

FOUNDATION INVESTIGATION REPORT

CONTRACT NO. 2017-2045

REPORT NO. 6



**THURBER** ENGINEERING LTD.

**FOUNDATION INVESTIGATION REPORT  
SEWER LATERALS  
HIGHWAY 404 HOV LANE EXPANSION AND REHABILITATION  
CONTRACT 1  
FROM STOUFFVILLE ROAD TO MAJOR MACKENZIE DRIVE  
MARKHAM, ONTARIO  
G.W.P. 2930-02-00**

**GEOCRES NO. 30M14-472**

**Report**

to

**WSP Canada Inc.**

Date: March 13, 2018  
File: 15786



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Each of Appendices A to D includes:

- Record of Borehole Sheets (present and previous investigations)
- Laboratory Test Results
- Drawings titled "Borehole Locations and Soil Strata"



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SEWER LATERALS  
HIGHWAY 404 HOV LANE EXPANSION AND REHABILITATION  
CONTRACT 1  
FROM STOUFFVILLE ROAD TO MAJOR MACKENZIE DRIVE  
MARKHAM, ONTARIO  
G.W.P. 2930-02-00**

**GEOCRES NO. 30M14-472**

**PART 1: FACTUAL INFORMATION**

**1. INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted for the proposed sewer laterals (Contract 1) which are to be installed at locations along Highway 404 from 1 km north of Stouffville Road to Major Mackenzie Drive in the City of Markham, Ontario.

The purpose of this investigation was to explore the subsurface conditions near the locations of the sewer lateral alignments and based on the data obtained, to provide borehole location plans, stratigraphic profiles, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber was retained by WSP Canada Inc. (WSP) to carry out this foundation investigation under the MTO Assignment Number 2016-E-0014.

Reference has been made to information on subsurface conditions contained in another foundation report prepared for this section of Highway 404. The title of the report is:

- Foundation Investigation Report, Median Sewer, Highway 404 HOV Lane Expansion and Rehabilitation, Contract 1, from Stouffville Road to Major Mackenzie, Markham, Ontario, G.W.P. 2930-02-00, Report to WSP Canada Inc., File: 15786, dated January 4, 2018. (Reference 1).
- Foundation Investigation Report, Overhead, High Occupancy Toll, High Occupancy message and Toll Station Sign Supports, Highway 404 HOV Lane Expansion and Rehabilitation, from Stouffville Road to Major Mackenzie, Markham, Ontario, G.W.P. 2930-02-00, Geocres No. 30M14-473, Report to WSP Canada Inc., File: 15786, dated February 16, 2018. (Reference 2).

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## 2. PROJECT AND SITE DESCRIPTION

The sewer lateral alignments covered in this report are located at specific locations along Highway 404 from approximately 1 km north of Stouffville Road to Major Mackenzie Drive. The approximate locations of the proposed sewer laterals are shown on the key plan on the Borehole Locations and Soil Strata Drawings in Appendices A to D. Table 2.1 shows the approximate locations of the proposed sewer laterals.

**Table 2.1.- Location of the proposed median sewer laterals**

| Station | Location Hwy 404 | Upstream ID       |
|---------|------------------|-------------------|
| 10+557  | NBL              | 111               |
| 10+297  | NBL              | 108               |
| 10+732  | NBL              | 102               |
| 24+526  | NBL              | 98                |
| 23+663  | SBL              | 85                |
| 22+922  | SBL              | 73 <sup>(1)</sup> |
| 22+133  | NBL              | 61                |
| 21+485  | SBL              | 51                |
| 21+352  | SBL              | 49 <sup>(1)</sup> |
| 20+842  | SBL              | 41                |
| 20+354  | SBL              | 35                |
| 18+410  | SBL              | 3                 |

(1) Lateral sewer incorporated in the design after the site investigation was completed.

The land use adjacent to this section of Highway 404 is largely rural and agricultural, although there is increasing residential and commercial developments in recent years. The vegetation cover beyond the paved areas of the highway comprises grasses, bushes and stands of trees.

The culvert site is located within the physiographic region known as the Peel Plain. The topography is flat to gently undulating. The soil cover in the region typically comprises silty clay glacial tills with sand and silt layers. Shale bedrock of the Georgian Bay Formation is anticipated at an approximate depth of 50 m.

### 3. SITE INVESTIGATION AND FIELD TESTING

Site investigation and field testing for the proposed sewer laterals were carried out from October 15, 2017 to December 14, 2017, January 8 and 30, 2018, and consisted of drilling and sampling twenty-one (21) boreholes, designated as Boreholes LS-01 to LS-21, at selected locations near the sewer lateral alignments. The boreholes were drilled on both the northbound lanes (NBL) and southbound lanes (SBL) of Highway 404. The boreholes were terminated at depths ranging from 8.2 m to 9.8 m (Elevations 202.2 to 259.7).

As part Contract 1 of the Highway 404 project, earlier investigations for the median sewer and sign supports were carried out between June 22, 2017 and August 16, 2017, and between November 20 and December 7, 2017. Selected boreholes (MS-05, MS-16, MS-22, MS-28, MS-41, MS-44, OHS6-1, OHS6-2 and HOT-3) from References 1 and 2 have been used in this report as they were located in close proximity to the sewer lateral alignments. These nine boreholes were terminated at depths ranging from 6.4 m to 8.2 m (Elevations 260.5 to 226.0).

Details of the borehole locations are presented in Table 3.1 below. Borehole location plans and stratigraphic profiles for the sewer laterals, where borehole data is available, are presented on the Borehole Locations and Soil Strata Drawings in Appendices A to D. Records of Borehole sheets, laboratory testing data and drawings relevant to each section are also included in the appendices. Chemical testing results for corrosivity assessment are included in Appendix A.

**Table 3.1 – Borehole Location and Designation Details**

| Section   | Reference Boreholes                                | Sewer Lateral Upstream ID | Approximate Hwy. 404 Station | Highway Section   | Appendix |
|-----------|--|---------------------------|------------------------------|---|----------|
| Section 1 | LS-14, LS-15                                       | 102                       | 10+800 to 24+700             | From 1 km north of Stouffville Road to Stouffville Road | A        |
|           | LS-16, MS-05 <sup>(1)</sup>                        | 108                       |                              |   |          |
|           | LS-20, LS-21                                       | 111                       |                              |   |          |
| Section 2 | LS-12, LS-13                                       | 98                        | 24+700 to 22+930             | From Stouffville Road to 19th Avenue                    | B        |
|           | LS-17, MS-16 <sup>(1)</sup><br>LS-11               | 85                        |                              |   |          |
|           | HOT-3 <sup>(1,2)</sup> ,<br>MS-22 <sup>(1,2)</sup> | 73                        |                              |   |          |



|           |  |    |                     |   |   |
|-----------|--|----|---------------------|---|---|
| Section 3 | LS-03, MS-44 <sup>(1)</sup>                          | 35 | 22+400 to<br>20+300 | From 19th<br>Avenue to Elgin<br>Mills Road              | C |
|           | LS-04, MS-41 <sup>(1)</sup>                          | 41 |                     |   |   |
|           | LS-05, LS-06   | 51 |                     |   |   |
|           | OHS6-1 <sup>(1,2)</sup> ,<br>OHS6-2 <sup>(1,2)</sup> | 49 |                     |   |   |
|           | LS-07, LS-08   | 61 |                     |   |   |
| Section 4 | LS-18, LS-19   | 3  | 20+300 to<br>18+300 | From Elgin Mills<br>Road to Major<br>Mackenzie<br>Drive | D |

(1) Boreholes from previous investigation (References 1 and 2)

(2) Selected boreholes, from previous investigation, closest to the lateral sewer.

It is important to note that lateral sewers 49 and 73 were recently incorporated in the design after the field investigation was completed; therefore, no boreholes were specifically drilled for these sites. Boreholes HOT-3, MS-22, OHS6-1 and OHS6-2 from previous investigations are located relatively closer to these two lateral sewers, and therefore have been selected to provide general recommendations and comments for design and construction. These boreholes are approximately 22 m to 35 m away from the proposed lateral sewer alignments.

The coordinates and elevations of the boreholes are provided on the drawings and on the individual Record of Borehole Sheets in Appendices A to D. The northing and easting coordinates at the borehole locations were obtained by Thurber using a Trimble GPS Pathfinder ProXRT, and the corresponding ground surface elevations were provided by WSP based on the project DTM survey.

The borehole locations were marked in the field and utility clearances were obtained prior to drilling. Lane closures and traffic control were carefully planned and implemented for drilling each borehole.

During this investigation, truck mounted drill rig was used to advance the boreholes using solid stem augers. Soil samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with the Standard Penetration Test (SPT). SPT's were conducted as per ASTM D1586.



Members of Thurber's geotechnical staff supervised the drilling and sampling operations on a full time basis. The supervisors logged the boreholes, visually examined the recovered soil samples, and transported them to Thurber's laboratory for further examination and testing.

Groundwater conditions were observed in the open boreholes during and upon completion of the drilling operations.

Upon completion of drilling operations, the boreholes were backfilled in general accordance with Ontario Regulation 903.

#### **4. LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size analysis and Atterberg Limits testing. All the laboratory tests were carried out in accordance to MTO and/or ASTM Standards, as appropriate. The results of the laboratory testing are summarized on the Record of Borehole sheets and on the accompanying Figures in Appendices A to D.

#### **5. DESCRIPTION OF SUBSURFACE CONDITIONS**

This section presents a generalized summary of the subsurface conditions encountered at the borehole locations drilled for the proposed lateral sewers.

It is important to note that the soil strata drawings presented in this report are for illustrative purposes and for providing a general description of the stratigraphy at the locations of the sewer laterals. The factual data presented in the Record of Borehole sheets governs any interpretation of the site conditions. It must be recognized that soil conditions may vary between and beyond the borehole locations.

In general, the soil stratigraphy encountered near the sewer laterals consists of pavement structure (asphalt on granular base) and fill overlying native firm to hard clayey silt to silty clay till, and/or compact to very dense sandy silt/silt and sand till deposits. Clayey silt, sand and silt interlayers are present between and/or within the glacial till deposits. Groundwater levels observed in open boreholes and noted upon completion of drilling typically range between 1.0 and 4.0 m depths below existing grade.

More detailed descriptions of the stratigraphy within these sections are presented below.



## **5.1 Section 1 - (Stations 10+800 to 24+700)**

### **From 1 km north of Stouffville Road to Stouffville Road**

### **Boreholes LS-14, LS-15, LS-16, LS-20, LS-21 and MS-05**

A total of five boreholes, numbered LS-14, LS-15, LS-16, LS-20 and LS-21 were drilled on the NBL and SBL on Highway 404 within 1.0 km north of Stouffville Road. Borehole MS-05 drilled during an earlier investigation (Reference 1) for the median sewer has been included in this report. Records of boreholes, laboratory testing results and stratigraphic drawings are presented in Appendix A.

#### **5.1.1 Asphalt**

Asphalt was encountered surficially in Boreholes LS-14 to LS-16, LS-20, LS-21 and MS-05, with a thickness ranging from 100 mm to 150 mm.

#### **5.1.2 Gravelly Sand Fill**

Pavement granular fill consisting of gravelly sand and trace silt was encountered below the asphalt. The thickness of the cohesionless fill ranged from 0.5 m to 0.7 m, and locally 200 mm in Borehole LS-21. The depth to the base of this cohesionless fill ranged from 0.7 m to 0.8 m (Elevations 266.4 to 264.5), and at 0.3 m (Elevation 268.6) in Borehole LS-20.

SPT 'N' values measured within this fill ranged between 27 and 51 blows per 0.3 m of penetration indicating a compact to very dense condition. The measured moisture contents of samples of this fill varied between 4 percent and 10 percent.

#### **5.1.3 Sandy Silt Fill**

A layer of sandy silt fill containing trace to some gravel and trace clay was encountered below the gravelly sand fill in Boreholes LS-14, LS-15 and LS-21. The thickness of this fill ranged from 0.7 m to 1.5 m. The depth to the base of the sand silt fill ranged from 1.1 m to 2.2 m (Elevations 264.3 to 263.0 and 268.0 in Borehole LS-21).

SPT 'N' values measured within this fill ranged between 17 and 54 blows per 0.3 m of penetration indicating a compact to very dense condition. An SPT 'N' value of 50 blows per 0.125 m of penetration, indicating a very dense state, was measured in



Borehole LS-21. The measured moisture contents of samples of this fill varied between 10 percent to 18 percent.

#### **5.1.4 Clayey Silt Fill**

A layer of brown clayey silt fill containing trace sand and trace gravel, was contacted below the gravelly sand in Borehole LS-20. The thickness of the clayey silt fill was 1.6m. The depth to the base of this fill was at 2.3 m (Elevation 267.0).

SPT 'N' values recorded in the clayey silt fill were 14 and 20 blows per 0.3 m of penetration, indicating a stiff to very stiff consistency. The measured moisture contents of samples of the cohesive fill were 10 percent and 13 percent.

#### **5.1.5 Silty Clay to Clayey Silt Till**

Deposits of native brown to grey silty clay to clayey silt till with sand and trace gravel were encountered below the fill in Boreholes LS-14 to LS-16, LS-20 and LS-21, and below the sandy silt in Borehole MS-05.

Boreholes LS-14 to LS-16, LS-20 and LS-21, were terminated within the silty clay till to clayey silt till at depths ranging from 9.5 m to 9.8 m (Elevations 259.7 to 255.4). Borehole MS-05 was terminated within this till at 6.7 m (Elevation 260.5).

SPT 'N' values recorded in the silty clay to clayey silt till ranged from 8 blows to 75 blows per 0.3 m of penetration, typically from 16 to 56 blows, indicating a stiff to hard consistency. An SPT 'N' value of 100 blows for less than 0.3 m of penetration inferred the presence of cobbles or boulders at the termination depth in Borehole LS-14. The measured moisture contents of samples of the cohesive till varied between 9 percent and 18 percent.

The results of grain size distribution analyses carried out on representative samples of the cohesive till are presented on the Record of Borehole Sheets included in Appendix A and in Figures A1 to A3 of Appendix A. Results of the gradation testing are summarized below:



| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 13        |
| Sand           | 4 to 45        |
| Silt           | 29 to 75       |
| Clay           | 18 to 45       |

The results of Atterberg Limits in the silty clay to clayey silt till are presented on the Record of Borehole sheets and in Figure A5 and A6 included in Appendix A. The results of Atterberg Limits testing are summarized below:

| Index Property   | Percentage (%) |
|------------------|----------------|
| Liquid Limit     | 16 to 26       |
| Plasticity Index | 7 to 13        |

The above results show that the silty clay to clayey silt till are of low plasticity with group symbols of CL and occasionally CL-ML.

Glacial tills inherently contain cobbles and boulders.

#### **5.1.6 Sand to Sandy Silt**

A 0.8 m thick layer of grey sand containing trace clay was contacted within the silty clay till at 6.4 m in Borehole LS-14.

A layer of brown sandy silt containing trace to some clay was contacted below the fill at 0.8 m depth in Borehole MS-05. The thickness of the sandy silt is 2.2 m with a depth to the base at 3.0 m (Elevation 264.2).

An SPT 'N' value of 50 blows per 0.3 m of penetration was recorded in the sand, indicating a dense condition. A measured moisture content of the sand was 17 percent. SPT 'N' values in the sandy silt ranged from 24 to 40 blows per 0.3 m of penetration, indicating a compact to dense state. The measured moisture content in the sandy silt ranged from 10 percent to 21 percent.

Grain size distribution result of sand and sandy silt samples tested are presented on the Record of Borehole sheets and on Figure A3 of Appendix A. The results of laboratory gradation tests are summarized as follows:



| Soil Particles | Silty Sand Percentage (%) | Sandy Silt Percentage (%) |
|----------------|---------------------------|---------------------------|
| Gravel         | 0                         | 0                         |
| Sand           | 80                        | 25                        |
| Silt           | 18                        | 65                        |
| Clay           | 2                         | 10                        |

### 5.1.7 Water Levels

The groundwater levels in the open boreholes were observed and noted during and upon completion of drilling. The water levels measured in the installed piezometer and in the open boreholes upon completion of drilling, are summarized in Table 5.1.

**Table 5.1.- Measured Groundwater Levels**

| Borehole | Date               | Water Level (m) |           | Comments      |
|----------|--------------------|-----------------|-----------|---------------|
|          |                    | Depth           | Elevation |               |
| LS-14    | October 19, 2017   | 6.1             | 259.6     | Open borehole |
| LS-15    | October 18, 2017   | 6.7             | 258.5     | Open borehole |
| LS-16    | October 22, 2017   | 4.6             | 262.4     | Open borehole |
| LS-20    | January 30, 2018   | 1.8             | 267.5     | Open borehole |
| LS-21    | January 8, 2018    | 2.0             | 267.1     | Open borehole |
| MS-05    | September 24, 2017 | 3.7             | 263.5     | Piezometer    |
|          | October 24, 2017   | 3.9             | 263.5     |               |

The above values are short term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

## 5.2 Section 2 – (24+700 to 22+400) From Stouffville Road to 19th Avenue Boreholes LS-09 to LS-13, LS17, MS-16, MS-28, HOT-3 and MS-22

A total of six boreholes, numbered LS-09 to LS13 and LS-17 were drilled between Stouffville Road and 19<sup>th</sup> Avenue on the NBL and SBL of Highway 404. Boreholes



MS-16, MS-28, HOT-3 and MS-22 drilled during earlier investigations (References 1 and 2) have been included in this report. Records of boreholes, laboratory testing results and stratigraphic drawings are presented in Appendix B.

