 E 600 106.8

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		189.77							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS		Grain Size Analysis: Gr 47%/ Sa 40%/ Si & Cl 13%	○		
					2	GS			○		
				189.21							
		CLAY, silty, trace sand, trace gravel, stiff to very stiff, brown, moist		0.56							
1											
					1	SS	14		○		
2											
					2	SS	17		○		
3											
					3	SS	10		○		
4											
		CLAY, silty, sandy, trace gravel, stiff, brown to grey, moist: (TILL) (CL)		185.66 4.11							
					4	SS	9	Grain Size Analysis: Gr 3%/ Sa 26%/ Si 48%/ Cl 23%	⊖		
5				184.59							
		END OF BOREHOLE AT 5.18m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-16

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 13, 2020
COMPLETED : August 13, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 823 072.4 E 600 262.3

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		190.75				
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00				
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS		
					2	GS		
		CLAY, silty, trace sand, trace gravel, some organics, brown, moist: (FILL)		0.38				
1					3	GS		
				189.22				
		CLAY, silty, trace gravel, trace sand, trace organics, trace rootlets, stiff to very stiff, brown to grey, moist (Cl)		1.52	4	SS	11	Grain Size Analysis: Gr 0%/ Sa 9%/ Si 49%/ Cl 42%
2								
					5	SS	17	
3								
					6	SS	26	
4				186.63				
		CLAY, silty, some sand to sandy, trace gravel, hard, brown to grey, moist: (TILL)		4.11				
					7	SS	38	
5				185.57				
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.57m and DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18				
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-17

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 6, 2020
COMPLETED : August 6, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 822 939.0 E 600 389.4

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		190.25				
		ASPHALT (200mm)		0.00				
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS		
					2	GS		
		SAND, some gravel, some silt, trace clay, brown, dry: (FILL)		0.46				
1								
				188.73				
		CLAY, silty, some to trace organics, trace rootlets and wood fragments, firm to stiff, dark brown to brown, moist		1.52	3	SS	7	
2	Solid Stem Augers / Rotary Drill				4	SS	11	
				187.28				
3		**CLAY**, silty, sandy, trace gravel, very stiff to stiff brown to grey, moist: (TILL)		2.97	5	SS	25	Grain Size Analysis: Gr 1%/ Sa 29%/ Si 47%/ Cl 23%
4								
					6	SS	11	
5				185.07				
		END OF BOREHOLE AT 5.18m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18				
6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 09/20 3.09 187.16						
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Bentonite; Filter Sand; Slotted Screen

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-18

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 12, 2020
COMPLETED : August 12, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 822 739.9 E 600 583.7

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		189.46				
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00				
		SAND, gravelly, some silt, brown, moist: (FILL)		0.20	1	GS		
					2	GS		Grain Size Analysis: Gr 31%/ Sa 46%/ Si & Cl 23%
		CLAY, silty, sandy, trace to some gravel, stiff to very stiff, brown to grey, moist: (TILL) (CL)		0.46				
1					3	GS		
					4	SS	14	
2					5	SS	22	Grain Size Analysis: Gr 4%/ Sa 26%/ Si 47%/ Cl 23%
3					6	SS	24	
4								
5					7	SS	19	
				184.28				
		END OF BOREHOLE AT 5.18m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18				
6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 09/20 2.50 186.96						
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Bentonite

Filter Sand

Slotted Screen

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-19

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 12, 2020
COMPLETED : August 12, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 822 582.5 E 600 749.8

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		189.79							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (FILL)		0.15	1	GS			○		
		CLAY, silty, some sand to sandy, trace gravel, trace organics, very stiff to stiff, brown to grey, moist: (TILL)		0.36							
1					2	GS		Grain Size Analysis: Gr 1%/ Sa 21%/ Si 41%/ Cl 37%	○		
2					3	SS	24		○		
					4	SS	21		○		
3					5	SS	25		○		
4											
5					6	SS	15		○		
				184.61							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-20

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 13, 2020
COMPLETED : August 13, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 822 434.1 E 600 901.4

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		189.41							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)		0.00				Grain Size Analysis:			
		SAND, gravelly, some silt, brown, moist: (FILL)		0.15	1	GS		Gr 29%/ Sa 54%/ Si & Cl 17%	○		
					2	GS			○		
		CLAY, silty, trace sand, trace gravel, some organics, black, moist: (FILL)		188.80 0.61							
1					3	GS			○		
		CLAY, silty, sandy, trace gravel, trace rootlets, stiff to hard, brown to grey, moist: (TILL)		188.12 1.30							
2					4	SS	15		○		
3					5	SS	32	Grain Size Analysis: Gr 6%/ Sa 33%/ Si 42%/ Cl 19%	○		
					6	SS	34		○		
4											
									○		
5		stiff			7	SS	14		○		
				184.23							
		END OF BOREHOLE AT 5.18m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-21

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 12, 2020
COMPLETED : August 12, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 822 298.5 E 601 040.6

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	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		189.28							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (175mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (FILL)		0.18	1	GS			○		
					2	GS			○		
		CLAY, silty, sandy, trace gravel, firm to hard, grey, moist to wet: (TILL)		0.41							
1					3	GS			○		
											Bentonite
2					4	SS	7		○		
											▼
					5	SS	24		○		
3											Filter Sand
					6	SS	30	Grain Size Analysis: Gr 3%/ Sa 30%/ Si 47%/ Cl 20%	○		
4											Slotted Screen
		stiff			7	SS	11		○		
5				184.10							
		END OF BOREHOLE AT 5.18m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18							
6		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) — Sep 09/20 / 2.24 / 187.04									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-22

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 12, 2020
COMPLETED : August 12, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 822 157.4 E 601 185.6

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		190.23							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)									
		SAND, gravelly, some silt, brown, moist: (FILL)		0.15	1	GS					
					2	GS		Grain Size Analysis: Gr 25%/ Sa 50%/ Si & Cl 25%			
		CLAY silty, sandy, trace organics, trace sand, trace gravel, stiff to very stiff, brown to grey, moist: (TILL) (CL)		0.41							
1					3	GS					
					4	SS	17				
2											
					5	SS	15	Grain Size Analysis: Gr 6%/ Sa 29%/ Si 45%/ Cl 20%			
3											
					6	SS	27				
4											
					7	SS	24				
5				185.05							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-23

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 13, 2020
COMPLETED : August 13, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 987.2 E 601 358.0

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		190.81							
		ASPHALT (175mm)									
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.18	1	GS			○		
					2	GS			○		
		CLAY, silty, sandy, trace gravel, occasional cobbles, firm to stiff, brown to grey, moist: (TILL)		0.41							
1	Solid Stem Augers / Rotary Drill				3	GS		Grain Size Analysis: Gr 10%/ Sa 30%/ Si 38%/ Cl 22%	○		
2					4	SS	6		○		
3					5	SS	19		○		
		very stiff			6	SS	28		○		
4											
5					7	SS	10		○		
				185.63							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-24

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 13, 2020
COMPLETED : August 13, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 854.2 E 601 494.3

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		191.86							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (150mm)		0.00				Grain Size Analysis: Gr 36%/Sa 47%/ Si & Cl 17%			
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS			○		
					2	GS			○		
		CLAY, silty, sandy, trace gravel, very stiff, brown to grey, moist: (TILL)		0.36							
1					3	GS			○		
2					4	SS	16		○		
3					5	SS	22		○		
4					6	SS	23		○		
5					7	SS	22		○		
				186.68							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-25

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 10, 2020
COMPLETED : August 10, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 698.4 E 601 652.8

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		193.87							
	Solid Stem Augers / Rotary Drill	**ASPHALT**(175mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.18	1	GS			wp, w		
					2	GS			wp, w		
		CLAY, silty, sandy, trace gravel, stiff to very stiff, brown to grey, moist: (TILL) (CL)		0.41							
1											
2					3	SS	10		w		
					4	SS	17		w		
3											
					5	SS	22		w		
4											
					6	SS	15	Grain Size Analysis: Gr 8%/ Sa 33%/ Si 42%/ Cl 17%	w		
5				188.69							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-26

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 13, 2020
COMPLETED : August 13, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 580.2 E 601 773.0

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		193.24							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (175mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (FILL)		0.18	1	GS					
					2	GS		Grain Size Analysis: Gr 27%/ Sa 56%/ Si & Cl 17%			
		CLAY, silty, trace sand, trace gravel, firm, mottled brown and grey, moist: (FILL)		0.41							
1					3	GS					
				191.94							
		CLAY, silty, sandy, trace to some gravel, very stiff to hard, brown, moist: (TILL)		1.30							
2					4	SS	7				
					5	SS	27				
3					6	SS	36	Grain Size Analysis: Gr 6%/ Sa 33%/ Si 41%/ Cl 20%			
				189.27	7	GS					
4		END OF BOREHOLE AT 3.96m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		3.96							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-27

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 10, 2020
COMPLETED : August 10, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 394.3 E 601 962.1

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		190.89				
		ASPHALT (150mm)		0.00				
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.15	1	GS		
				190.44	2	GS		
		CLAY, silty, sandy, trace gravel, stiff to hard, brown to grey, moist: (TILL) (CL)		0.46				
1	Solid Stem Augers / Rotary Drill							
2					3	SS	14	
3					4	SS	20	Grain Size Analysis: Gr 3%/ Sa 34%/ Si 44%/ Cl 19%
					5	SS	42	
4								
5		stiff			6	SS	14	
				185.71				
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.57m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18				
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-28

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 10, 2020
COMPLETED : August 10, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 289.9 E 602 067.6

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		188.00				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
		ASPHALT (175mm)		0.00				Grain Size Analysis:			
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.18	1	GS		Gr 41%/Sa 46%/ Si & Cl 13%	○		
				187.52	2	GS			○		
		CLAY, silty, sandy, trace to some gravel, very stiff to hard, brown to grey, moist: (TILL)		0.48							
1	Solid Stem Augers / Rotary Drill										Bentonite ▼
2					3	SS	16		○		
					4	SS	39		○		
3		375mm silty sandy seam			5	SS	31	Grain Size Analysis: Gr 5%/ Sa 32%/ Si 43%/ Cl 20%	○		Filter Sand
4											Slotted Screen
5		stiff			6	SS	13		○		
				182.82							
6		END OF BOREHOLE AT 5.18m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		5.18							
7		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 09/20 1.67 186.33									
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER
September 9, 2020

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-29

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 11, 2020
COMPLETED : August 11, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 178.7 E 602 180.1

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		187.11				
	Solid Stem Augers / Rotary Drill	**ASPHALT** (175mm)		0.00				
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.18				
				186.63	1	GS		
		CLAY, silty, sandy, trace gravel, very stiff to hard, brown, moist: (TILL) (CL)		0.48	2	GS		
					3	SS	26	Grain Size Analysis: Gr 3%/ Sa 22%/ Si 47%/ Cl 28%
					4	SS	34	
		END OF BOREHOLE AT 3.05m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		184.07 3.05				

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 : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

RECORD OF BOREHOLE 20-30

PROJECT : Ninth Line Class EA
LOCATION : Mississauga, ON
STARTED : August 11, 2020
COMPLETED : August 11, 2020

Project No. 27269
SHEET 1 OF 1
DATUM Geodetic

N 4 821 052.3 E 602 307.1

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		187.01							
	Solid Stem Augers / Rotary Drill	**ASPHALT** (200mm)		0.00							
		SAND and **GRAVEL**, some silt, brown, moist: (FILL)		0.20	1	GS			○		
				186.53	2	GS		Grain Size Analysis: Gr 36%/ Sa 47%/ Si & Cl 17%	○		
		CLAY, silty, sandy, trace gravel, very stiff to hard, brown to grey, moist: (TILL) (CL)		0.48							
1											
2					3	SS	18		○		
					4	SS	23		○		
3					5	SS	32		○		
4											
5		stiff			6	SS	14	Grain Size Analysis: Gr 8%/ Sa 37%/ Si 38%/ Cl 17%	○ ⊢		
				181.83							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN TO 4.57m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND ASPHALT COLDPATCH TO SURFACE.		5.18							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

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

LOGGED : RB
CHECKED : CAR

THURBER

THURBER2S TEL-27269.GPJ 4/8/21

THURBER

Appendix C

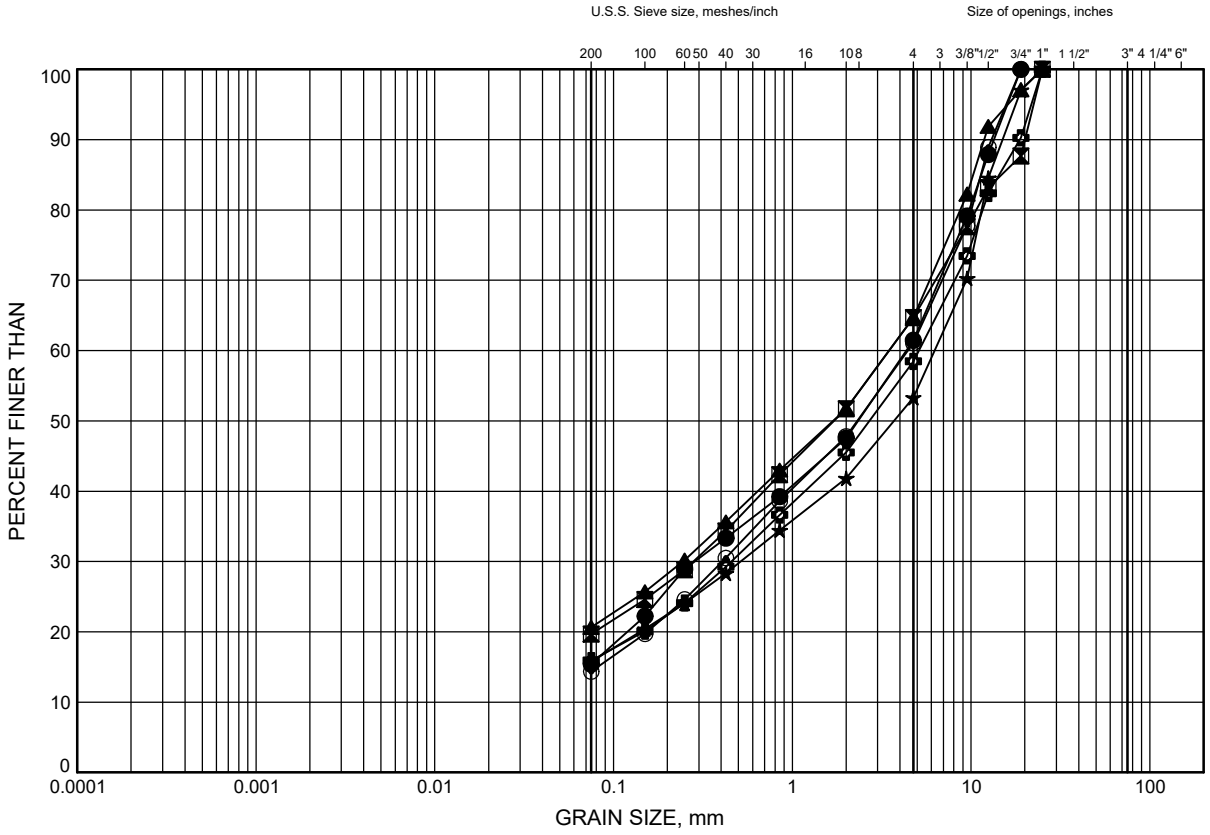
Geotechnical Laboratory Test Results

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C1

Granular FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-01	0.38	201.02
⊠	20-03	0.43	197.88
▲	20-06	0.25	193.77
★	20-07	0.48	192.37
⊙	20-09	0.20	191.03
✿	20-12	0.38	190.22