### **5.2.1 Asphalt**

Asphalt was encountered surficially in Boreholes LS-10 to LS13, LS-17 and HOT-3, with a thickness of 150 mm, and reducing to 100 mm in Boreholes MS-16, MS-22 and MS-28.

### **5.2.2 Gravelly Sand to Sand Fill**

Pavement granular fill consisting of gravelly sand to sand containing trace silt and trace clay was contacted below the asphalt in Boreholes LS-10 to LS13, LS-17, MS-16, MS-22, MS-28 and HOT-3, and surficially in Borehole LS-09. The thickness of the granular fill ranged from 0.5 m to 0.7 m. The depth to the base of the cohesionless fill ranged from 0.7 m to 0.8 m (Elevations 263.6 to 241.6).

A 1.4 m thick layer of clayey silt fill with sand and trace gravel was contacted below the granular fill in Boreholes LS-17.

SPT 'N' values within the cohesionless fill ranged from 29 and 43 blows per 0.3 m penetration indicating compact to dense conditions. The measured moisture contents of samples of the cohesionless fill varied between 3 percent and 9 percent.

SPT 'N' values within the cohesive fill were 43 to 50 blows per 0.3 m penetration, indicating a hard consistency. The measured moisture contents of samples of the cohesive fill were 8 percent.

Grain size distribution result of fill samples tested are presented on the Record of Borehole sheets and on Figures B1 and B2 of Appendix B. The results of laboratory gradation tests are summarized as follows:



| Soil Particles | Sand Fill Percentage (%) | Clayey Silt Fill Percentage (%) |
|----------------|--------------------------|---------------------------------|
| Gravel         | 13                       | 5                               |
| Sand           | 65                       | 42                              |
| Silt           | -                        | 31                              |
| Clay           | -                        | 22                              |
| Silt and Clay  | 22                       | -                               |

### 5.2.3 Silty Clay to Clayey Silt Till

A native deposit of brown to grey silty clay to clayey silt till with sand and trace gravel were encountered below the fill in Boreholes LS-09, LS-10, LS-11, LS-17, MS-16, MS-22, MS-28 and HOT-3, and below the sand, silty sand and silty sand till in Boreholes LS-12, LS-13, MS-22 and HOT-3. Where fully penetrated, the thickness of this till ranged from 2.2 m to 6.5m in Boreholes LS-09, LS-13, MS-22 and HOT-3. The depth to the base of this till was 7.2 m (Elevations 235.2 and 256.7) in Boreholes LS-09 and LS-13, respectively, and 3.0 m and 3.2 m (Elevations 244.5 and 243.8) in Boreholes MS-22 and HOT-3, respectively.

Boreholes LS-10, LS-11, LS-12 and LS-17 were terminated within the silty clay to clayey silt till at 9.3 m depth (Elevations 255.0 to 245.2). Borehole HOT-3 was terminated within the clayey silt till at 8.1 m depth (Elevation 238.9). Boreholes MS-16, MS-22 and MS-28 were terminated within this till at 6.7 m depth (Elevations 248.5 and 235.7).

SPT 'N' values recorded in this till typically ranged from 15 to 85 blows per 0.3 m penetration, indicating a very stiff to hard consistency. Higher values of 100 blows for less than 0.3 m of penetration near borehole termination depths infer the presence of cobbles or boulders. The measured moisture contents of samples of this cohesive till varied between 6 percent and 27 percent.

Grain size distribution results for the cohesive till samples tested are presented on the Record of Borehole sheets and on Figures B3 to B5 of Appendix B. Results of the gradation testing are summarized below:



| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 9         |
| Sand           | 8 to 49        |
| Silt           | 30 to 63       |
| Clay           | 13 to 49       |

The results of Atterberg Limits in the silty clay to clayey silt till are presented on the Record of Borehole sheets and in Figures B10 and B11 included in Appendix B. The results of Atterberg Limits testing are summarized below:

| Index Property   | Percentage (%) |
|------------------|----------------|
| Liquid Limit     | 15 to 32       |
| Plasticity Index | 5 to 15        |

The above results show that the cohesive tills have typically low plasticity with group symbols of CL and CL-ML.

Glacial tills inherently contain cobbles and boulders.

#### 5.2.4 Silty Sand

Brown silty sand containing trace gravel and some clay was contacted in Borehole LS-LS-13 at 0.7 m depth. The thickness of the silty sand was 1.5 m. The depth to the base of the silty sand in Borehole LS-13 was at 2.2 m (Elevation 261.7).

SPT 'N' values in the silty sand were 34 and 48 blows per 0.3 m of penetration, indicating a dense state. Measured moisture contents of the silty sand were 7 percent and 9 percent.

Grain size distribution results of a tested silty sand sample are presented on the Record of Borehole sheets and on Figure B6 of Appendix B. The results of laboratory gradation tests are summarized as follows:



| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 6              |
| Sand           | 55             |
| Silt           | 26             |
| Clay           | 13             |

### 5.2.5 Silt

A layer of brown silt containing some sand and some clay was encountered at 3.2 m depth in Borehole HOT-3. The thickness of the silt was 2.6 m. The depth to the base of the silt was at 5.8 m (Elevation 241.2).

SPT 'N' values recorded in the silt were 36 and 40 blows per 0.3 m penetration, indicating a dense condition. The measured moisture contents of the silt samples were 18 percent and 21 percent.

Grain size distribution test results for a silt sample are presented on the Record of Borehole sheets and on Figure B8 of Appendix B. The results of the laboratory gradation test are summarized as follows:

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0              |
| Sand           | 20             |
| Silt           | 68             |
| Clay           | 12             |

### 5.2.6 Sand

A 0.8 m thick layer of sand was encountered within the silty clay till at 7.3 m depth in Borehole LS-12. Brown and grey sand containing some silt and trace clay was encountered at 7.2 m and 5.8 m depth in Boreholes LS-09 and HOT-3, respectively. The thickness of the sand was 1.9 m in Borehole HOT-3. Borehole LS-09 was terminated within the sand at 9.8 m depth (Elevation 232.6).

SPT 'N' values recorded in the sand ranged between 15 and 57 blows per 0.3 m penetration indicating compact to very dense conditions. The measured moisture contents of the sand samples ranged from 14 percent and 17 percent.



Grain size distribution test results for two sand samples are presented on the Record of Borehole sheets and on Figure B7 of Appendix B. The results of the laboratory gradation test are summarized as follows:

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 1         |
| Sand           | 96 to 84       |
| Silt           | 20             |
| Clay           | 3              |
| Silt and Clay  | 3 to 16        |

### 5.2.7 Silty Sand to Sandy Silt Till

Layers of brown to grey silty sand till to sandy silt till containing trace to some gravel and trace to some clay, were contacted at 0.7 m, 7.2 m and 3.0 m depths in Boreholes LS-12, LS-13 and MS-22, respectively. The thickness of the silty sand till/sandy silt till where fully penetrated, was 2.3 m and 2.6 m in Boreholes LS-12 and MS-22, respectively. The depth to the base of the silty sand to sandy silt till was at 3.0 m and 5.6 m (Elevations 261.3 and 241.9). Borehole LS-13 was terminated within the silty sand till at 9.5 m (Elevation 254.4).

SPT 'N' values recorded in the silty sand to sandy silt till typically ranged from 40 to 67 blows per 0.3 m penetration, indicating a dense to very dense condition. An SPT 'N' value of 100 blows for less than 0.3 m of penetration inferred the presence of cobbles or boulders near the termination depth in Borehole LS-13. The measured moisture contents of cohesionless till samples varied between 8 percent and 16 percent.

Grain size distribution results for tested silty sand till/sandy silt till samples, are presented on the Record of Borehole sheets and on Figure B9 of Appendix B. The results of laboratory gradation tests are summarized as follows:



| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 13        |
| Sand           | 30 to 44       |
| Silt           | 29 to 65       |
| Clay           | 5 to 14        |

Glacial tills inherently contain cobbles and boulders.

### 5.2.8 Water Levels

The groundwater levels in the open boreholes were observed and noted during and upon completion of drilling. The water levels measured in the installed piezometer and in the open boreholes upon completion of drilling are summarized in Table 5.2.

**Table 5.2 - Measured Groundwater Levels**

| Borehole | Date               | Water Level (m) |           | Comments      |
|----------|--------------------|-----------------|-----------|---------------|
|          |                    | Depth           | Elevation |               |
| LS-09    | October 16, 2017   | 6.1             | 236.3     | Open borehole |
| LS-10    | October 19, 2017   | 8.2             | 246.5     | Open borehole |
| LS-11    | October 18, 2017   | Dry             | -         | Open borehole |
| LS-12    | October 19, 2017   | 5.5             | 258.8     | Open borehole |
| LS-13    | October 18, 2017   | 5.2             | 258.7     | Open borehole |
| LS-17    | November 11, 2017  | 5.2             | 249.6     | Open borehole |
| MS-16    | September 24, 2017 | 3.0             | 252.2     | Piezometer    |
|          | October 25, 2017   | 2.8             | 252.4     | Piezometer    |
| MS-22    | July 18, 2017      | 1.8             | 245.7     | Open borehole |
| MS-28    | June 7, 2017       | 4.9             | 237.5     | Open borehole |
| HOT-3    | November 20, 2017  | 3.4             | 243.6     | Open borehole |

The above values are short term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.





**5.3 Section 3 - (Stations 22+400 to 20+300)  
From 19th Avenue to Elgin Mills Road  
Boreholes LS-03 to LS-08, MS-41, MS-44, OHS6-1 and OHS6-2**

A total of six boreholes, numbered LS-03 to LS-08 were drilled between 19<sup>th</sup> Avenue and Elgin Mills Road on the NBL and SBL of Highway 404. Boreholes MS-41, MS-44, OHS6-1 and OHS6-2 drilled during earlier investigations (References 1 and 2) have also been included in this report. Records of boreholes, laboratory testing results and stratigraphic drawings are presented in Appendix C.

**5.3.1 Asphalt**

Asphalt was encountered surficially in Boreholes LS-03 to LS-08, OHS6-1 and OHS6-2 with a thickness of 150 mm, and reducing to 100 mm in Borehole MS-41 and MS-44.

**5.3.2 Gravelly Sand to Sand Fill and Clayey Silt Fill**

Pavement granular fill materials consisting of brown to grey sand, gravelly sand and silty sand containing trace to some silt and trace gravel were encountered below the asphalt in Boreholes LS-03 to LS-08, MS-41, MS-44, OHS6-1 and OHS6-2. A layer of sand fill was also contacted in Borehole LS-05 at 1.5 m depth. The thickness of the granular fill ranged from 0.3 m to 1.0 m. The depth to the base of the cohesionless fill ranged from 0.5 m to 2.2 m (Elevations 230.7 to 240.7).

A layer of clayey silt fill containing some sand and trace to some gravel was encountered below the granular fill in Boreholes LS-03, LS-04, LS-05, LS-06, MS-44, OHS6-1 and OHS6-2. The thickness of the clayey silt fill ranged from 0.3 m to 1.5 m. The depth to the base of the clayey silt fill ranged from 0.7 m to 2.2 m (Elevations 235.8 to 229.9).

SPT 'N' values in the granular fill ranged from 19 to 71 blows per 0.3 m of penetration, indicating a compact to very dense state. SPT 'N' values in the cohesive fill varied from 20 to 43 blows per 0.3 m of penetration, indicating a very stiff to hard consistency. The measured moisture contents of fill samples ranged between 3 percent and 15 percent.



Grain size distribution results for a sample of the sand fill are presented on the Record of Borehole sheets and on Figure C1 of Appendix C.

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 13             |
| Sand           | 58             |
| Silt           | 19             |
| Clay           | 10             |

### 5.3.3 Organics

A 0.8 m thick layer of black organics was contacted at 2.2 m depth in Borehole LS-06. The depth to the base of the organics was at 3.0 m (Elevations 234.2).

An SPT 'N' value of 18 blows per 0.3 m of penetration was measured in the organics indicating a compact state. The moisture content in the organics layer was 10 percent.

### 5.3.4 Silty Clay

A 1.9 m thick layer of dark brown to brown silty clay containing some sand and some organics was contacted below the fill at 2.2 m depth in Borehole OHS6-1. The depth to the base of the silty clay was 4.1 m (Elevation 232.6).

SPT 'N' values of 8 and 14 blows per 0.3 m of penetration, indicating a stiff consistency, were measured in the silty clay layer. The measured moisture contents of samples of the cohesive soils were 16 percent and 21 percent.

Grain size distribution results for a silty clay samples are presented on the Record of Borehole sheets and on Figures C2 of Appendix C.

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0              |
| Sand           | 18             |
| Silt           | 30             |
| Clay           | 52             |



### 5.3.5 Silty Clay to Clayey Silt Till

Layers of brown to grey native silty clay to clayey silt till with sand and trace to some gravel were encountered in Boreholes LS-04 to LS-08, MS-41, OHS6-1 and OHS6-2 below the fill, organics and silty clay. The thickness of the silty clay to clayey silt till ranged from 0.8 m to 8.1 m. The depth to the base of the silty clay to clayey silt till ranged from 1.5 m to 8.8 m (Elevations 234.2 to 229.2).

SPT 'N' values ranged from 9 blows per 0.3 m of penetration to greater than 100 blows for less than 0.3 m of penetration indicating a stiff to hard consistency. The measured moisture contents of samples of the cohesive soils varied between 7 percent and 26 percent.

Grain size distribution results for the tested cohesive soil samples are presented on the Record of Borehole sheets and on Figures C3 and C4 of Appendix C.

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 8         |
| Sand           | 34 to 45       |
| Silt           | 34 to 43       |
| Clay           | 15 to 23       |

The results of Atterberg Limits in the silty clay till and clayey silt till are presented on the Record of Borehole sheets and in Figures C7 and C8 included in Appendix C. The results of Atterberg Limits testing are summarized below:

| Index Property   | Percentage (%) |
|------------------|----------------|
| Liquid Limit     | 17 to 21       |
| Plasticity Index | 7 to 10        |

The above results show that the silty clay to clayey silt till has low to slight plasticity with group symbols of CL and CL-ML.

Glacial tills inherently contain cobbles and boulders.

### 5.3.6 Sand

A 1.5 m thick layer of brown sand containing some gravel, trace to some silt and trace clay was contacted below the clayey silt till at 1.5 m depth in Borehole LS-03.



SPT 'N' values of 47 blows per 0.3 m of penetration and 100 blows for less than 0.3 m of penetration were recorded in the sand indicating a dense to very dense state. Measured moisture contents of the sand were 4 percent and 12 percent.

### **5.3.7 Sandy Silt to Silty Sand Till**

Layers of brown to grey native silty sand to sandy silt till containing trace to some gravel and trace to some clay was contacted at depths ranging from 1.4 m to 5.6 m in Boreholes LS-03, LS-04, LS-05, LS-06 and MS-44. Boreholes LS-03, LS-04, LS-05 and LS-06 were terminated within the cohesionless till at 9.4 m and 9.8 m depths (Elevations 227.4 to 222.0), and Borehole MS-44 was terminated at 6.4 m depth (Elevation 226.0).

SPT 'N' values recorded in this till ranged from 27 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m of penetration indicating compact to very dense conditions. An SPT 'N' value of 5 blows per 0.3 m of penetration, indicating a loose zone, was measured in Borehole LS-05 near Elevation 229.5. The measured moisture contents of samples of the cohesionless till varied between 5 percent and 17 percent.

Grain size distribution results for selected cohesionless till samples are presented on the Record of Borehole sheets and on Figure C3 of Appendix C. The results of laboratory gradation tests are summarized as follows:

| <b>Soil Particles</b> | <b>Percentage (%)</b> |
|-----------------------|-----------------------|
| Gravel                | 0 to 17               |
| Sand                  | 32 to 62              |
| Silt                  | 21 to 60              |
| Clay                  | 2 to 14               |

Glacial tills inherently contain cobbles and boulders.

### **5.3.8 Silty Sand to Sand and Silt**

Layers of brown to grey silty sand to sand and silt containing trace gravel and trace to some clay was contacted at depth ranging from 3.0 m to 8.8 m in Boreholes LS-07, LS-08, MS-41, OHS6-1 and OHS6-2. Boreholes LS-07, LS-08, OHS6-1 and OHS6-2



were terminated within the silty sand to sand and silt at 8.2 m to 9.8 m (Elevations 231.6 to 228.2), and Borehole MS-41 was terminated at 6.7 m (Elevation 227.8).

SPT 'N' values recorded in the silty sand to sand and silt ranged from 15 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m of penetration, indicating compact to very dense conditions. The measured moisture contents of samples of the sands and silts varied between 9 percent and 21 percent.

Grain size distribution results for selected silty sand to sand and silt samples are presented on the Record of Borehole sheets and on Figure C6 of Appendix C. The results of laboratory gradation tests are summarized as follows:

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 6         |
| Sand           | 52 to 76       |
| Silt           | 17 to 43       |
| Clay           | 3 to 5         |

### 5.3.9 Water Levels

The groundwater levels in open boreholes were observed and noted during and upon completion of drilling. The water levels measured in the open boreholes are summarized in Table 5.3.

**Table 5.3.- Observed Groundwater Levels**

| Borehole | Date             | Water Level (m) |           | Comments      |
|----------|------------------|-----------------|-----------|---------------|
|          |                  | Depth           | Elevation |               |
| LS-03    | October 15, 2017 | 6.1             | 225.3     | Open borehole |
| LS-04    | October 15, 2017 | 3.0             | 230.8     | Open borehole |
| LS-05    | October 17, 2017 | 6.7             | 230.6     | Open borehole |
| LS-06    | October 16, 2017 | 6.4             | 230.8     | Open borehole |
| LS-07    | October 17, 2017 | 4.6             | 236.8     | Open borehole |
| LS-08    | October 16, 2017 | 6.1             | 235.2     | Open borehole |
| MS-41    | July 12, 2017    | 2.7             | 231.8     | Open borehole |
| MS-44    | August 18, 2017  | 5.2             | 227.2     | Open borehole |



|        |                   |     |       |               |
|--------|-------------------|-----|-------|---------------|
| OHS6-1 | November 30, 2017 | 5.5 | 231.1 | Open borehole |
| OHS6-2 | February 15, 2018 | 2.3 | 234.1 | Piezometer    |

Piezometers installed during an earlier investigation (Reference 1) for this section of the highway indicated groundwater levels readings ranging from 1.2 m to 4.1 m (Elevations 237.8 to 230.1).

The above values are short term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

#### **5.4 Section 4 (Stations 20+300 to 18+300) From Elgin Mills Road to Major Mackenzie Drive Boreholes LS-01, LS-02, LS-18, LS-19**

A total of four boreholes, numbered LS-01, LS-02, LS-18 and LS-19 were drilled between Elgin Mills Road and Major Mackenzie Drive on the NBL and SBL of Highway 404. Records of boreholes, laboratory testing results and stratigraphic drawings are presented in Appendix D.

##### **5.4.1 Asphalt**

Asphalt was encountered surficially in Boreholes LS-01 and LS-02, with a thickness of 150 mm, and reducing to 100 mm in Borehole LS-19.

##### **5.4.2 Concrete**

A 150 mm thick concrete slab was encountered immediately below the asphalt in Borehole LS-19.

##### **5.4.3 Sand Fill**

Pavement granular materials consisting of brown sand containing trace to some silt and trace gravel were encountered below the asphalt in Boreholes LS-01, LS-02 and LS-18. The thickness of the sand fill was 0.5 m and 0.6 m. The depth to the base of this cohesionless fill was at 0.7 m and 0.8 m (Elevations 215.2 and 211.1).



SPT 'N' values measured in the sand fill were 36 and 50 blows per 0.3 m of penetration indicating a dense to very dense state. Measured moisture contents of the fill ranged between 3 percent and 5 percent.

#### **5.4.4 Silty Clay Fill**

A layer of silty clay till containing trace sand and trace gravel was encountered below the concrete in Borehole LS-19. The thickness of this fill was 1.4 m. The depth to the base of this cohesive fill was at 1.7 m (Elevation 209.9).

SPT 'N' values measured in this cohesive fill varied between 16 and 22 blows per 0.3m of penetration indicating a very stiff consistency. Measured moisture contents of the fill ranged between 16 percent and 18 percent.

Grain size distribution results for a sample of this cohesive till are presented on the Record of Borehole sheets and on Figure D1 of Appendix D.

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 3              |
| Sand           | 30             |
| Silt           | 37             |
| Clay           | 30             |

#### **5.4.5 Upper Silty Clay Till**

An upper layer of dark brown to grey native silty clay till containing trace to some sand and trace to some gravel and occasional organics was contacted below the fill in Boreholes LS-01 and LS-02. The thickness of this till was 0.8 m. The depth to the base of the upper silty clay till was 1.5 m (Elevations 214.4 to 214.3).

SPT 'N' values measured in the upper silty clay till were 13 to 21 blows per 0.3 m of penetration indicating a stiff to very stiff consistency. Measured moisture contents of this cohesive till ranged from 18 percent to 21 percent.



#### 5.4.6 Silty Sand to Sand and Silt Till

Layers of brown native silty sand to sand and silt till containing trace gravel and some clay were contacted below the upper silty clay till at 1.5 m depth. The thickness of these layers were 1.5 m and 2.6 m. A lower layer of sandy silt till was contacted at 8.7m in Borehole LS-01. The depth to the base of the silty sand to silty sand till were 3.0 m and 4.1 m (Elevations 212.8 and 211.8). Borehole LS-01 was terminated within the lower sandy silt till at 9.4 m depth (Elevation 206.4).

SPT 'N' values recorded in the silty sand to sand and silt till ranged from 33 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m of penetration, indicating dense to very dense conditions. The measured moisture contents of the cohesionless till samples varied between 7 percent and 21 percent.

Grain size distribution results for the cohesionless till samples tested are presented on the Record of Borehole sheets and on Figure D2 of Appendix D.

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 0 to 15        |
| Sand           | 48 to 54       |
| Silt           | 21 to 35       |
| Clay           | 11 to 16       |

Glacial tills inherently contain cobbles and boulders.

#### 5.4.7 Sand

Brown to grey sand containing some silt, trace gravel and trace to some clay was contacted at 3.0 m and 4.1 m depths in Boreholes LS-01 and LS-02, respectively. The thickness of the sand ranged between 1.9 m and 3.6 m. The depth to the base of the sand varied from 6.6 m to 6.0 m (Elevations 209.2 and 209.9).

SPT 'N' values recorded in the sand ranged from 13 to 44 blows per 0.3 m penetration, indicating compact to dense conditions. The measured moisture contents of samples of this layer varied between 10 percent and 19 percent.





Grain size distribution results for two sand samples are presented on the Record of Borehole sheets and on Figure D3 of Appendix D. The results of laboratory gradation tests are summarized as follows:

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 8 to 9         |
| Sand           | 74 to 77       |
| Silt and Clay  | 15 to 17       |

#### 5.4.8 Silty Clay to Clayey Silt Till

A grey layer of silty clay to clayey silt till was contacted at 6.6 m and 6.0 m depth in Boreholes LS-01 and LS-02, respectively, and below the fill at 0.8 m to 1.7 m depths in Boreholes LS-18 and LS-19. Where fully penetrated in Boreholes LS-01 and LS-02, the thickness of this cohesive till were between 8.5 m and 8.7 m. Boreholes LS-18 and LS-19 were terminated at 8.2 m to 9.7 m depths (Elevations 202.2 to 203.4).

SPT 'N' values in this cohesive till typically ranged from 31 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m penetration indicating a hard consistency. An occasional 'N' value of 27 blows per 0.3 m of penetration was measured at the top of the deposit in Borehole LS-18 indicating a very stiff zone. The measured moisture contents of samples of the cohesive till varied between 7 percent and 18 percent.

Grain size distribution results for the tested cohesive till samples are presented on the Record of Borehole sheets and on Figure D4 of Appendix D.

| Soil Particles | Percentage (%) |
|----------------|----------------|
| Gravel         | 4 to 15        |
| Sand           | 20 to 39       |
| Silt           | 29 to 41       |
| Clay           | 19 to 47       |

The results of Atterberg Limits testing on a sample of silty clay till are presented on the Record of Borehole sheets and in Figure D5 included in Appendix D. The results of the testing are summarized below:



| Index Property   | Percentage (%) |
|------------------|----------------|
| Liquid Limit     | 17             |
| Plasticity Index | 7              |

The above results show that the silty clay till has low plasticity with a group symbol of CL.

Glacial tills inherently contain cobbles and boulders.

#### 5.4.9 Gravelly Sand

Grey gravelly sand was contacted at 8.5 m depth in Borehole LS-02 which was terminated within this deposit at 9.3 m depth (Elevation 206.6).

An SPT 'N' value recorded in the gravelly sand was 100 blows for less than 0.3 m of penetration indicating a very dense condition.

#### 5.4.10 Water Levels

The groundwater levels in open boreholes was observed and noted during and upon completion of drilling. The water levels measured in the open boreholes are summarized in Table 5.4.

**Table 5.4.- Measured Groundwater Levels**

| Borehole | Date              | Water Level (m) |           | Comments      |
|----------|-------------------|-----------------|-----------|---------------|
|          |                   | Depth           | Elevation |               |
| LS-01    | October 22, 2017  | 3.7             | 212.1     | Open borehole |
| LS-02    | October 17, 2017  | 4.6             | 211.3     | Open borehole |
| LS-18    | December 5, 2017  | 5.1             | 206.8     | Open borehole |
| LS-19    | December 13, 2017 | Dry             | -         | Open borehole |

Piezometers installed during the previous investigation (Reference 1) within this section of the highway indicated groundwater level readings ranging from 2.9 m to 3.1m (Elevations 210.7 to 210.5).



The above values are short term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

## **6. MISCELLANEOUS**

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. WSP provided the northing and easting coordinates and ground surface elevations.

DBW of Ajax, Ontario and Walker Drilling Ltd. of Utopia, Ontario, supplied and operated a truck-mounted D-90 and a truck mounted CME-75 drill rig to carry out the drilling, sampling and in-situ testing operations for the boreholes.

The drilling and sampling operations in the field were supervised on a full time basis by Mr. Omar Ali and Mr. Stephane Loranger, CET of Thurber. Geotechnical laboratory testing was carried out by Thurber in its MTO-approved laboratory. Overall supervision of the field program was carried out by Mr. Stephane Loranger, CET.

Overall project management was provided by Dr. Sydney Pang, P.Eng. Interpretation of the field data and preparation of this report was completed by Ms. Rocio Palomeque Reyna, P.Eng. The report was reviewed by Messrs. Sydney Pang, P.Eng. and P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.



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Client: WSP  
File No.: 15786

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Date: March 13, 2018

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## 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 <sup>(1)</sup> '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


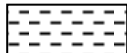



$C_{pen}$  Shear Strength Determination by Pocket Penetrometer

- (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<br>W <sub>L</sub> < 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.<br>(W <sub>L</sub> < 30%). |
|                      |   | CI           | Inorganic clays of medium plasticity, silty clays.<br>(30% < W <sub>L</sub> < 50%).   |
|                      |   | OL           | Organic silts and organic silty-clays of low plasticity.  |
|                      | SILTS AND CLAYS<br>W <sub>L</sub> > 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                 |   |              |   |

## EXPLANATION OF ROCK LOGGING TERMS

| <u>ROCK WEATHERING CLASSIFICATION</u> |   | <u>SYMBOLS</u>  |                   |
|---------------------------------------|---|---|-------------------|
| <b>Fresh (FR)</b>                     | No visible signs of weathering.   |   |                   |
| <b>Fresh Jointed (FJ)</b>             | Weathering limited to the surface of major discontinuities.   |  | CLAYSTONE         |
| <b>Slightly Weathered (SW)</b>        | Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material. |  | SILTSTONE         |
| <b>Moderately Weathered (MW)</b>      | Weathering extends throughout the rock mass, but the rock material is not friable.                            |  | SANDSTONE         |
| <b>Highly Weathered (HW)</b>          | Weathering extends throughout the rock mass and the rock is partly friable.                                   |  | COAL              |
| <b>Completely Weathered (CW)</b>      | Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.       |  | Bedrock (general) |

| <u>DISCONTINUITY SPACING</u> |                       | <u>STRENGTH CLASSIFICATION</u> |   |                     |   |
|------------------------------|-----------------------|--------------------------------|---|---------------------|---|
| Bedding                      | Bedding Plane Spacing | Rock Strength                  | Approximate Uniaxial Compressive Strength |                     | Field Estimation of Hardness*                             |
|                              |                       |                                | (MPa)                                     | (psi)               |   |
| Very thickly bedded          | Greater than 2m       | Extremely Strong               | Greater than 250                          | Greater than 36,000 | Specimen can only be chipped with a geological hammer     |
| Thickly bedded               | 0.6 to 2m             |                                |   |                     |   |
| Medium bedded                | 0.2 to 0.6m           | Very Strong                    | 100-250                                   | 15,000 to 36,000    | Requires many blows of geological hammer to break         |
| Thinly bedded                | 60mm to 0.2m          | Strong                         | 50-100                                    | 7,500 to 15,000     | Requires more than one blow of geological hammer to break |
| Very thinly bedded           | 20 to 60mm            |                                |   |                     |   |
| Laminated                    | 6 to 20mm             | Medium Strong                  | 25.0 to 50.0                              | 3,500 to 7,500      | Breaks under single blow of geological hammer.            |
| Thinly Laminated             | Less than 6mm         |                                |   |                     |   |

| <u>TERMS</u>                        |  |                       |             |              |  |  |
|-------------------------------------|--|-----------------------|-------------|--------------|--|--|
| Total Core Recovery: (TCR)          | Core recovered as a percentage of total core run length.   | Weak                  | 5.0 to 25.0 | 750 to 3,500 | Can be peeled by a pocket knife with difficulty<br>Can be peeled by a pocket knife, crumbles under firm blows of geological pick.<br>Indented by thumbnail |  |
| Solid Core Recovery: (SCR)          | Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run. | Very Weak             | 1.0 to 5.0  | 150 to 750   |  |  |
| Rock Quality Designation: (RQD)     | Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.        | Extremely Weak (Rock) | 0.25 to 1.0 | 35 to 150    |  |  |
| Uniaxial Compressive Strength (UCS) | Axial stress required to break the specimen  |                       |             |              |  |  |
| Fracture Index: (FI)                | Frequency of natural fractures per 0.3m of core run.   |                       |             |              |  |  |



## **Appendix A**

### **Section 1 (Stations 10+800 to 24+700) From 1 km north of Stouffville Road to Stouffville Road Boreholes LS-14, LS-15, LS-16, LS-20, LS-21 and MS-05**

- Record of Borehole Sheets
- Laboratory Test Results
- Drawings titled "Borehole Locations and Soil Strata"



# RECORD OF BOREHOLE No LS-14

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 766.5 E 313 669.4 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.19 - 2017.10.19 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|------------|---------|------|---------------|----------------------------|-----------------|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED    + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |  |  |  |                                    |                                     |                                   |  |  |
| 265.7         | GROUND SURFACE  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.0           | ASPHALT (150mm)   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.2           | Gravelly SAND   |            | 1       | GS   | -             |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 265.0         | Brown Moist (FILL)  |            |         |      |               |                            | 265             |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.7           | Sandy SILT, trace to some gravel, trace clay Compact Grey Moist (FILL)    |            | 1       | SS   | 17            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 264.3         |   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 1.4           | Silty CLAY, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL) |            | 2       | SS   | 18            |                            | 264             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |   |            | 3       | SS   | 16            |                            | 263             |  |  |  |  |                                    |                                     |                                   |  |  |
| 262.7         |   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 3.0           | Stiff   |            | 4       | SS   | 13            |                            | 262             |  |  |  |  |                                    |                                     |                                   |  | 5 34 39 22   |
| 261.6         |   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 4.1           |   |            |         |      |               |                            | 261             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |   |            | 5       | SS   | 30            |                            | 260             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 259.3         | Grey Wet  |            | 6       | SS   | 50            |                            | 259             |  |  |  |  |                                    |                                     |                                   |  | 4 45 29 22   |
| 6.4           | SAND, trace clay Dense Grey Wet   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  | 0 80 18 2  |
| 258.5         |   |            |         |      |               |                            | 258             |  |  |  |  |                                    |                                     |                                   |  |  |
| 7.2           | Wet   |            | 7       | SS   | 52            |                            | 257             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 256.2         |   |            | 8       | SS   | 100/<br>0.250 |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 9.5           | END OF BOREHOLE AT 9.5m. BOREHOLE OPEN to 0.8m AND WATER LEVEL AT 6.1m    |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
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 (%) STRAIN AT FAILURE

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No LS-14

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 766.5 E 313 669.4 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.19 - 2017.10.19 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page   |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No LS-15