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

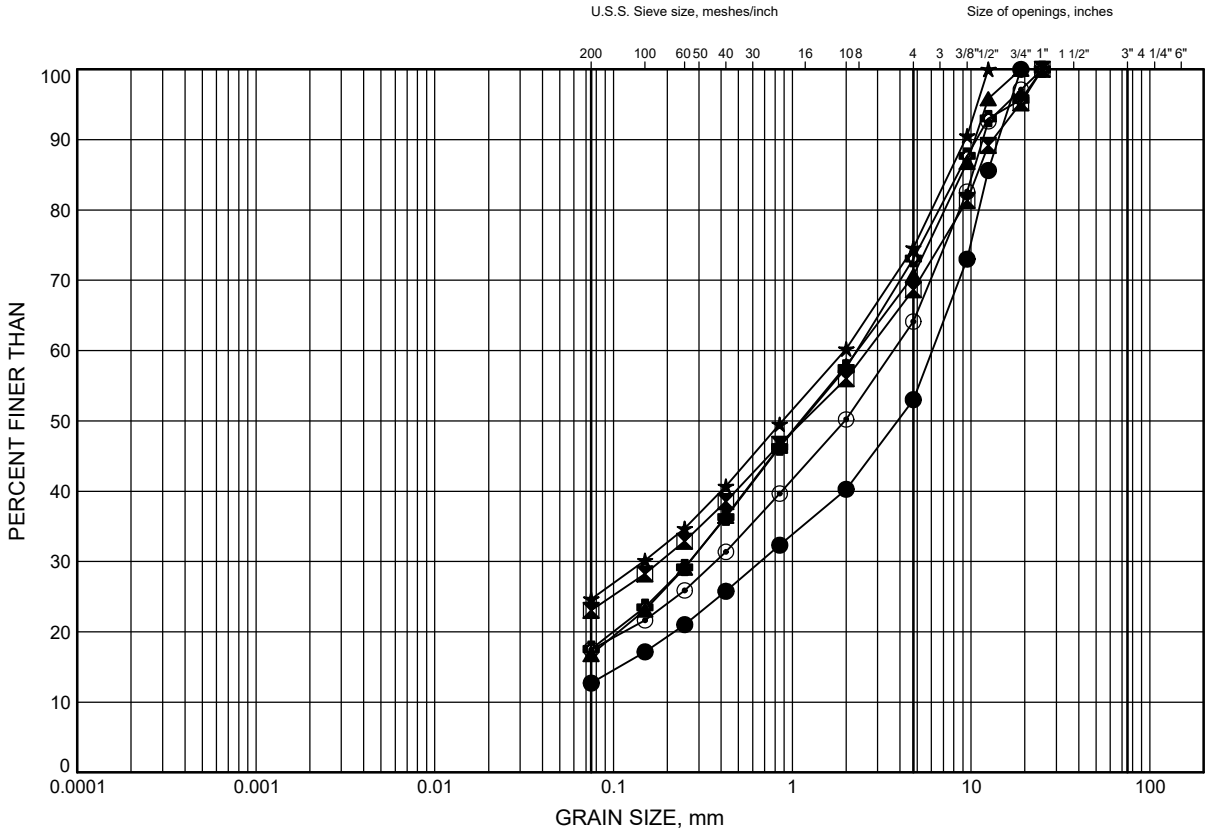
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C2

Granular FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-15	0.25	189.52
⊠	20-18	0.51	188.95
▲	20-20	0.23	189.18
★	20-22	0.46	189.77
⊙	20-24	0.15	191.71
✿	20-26	0.43	192.80

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

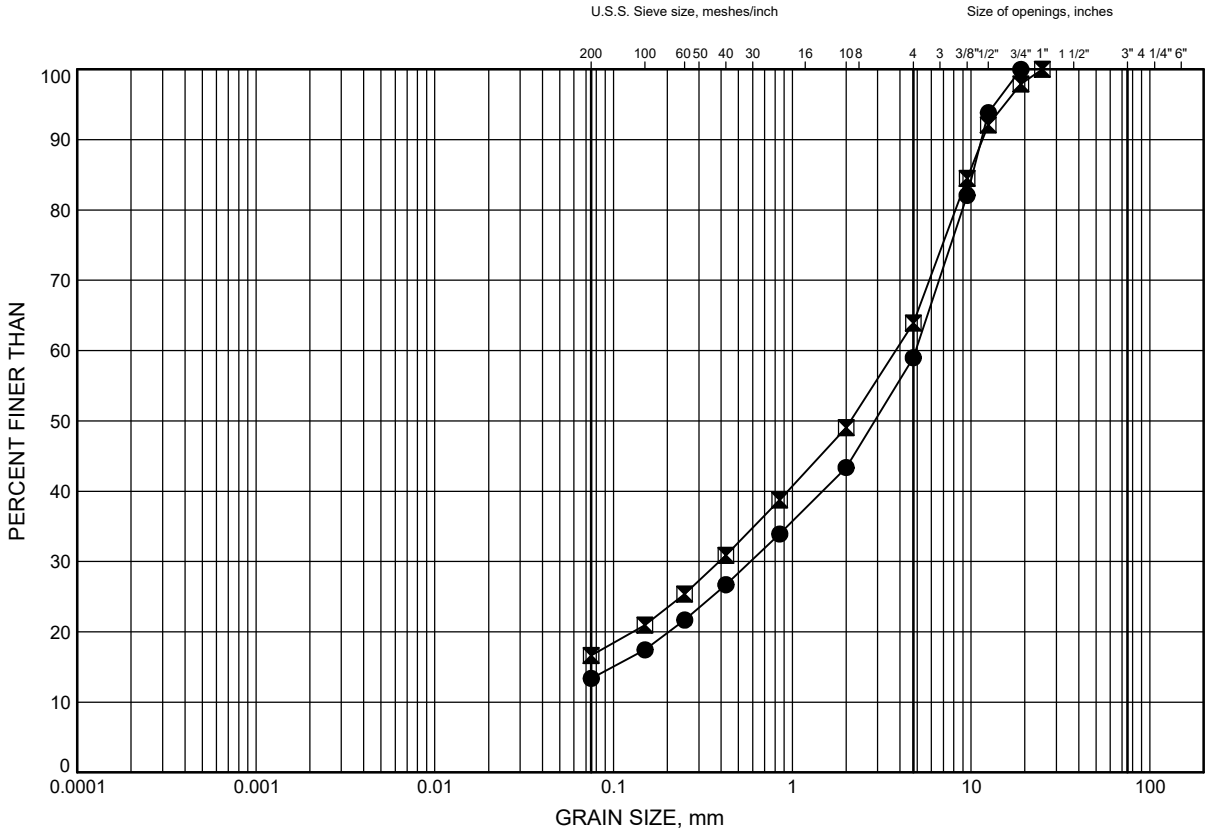
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C3

Granular FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-28	0.23	187.77
⊠	20-30	0.51	186.50

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

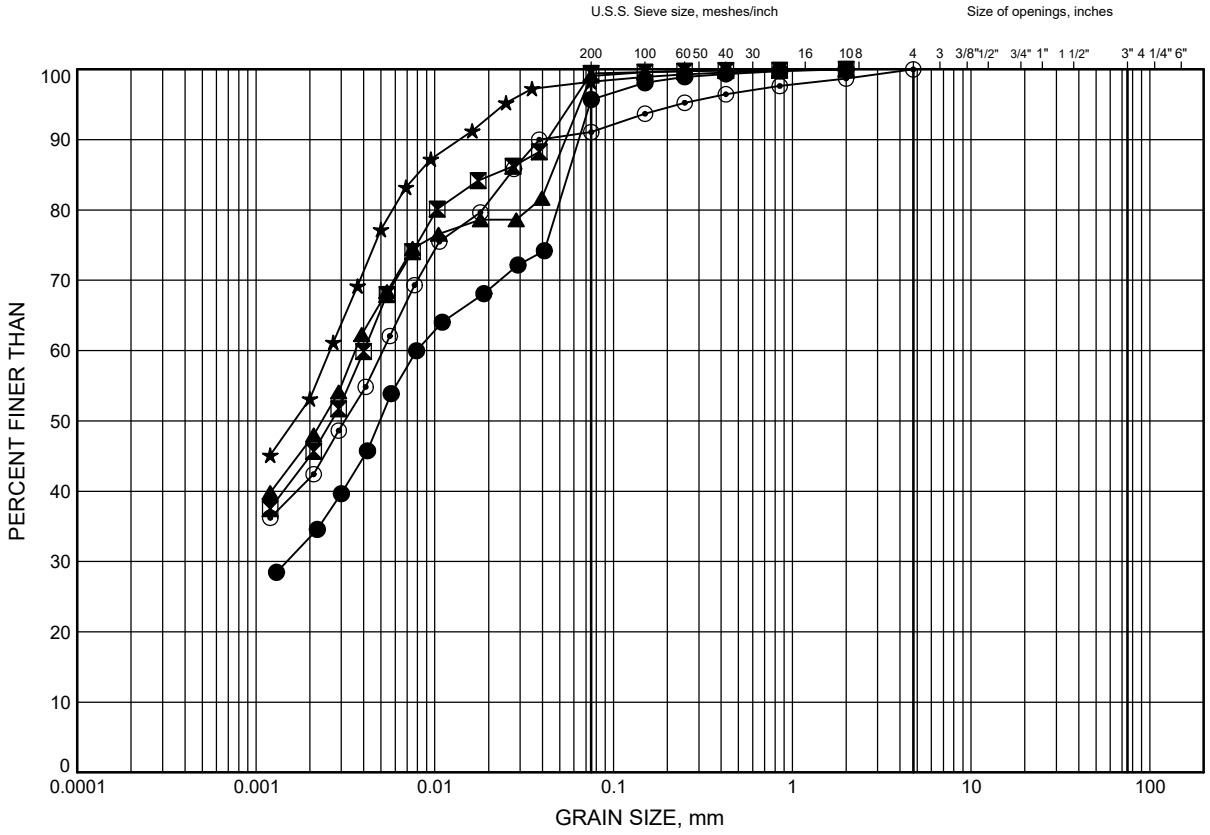
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C4

Silty CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-11	1.83	188.75
⊠	20-12	3.35	187.25
▲	20-13	2.59	187.65
★	20-14	3.35	187.21
⊙	20-16	1.83	188.92

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

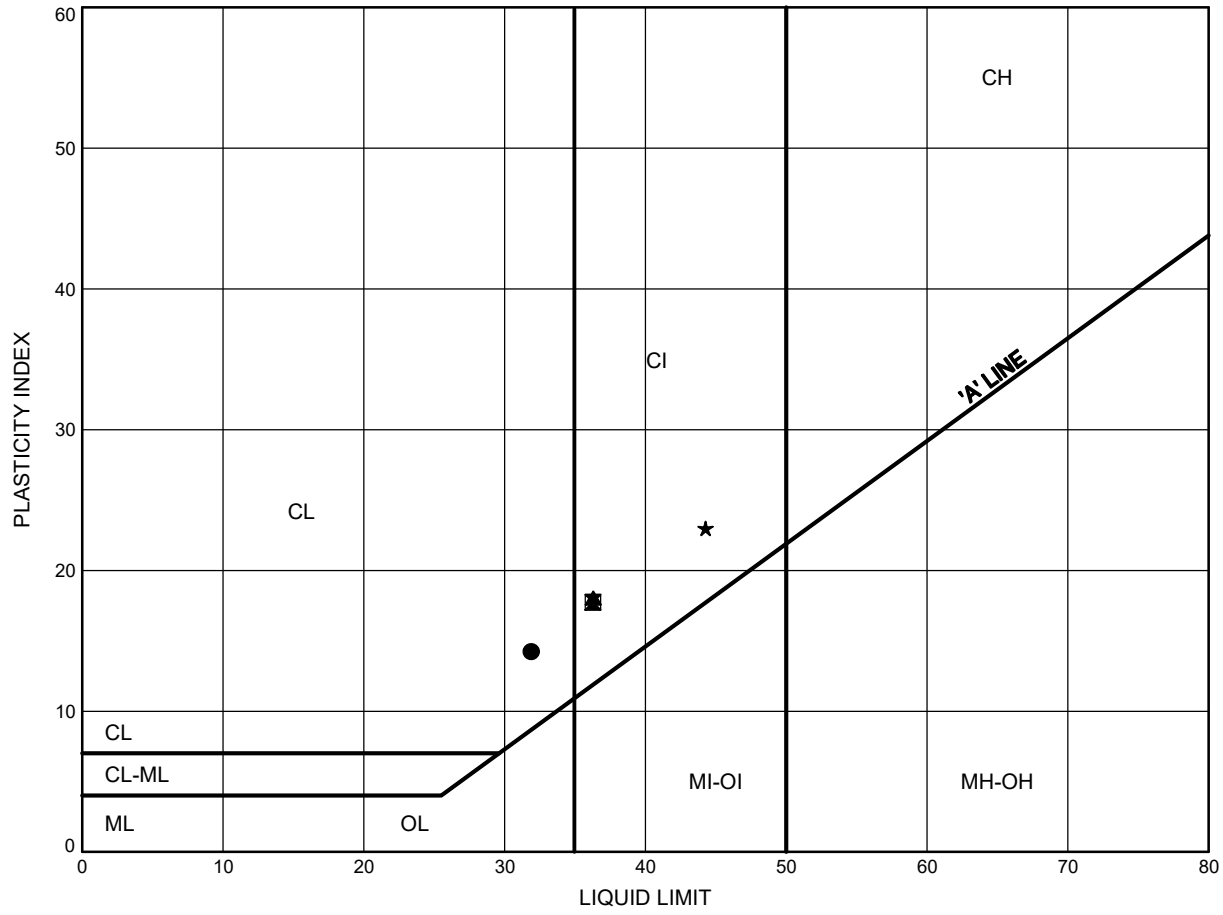
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE C5

Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-11	1.83	188.75
⊠	20-12	3.35	187.25
▲	20-13	2.59	187.65
★	20-16	1.83	188.92