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 765.8 E 313 649.4 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.18 - 2017.10.18 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|---|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |  |
| 265.2         | GROUND SURFACE   |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 0.0           | ASPHALT: (150mm)   |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 0.2           | Gravelly <b>SAND</b> , trace silt<br>Very Dense                                  |            | 1       | SS   | 51         |                            |                 |   |  |  |  |   |  |
| 264.5         | Brown  |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 0.7           | Moist<br>(FILL)  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               | Sandy <b>SILT</b> , trace to some gravel,<br>trace clay<br>Compact to Very Dense |            | 2       | SS   | 29         |                            |                 |   |  |  |  |   |  |
|               | Grey<br>Moist<br>(FILL)  |            | 3       | SS   | 54         |                            |                 |   |  |  |  |   |  |
| 263.0         |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 2.2           | Clayey <b>SILT</b> , with sand, trace gravel<br>Very Stiff to Hard               |            | 4       | SS   | 22         |                            |                 |   |  |  |  |   |  |
|               | Brown<br>Moist<br>(TILL)   |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 5       | SS   | 15         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 6       | SS   | 73         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 7       | SS   | 56         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
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|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-15

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 765.8 E 313 649.4 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.18 - 2017.10.18 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE OPEN AND WATER<br>LEVEL AT 6.7m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

# RECORD OF BOREHOLE No LS-16

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 867 089.4 E 313 620.2 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.22 - 2017.10.22 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    |     | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |   |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR   SA   SI   CL |   |          |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|----|-----|---|---|--|---|--|---|----------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL      x LAB VANE |    |    |    |     | WATER CONTENT (%)<br>w <sub>P</sub> w      w <sub>L</sub>     |   |  |   |  |   |          |  |
| 267.0         | GROUND SURFACE  |            |         |      |            |                            |                 | 20   | 40 | 60 | 80 | 100 |   |   |  |   |  |   |          |  |
| 0.0           | ASPHALT (150mm)   |            |         |      |            |                            |                 | 20   | 40 | 60 | 80 | 100 |   |   |  |   |  |   |          |  |
| 0.2           | Gravelly SAND, trace silt<br>Brown<br>Moist<br>(FILL)                                 |            | 1       | GS   | -          |                            |                 |  |    |    |    |     |   | ○ |  |   |  |   |          |  |
| 266.3         |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
| 0.7           | Silty CLAY, with sand, trace gravel<br>Very Stiff to Stiff<br>Grey<br>Moist<br>(TILL) |            | 1       | SS   | 26         |                            | 266             |  |    |    |    |     |   | ○ |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            | 2       | SS   | 24         |                            | 265             |  |    |    |    |     |   | ○ |  |   |  | 6 | 39 34 21 |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            | 3       | SS   | 15         |                            | 264             |  |    |    |    |     |   | ○ |  |   |  |   |          |  |
|               | Grey<br>Wet   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            | 4       | SS   | 8          |                            | 263             |  |    |    |    |     |   | ○ |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               | Very Stiff  |            | 5       | SS   | 25         |                            | 262             |  |    |    |    |     |   | ○ |  |   |  | 4 | 39 38 19 |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            | 6       | SS   | 18         |                            | 261             |  |    |    |    |     |   | ○ |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               | Hard  |            | 7       | SS   | 30         |                            | 259             |  |    |    |    |     |   | ○ |  |   |  | 3 | 34 35 28 |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |
|               |   |            |         |      |            |                            |                 |  |    |    |    |     |   |   |  |   |  |   |          |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-16

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 867 089.4 E 313 620.2 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.22 - 2017.10.22 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE OPEN TO 0.6m AND<br>WATER LEVEL AT 4.6m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

# RECORD OF BOREHOLE No LS-20

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION N 4 867 375.1 E 313 535.4 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.01.30 - 2018.01.30 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |  |  |  |   | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |  |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|--|--|--|---|---|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |  |  |  |   |   |  | PLASTIC<br>LIMIT<br>w <sub>P</sub><br><br>NATURAL<br>MOISTURE<br>CONTENT<br>w<br><br>LIQUID<br>LIMIT<br>w <sub>L</sub> |  |
| 269.3         | GROUND SURFACE  |            |         |      |            | ▽                          |                 |  |  |  |  |   |   |  |  |  |
| 0.0           | ASPHALT (100mm)   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
| 0.1           | Gravelly SAND, trace silt<br>Brown<br>Moist<br>(FILL)                                 |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
| 268.6         |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
| 0.7           | Clayey SILT, trace sand and gravel<br>Very Stiff to Stiff<br>Brown<br>Moist<br>(FILL) |            | 1       | SS   | 20         |                            |                 |  |  |  |  |   | ○   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            | 2       | SS   | 14         |                            |                 |  |  |  |  |   | ○   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
| 267.0         |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
| 2.3           | Silty CLAY, with sand, trace gravel<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL) |            | 3       | SS   | 26         |                            |                 |  |  |  |  |   | ○   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            | 4       | SS   | 15         |                            |                 |  |  |  |  | ○ |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |   |   |  |  |  |
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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No LS-20

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION N 4 867 375.1 E 313 535.4 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.01.30 - 2018.01.30 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page   |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | LEVEL AT 1.8m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS, THEN<br>CONCRETE AND COLD PATCH<br>ASPHALT TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/26/18



# RECORD OF BOREHOLE No LS-21

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION N 4 867 378.7 E 313 554.5 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.01.08 - 2018.01.30 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |              | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |     | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |  |  | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR   SA   SI   CL |  |                  |  |
|---------------|--|------------|---------|------|--------------|----------------------------|-----------------|--|----|----|-----|---|--|--|---|--|--|------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES   |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL      × LAB VANE |    |    |     | WATER CONTENT (%)<br>w <sub>p</sub> w      w <sub>L</sub>     |  |  |   |  |  |                  |  |
| 269.1         | GROUND SURFACE   |            |         |      |              | ▽                          | 20              | 40   | 60 | 80 | 100 |   |  |  |   |  |  |                  |  |
| 0.0           | ASPHALT (100mm)  |            |         |      |              |                            | 269             |  |    |    |     |   |  |  |   |  |  |                  |  |
| 268.8         |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
| 0.3           | Gravelly <b>SAND</b> , trace silt<br>Brown<br>Moist<br>(FILL)  |            | 1       | SS   | 50/<br>0.125 |                            |                 |  |    |    |     |   |  |  |   | ○  |  |                  |  |
| 268.0         | Sandy <b>SILT</b> , trace to some gravel,<br>trace clay<br>Very Dense to Dense<br>Brown<br>Moist<br>(FILL) |            | 2       | SS   | 32           |                            |                 |  |    |    |     |   |  |  |   | ○  |  |                  |  |
| 1.1           |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               | Silty <b>CLAY</b> , with sand, trace gravel<br>Stiff to Hard<br>Grey<br>Moist<br>(TILL)                    |            | 3       | SS   | 35           |                            |                 |  |    |    |     |   |  |  |   | ○  |  | 4   32   41   23 |  |
|               |  |            | 4       | SS   | 12           |                            |                 |  |    |    |     |   |  |  |   | ○  |  |                  |  |
|               | Brown  |            | 5       | SS   | 17           |                            |                 |  |    |    |     |   |  |  |   | ○  |  | 1   38   41   20 |  |
|               |  |            | 6       | SS   | 26           |                            |                 |  |    |    |     |   |  |  |   | ○  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |
|               |  |            |         |      |              |                            |                 |  |    |    |     |   |  |  |   |  |  |                  |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-21

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION N 4 867 378.7 E 313 554.5 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.01.08 - 2018.01.30 CHECKED BY RPR

| SOIL PROFILE |  |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |                   |    |    |    |
|--------------|--|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|-------------------|----|----|----|
| ELEV DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                         |                 | SHEAR STRENGTH kPa                       |    |    |    |     |                                 |                               |                                |                  |                                       | WATER CONTENT (%) |    |    |    |
|              |  |            |         |      |            |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 | 20                            | 40                             | 60               |                                       | GR                | SA | SI | CL |
|              | Continued From Previous Page   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |                   |    |    |    |
|              | LEVEL AT 2.0m.<br>BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS, THEN CONCRETE AND COLD PATCH ASPHALT TO SURFACE. |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |                   |    |    |    |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/26/18

# RECORD OF BOREHOLE No MS-05

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION NB N 4 867 083.0 E 313 590.1 ORIGINATED BY TM  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.06.30 - 2017.06.30 CHECKED BY PP

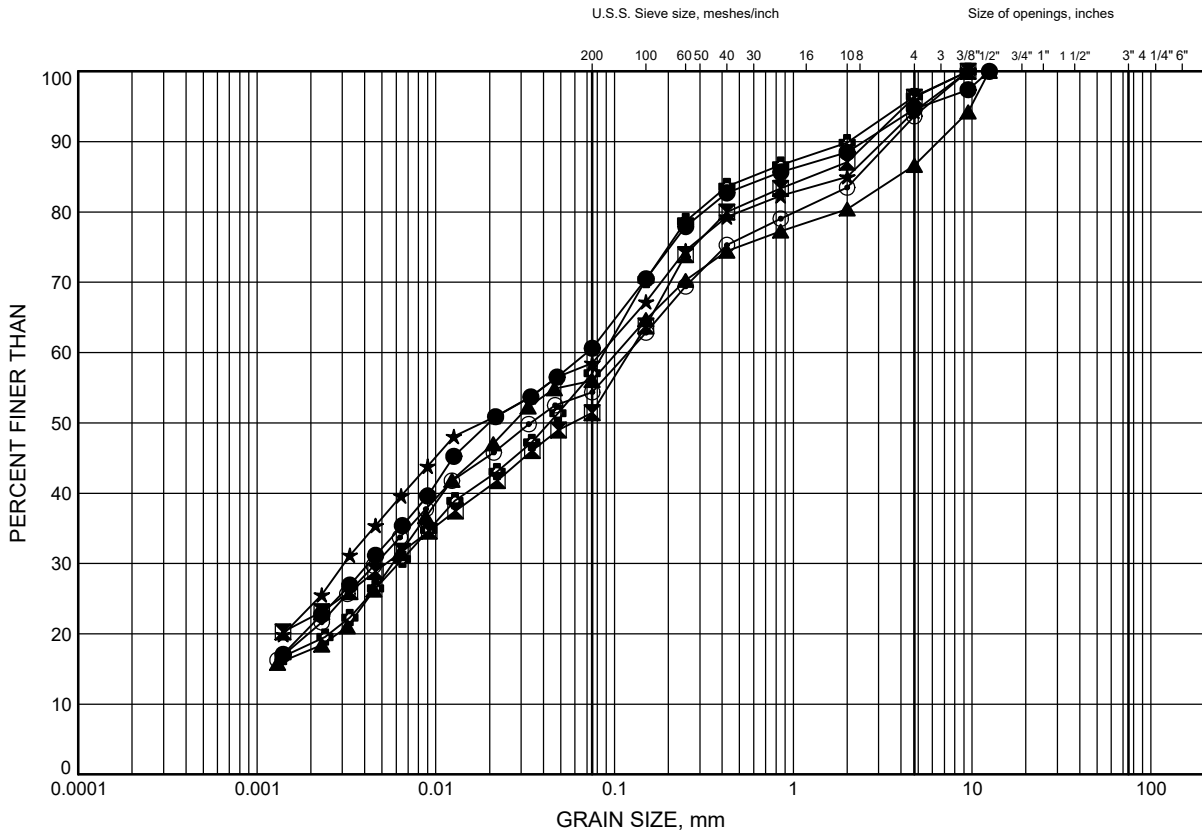
| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|---|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |  |
| 267.2         | GROUND SURFACE   |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 0.0           | ASPHALT: (100mm)   |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 0.1           | Gravelly SAND, trace silt<br>Compact<br>Brown<br>Moist<br>(FILL)   |            | 1       | SS   | 27         |                            |                 |   |  |  |  |   |  |
| 266.4         |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 0.8           | Sandy SILT, trace to some clay<br>Compact to Dense<br>Brown<br>Moist   |            | 2       | SS   | 24         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 3       | SS   | 40         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 4       | SS   | 39         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 264.2         |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 3.0           | Clayey SILT, trace sand, trace gravel<br>Stiff to Hard<br>Grey to Brown<br>Moist<br>(TILL)   |            | 5       | SS   | 9          |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 6       | SS   | 18         |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
|               |  |            | 7       | SS   | 43         |                            |                 |   |  |  |  |   |  |
| 260.5         |  |            |         |      |            |                            |                 |   |  |  |  |   |  |
| 6.7           | END OF BOREHOLE AT 6.7m.<br>BOREHOLE CAVED TO 4.9m AND<br>WATER LEVEL AT 4.6m DEPTH<br>UPON COMPLETION.<br>Piezometer installation consists of<br>25mm diameter Schedule 40 PVC pipe<br>with a 1.52m slotted screen.<br><br>WATER LEVEL READINGS<br>DATE DEPTH(m) ELEV.(m)<br>2017.09.24 3.7 263.5<br>2017.10.24 3.9 263.3 |            |         |      |            |                            |                 |   |  |  |  |   |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE A1

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-14    | 3.4       | 262.3     |
| ⊠      | LS-14    | 6.2       | 259.5     |
| ▲      | LS-15    | 3.4       | 261.8     |
| ★      | LS-15    | 7.9       | 257.3     |
| ⊙      | LS-16    | 1.8       | 265.2     |
| ⊕      | LS-16    | 4.9       | 262.1     |

Date February 2018  
W.P. 2930-02-00

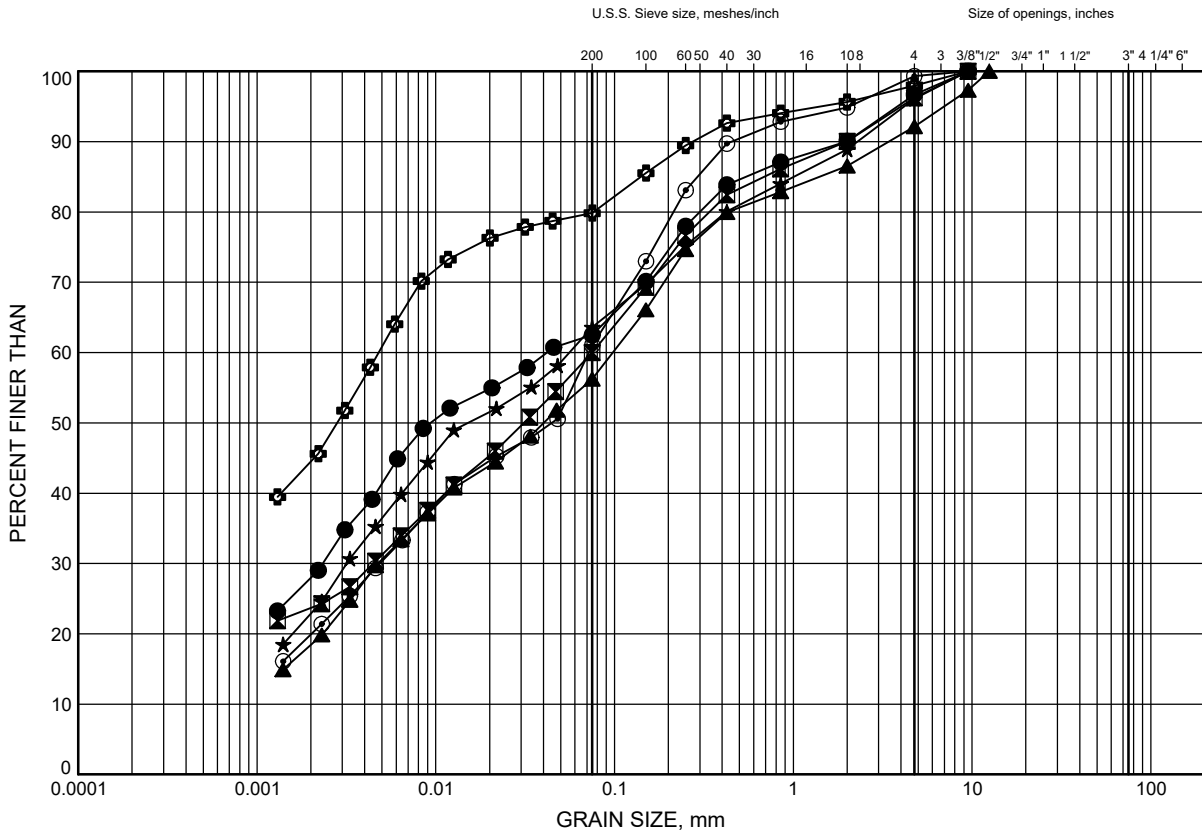


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE A2

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-16    | 7.9       | 259.1     |
| ⊠      | LS-20    | 2.6       | 266.7     |
| ▲      | LS-20    | 6.4       | 262.9     |
| ★      | LS-21    | 1.8       | 267.3     |
| ⊙      | LS-21    | 3.3       | 265.8     |
| ⊕      | LS-21    | 7.8       | 261.3     |

Date February 2018  
W.P. 2930-02-00

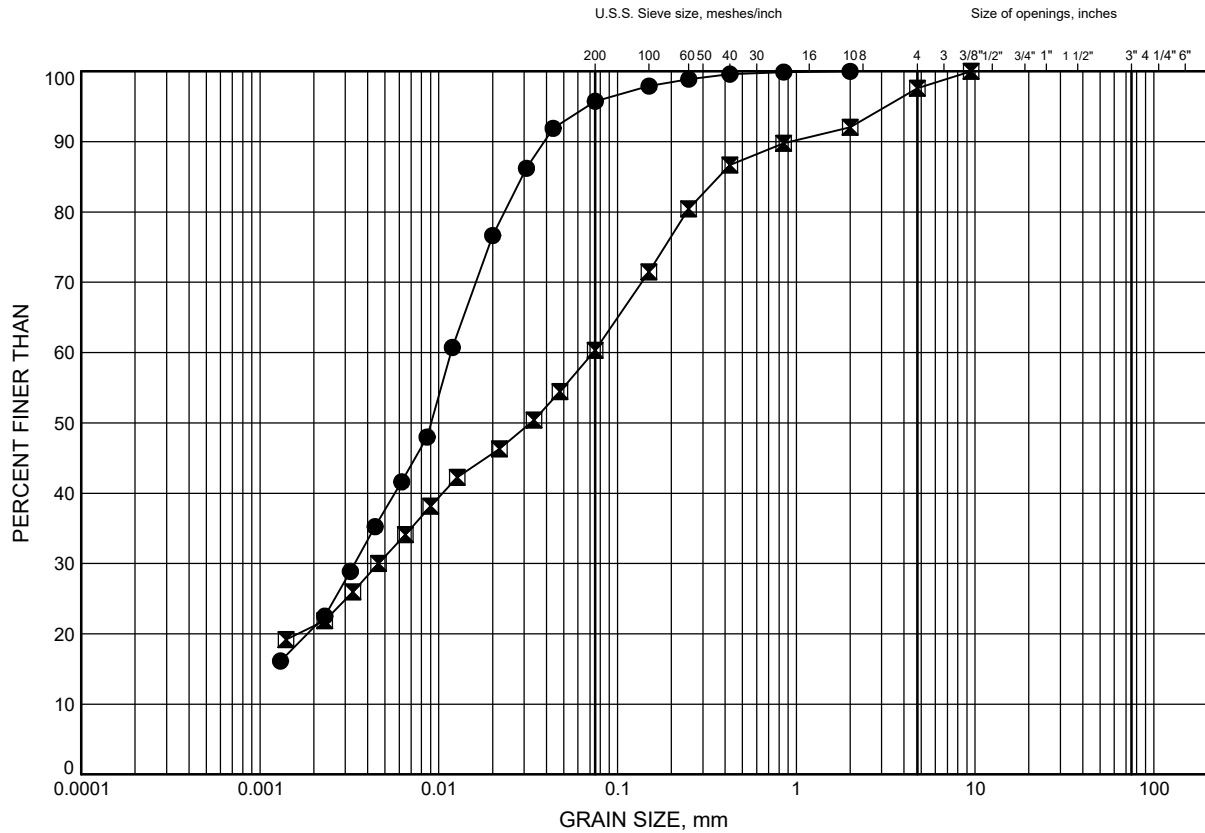


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE A3

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | MS-05    | 4.9       | 262.3     |
| ⊠      | MS-05    | 6.4       | 260.8     |

Date February 2018  
W.P. 2930-02-00

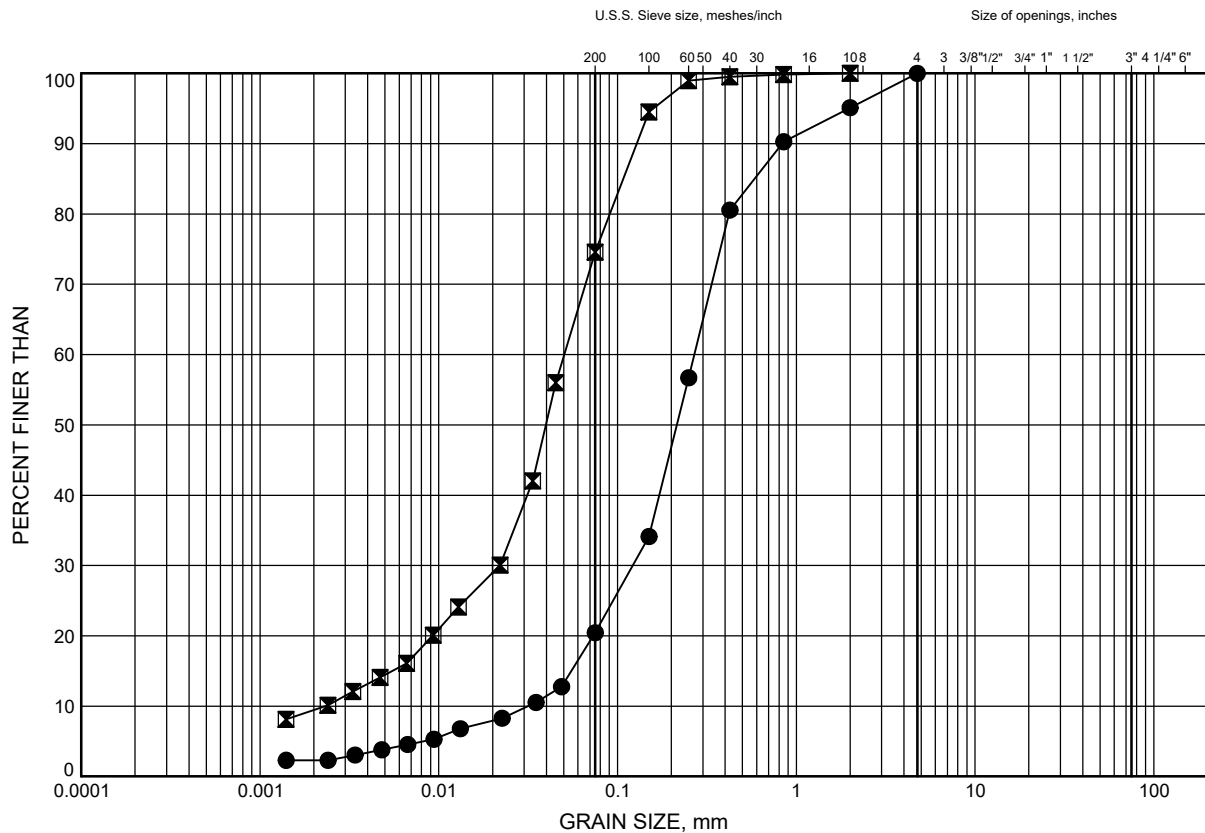


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE A4

## SAND to Sandy SILT



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-14    | 6.6       | 259.1     |
| ◻      | MS-05    | 2.6       | 264.6     |

Date February 2018  
W.P. 2930-02-00

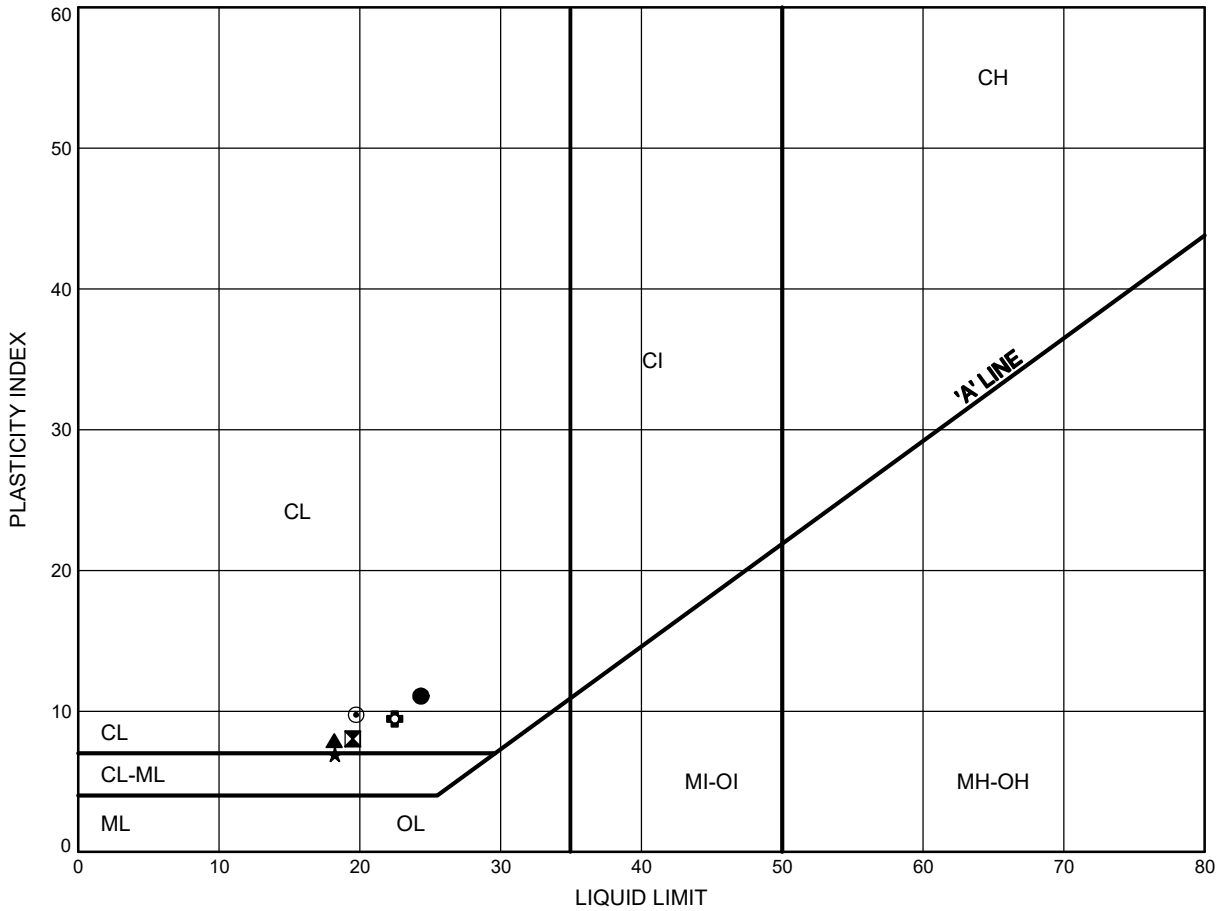


Prep'd AN  
Chkd. RPR

# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE A5

Silty CLAY to Clayey SILT TILL



## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-14    | 3.4       | 262.3     |
| ⊠      | LS-15    | 3.4       | 261.8     |
| ▲      | LS-15    | 7.9       | 257.3     |
| ★      | LS-16    | 4.9       | 262.1     |
| ⊙      | LS-16    | 7.9       | 259.1     |
| ⊕      | LS-20    | 2.6       | 266.7     |

Date February 2018  
W.P. 2930-02-00



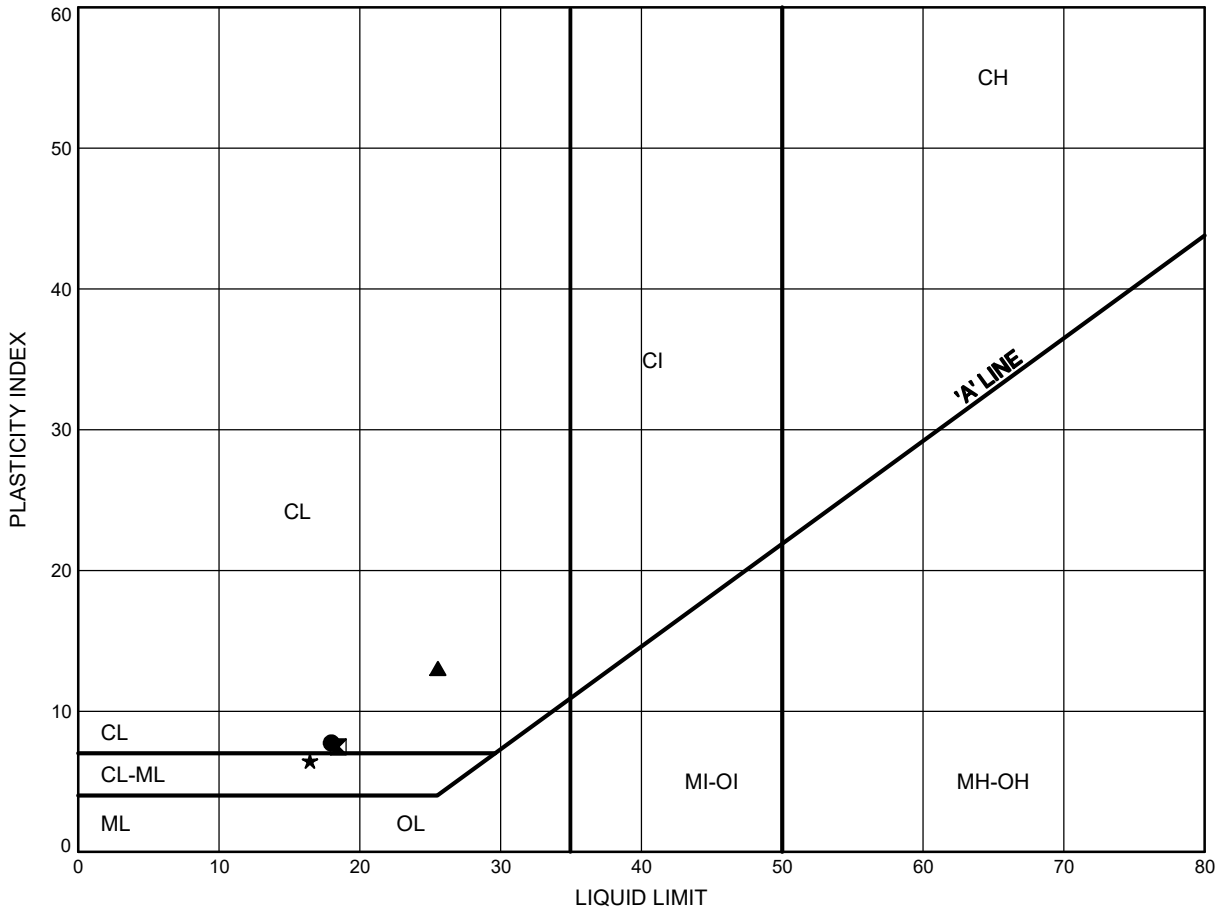
Prep'd AN  
Chkd. RPR



# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE A6

Silty CLAY to Clayey SILT TILL



### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-20    | 6.4       | 262.9     |
| ⊠      | LS-21    | 3.3       | 265.8     |
| ▲      | LS-21    | 7.8       | 261.3     |
| ★      | MS-05    | 6.4       | 260.8     |

Date February 2018  
W.P. 2930-02-00



Prep'd AN  
Chkd. RPR



## FINAL REPORT

CA14333-DEC17 R1

15786 Hwy 404

Prepared for

**Thurber Engineering Ltd.**

## First Page

### CLIENT DETAILS

Client **Thurber Engineering Ltd.**

Address **103, 2010 Winston Park Drive  
Oakville, ON  
L6H 5R7.**

Contact **Rocio Reyna**

Telephone **905-829-8666 x 263**

Facsimile

Email **rreyna@thurber.ca**

Project **15786 Hwy 404**

Order Number

Samples **Soil (11)**

### LABORATORY DETAILS

Project Specialist **Brian Graham B.Sc.**

Laboratory **SGS Canada Inc.**

Address **185 Concession St., Lakefield ON, K0L 2H0**

Telephone **705-652-2143**

Facsimile **705-652-6365**

Email **brian.graham@sgs.com**

SGS Reference **CA14333-DEC17**

Received **12/15/2017**

Approved **12/22/2017**

Report Number **CA14333-DEC17 R1**

Date Reported **12/22/2017**

### COMMENTS

Temperature of Sample upon Receipt: 7 degrees C

Cooling Agent Present: Yes

Custody Seal Present: No

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

### SIGNATORIES



Brian Graham B.Sc.



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# FINAL REPORT

CA14333-DEC17 R1

Client: Thurber Engineering Ltd.