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

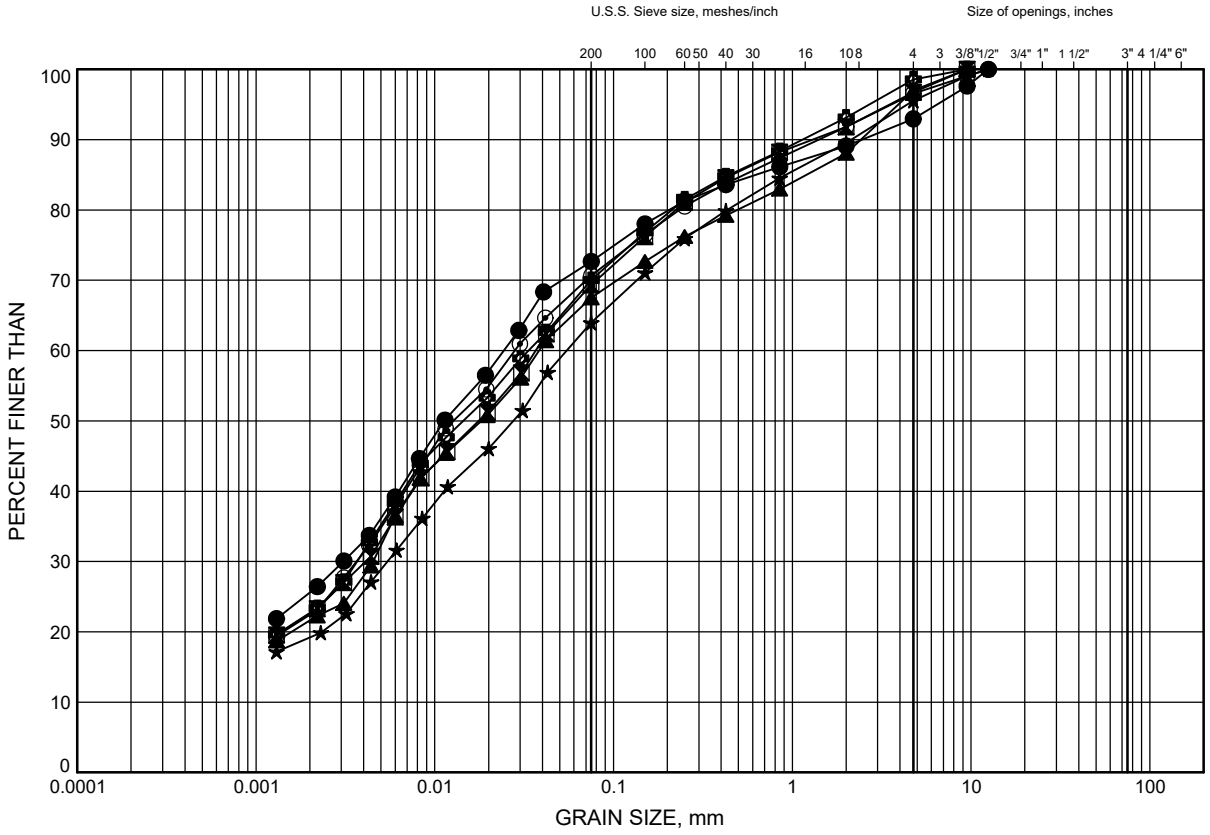
THURBALT TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C6

Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-02	1.83	198.61
⊠	20-08	3.35	188.45
▲	20-09	2.59	188.64
★	20-10	4.88	185.90
⊙	20-15	4.88	184.89
✿	20-17	3.35	186.90

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

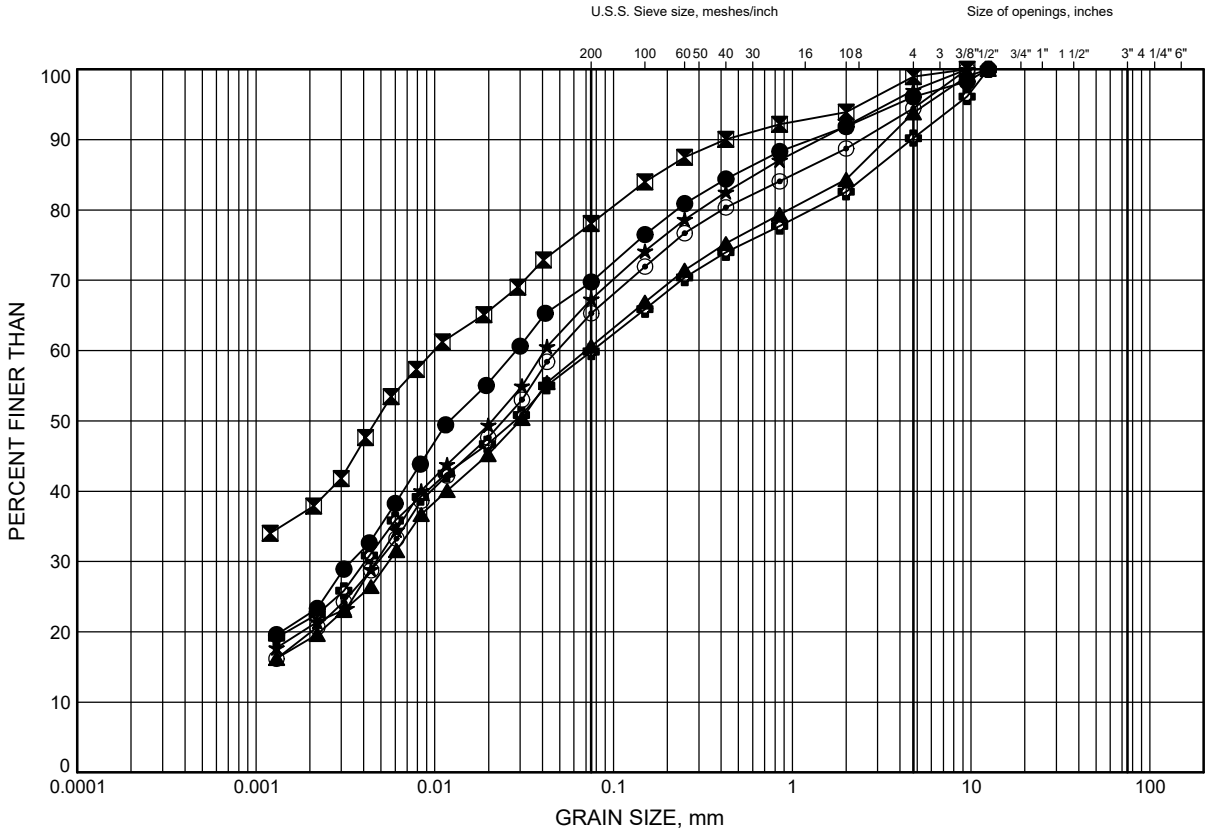
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C7

Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-18	2.59	186.87
⊠	20-19	1.07	188.73
▲	20-20	2.90	186.52
★	20-21	3.35	185.93
⊙	20-22	2.59	187.64
✿	20-23	1.07	189.75

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

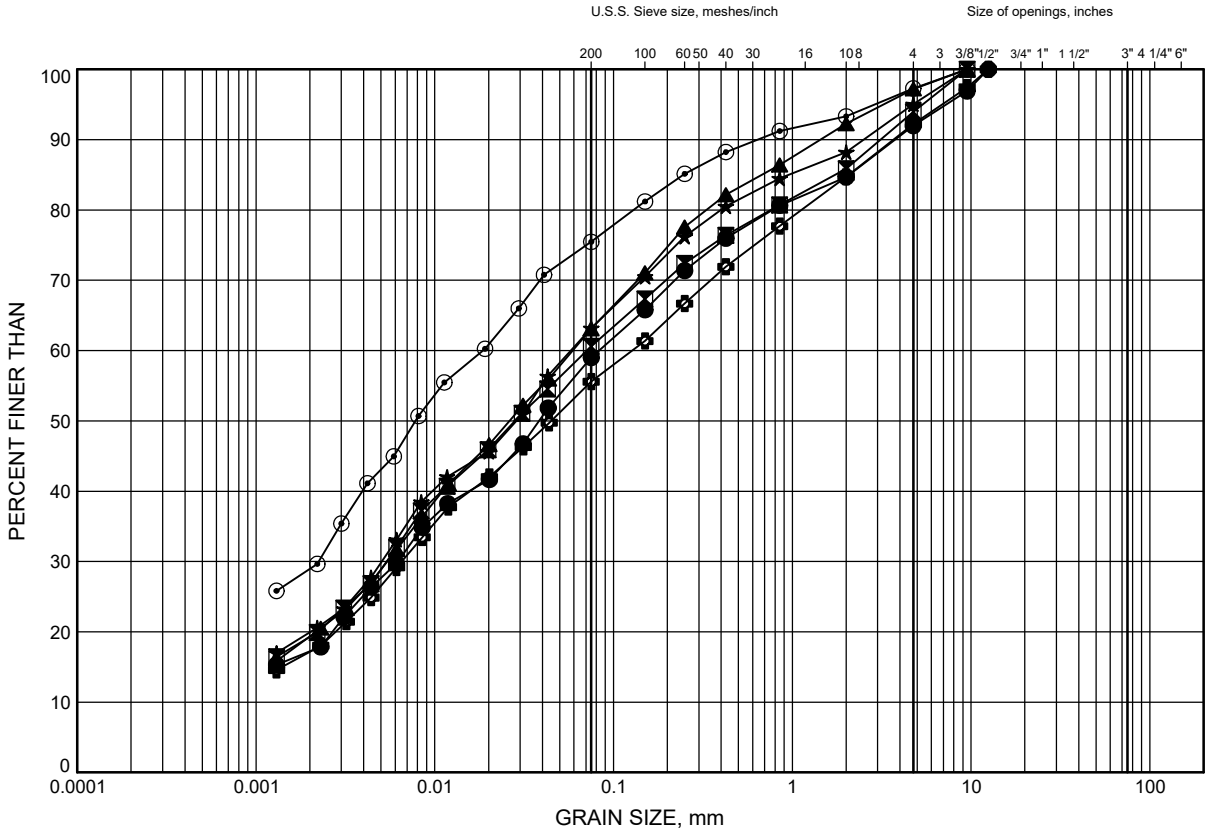
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C8

Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-25	4.88	189.00
⊠	20-26	3.35	189.88
▲	20-27	2.59	188.30
★	20-28	3.35	184.65
⊙	20-29	1.83	185.28
✿	20-30	4.88	182.13

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

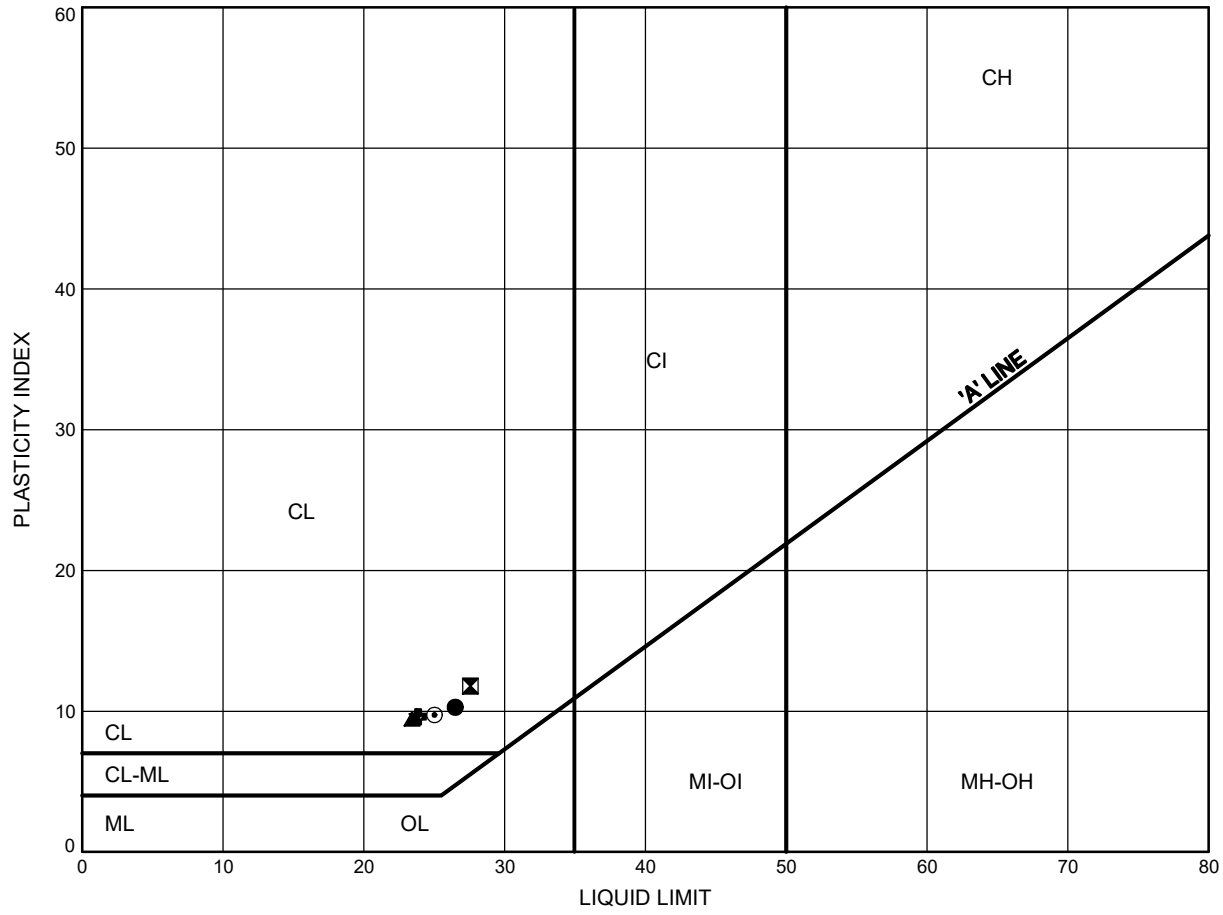
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE C9

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-02	1.83	198.61
⊠	20-08	3.35	188.45
▲	20-10	4.88	185.90
★	20-15	4.88	184.89
⊙	20-18	2.59	186.87
✿	20-22	2.59	187.64

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

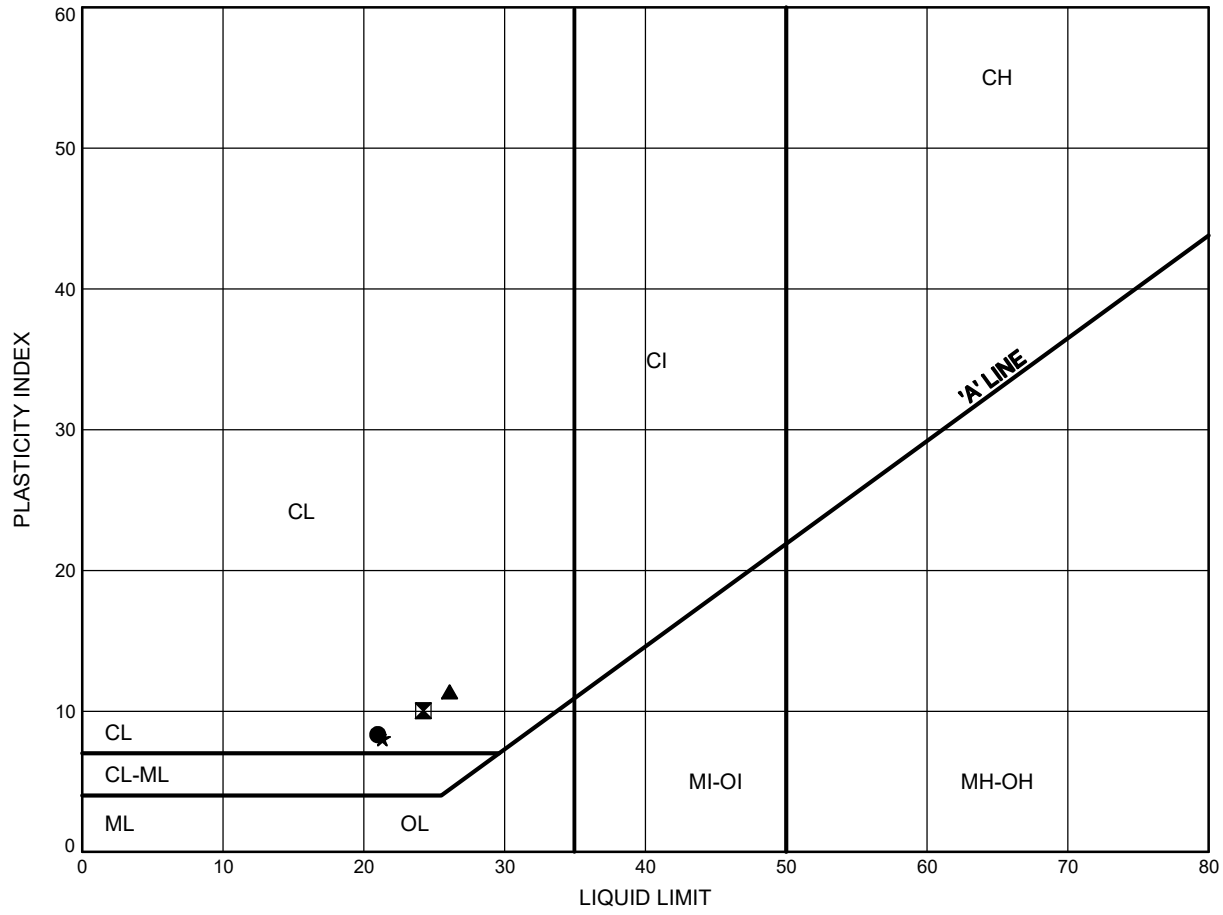
THURBALT TEL-27269.GPJ 11/27/20

Ninth Line Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE C10

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-25	4.88	189.00
⊠	20-27	2.59	188.30
▲	20-29	1.83	185.28
★	20-30	4.88	182.13