Project: 15786 Hwy 404

Project Manager: Rocío Reyna

Samplers: N/A

PACKAGE: - 1.3 Other (ORP) ()

| Sample Number | 5          | 6          | 7          | 8          | 9          | 10         | 11         | 12         |
|---------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Sample Name   | LS16-SS#2  | LS18-SS#4  | LS14-SS#3  | LS07-SS#3  | LS09-SS#3  | LS17-SS#4  | LS13-SS#3  | LS03-SS#2  |
| Sample Matrix | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 09/12/2017 | 19/10/2017 | 17/10/2017 | 17/10/2017 | 15/10/2017 | 19/10/2017 | 15/10/2017 |

| Parameter | Units | RL |  | Result | Result | Result | Result | Result | Result | Result |
|-----------|-------|----|--|--------|--------|--------|--------|--------|--------|--------|
|-----------|-------|----|--|--------|--------|--------|--------|--------|--------|--------|

1.3 Other (ORP)

|          |      |     |  |     |     |     |     |     |     |     |     |
|----------|------|-----|--|-----|-----|-----|-----|-----|-----|-----|-----|
| Chloride | µg/g | 0.4 |  | 400 | 240 | 480 | 520 | 520 | 420 | 400 | 520 |
|----------|------|-----|--|-----|-----|-----|-----|-----|-----|-----|-----|

PACKAGE: - 1.3 Other (ORP) ()

| Sample Number | 13         | 14         | 15         |
|---------------|------------|------------|------------|
| Sample Name   | LS01-SS#5  | LS06-SS#4  | LS04-SS#4  |
| Sample Matrix | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 16/10/2017 | 15/10/2017 |

| Parameter | Units | RL |  | Result | Result | Result |
|-----------|-------|----|--|--------|--------|--------|
|-----------|-------|----|--|--------|--------|--------|

1.3 Other (ORP)

|          |      |     |  |     |     |     |
|----------|------|-----|--|-----|-----|-----|
| Chloride | µg/g | 0.4 |  | 240 | 380 | 300 |
|----------|------|-----|--|-----|-----|-----|

PACKAGE: - Corrosivity Index ()

| Sample Number | 5          | 6          | 7          | 8          | 9          | 10         | 11         | 12         |
|---------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Sample Name   | LS16-SS#2  | LS18-SS#4  | LS14-SS#3  | LS07-SS#3  | LS09-SS#3  | LS17-SS#4  | LS13-SS#3  | LS03-SS#2  |
| Sample Matrix | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 09/12/2017 | 19/10/2017 | 17/10/2017 | 17/10/2017 | 15/10/2017 | 19/10/2017 | 15/10/2017 |

| Parameter | Units | RL |  | Result | Result | Result | Result | Result | Result | Result |
|-----------|-------|----|--|--------|--------|--------|--------|--------|--------|--------|
|-----------|-------|----|--|--------|--------|--------|--------|--------|--------|--------|

Corrosivity Index

|                          |         |       |  |        |        |        |        |        |        |        |        |
|--------------------------|---------|-------|--|--------|--------|--------|--------|--------|--------|--------|--------|
| Corrosivity Index        | none    | 1     |  | 9      | 2      | 11     | 12     | 12     | 2      | 6      | 14     |
| Soil Redox Potential     | mV      | -     |  | 243    | 224    | 218    | 174    | 224    | 182    | 208    | 207    |
| Sulphide                 | %       | 0.02  |  | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| pH                       | no unit | 0.05  |  | 9.49   | 8.34   | 7.63   | 9.18   | 8.58   | 8.26   | 9.22   | 9.06   |
| Resistivity (calculated) | ohms.cm | -9999 |  | 1810   | 2860   | 1270   | 1750   | 1520   | 2590   | 2260   | 1050   |



# FINAL REPORT

CA14333-DEC17 R1

**Client:** Thurber Engineering Ltd.

**Project:** 15786 Hwy 404

**Project Manager:** Rocío Reyna

**Samplers:** N/A

## PACKAGE: - Corrosivity Index ()

| Sample Number | 13         | 14         | 15         |
|---------------|------------|------------|------------|
| Sample Name   | LS01-SS#5  | LS06-SS#4  | LS04-SS#4  |
| Sample Matrix | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 16/10/2017 | 15/10/2017 |

| Parameter                | Units   | RL    |  | Result | Result | Result |
|--------------------------|---------|-------|--|--------|--------|--------|
| <b>Corrosivity Index</b> |         |       |  |        |        |        |
| Corrosivity Index        | none    | 1     |  | 5      | 9      | 4      |
| Soil Redox Potential     | mV      | -     |  | 203    | 224    | 246    |
| Sulphide                 | %       | 0.02  |  | < 0.02 | < 0.02 | < 0.02 |
| pH                       | no unit | 0.05  |  | 8.73   | 8.32   | 8.53   |
| Resistivity (calculated) | ohms.cm | -9999 |  | 2980   | 1590   | 3160   |

## PACKAGE: - Metals and Inorganics ()

| Sample Number | 5          | 6          | 7          | 8          | 9          | 10         | 11         | 12         |
|---------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Sample Name   | LS16-SS#2  | LS18-SS#4  | LS14-SS#3  | LS07-SS#3  | LS09-SS#3  | LS17-SS#4  | LS13-SS#3  | LS03-SS#2  |
| Sample Matrix | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 09/12/2017 | 19/10/2017 | 17/10/2017 | 17/10/2017 | 15/10/2017 | 19/10/2017 | 15/10/2017 |

| Parameter             | Units | RL  |  | Result | Result | Result | Result | Result | Result | Result | Result |
|-----------------------|-------|-----|--|--------|--------|--------|--------|--------|--------|--------|--------|
| Metals and Inorganics |       |     |  |        |        |        |        |        |        |        |        |
| Sulphate              | µg/g  | 0.4 |  | 57     | 33     | 55     | 54     | 40     | 14     | 29     | 46     |

## PACKAGE: - Metals and Inorganics ()

| Sample Number | 13         | 14         | 15         |
|---------------|------------|------------|------------|
| Sample Name   | LS01-SS#5  | LS06-SS#4  | LS04-SS#4  |
| Sample Matrix | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 16/10/2017 | 15/10/2017 |

| Parameter                    | Units | RL  |  | Result | Result | Result |
|------------------------------|-------|-----|--|--------|--------|--------|
| <b>Metals and Inorganics</b> |       |     |  |        |        |        |
| Sulphate                     | µg/g  | 0.4 |  | 11     | 49     | 22     |



FINAL REPORT

CA14333-DEC17 R1

Client: Thurber Engineering Ltd.

Project: 15786 Hwy 404

Project Manager: Rocío Reyna

Samplers: N/A

PACKAGE: - UNDEFINED ()

|               |            |            |            |            |            |            |            |            |
|---------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Sample Number | 5          | 6          | 7          | 8          | 9          | 10         | 11         | 12         |
| Sample Name   | LS16-SS#2  | LS18-SS#4  | LS14-SS#3  | LS07-SS#3  | LS09-SS#3  | LS17-SS#4  | LS13-SS#3  | LS03-SS#2  |
| Sample Matrix | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 09/12/2017 | 19/10/2017 | 17/10/2017 | 17/10/2017 | 15/10/2017 | 19/10/2017 | 15/10/2017 |

| Parameter        | Units | RL  |  | Result | Result | Result | Result | Result | Result | Result |     |
|------------------|-------|-----|--|--------|--------|--------|--------|--------|--------|--------|-----|
| UNDEFINED        |       |     |  |        |        |        |        |        |        |        |     |
| Moisture Content | %     | 0.1 |  | 9.1    | 8.0    | 20.1   | 8.4    | 8.4    | 12.0   | 7.1    | 6.3 |
| Conductivity     | uS/cm | 2   |  | 554    | 350    | 785    | 572    | 658    | 386    | 442    | 955 |

PACKAGE: - UNDEFINED ()

|               |            |            |            |
|---------------|------------|------------|------------|
| Sample Number | 13         | 14         | 15         |
| Sample Name   | LS01-SS#5  | LS06-SS#4  | LS04-SS#4  |
| Sample Matrix | Soil       | Soil       | Soil       |
| Sample Date   | 22/10/2017 | 16/10/2017 | 15/10/2017 |

| Parameter        | Units | RL  |  | Result | Result | Result |
|------------------|-------|-----|--|--------|--------|--------|
| UNDEFINED        |       |     |  |        |        |        |
| Moisture Content | %     | 0.1 |  | 15.3   | 8.5    | 9.4    |
| Conductivity     | uS/cm | 2   |  | 336    | 629    | 316    |



# FINAL REPORT

CA14333-DEC17 R1

## QC SUMMARY

### Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

| Parameter | QC batch Reference | Units | RL  | Method Blank | Duplicate |        | LCS/Spike Blank    |                     |      | Matrix Spike / Ref. |                     |      |
|-----------|--------------------|-------|-----|--------------|-----------|--------|--------------------|---------------------|------|---------------------|---------------------|------|
|           |                    |       |     |              | RPD       | AC (%) | Spike Recovery (%) | Recovery Limits (%) |      | Spike Recovery (%)  | Recovery Limits (%) |      |
|           |                    |       |     |              |           |        |                    | Low                 | High |                     | Low                 | High |
| Chloride  | DIO0256-DEC17      | µg/g  | 0.4 | <0.4         | 2         | 20     | 100                | 80                  | 120  | 117                 | 75                  | 125  |
| Sulphate  | DIO0256-DEC17      | µg/g  | 0.4 | <0.4         | 2         | 20     | 95                 | 80                  | 120  | 91                  | 75                  | 125  |

### Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

| Parameter | QC batch Reference | Units | RL   | Method Blank | Duplicate |        | LCS/Spike Blank    |                     |      | Matrix Spike / Ref. |                     |      |
|-----------|--------------------|-------|------|--------------|-----------|--------|--------------------|---------------------|------|---------------------|---------------------|------|
|           |                    |       |      |              | RPD       | AC (%) | Spike Recovery (%) | Recovery Limits (%) |      | Spike Recovery (%)  | Recovery Limits (%) |      |
|           |                    |       |      |              |           |        |                    | Low                 | High |                     | Low                 | High |
| Sulphide  | ECS0014-DEC17      | %     | 0.02 | <0.02        | ND        | 20     | 115                | 80                  | 120  |                     |                     |      |

### pH

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

| Parameter | QC batch Reference | Units   | RL   | Method Blank | Duplicate |        | LCS/Spike Blank    |                     |      | Matrix Spike / Ref. |                     |      |
|-----------|--------------------|---------|------|--------------|-----------|--------|--------------------|---------------------|------|---------------------|---------------------|------|
|           |                    |         |      |              | RPD       | AC (%) | Spike Recovery (%) | Recovery Limits (%) |      | Spike Recovery (%)  | Recovery Limits (%) |      |
|           |                    |         |      |              |           |        |                    | Low                 | High |                     | Low                 | High |
| pH        | EWL0236-DEC17      | no unit | 0.05 | NA           | 0         |        | 100                |                     |      | NA                  |                     |      |



## QC SUMMARY

---

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

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

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

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

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

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

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

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

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

## LEGEND

### FOOTNOTES

**NSS** Insufficient sample for analysis.

**RL** Reporting Limit.

↑ Reporting limit raised.

↓ Reporting limit lowered.

**NA** The sample was not analysed for this analyte

**ND** Non Detect

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

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

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-- End of Analytical Report --

## Request for Laboratory Services and CHAIN OF CUSTODY

No: 11  
Page 1 of 1

SGS Environmental Services

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

## Laboratory Information Section - Lab use only

Received By: Trick - Andre  
Received Date (mm/dd/yyyy): 12/15/2017 (mm/dd/yyyy)  
Received Time: 01:45 PMReceived By (signature): [Signature]  
Custody Seal Present: ☒  
Custody Seal Intact: ☒

LAB LIMS #:

Cooling Agent Present: ☒ ICE  
Temperature Upon Receipt (°C): 10.1/10.2/10.3 7.3

## REPORT INFORMATION

Company: Thurber Engineering  
Contact: Rocio Reyna  
Address: 103-2010 Winston Park Dr.  
Phone: 905-829-8666  
Fax:  
Email: rreyna@thurber.ca

## INVOICE INFORMATION

☒ (same as Report Information)

Company:

Contact:

Address:

Phone:

Email:

## PROJECT INFORMATION

Quotation #: 15786 P.O. #: ANY 404  
Project #: 15786 Site Location/ID: ANY 404

## TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7 days) TAT's are quoted in business days (exclude statutory holidays & weekends).  
Samples received after 3pm or on weekends : TAT begins the next business day☒ RUSH TAT (Additional Charges May Apply) ☐ 1 Day ☐ 2 Days ☐ 3-4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

## REGULATIONS

## Regulation 153 (2011):

☐ Table 1 ☐ Res/Park ☐ Soil Texture:  
☐ Table 2 ☐ Ind/Com ☐ Coarse  
☐ Table 3 ☐ Agri/Other ☐ Medium  
☐ Table ☐ Fine

## Other Regulations:

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

## Sewer By-Law:

☐ Sanitary  
☐ Storm  
Municipality:RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

| SAMPLE IDENTIFICATION                      | DATE SAMPLED | TIME SAMPLED | # OF BOTTLES | MATRIX |
|--|--------------|--------------|--------------|--------|
| 1 LS16-SS#2                                | Oct/22/17    |              | 1            | Soil   |
| 2 LS18-SS#4                                | Oct/22/17    |              | 1            | Soil   |
| 3 LS14-SS#3                                | Oct/19/17    |              | 1            | Soil   |
| 4 LS07-SS#3                                | Oct/17/17    |              | 1            | Soil   |
| 5 LS09-SS#3                                | Oct/16/17    |              | 1            | Soil   |
| 6 LS17-SS#4                                | Oct/15/17    |              | 1            | Soil   |
| 7 LS03-SS#3                                | Oct/14/17    |              | 1            | Soil   |
| 8 LS03-SS#2                                | Oct/15/17    |              | 1            | Soil   |
| 9 LS01-SS#5                                | Oct/12/17    |              | 1            | Soil   |
| 10 LS06-SS#4                               | Oct/16/17    |              | 1            | Soil   |
| Observations/Comments/Special Instructions |              |              |              |        |
| LS-04-SS#4 Oct/15/17                       |              |              |              |        |

## ANALYSIS REQUESTED

Corrosivity Analysis

COMMENTS:  
Field Filtered (F)  
Preserved (P)

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

Sampled By (NAME):

Signature:

Signature:

Date:

Date: 12/15/17

(mm/dd/yy)

Pink Copy - Client

Relinquished by (NAME):

Signature:

Signature:

Date:

Date: 12/15/17

(mm/dd/yy)

Yellow &amp; White Copy - SGS

Revision #: 1.0  
Date of Issue: 01 June, 2014

20.20 AZ



# SAMPLE INTEGRITY REPORT

Project Number:

15786

ONTARIO REGULATION 153/04

SGS Sample ID

CA14333-DEC17

Date / Time Sampled

Client Sample ID

see CoC

ALL

## Sample Submission General Sample Integrity Violations

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

☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐

## Sample Specific Sample Integrity Violations

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

|                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
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| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Sediment Log

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

|                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Additional Comments/Remarks:

No issues upon receipt



Initials:



## FINAL REPORT

CA14016-FEB18 R1

15786 Hwy 404

Prepared for

**Thurber Engineering Ltd.**

## First Page

### CLIENT DETAILS

Client Thurber Engineering Ltd.

Address 103, 2010 Winston Park Drive  
Oakville, ON  
L6H 5R7.

Contact Rocio Reyna

Telephone 905-829-8666 x 263

Facsimile

Email rreyna@thurber.ca

Project 15786 Hwy 404

Order Number

Samples Soil (1)

### LABORATORY DETAILS

Project Specialist Deanna Edwards, B.Sc, C.Chem

Laboratory SGS Canada Inc.