Date November 2020

Project 27269

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Prep'd AN

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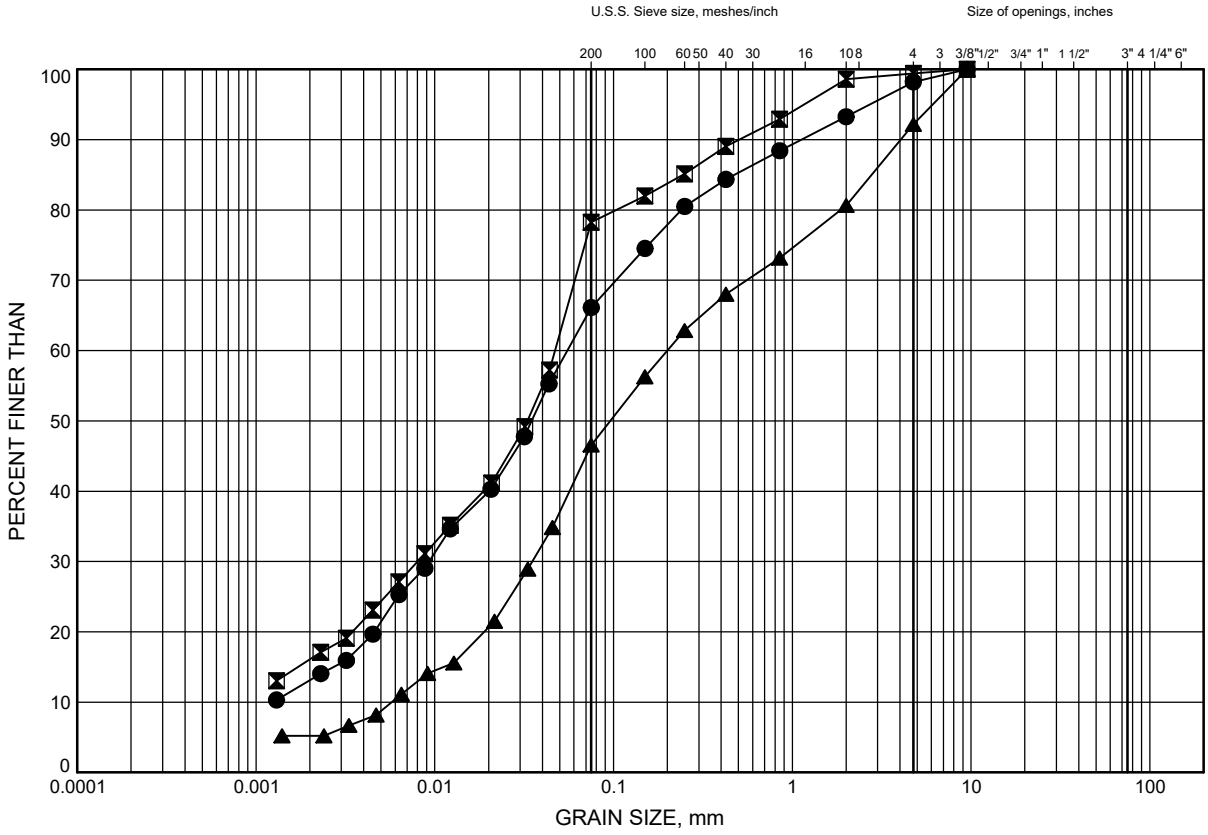
THURBALT TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C11

Silty SAND to Sandy SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-04	1.83	194.83
⊠	20-05	1.83	193.56
▲	20-06	2.59	191.43

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

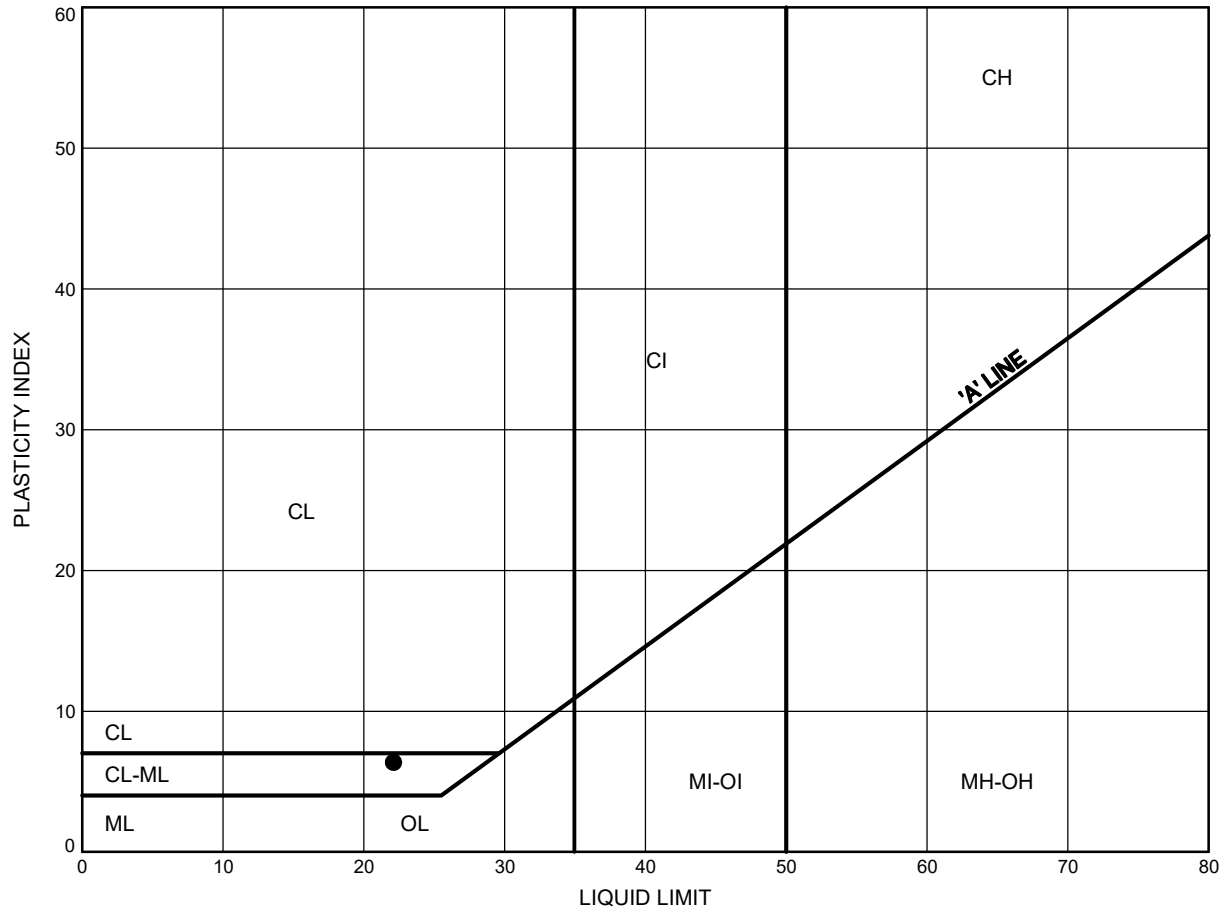
GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

Ninth Line Class EA

ATTERBERG LIMITS TEST RESULTS

FIGURE C12

Silty SAND to Sandy SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-05	1.83	193.56

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

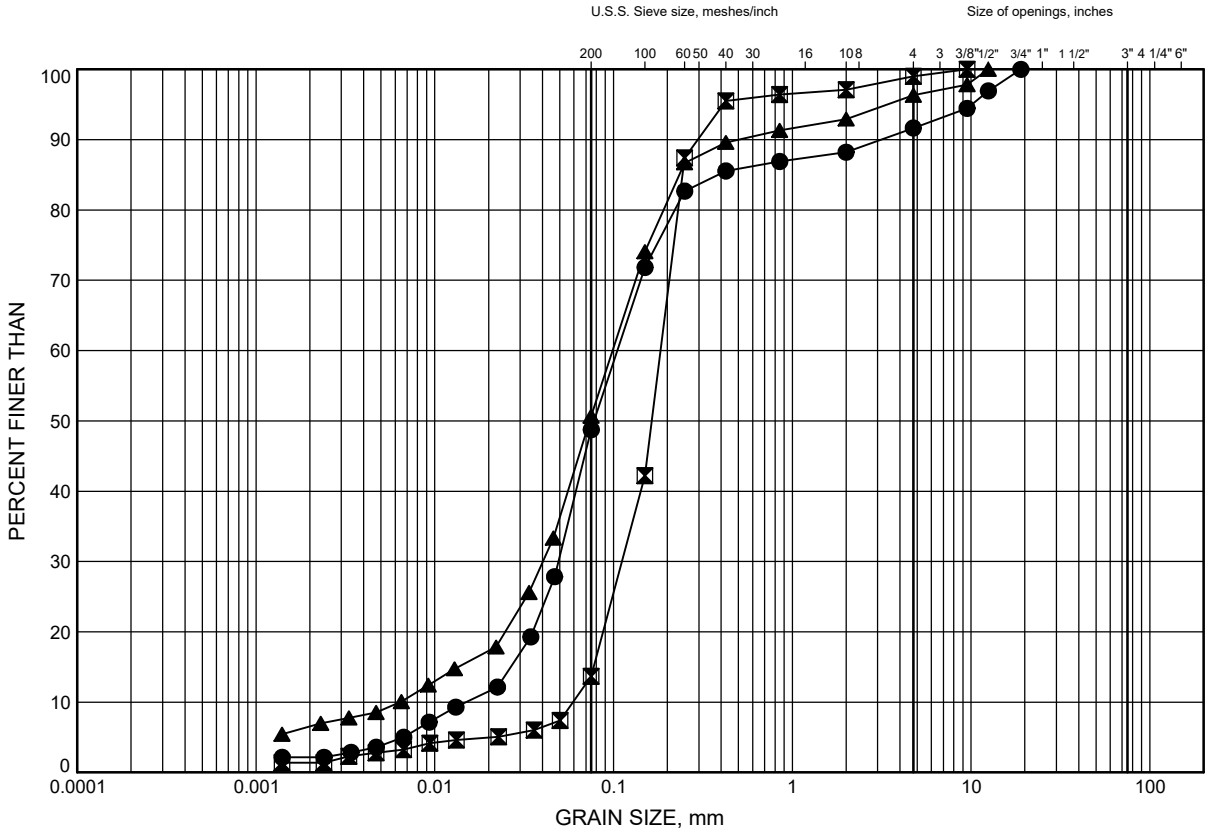
THURBALT TEL-27269.GPJ 11/27/20

Ninth Line Class EA

GRAIN SIZE DISTRIBUTION

FIGURE C13

SAND to SAND and SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-01	3.35	198.05
⊠	20-03	2.59	195.72
▲	20-07	4.84	188.01

Date November 2020

Project 27269

THURBER

Prep'd AN

Chkd. KF

GRAIN SIZE DISTRIBUTION - THURBER TEL-27269.GPJ 11/27/20

THURBER

Appendix D

Analytical Laboratory Certificates of Analysis

Your Project #: 27269
Site Location: 9TH LINE CLASS EA
Your C.O.C. #: 785369-01-01

Attention: Cecile Ritchie

Thurber Engineering Ltd
2010 Winston Park Dr
Suite 103
Oakville, ON
CANADA L6H 5R7

Report Date: 2020/11/26
Report #: R6425922
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C0K7490
Received: 2020/08/13, 17:00

Sample Matrix: Soil
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity	10	2020/08/20	2020/08/20	CAM SOP-00414	OMOE E3530 v1 m
Petroleum Hydro. CCME F1 & BTEX in Soil (1)	10	N/A	2020/08/20	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (2)	10	2020/08/19	2020/08/20	CAM SOP-00316	CCME CWS m
Moisture	10	N/A	2020/08/18	CAM SOP-00445	Carter 2nd ed 51.2 m
Sodium Adsorption Ratio (SAR)	10	N/A	2020/08/21	CAM SOP-00102	EPA 6010C

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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

Your Project #: 27269
Site Location: 9TH LINE CLASS EA
Your C.O.C. #: 785369-01-01

Attention: Cecile Ritchie

Thurber Engineering Ltd
2010 Winston Park Dr
Suite 103
Oakville, ON
CANADA L6H 5R7

Report Date: 2020/11/26
Report #: R6425922
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C0K7490
Received: 2020/08/13, 17:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Antonella Brasil, Senior Project Manager
Email: Antonella.Brasil@bvlabs.com
Phone# (905)817-5817
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

BV Labs ID			NJI467	NJI467	NJI468	NJI469		
Sampling Date			2020/08/10 13:00	2020/08/10 13:00	2020/08/10 10:00	2020/08/07 10:00		
COC Number			785369-01-01	785369-01-01	785369-01-01	785369-01-01		
	UNITS	Criteria	20-01 SS6(15'-17')	20-01 SS6(15'-17') Lab-Dup	20-04 SS5(10'-12')	20-05 SS3(5'-7')	RDL	QC Batch
Inorganics								
Moisture	%	-	9.6	N/A	18	11	1.0	6896162
BTEX & F1 Hydrocarbons								
Benzene	ug/g	**0.21**	<0.020	N/A	<0.020	<0.020	0.020	6899935
Toluene	ug/g	**2.3**	<0.020	N/A	<0.020	<0.020	0.020	6899935
Ethylbenzene	ug/g	**1.1**	<0.020	N/A	<0.020	<0.020	0.020	6899935
o-Xylene	ug/g	-	<0.020	N/A	<0.020	<0.020	0.020	6899935
p+m-Xylene	ug/g	-	<0.040	N/A	<0.040	<0.040	0.040	6899935
Total Xylenes	ug/g	**3.1**	<0.040	N/A	<0.040	<0.040	0.040	6899935
F1 (C6-C10)	ug/g	**55**	<10	N/A	<10	<10	10	6899935
F1 (C6-C10) - BTEX	ug/g	**55**	<10	N/A	<10	<10	10	6899935
F2-F4 Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	ug/g	**98**	<10	<10	<10	<10	10	6898513
F3 (C16-C34 Hydrocarbons)	ug/g	**300**	<50	<50	<50	<50	50	6898513
F4 (C34-C50 Hydrocarbons)	ug/g	**2800**	<50	<50	<50	<50	50	6898513
Reached Baseline at C50	ug/g	-	Yes	Yes	Yes	Yes	N/A	6898513
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	-	102	N/A	101	101	N/A	6899935
4-Bromofluorobenzene	%	-	97	N/A	99	98	N/A	6899935
D10-o-Xylene	%	-	99	N/A	105	98	N/A	6899935
D4-1,2-Dichloroethane	%	-	100	N/A	107	97	N/A	6899935
o-Terphenyl	%	-	102	101	110	99	N/A	6898513