Address 185 Concession St., Lakefield ON, K0L 2H0

Telephone 705-652-2000

Facsimile 705-652-6365

Email deanna.edwards@sgs.com

SGS Reference CA14016-FEB18

Received 02/01/2018

Approved 02/07/2018

Report Number CA14016-FEB18 R1

Date Reported 02/07/2018

### COMMENTS

Temperature of Sample upon Receipt: 8 degrees C

Cooling Agent Present: Yes

Custody Seal Present: No

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

### SIGNATORIES

Deanna Edwards, B.Sc, C.Chem





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---

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# FINAL REPORT

CA14016-FEB18 R1

**Client:** Thurber Engineering Ltd.

**Project:** 15786 Hwy 404

**Project Manager:** Rocío Reyna

**Samplers:** N/A

## PACKAGE: REG153 - 1.1.6 PHCs (SOIL)

**Sample Number** 5  
**Sample Name** LS-20, SS#4  
**Sample Matrix** Soil  
**Sample Date** 30/01/2018

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

| Parameter        | Units | RL  | L1 | Result |
|------------------|-------|-----|----|--------|
| 1.1.6 PHCs       |       |     |    |        |
| Moisture Content | %     | 0.1 |    | 12.4   |

## PACKAGE: REG153 - 1.3 Other (ORP) (SOIL)

**Sample Number** 5  
**Sample Name** LS-20, SS#4  
**Sample Matrix** Soil  
**Sample Date** 30/01/2018

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

| Parameter       | Units | RL  | L1 | Result |
|-----------------|-------|-----|----|--------|
| 1.3 Other (ORP) |       |     |    |        |
| Chloride        | µg/g  | 0.4 |    | 160    |

## PACKAGE: REG153 - Corrosivity Index (SOIL)

**Sample Number** 5  
**Sample Name** LS-20, SS#4  
**Sample Matrix** Soil  
**Sample Date** 30/01/2018

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

| Parameter                | Units   | RL    | L1 | Result |
|--------------------------|---------|-------|----|--------|
| Corrosivity Index        | none    | 1     |    | 1      |
| Soil Redox Potential     | mV      | -     |    | 166    |
| Sulphide                 | %       | 0.02  |    | < 0.02 |
| pH                       | no unit | 0.05  |    | 8.02   |
| Resistivity (calculated) | ohms.cm | -9999 |    | 4100   |





FINAL REPORT

CA14016-FEB18 R1

Client: Thurber Engineering Ltd.  
Project: 15786 Hwy 404  
Project Manager: Rocío Reyna  
Samplers: N/A

PACKAGE: REG153 - General Chemistry (SOIL)

Sample Number 5  
Sample Name LS-20, SS#4  
Sample Matrix Soil  
Sample Date 30/01/2018

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

| Parameter         | Units | RL | L1 | Result |
|-------------------|-------|----|----|--------|
| General Chemistry |       |    |    |        |
| Conductivity      | uS/cm | 2  |    | 242    |

PACKAGE: REG153 - Metals and Inorganics (SOIL)

Sample Number 5  
Sample Name LS-20, SS#4  
Sample Matrix Soil  
Sample Date 30/01/2018

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

| Parameter             | Units | RL  | L1 | Result |
|-----------------------|-------|-----|----|--------|
| Metals and Inorganics |       |     |    |        |
| Sulphate              | µg/g  | 0.4 |    | 5.0    |

## EXCEEDANCE SUMMARY

---

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



FINAL REPORT

CA14016-FEB18 R1

QC SUMMARY

Anions by IC  
Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

| Parameter | QC batch Reference | Units | RL  | Method Blank | Duplicate |        | LCS/Spike Blank    |                     |      | Matrix Spike / Ref. |                     |      |
|-----------|--------------------|-------|-----|--------------|-----------|--------|--------------------|---------------------|------|---------------------|---------------------|------|
|           |                    |       |     |              | RPD       | AC (%) | Spike Recovery (%) | Recovery Limits (%) |      | Spike Recovery (%)  | Recovery Limits (%) |      |
|           |                    |       |     |              |           |        |                    | Low                 | High |                     | Low                 | High |
| Chloride  | DIO0064-FEB18      | µg/g  | 0.4 | <0.4         | 1         | 20     | 100                | 80                  | 120  | 107                 | 75                  | 125  |
| Sulphate  | DIO0064-FEB18      | µg/g  | 0.4 | <0.4         | 1         | 20     | 98                 | 80                  | 120  | 98                  | 75                  | 125  |

Carbon/Sulphur  
Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

| Parameter | QC batch Reference | Units | RL   | Method Blank | Duplicate |        | LCS/Spike Blank    |                     |      | Matrix Spike / Ref. |                     |      |
|-----------|--------------------|-------|------|--------------|-----------|--------|--------------------|---------------------|------|---------------------|---------------------|------|
|           |                    |       |      |              | RPD       | AC (%) | Spike Recovery (%) | Recovery Limits (%) |      | Spike Recovery (%)  | Recovery Limits (%) |      |
|           |                    |       |      |              |           |        |                    | Low                 | High |                     | Low                 | High |
| Sulphide  | ECS0007-FEB18      | %     | 0.02 | 0.020        | ND        | 20     | 110                | 80                  | 120  |                     |                     |      |

Conductivity  
Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

| Parameter    | QC batch Reference | Units | RL | Method Blank | Duplicate |        | LCS/Spike Blank    |                     |      | Matrix Spike / Ref. |                     |      |
|--------------|--------------------|-------|----|--------------|-----------|--------|--------------------|---------------------|------|---------------------|---------------------|------|
|              |                    |       |    |              | RPD       | AC (%) | Spike Recovery (%) | Recovery Limits (%) |      | Spike Recovery (%)  | Recovery Limits (%) |      |
|              |                    |       |    |              |           |        |                    | Low                 | High |                     | Low                 | High |
| Conductivity | EWL0022-FEB18      | uS/cm | 2  | 0.002        | 1         | 10     | 101                | 90                  | 110  | NA                  |                     |      |



QC SUMMARY

pH  
Method: SM 4500 | Internal ref.: ME-CA-|ENVIEWL-LAK-AN-001

| Parameter | QC batch<br>Reference | Units   | RL   | Method<br>Blank | Duplicate |           | LCS/Spike Blank          |                        |      | Matrix Spike / Ref.      |                        |      |
|-----------|-----------------------|---------|------|-----------------|-----------|-----------|--------------------------|------------------------|------|--------------------------|------------------------|------|
|           |                       |         |      |                 | RPD       | AC<br>(%) | Spike<br>Recovery<br>(%) | Recovery Limits<br>(%) |      | Spike<br>Recovery<br>(%) | Recovery Limits<br>(%) |      |
|           |                       |         |      |                 |           |           |                          | Low                    | High |                          | Low                    | High |
| pH        | EWL0022-FEB18         | no unit | 0.05 | NA              | 0         |           | 101                      |                        |      | NA                       |                        |      |

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

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

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

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

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

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

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

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

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

## LEGEND

### FOOTNOTES

**NSS** Insufficient sample for analysis.

**RL** Reporting Limit.

↑ Reporting limit raised.

↓ Reporting limit lowered.

**NA** The sample was not analysed for this analyte

**ND** Non Detect

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

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

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-- End of Analytical Report --





## SAMPLE INTEGRITY REPORT

Project Number: 15786 Hwy 404

ONTARIO REGULATION 153/04

SGS Sample ID CA 14016-Feb18

Date / Time Sampled Jan 30/18

Client Sample ID See CoC

ALL

### Sample Submission General Sample Integrity Violations

- |  |                          |
|--|--------------------------|
| Temperature >10 C upon receipt if not sampled same day     | <input type="checkbox"/> |
| No evidence of cooling trend initiated if sampled same day | <input type="checkbox"/> |
| Chain of Custody not submitted                             | <input type="checkbox"/> |
| Chain of Custody incomplete                                | <input type="checkbox"/> |
| Chain of Custody not signed / dated                        | <input type="checkbox"/> |
| Chain of Custody not a current version                     | <input type="checkbox"/> |
| Bottles / Samples listed on CoC but not received           | <input type="checkbox"/> |
| Bottles / Samples received but not listed on the CoC       | <input type="checkbox"/> |
| Sample container received empty                            | <input type="checkbox"/> |

### Sample Specific Sample Integrity Violations

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

### Sediment Log

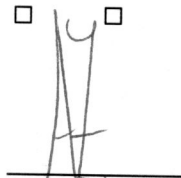
- |  |                          |                          |                          |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Groundwater samples contain visible sediment / particulate                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Groundwater contains greater than 1cm of sediment / particulate matter in bottle | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Additional Comments/Remarks:

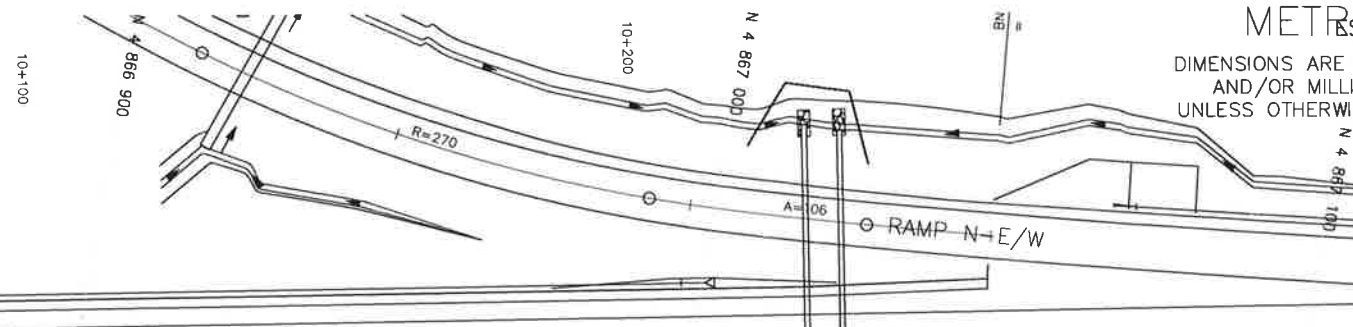
No issues upon receipt



Initials:







CONT No  
WP No 2930-02-00



SHEET








**THURBER** ENGINEERING LTD



## KEYPLAN

## LEGEND

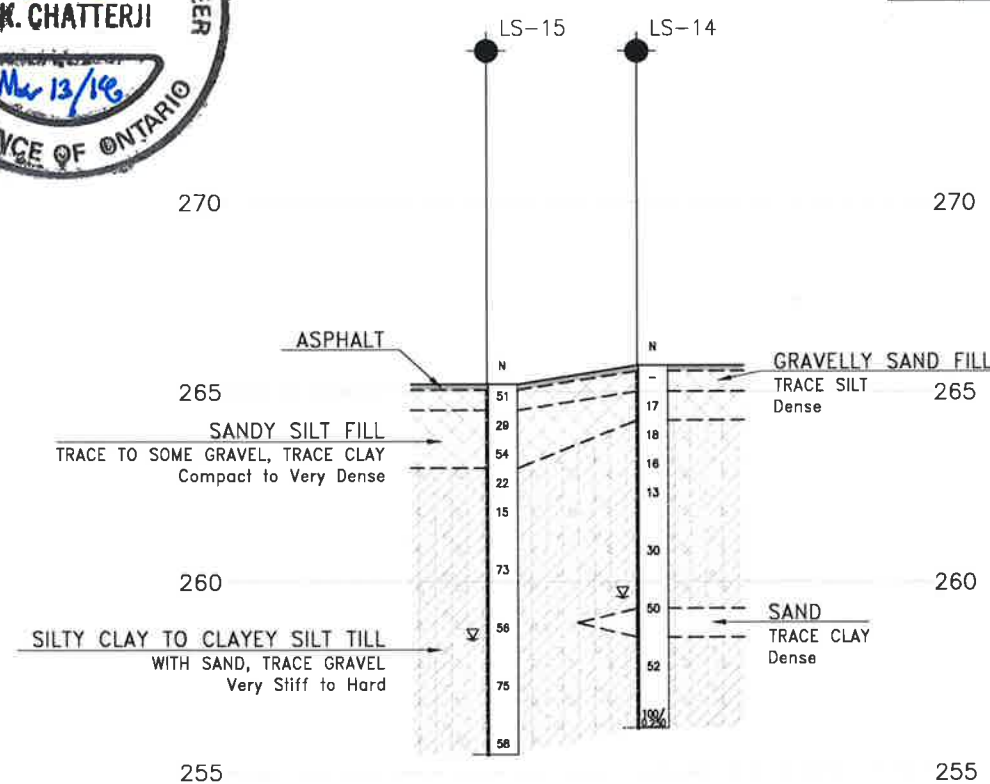
- |   |                                       |
|---|---------------------------------------|
|  | Borehole                              |
|  | Borehole and Cone                     |
| N   | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE  | Blows /0.3m (60° Cone, 475J/blow)     |
| PH  | Pressure, Hydraulic                   |
|  | Water Level                           |
|  | Head Artesian Water                   |
|  | Piezometer                            |
| 90%   | Rock Quality Designation (RQD)        |
| A/R   | Auger Refusal                         |

[illegible]

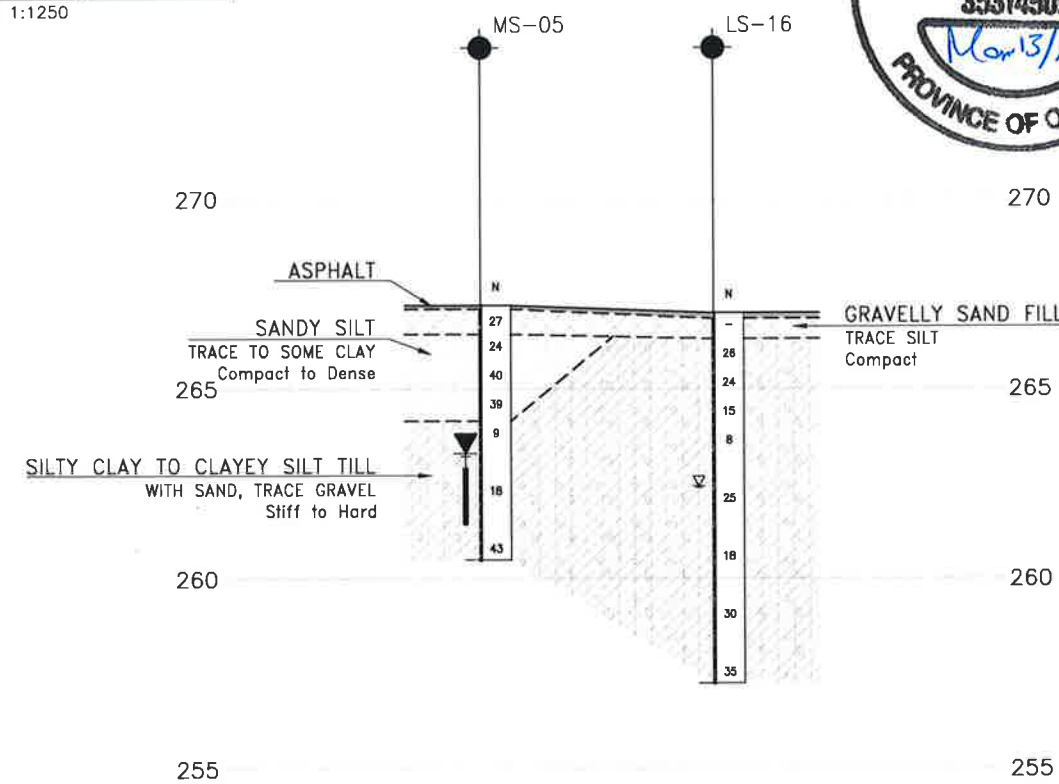
-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 30M14-472**



SECTION A-A'  
(SEWER LATERAL UPSTREAM ID 102)



SECTION B-B'  
(SEWER LATERAL UPSTREAM ID 108)

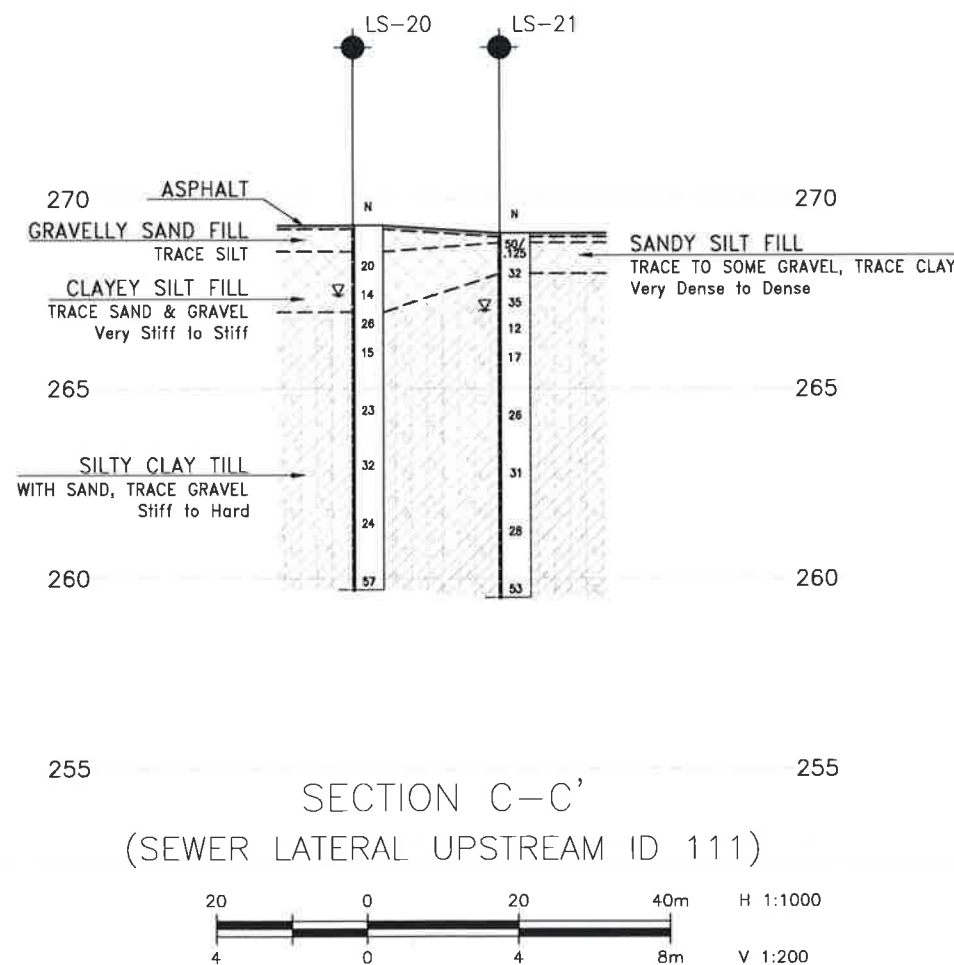
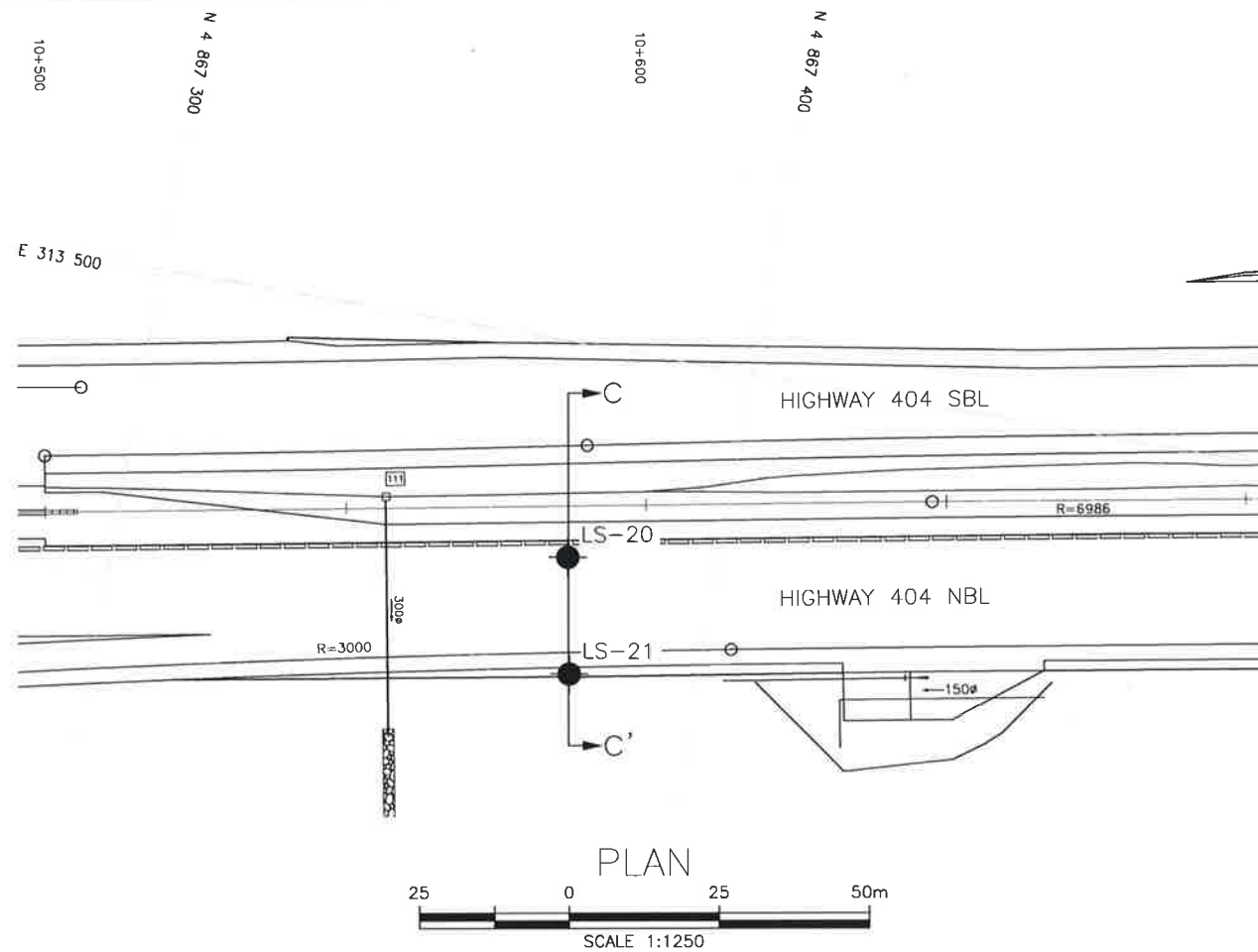