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
Soil - Residential/Parkland/Institutional Property Use - Coarse Textured Soil
N/A = Not Applicable

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

BV Labs ID			NJI470	NJI471	NJI472	NJI473		
Sampling Date			2020/08/07 12:00	2020/08/06 15:00	2020/08/12 11:00	2020/08/12 12:15		
COC Number			785369-01-01	785369-01-01	785369-01-01	785369-01-01		
	UNITS	Criteria	20-09 SS4 (7.5'-9.5')	20-15 SS3 (5'-7')	20-18 SS4(7.5'-9.5')	20-19 SS5(10'-12')	RDL	QC Batch
Inorganics								
Moisture	%	-	11	18	12	11	1.0	6896162
BTEX & F1 Hydrocarbons								
Benzene	ug/g	**0.21**	<0.020	<0.020	<0.020	<0.020	0.020	6899935
Toluene	ug/g	**2.3**	<0.020	<0.020	<0.020	<0.020	0.020	6899935
Ethylbenzene	ug/g	**1.1**	<0.020	<0.020	<0.020	<0.020	0.020	6899935
o-Xylene	ug/g	**-**	<0.020	<0.020	<0.020	<0.020	0.020	6899935
p+m-Xylene	ug/g	**-**	<0.040	<0.040	<0.040	<0.040	0.040	6899935
Total Xylenes	ug/g	**3.1**	<0.040	<0.040	<0.040	<0.040	0.040	6899935
F1 (C6-C10)	ug/g	**55**	<10	<10	<10	<10	10	6899935
F1 (C6-C10) - BTEX	ug/g	**55**	<10	<10	<10	<10	10	6899935
F2-F4 Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	ug/g	**98**	<10	<10	<10	<10	10	6898513
F3 (C16-C34 Hydrocarbons)	ug/g	**300**	<50	<50	<50	<50	50	6898513
F4 (C34-C50 Hydrocarbons)	ug/g	**2800**	<50	<50	<50	<50	50	6898513
Reached Baseline at C50	ug/g	**-**	Yes	Yes	Yes	Yes	N/A	6898513
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	**-**	108	111	102	108	N/A	6899935
4-Bromofluorobenzene	%	**-**	98	96	100	98	N/A	6899935
D10-o-Xylene	%	**-**	112	118	101	101	N/A	6899935
D4-1,2-Dichloroethane	%	**-**	111	113	108	111	N/A	6899935
o-Terphenyl	%	**-**	101	105	99	99	N/A	6898513

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
Soil - Residential/Parkland/Institutional Property Use - Coarse Textured Soil
N/A = Not Applicable

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BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

BV Labs ID			NJI474	NJI475	NJI476		
Sampling Date			2020/08/13 15:00	2020/08/11 12:00	2020/08/13 12:30		
COC Number			785369-01-01	785369-01-01	785369-01-01		
	UNITS	Criteria	20-26 SS4 (5'-7')	20-30 SS5(10'-12')	20-23 SS6(10-12')	RDL	QC Batch
Inorganics							
Moisture	%	-	11	11	12	1.0	6896162
BTEX & F1 Hydrocarbons							
Benzene	ug/g	**0.21**	<0.020	<0.020	<0.020	0.020	6899935
Toluene	ug/g	**2.3**	<0.020	<0.020	<0.020	0.020	6899935
Ethylbenzene	ug/g	**1.1**	<0.020	<0.020	<0.020	0.020	6899935
o-Xylene	ug/g	**-**	<0.020	<0.020	<0.020	0.020	6899935
p+m-Xylene	ug/g	**-**	<0.040	<0.040	<0.040	0.040	6899935
Total Xylenes	ug/g	**3.1**	<0.040	<0.040	<0.040	0.040	6899935
F1 (C6-C10)	ug/g	**55**	<10	<10	<10	10	6899935
F1 (C6-C10) - BTEX	ug/g	**55**	<10	<10	<10	10	6899935
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/g	**98**	<10	<10	<10	10	6898513
F3 (C16-C34 Hydrocarbons)	ug/g	**300**	<50	<50	<50	50	6898513
F4 (C34-C50 Hydrocarbons)	ug/g	**2800**	<50	<50	<50	50	6898513
Reached Baseline at C50	ug/g	**-**	Yes	Yes	Yes	N/A	6898513
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	**-**	100	107	101	N/A	6899935
4-Bromofluorobenzene	%	**-**	92	98	100	N/A	6899935
D10-o-Xylene	%	**-**	93	106	110	N/A	6899935
D4-1,2-Dichloroethane	%	**-**	105	110	105	N/A	6899935
o-Terphenyl	%	**-**	99	100	101	N/A	6898513

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
Soil - Residential/Parkland/Institutional Property Use - Coarse Textured Soil
N/A = Not Applicable

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

RESULTS OF ANALYSES OF SOIL

BV Labs ID			NJI467	NJI468	NJI469	NJI470		
Sampling Date			2020/08/10 13:00	2020/08/10 10:00	2020/08/07 10:00	2020/08/07 12:00		
COC Number			785369-01-01	785369-01-01	785369-01-01	785369-01-01		
	UNITS	Criteria	20-01 SS6(15'-17')	20-04 SS5(10'-12')	20-05 SS3(5'-7')	20-09 SS4 (7.5'-9.5')	RDL	QC Batch
Calculated Parameters								
Sodium Adsorption Ratio	N/A	**5.0**	2.7	1.0	**5.3**	4.8	N/A	6895475
Inorganics								
Conductivity	mS/cm	**0.7**	0.52	0.16	**1.9**	0.52	0.002	6900448

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
Soil - Residential/Parkland/Institutional Property Use - Coarse Textured Soil
N/A = Not Applicable

BV Labs ID			NJI471	NJI472	NJI473	NJI474		
Sampling Date			2020/08/06 15:00	2020/08/12 11:00	2020/08/12 12:15	2020/08/13 15:00		
COC Number			785369-01-01	785369-01-01	785369-01-01	785369-01-01		
	UNITS	Criteria	20-15 SS3 (5'-7')	20-18 SS4(7.5'-9.5')	20-19 SS5(10'-12')	20-26 SS4 (5'-7')	RDL	QC Batch
Calculated Parameters								
Sodium Adsorption Ratio	N/A	**5.0**	0.28 (1)	**18**	0.39 (1)	0.98	N/A	6895475
Inorganics								
Conductivity	mS/cm	**0.7**	**2.7**	**2.2**	0.49	0.34	0.002	6900448

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
Soil - Residential/Parkland/Institutional Property Use - Coarse Textured Soil
N/A = Not Applicable
(1) Sodium was not detected. To report SAR the sodium detection limit was used in the calculation. This value represents a maximum ratio.

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BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

RESULTS OF ANALYSES OF SOIL

BV Labs ID			NJI475	NJI476		
Sampling Date			2020/08/11 12:00	2020/08/13 12:30		
COC Number			785369-01-01	785369-01-01		
	UNITS	Criteria	20-30 SS5(10'-12')	20-23 SS6(10-12')	RDL	QC Batch
Calculated Parameters						
Sodium Adsorption Ratio	N/A	**5.0**	0.40	2.7	N/A	6895475
Inorganics						
Conductivity	mS/cm	**0.7**	0.21	**0.88**	0.002	6900448

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition
Soil - Residential/Parkland/Institutional Property Use - Coarse Textured Soil
N/A = Not Applicable

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BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	21.3°C

Revised Report (2020/11/26): Report re-issued to include criteria limits.

F1/BTEX Analysis: Soil weight exceeds the protocol specification of approximately 5g in the field preserved vial. Additional methanol was added to the vial to ensure extraction efficiency.

Results relate only to the items tested.

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BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6896162	MIS	RPD	Moisture	2020/08/18	0		%	20
6898513	GUL	Matrix Spike [NJI467-02]	o-Terphenyl	2020/08/20		95	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2020/08/20		86	%	50 - 130
			F3 (C16-C34 Hydrocarbons)	2020/08/20		98	%	50 - 130
			F4 (C34-C50 Hydrocarbons)	2020/08/20		97	%	50 - 130
6898513	GUL	Spiked Blank	o-Terphenyl	2020/08/20		84	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2020/08/20		86	%	80 - 120
			F3 (C16-C34 Hydrocarbons)	2020/08/20		98	%	80 - 120
			F4 (C34-C50 Hydrocarbons)	2020/08/20		97	%	80 - 120
6898513	GUL	Method Blank	o-Terphenyl	2020/08/19		92	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2020/08/19	<10		ug/g	
			F3 (C16-C34 Hydrocarbons)	2020/08/19	<50		ug/g	
			F4 (C34-C50 Hydrocarbons)	2020/08/19	<50		ug/g	
6898513	GUL	RPD [NJI467-02]	F2 (C10-C16 Hydrocarbons)	2020/08/20	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2020/08/20	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2020/08/20	NC		%	30
6899935	H_W	Matrix Spike	1,4-Difluorobenzene	2020/08/20		94	%	60 - 140
			4-Bromofluorobenzene	2020/08/20		98	%	60 - 140
			D10-o-Xylene	2020/08/20		106	%	60 - 140
			D4-1,2-Dichloroethane	2020/08/20		91	%	60 - 140
			Benzene	2020/08/20		92	%	50 - 140
			Toluene	2020/08/20		92	%	50 - 140
			Ethylbenzene	2020/08/20		109	%	50 - 140
			o-Xylene	2020/08/20		101	%	50 - 140
			p+m-Xylene	2020/08/20		104	%	50 - 140
			F1 (C6-C10)	2020/08/20		88	%	60 - 140
6899935	H_W	Spiked Blank	1,4-Difluorobenzene	2020/08/20		95	%	60 - 140
			4-Bromofluorobenzene	2020/08/20		99	%	60 - 140
			D10-o-Xylene	2020/08/20		104	%	60 - 140
			D4-1,2-Dichloroethane	2020/08/20		90	%	60 - 140
			Benzene	2020/08/20		99	%	50 - 140
			Toluene	2020/08/20		98	%	50 - 140
			Ethylbenzene	2020/08/20		118	%	50 - 140
			o-Xylene	2020/08/20		112	%	50 - 140
			p+m-Xylene	2020/08/20		113	%	50 - 140
			F1 (C6-C10)	2020/08/20		97	%	80 - 120
6899935	H_W	Method Blank	1,4-Difluorobenzene	2020/08/20		100	%	60 - 140
			4-Bromofluorobenzene	2020/08/20		99	%	60 - 140
			D10-o-Xylene	2020/08/20		98	%	60 - 140
			D4-1,2-Dichloroethane	2020/08/20		103	%	60 - 140
			Benzene	2020/08/20	<0.020		ug/g	
			Toluene	2020/08/20	<0.020		ug/g	
			Ethylbenzene	2020/08/20	<0.020		ug/g	
			o-Xylene	2020/08/20	<0.020		ug/g	
			p+m-Xylene	2020/08/20	<0.040		ug/g	
			Total Xylenes	2020/08/20	<0.040		ug/g	
			F1 (C6-C10)	2020/08/20	<10		ug/g	
			F1 (C6-C10) - BTEX	2020/08/20	<10		ug/g	
6899935	H_W	RPD	Benzene	2020/08/20	NC		%	50
			Toluene	2020/08/20	NC		%	50
			Ethylbenzene	2020/08/20	NC		%	50

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			o-Xylene	2020/08/20	NC		%	50
			p+m-Xylene	2020/08/20	NC		%	50
			Total Xylenes	2020/08/20	NC		%	50
			F1 (C6-C10)	2020/08/20	NC		%	30
			F1 (C6-C10) - BTEX	2020/08/20	NC		%	30
6900448	NYS	Spiked Blank	Conductivity	2020/08/20		103	%	90 - 110
6900448	NYS	Method Blank	Conductivity	2020/08/20	<0.002		mS/cm	
6900448	NYS	RPD	Conductivity	2020/08/20	3.0		%	10

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

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

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

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

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

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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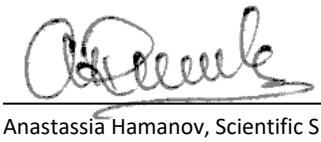
BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

VALIDATION SIGNATURE PAGE

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



Anastassia Hamanov, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

Page of

CHAIN OF CUSTODY RECORD

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#5843 Thurber Engineering Ltd	Company Name:	Thurber Engineering LTD	Quotation #:	B90187	BV Labs Job #:	Bottle Order #: 785369
Attention:	Cecile Ritchie	Attention:	Cecile Ritchie	P.O. #:			
Address:	2010 Winston Park Dr Suite 103, Oakville ON L6H 5R7	Address:	2010 Winston Park Dr Suite 103, Oakville ON	Project:	27269	COC #: C#785369-01-01	Project Manager: Antonella Brasil
Tel:	(905) 829-8666 Fax:	Tel:	905-829-8666 Fax:	Project Name:	9th Line Class EA		
Email:	critchie@thurber.ca	Email:	critchie@thurber.ca	Site #:			
				Sampled By:	Rachel Bourassa		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☑ Res/Park ☑ Medium/Fine ☐ Table 2 ☑ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ☐ PWQO ☐ Reg 406 Table ☐ Other

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects
Regular (Standard) TAT: Regular ☑
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.
Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	O. Reg 153 PHCs, BTEX/F1-F4 (Soil)	SAR - ICP Metals	Conductivity	EC	# of Bottles	Comments
1	20-01 SS6 (15'-17')		Aug 10	1:00 pm	Soil		✓	✓		✓	4	
2	20-04 SS5 (10'-12')		Aug 10	10 AM	"		✓	✓		✓	4	
3	20-05 SS3 (5'-7')		Aug 7	10 AM	"		✓	✓		✓	4	
4	20-09 SS4 (7.5-9.5)		Aug 7	12 pm	"		✓	✓		✓	4	
5	20-15 SS3 (5-7)		Aug 6	3 PM	"		✓	✓		✓	4	
6	20-18 SS4 (7.5-9.5)		Aug 12	11 AM	"		✓	✓		✓	4	
7	20-19 SS5 (10'-12')		Aug 12	12:15	"		✓	✓		✓	4	
8	20-[illegible]26 (5'-7')		Aug 13	3pm	"		✓	✓		✓	4	2 Jars were not labeled as there were not enough stickers. Cap is labelled
9	20-30 SS8 (10'-12')		Aug 11	12 pm	"		✓	✓		✓	4	
10	20-23 (10-12')		Aug 13	12:30 pm	"		✓	✓		✓	4	

13-Aug-20 17:00
Antonella Brasil
C0K7490
DSG ENV-1314

SS6 * RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
R Bourassa	20/08/13	5:00PM	[signature]	2020/08/13	1700	
R Bourassa	20/08/13	5:00 PM				

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	22 21 21 ICE	Present	✓	
		Intact	✓	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

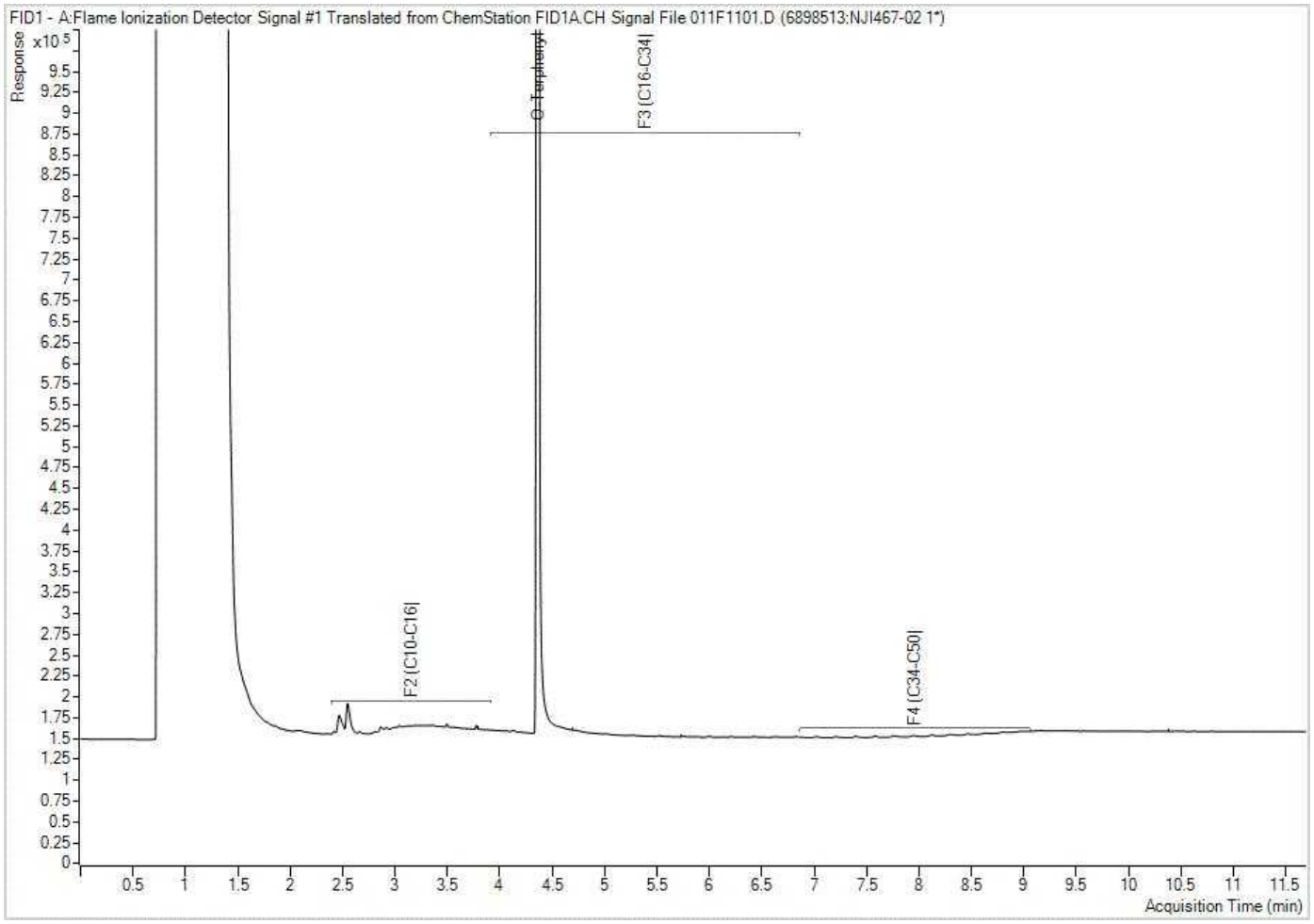
White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI467

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-01 SS6(15'-17')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

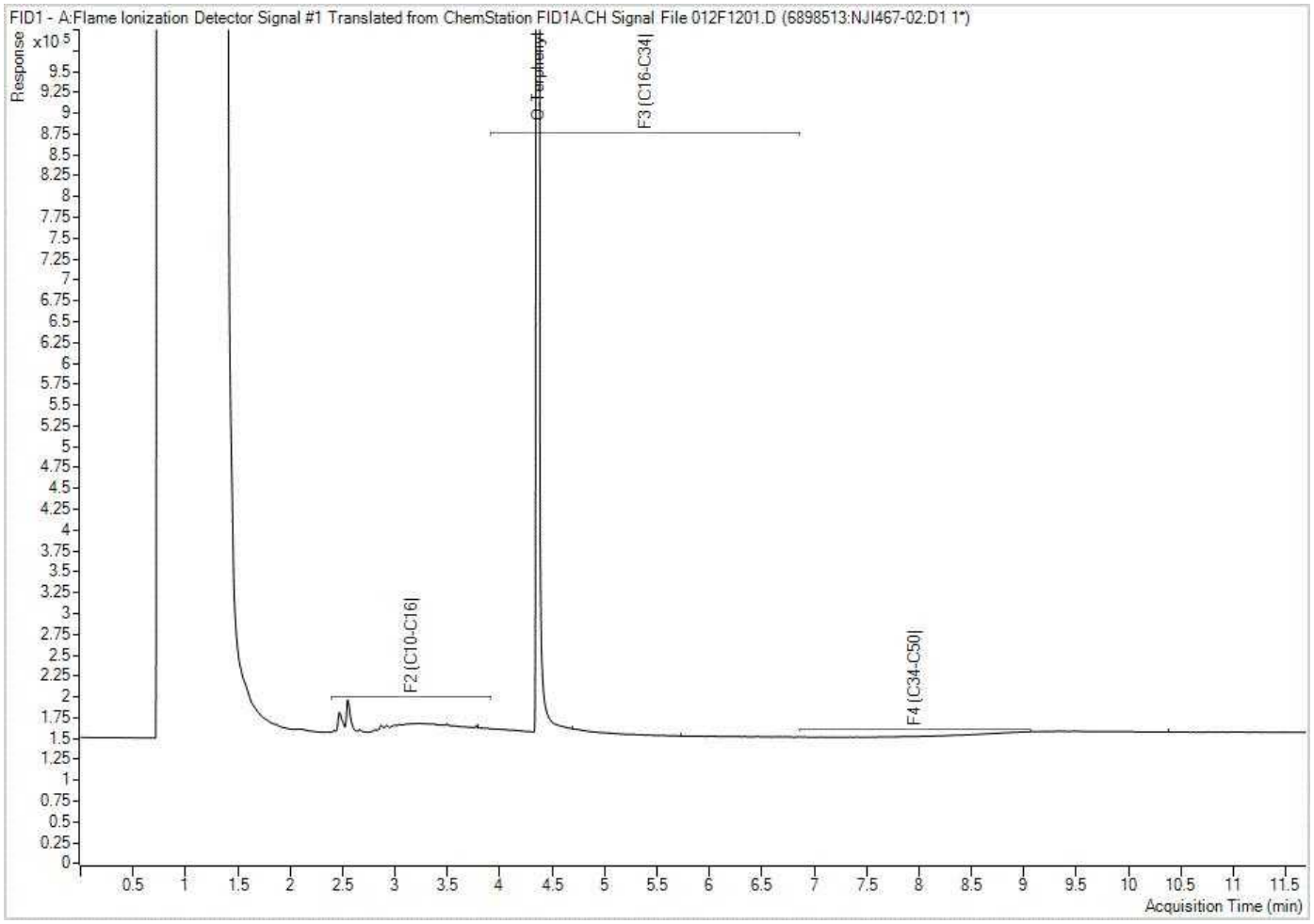


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI467 Lab-Dup

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-01 SS6(15'-17')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

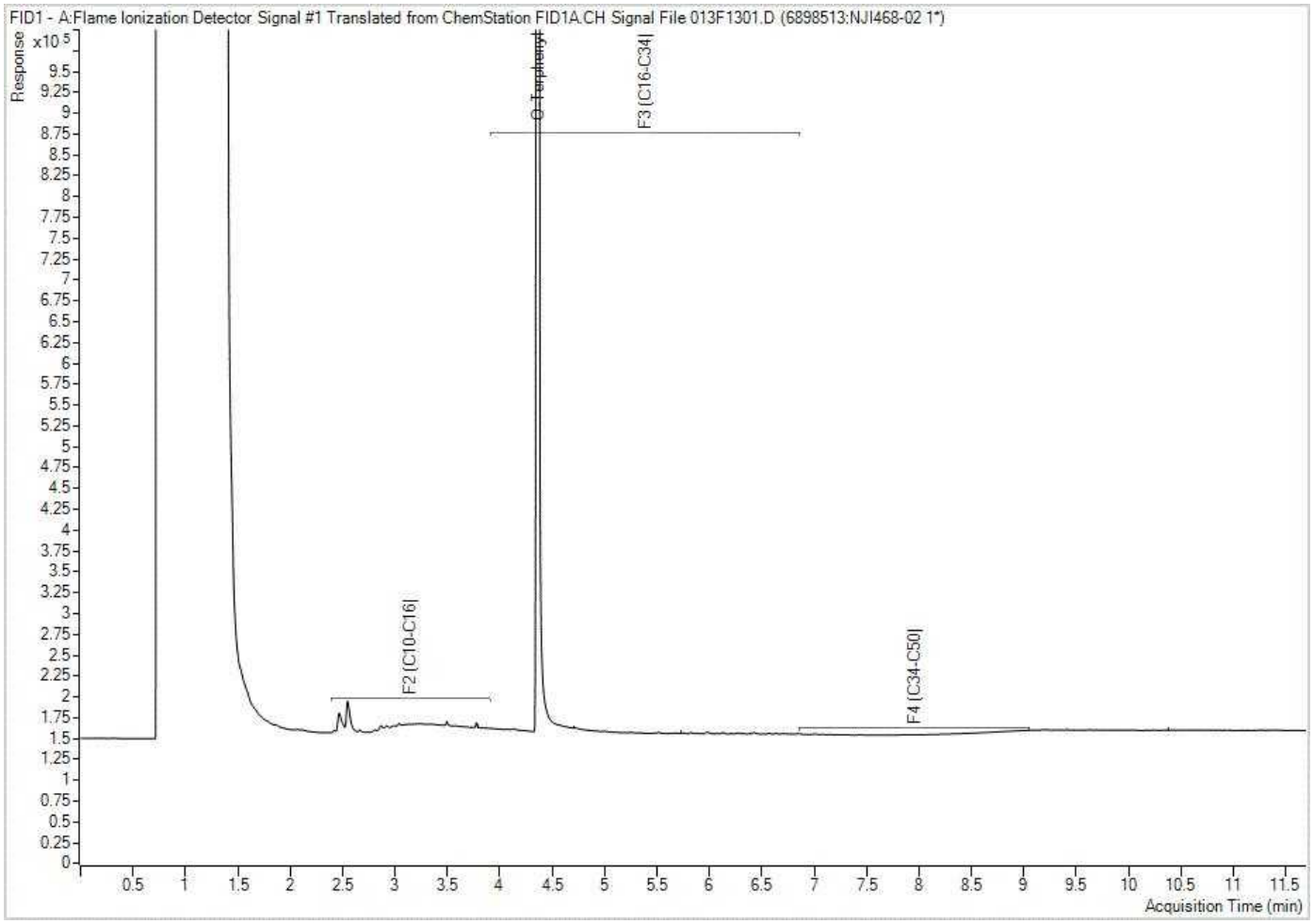


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI468

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-04 SS5(10'-12')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

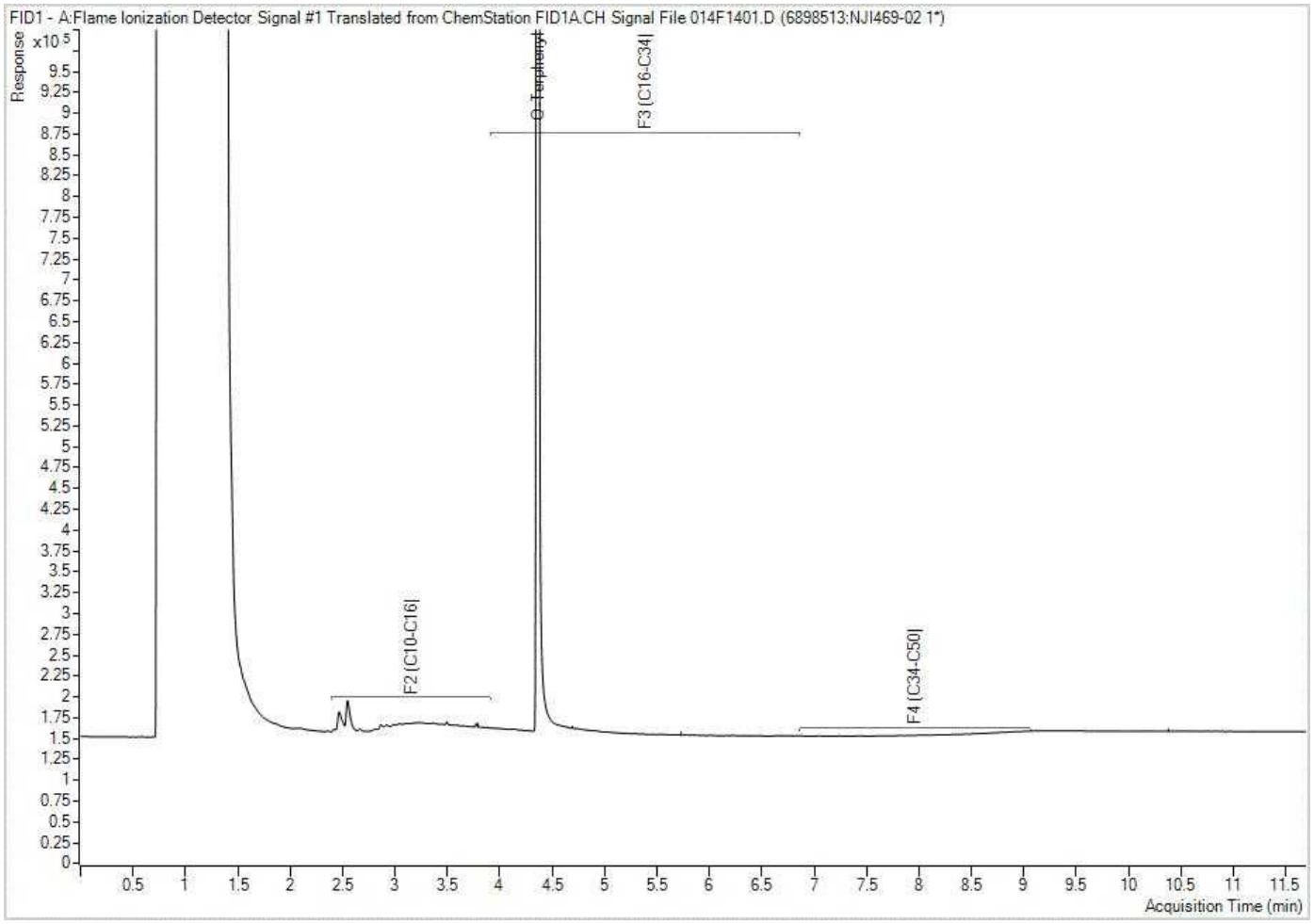


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI469

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-05 SS3(5'-7')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

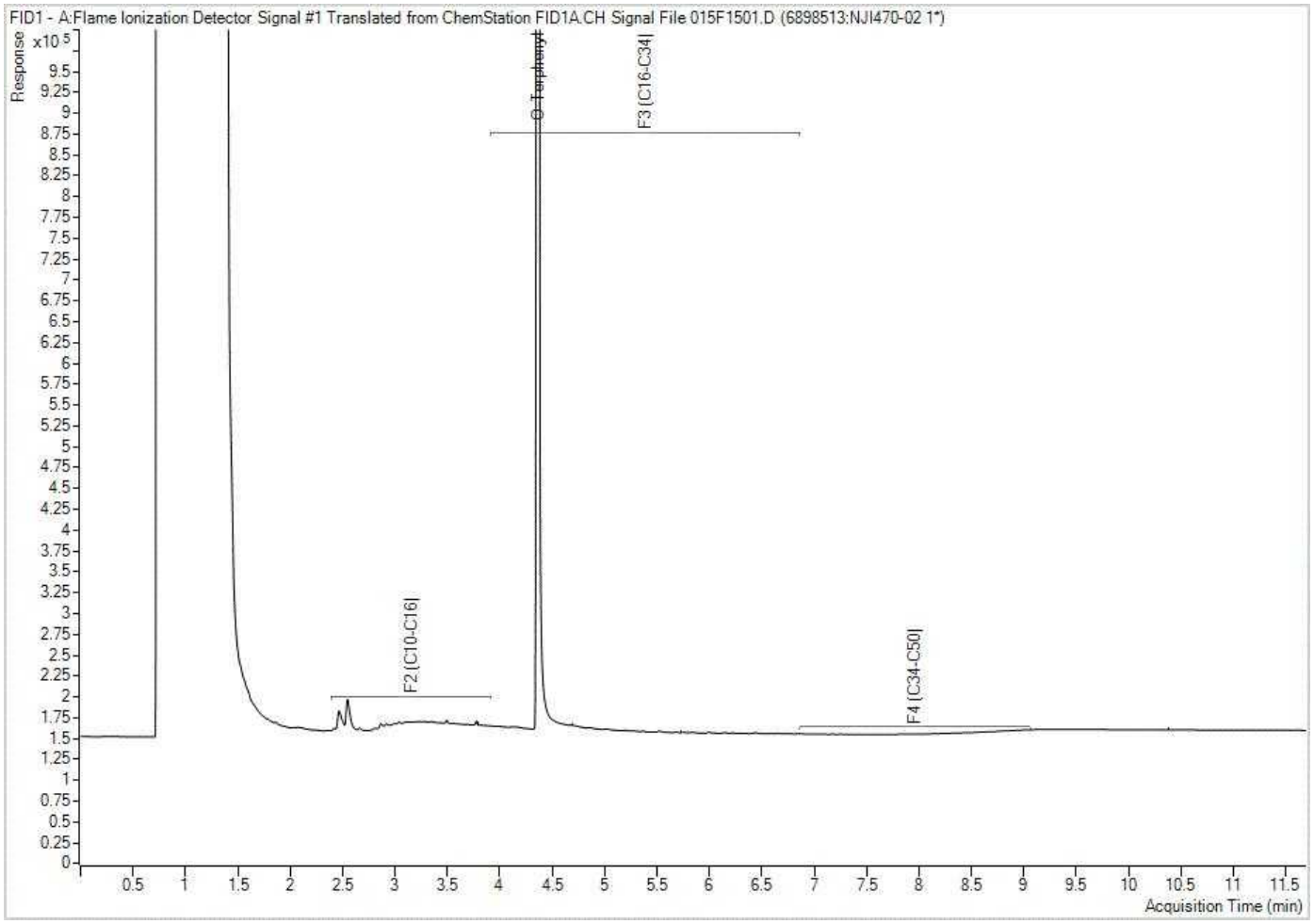


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI470

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-09 SS4 (7.5'-9.5')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

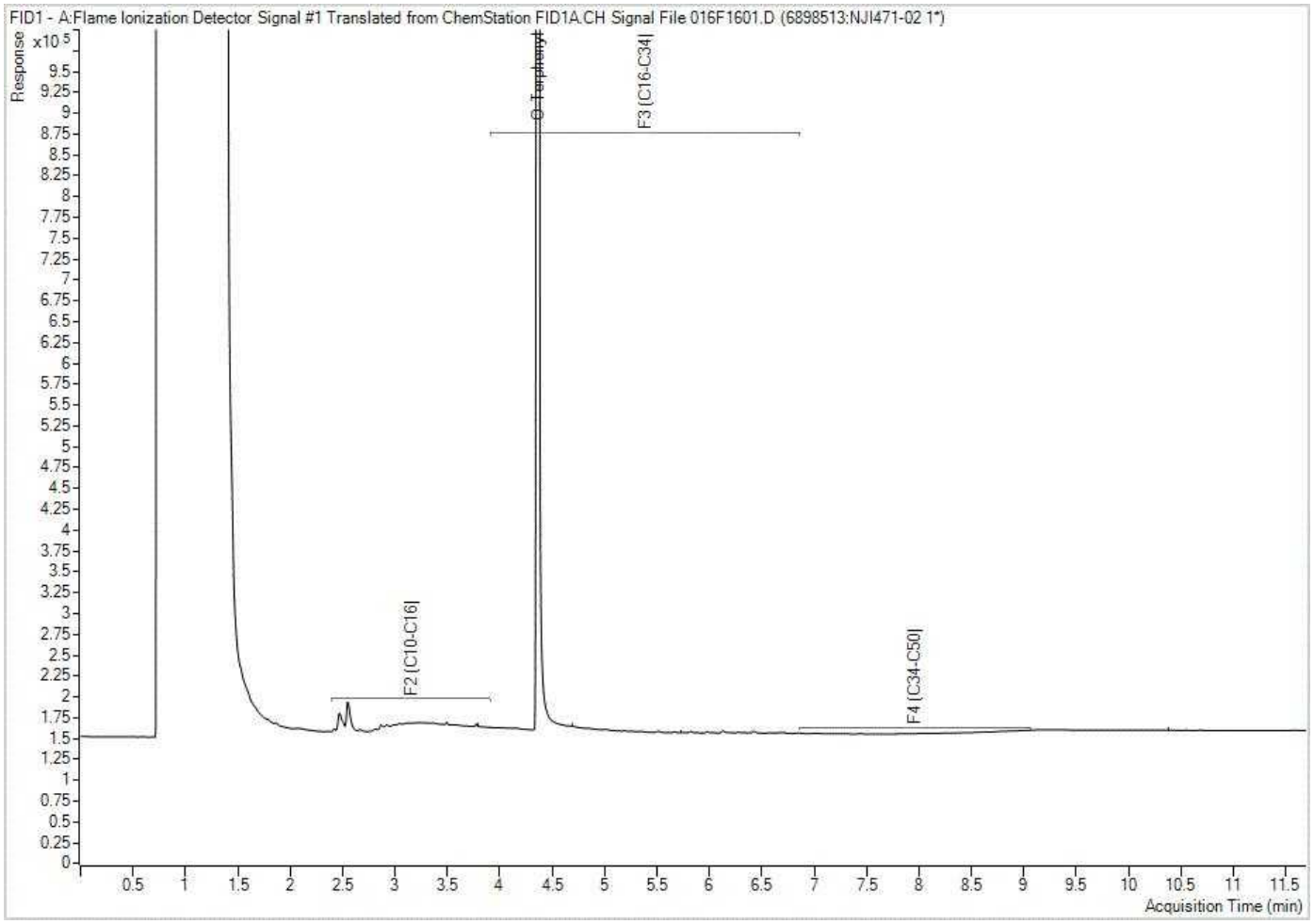


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI471

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-15 SS3 (5'-7')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

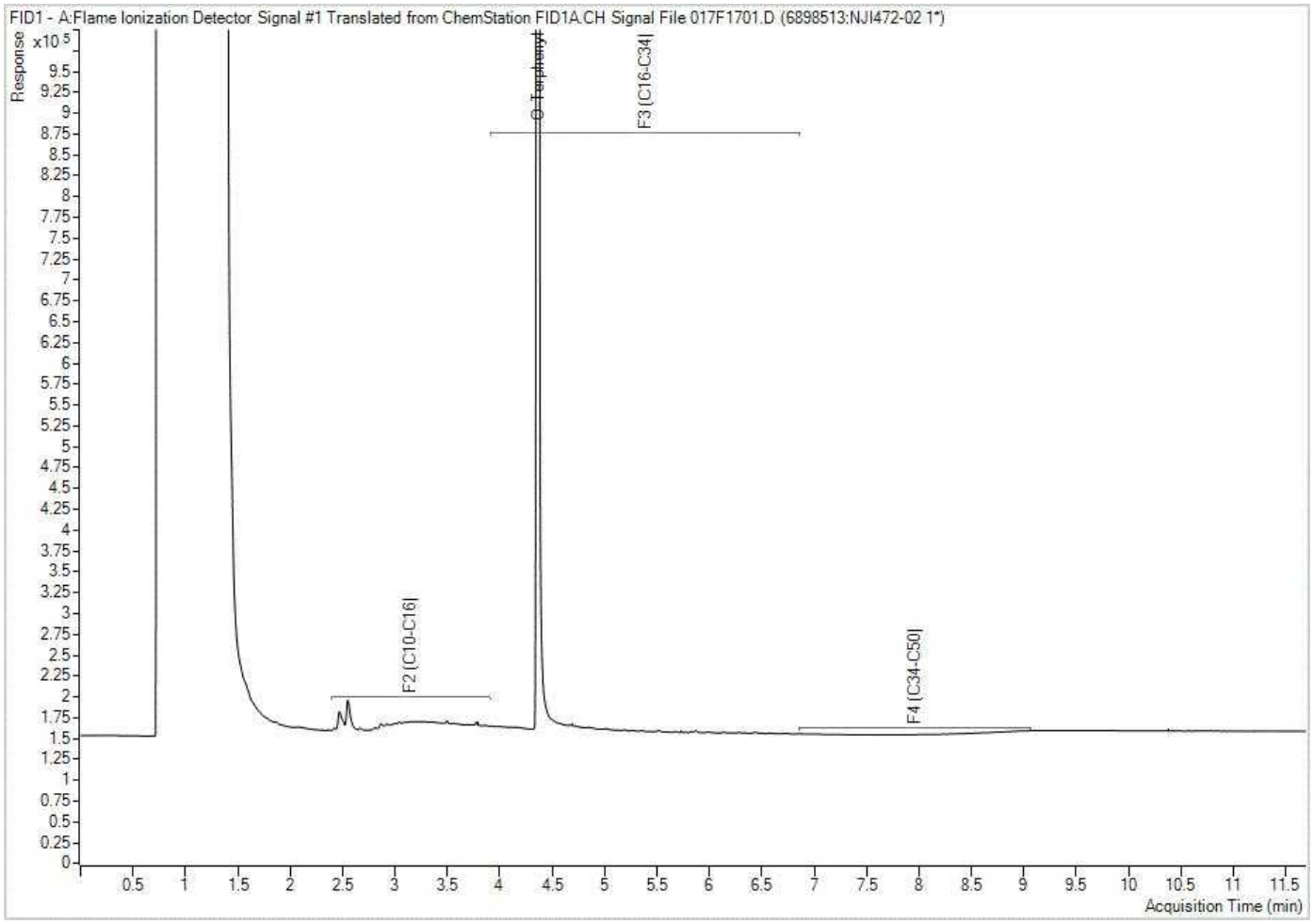


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI472

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-18 SS4(7.5'-9.5')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

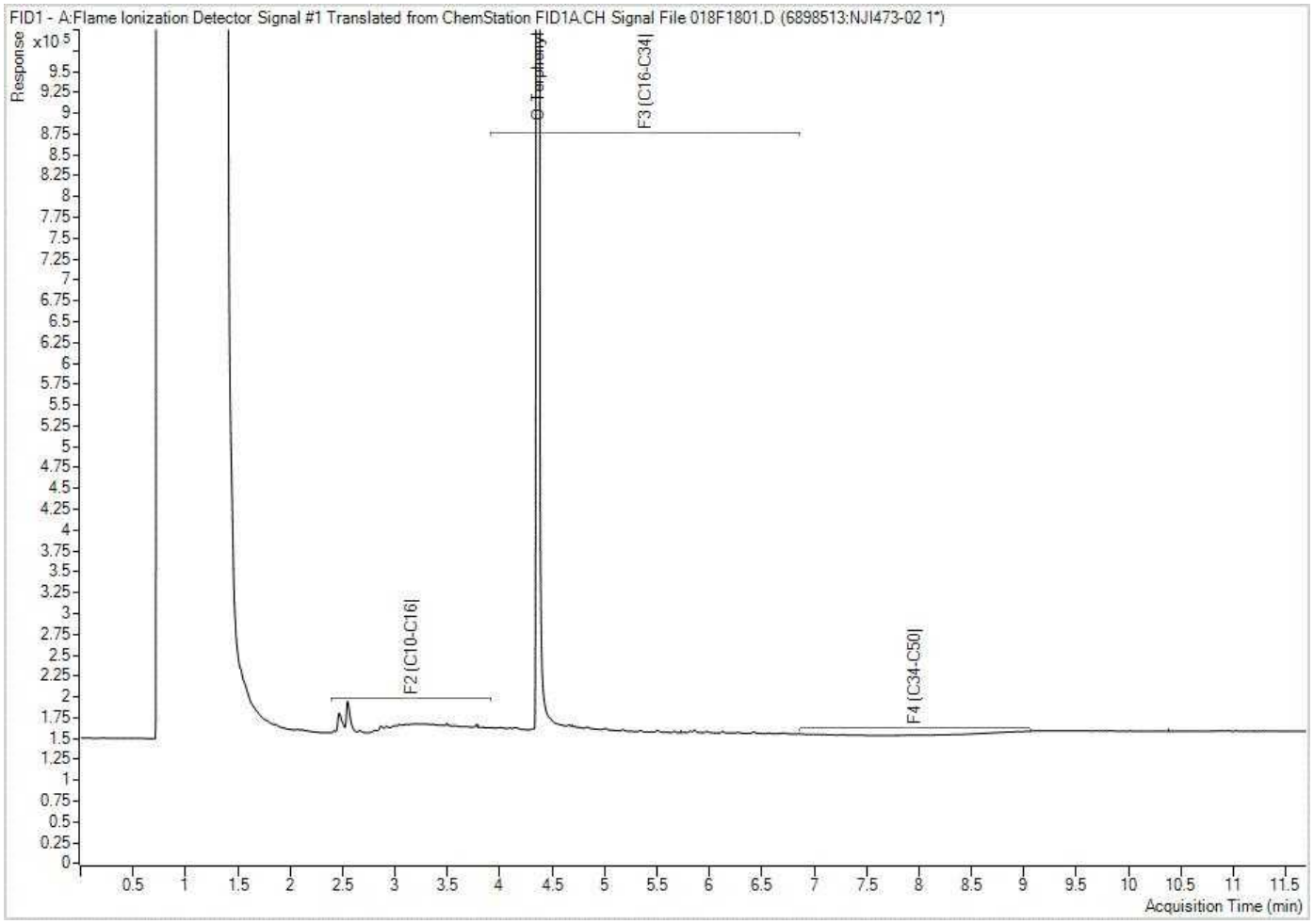


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI473

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-19 SS5(10'-12')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

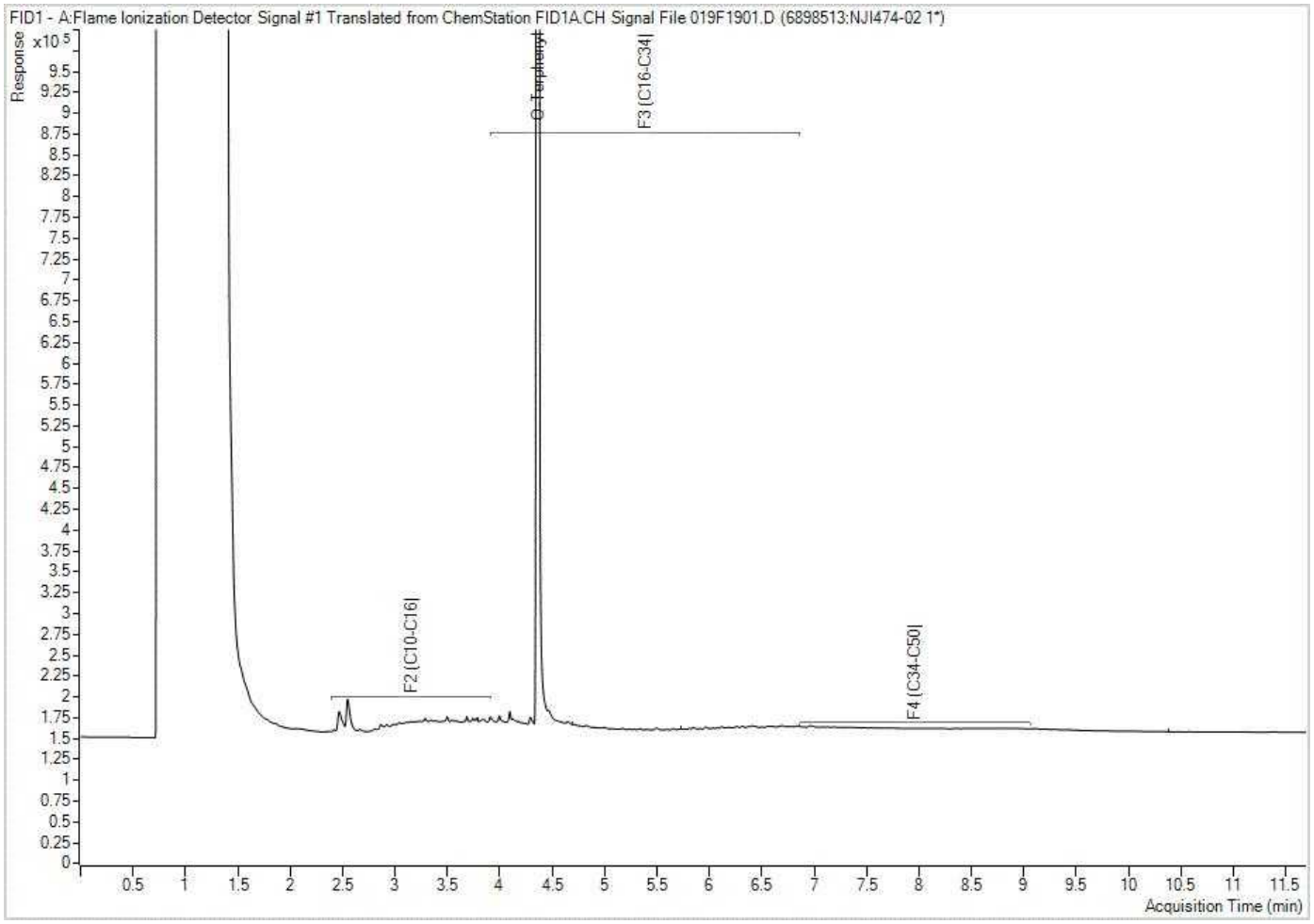


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI474

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-26 SS4 (5'-7')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

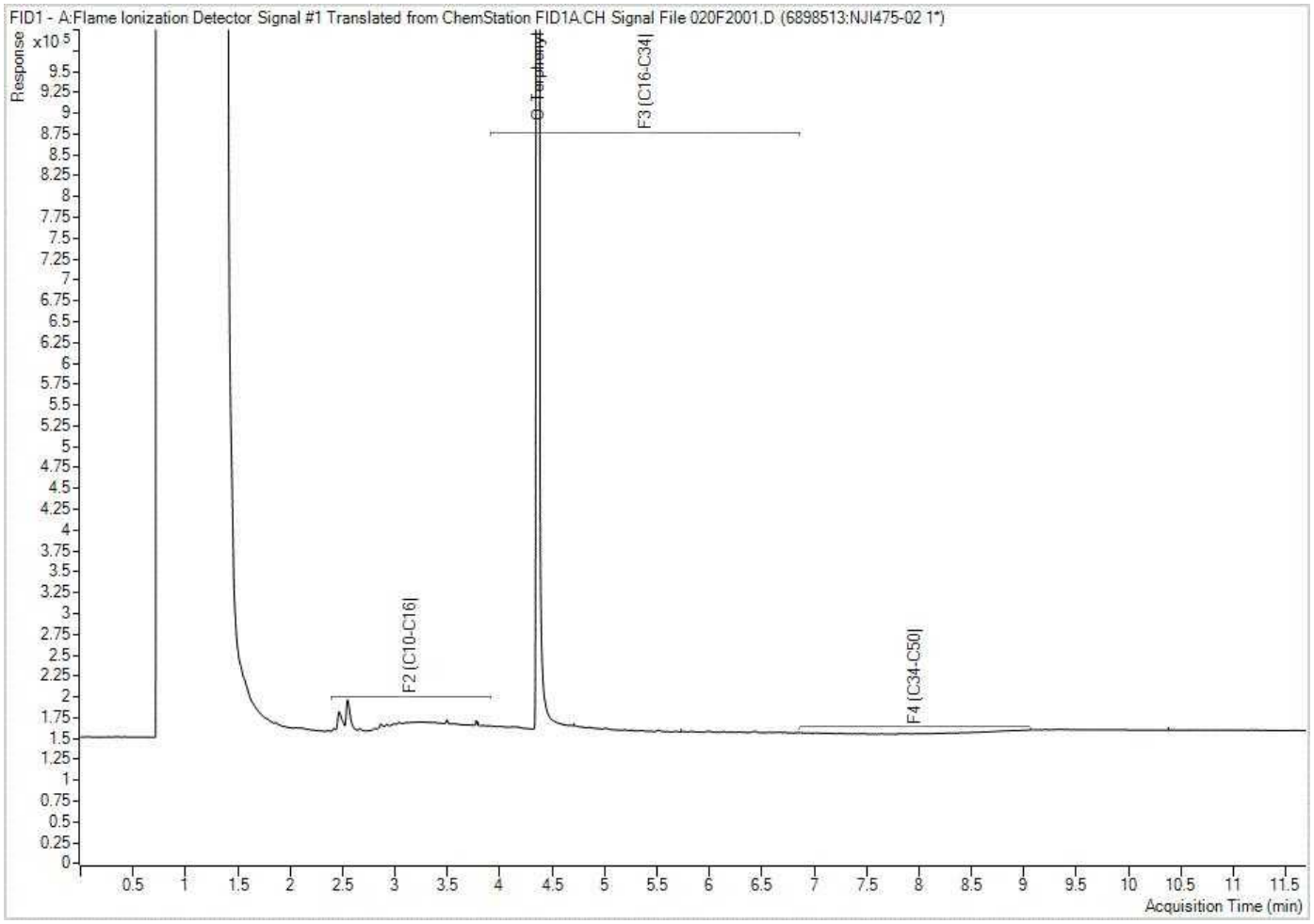


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI475

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-30 SS5(10'-12')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

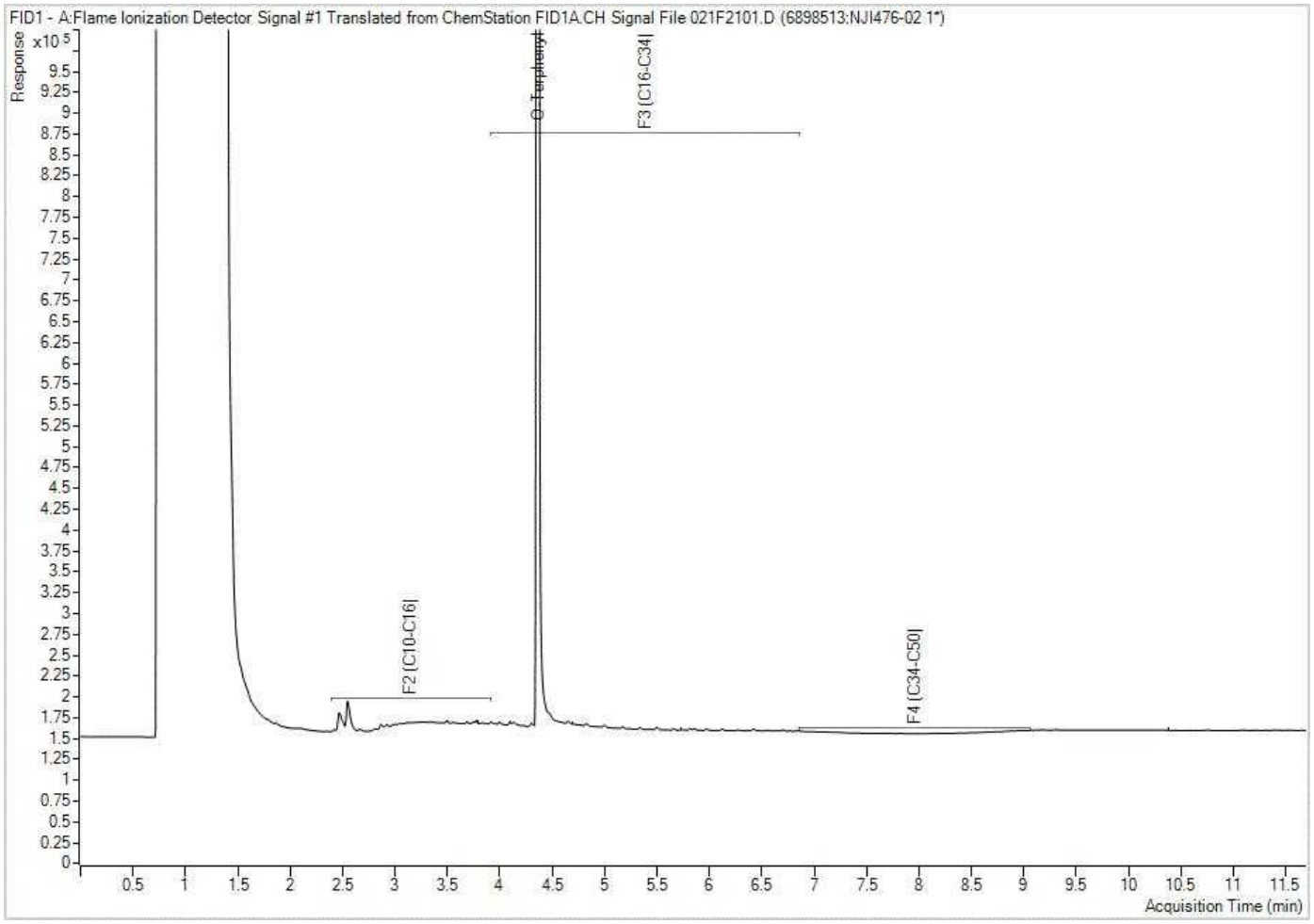


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26
BV Labs Sample: NJI476

Thurber Engineering Ltd
Client Project #: 27269
Project name: 9TH LINE CLASS EA
Client ID: 20-23 SS6(10-12')

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C0K7490
Report Date: 2020/11/26

Thurber Engineering Ltd
Client Project #: 27269
Site Location: 9TH LINE CLASS EA
Sampler Initials: RB

Exceedance Summary Table – Reg153/04 T2-Soil/Res-C

Result Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
20-05 SS3(5'-7')	NJI469-01	Conductivity	0.7	1.9	0.002	mS/cm
20-05 SS3(5'-7')	NJI469-01	Sodium Adsorption Ratio	5.0	5.3		N/A
20-15 SS3 (5'-7')	NJI471-01	Conductivity	0.7	2.7	0.002	mS/cm
20-18 SS4(7.5'-9.5')	NJI472-01	Conductivity	0.7	2.2	0.002	mS/cm
20-18 SS4(7.5'-9.5')	NJI472-01	Sodium Adsorption Ratio	5.0	18		N/A
20-23 SS6(10-12')	NJI476-01	Conductivity	0.7	0.88	0.002	mS/cm

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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THURBER

Appendix E

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

Ninth Line Pavement Rehabilitation
Full Depth Asphalt Removal with New HMA
20-Year Design Life

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	4,495,530
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	90 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	30,000 kPa
Stage Construction	1
Calculated Design Structural Number	128 mm

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	20,452
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	80 %
Percent Trucks in Design Direction	50 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	2.15 %
Average Initial Truck Factor (ESALs/truck)	2.5
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	3.4 %
Growth	Compound
Total Calculated Cumulative ESALs	4,495,530

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(mm)	Width (m)	Calculated SN (mm)
1	New HMA	0.42	1	190	-	80
2	New Granular A	0.14	1	150	-	21
3	Existing Granular	0.1	0.95	280	-	27
Total	-	-	-	620	-	127

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	New HMA	0.42	1	-	50	2,750,000	-	190	80
2	New Granular A	0.14	1	150	-	250,000	-	150	21
3	Existing Granular	0.1	0.95	280	-	150,000	-	280	27
Total	-	-	-	-	-	-	-	620	128

1997 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product
Thurber Engineering Ltd.

Flexible Structural Design Module

Ninth Line Pavement Rehabilitation
Mill and Overlay with Base Repairs
20-Year Design Life

Flexible Structural Design

80-kN ESALs Over Initial Performance Period	4,495,530
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	90 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	30,000 kPa
Stage Construction	1
Calculated Design Structural Number	128 mm

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	20,452
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	80 %
Percent Trucks in Design Direction	50 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	2.15 %
Average Initial Truck Factor (ESALs/truck)	2.5
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	3.4 %
Growth	Compound
Total Calculated Cumulative ESALs	4,495,530

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(mm)	Width (m)	Calculated SN (mm)
1	New HMA	0.42	1	110	-	46
2	Existing HMA	0.38	1	150	-	57
3	Existing Granular	0.1	0.95	280	-	27
Total	-	-	-	540	-	130

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	New HMA	0.42	1	110	-	2,750,000	-	110	46
2	Existing HMA	0.38	1	-	50	2,500,000	-	146	55
3	Existing Granular	0.1	0.95	280	-	150,000	-	280	27
Total	-	-	-	-	-	-	-	536	128