H 1:1000

V 1:200

| REV   | DATE |     | BY  |      | DESCRIPTION |      | DATE    |
|-------|------|-----|-----|------|-------------|------|---------|
|       | DATE | BY  | CHK | SKP  | CODE        | LOAD | MAR 201 |
| DRAWN | AN   | CHK | RPR | SITE | STRUCT      | DWG  | A1      |





METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

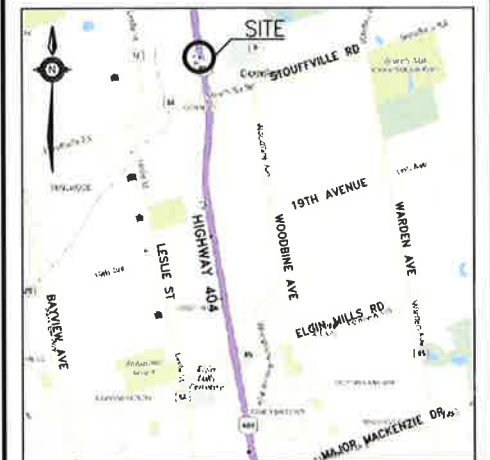
CONT No  
WP No 2930-02-00

HIGHWAY 404 WIDENING  
SEWER LATERALS  
NORTH OF STOUFFVILLE ROAD  
BOREHOLE LOCATIONS AND SOIL STRATA

wsp



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- Borehole
- ⊙ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- ▽ Water Level
- ⊕ Head Artesian Water
- ⊕ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| LS-20 | 265.7     | 4 867 375.1 | 313 535.4 |
| LS-21 | 265.7     | 4 867 378.7 | 313 554.5 |

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 30M14-472



| REVISIONS | DATE | BY      | DESCRIPTION   |
|-----------|------|---------|---------------|
| DESIGN    | RPR  | CHK SKP | CODE          |
| DRAWN     | AN   | CHK RPR | SITE          |
|           |      |         | LOAD          |
|           |      |         | STRUCT        |
|           |      |         | DWG A2        |
|           |      |         | DATE MAR 2018 |



## **Appendix B**

**Section 2 (Stations 24+700 to 22+922)  
From Stouffville Road to 19<sup>th</sup> Avenue  
Boreholes LS-09 to LS-13, LS-17, MS-16, MS-28, HOT-3 and MS-22**


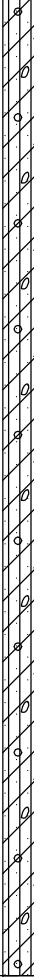

- Record of Borehole Sheets
- Laboratory Test Results
- Drawings titled "Borehole Locations and Soil Strata"

# RECORD OF BOREHOLE No LS-09

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 403.1 E 313 712.5 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.16 - 2017.10.16 CHECKED BY RPR

| SOIL PROFILE  |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS                                       | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |   |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |
|---------------|--|---|---------|------|------------|--|--------------------|---|--|--|--|---|---|--|---|---|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |  |                    | SHEAR STRENGTH kPa                          |  |  |  | WATER CONTENT (%)   |   |  |   |   |  |  |
|               |  |   |         |      |            |  |                    | 20    40    60    80    100                 |  |  |  | W <sub>P</sub> W                      W <sub>L</sub>          |   |  |   |   |  |  |
|               |  |   |         |      |            | ○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    x LAB VANE |                    |   |  |  |  |   |   |  |   |   |  |  |
| 242.4         | GROUND SURFACE   |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
| 0.0           | Gravelly <b>SAND</b><br>Dense<br>Brown<br>Moist<br>(FILL)                                      |    | 1       | SS   | 31         |  | 242                |   |  |  |  |   | ○ |  |   |   |  |  |
| 241.7         |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
| 0.7           | Clayey <b>SILT</b> , with sand, trace gravel<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL) |   | 2       | SS   | 27         |  | 241                |   |  |  |  |   | ○ |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   | 3       | SS   | 37         |  | 240                |   |  |  |  |   | ○ |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   | 4       | SS   | 54         |  | 240                |   |  |  |  |   | ⊕ |  |   | 6    36    38    20                               |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               | Moist to Wet   |   | 5       | SS   | 66         |  | 239                |   |  |  |  |   | ○ |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   |         |      |            |  | 238                |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   | 6       | SS   | 52         |  | 238                |   |  |  |  |   | ○ |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   |         |      |            |  | 237                |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   | 7       | SS   | 46         |  | 236                |   |  |  |  |   | ○ |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
| 235.2         |  |   |         |      |            |  | 235                |   |  |  |  |   |   |  |   |   |  |  |
| 7.2           | <b>SAND</b> , some silt, trace clay<br>Very Dense to Compact<br>Grey<br>Wet                    |  | 8       | SS   | 54         |  | 235                |   |  |  |  |   | ○ |  |   | 0    84    13    3                                |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   |         |      |            |  | 234                |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
|               |  |   | 9       | SS   | 15         |  | 233                |   |  |  |  |   | ○ |  |   |   |  |  |
| 232.6         |  |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |
| 9.8           | END OF BOREHOLE AT 9.8m.   |   |         |      |            |  |                    |   |  |  |  |   |   |  |   |   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

[illegible]

# RECORD OF BOREHOLE No LS-10

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 865 686.5 E 313 649.8 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.19 - 2017.10.19 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    | PLASTIC<br>LIMIT<br>w <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |            |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|------------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |    |    |    |                                    |                                     |                                   |  |  |            |
| 254.7         | GROUND SURFACE  |            |         |      |            |                            |                 | 20   | 40 | 60 | 80 | 100                                |                                     |                                   |  |  |            |
| 0.0           | ASPHALT (150mm)   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
| 0.2           | SAND, some gravel, trace silt, trace clay<br>Brown<br>Moist<br>(FILL) |            | 1       | GS   | -          |                            |                 |  |    |    |    |                                    | ○                                   |                                   |  |  |            |
| 254.0         |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
| 0.7           | Clayey SILT, with sand<br>Hard<br>Grey<br>Moist<br>(TILL)             |            | 2       | SS   | 45         |                            |                 |  |    |    |    |                                    | ○                                   |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            | 3       | SS   | 50         |                            |                 |  |    |    |    |                                    | ○                                   |                                   |  |  | 4 48 30 18 |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            | 4       | SS   | 52         |                            |                 |  |    |    |    |                                    | ○                                   |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
| 251.7         |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
| 3.0           | Very Stiff  |            | 5       | SS   | 22         |                            |                 |  |    |    |    |                                    | ○                                   |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
| 250.6         |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
| 4.1           |   |            | 6       | SS   | 30         |                            |                 |  |    |    |    |                                    | ○                                   |                                   |  |  | 4 49 34 13 |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |
|               |   |            |         |      |            |                            |                 |  |    |    |    |                                    |                                     |                                   |  |  |            |

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

## METRIC

[illegible]

# RECORD OF BOREHOLE No LS-11

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 865 688.9 E 313 631.8 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.18 - 2017.10.18 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    | PLASTIC<br>LIMIT<br>w <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |
|---------------|--|------------|---------|------|---------------|----------------------------|-----------------|---|----|----|----|------------------------------------|-------------------------------------|-----------------------------------|-------------------------|---|-------------------|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |                                    |                                     |                                   |                         |   | WATER CONTENT (%) |
| 254.5         | GROUND SURFACE   |            |         |      |               |                            |                 | 20  | 40 | 60 | 80 | 100                                |                                     |                                   |                         |   |                   |
| 0.0           | ASPHALT (150mm)  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 0.2           | SAND, some gravel, trace silt, trace clay  |            | 1       | SS   | 29            |                            | 254             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 253.8         | Compact Brown Moist (FILL)   |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 0.7           | Clayey SILT, with sand, trace gravel   |            | 2       | SS   | 85            |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               | Hard Grey Moist (TILL)   |            |         |      |               |                            | 253             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            | 3       | SS   | 48            |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            | 4       | SS   | 35            |                            | 252             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            | 5       | SS   | 41            |                            | 251             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 250.4         |  |            |         |      |               |                            | 250             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 4.1           | Very Stiff   |            | 6       | SS   | 19            |                            | 249             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 248.5         | Silty CLAY, with sand, trace clay  |            | 7       | SS   | 30            |                            | 248             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 6.0           | Hard Grey Moist (TILL)   |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            | 8       | SS   | 100/<br>0.225 |                            | 247             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
|               |  |            |         |      |               |                            | 246             |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 245.2         |  |            | 9       | SS   | 100/<br>0.150 |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |
| 9.3           | END OF BOREHOLE AT 9.3m.<br>BOREHOLE OPEN AND DRY.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND |            |         |      |               |                            |                 |   |    |    |    |                                    |                                     |                                   |                         |   |                   |

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

## METRIC

[illegible]



# RECORD OF BOREHOLE No LS-12

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 580.0 E 313 691.0 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.19 - 2017.10.19 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|---|---|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |   |  |
| 264.3         | GROUND SURFACE  |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
| 0.0           | ASPHALT (150mm)   |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
| 0.2           | Gravelly SAND<br>Brown<br>Moist<br>(FILL)   |            | 1       | GS   | -          |                            | 264             |   |  |  |  |   |   |  |
| 263.6         |   |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
| 0.7           | Silty SAND, some clay, trace gravel<br>Very Dense<br>Grey<br>Moist<br>(TILL)                              |            | 1       | SS   | 53         |                            | 263             |   |  |  |  |   |   |  |
|               |   |            | 2       | SS   | 67         |                            | 262             |   |  |  |  |   |   |  |
|               |   |            | 3       | SS   | 52         |                            | 261             |   |  |  |  |   |   |  |
| 261.3         |   |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
| 3.0           | Silty CLAY, with sand, trace gravel<br>Very Stiff to Hard<br>Brown to Grey<br>Moist<br>(TILL)             |            | 4       | SS   | 25         |                            | 260             |   |  |  |  |   |   |  |
|               |   |            | 5       | SS   | 35         |                            | 259             |   |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
|               | Grey  |            | 6       | SS   | 38         |                            | 258             |   |  |  |  |   |   |  |
| 257.0         |   |            |         |      |            |                            | 257             |   |  |  |  |   |   |  |
| 7.3           | SAND, trace silt, trace gravel<br>Very Dense<br>Grey<br>Wet   |            | 7       | SS   | 57         |                            | 256             |   |  |  |  |   |   |  |
| 256.2         |   |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
| 8.1           | Wet   |            |         |      |            |                            |                 |   |  |  |  |   |   |  |
| 255.0         |   |            | 8       | SS   | 100/       |                            | 255             |   |  |  |  |   |   |  |
| 9.3           | END OF BOREHOLE AT 9.4m.<br>BOREHOLE OPEN to 8.7m AND<br>WATER LEVEL AT 5.5m.<br>BOREHOLE BACKFILLED WITH |            |         |      | 0.200      |                            |                 |   |  |  |  |   |   |  |

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-12

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 580.0 E 313 691.0 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.19 - 2017.10.19 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page                         |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

# RECORD OF BOREHOLE No LS-13

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 581.3 E 313 674.0 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.18 - 2017.10.18 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|---------------|----------------------------|-----------------|---|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |   |
| 263.9         | GROUND SURFACE  |            |         |      |               |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 0.0           | ASPHALT (150mm)   |            |         |      |               |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 0.2           | Gravelly SAND<br>Dense<br>Brown<br>Moist<br>(FILL)                                    |            | 1       | SS   | 43            |                            |                 |   |  |  |  |   |   |
| 263.2         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 0.7           | Silty SAND, trace gravel, some clay<br>Dense<br>Brown<br>Moist                        |            | 2       | SS   | 48            |                            | 263             |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               |   |            | 3       | SS   | 34            |                            | 262             |   |  |  |  |   | 6 55 26 13  |
| 261.7         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 2.2           | Silty CLAY, some sand, trace gravel<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL) |            | 4       | SS   | 16            |                            | 261             |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               |   |            | 5       | SS   | 18            |                            | 260             |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               |   |            | 6       | SS   | 23            |                            | 259             |   |  |  |  |   | 0 20 60 20  |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               |   |            | 7       | SS   | 37            |                            | 258             |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               |   |            |         |      |               |                            | 257             |   |  |  |  |   |   |
| 256.7         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 7.2           | Silty SAND, some gravel, some clay<br>Very Dense<br>Grey<br>Wet<br>(TILL)             |            | 8       | SS   | 65            |                            | 256             |   |  |  |  |   | 13 44 29 14                                       |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               |   |            |         |      |               |                            | 255             |   |  |  |  |   |   |
|               |   |            | 9       | SS   | 100/<br>0.200 |                            |                 |   |  |  |  |   |   |
| 254.4         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 9.5           | END OF BOREHOLE AT 9.5m.<br>BOREHOLE OPEN to 9.2m AND<br>WATER LEVEL AT 5.2m.         |            |         |      |               |                            |                 |   |  |  |  |   |   |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No LS-13

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 581.3 E 313 674.0 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.18 - 2017.10.18 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page   |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

# RECORD OF BOREHOLE No LS-17

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 865 702.4 E 313 602.0 ORIGINATED BY TM  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.11.17 - 2017.11.17 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |   |          |
|---------------|---|------------|---------|------|---------------|----------------------------|-----------------|---|----|----|----|-----|---|---|--|--|---|----------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |     |   |   |  |  |   |          |
| 254.8         | GROUND SURFACE  |            |         |      |               |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |  |  |   |          |
| 0.0           | ASPHALT (150mm)   |            |         |      |               |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |  |  |   |          |
| 0.1           | Gravelly <b>SAND</b> , trace silt<br>Brown<br>Moist<br>(FILL)   |            | 1       | GS   |               |                            |                 |   |    |    |    |     |   |   |  |  |   |          |
| 254.0         |   |            |         |      |               |                            |                 |   |    |    |    |     |   |   |  |  |   |          |
| 0.8           | Clayey <b>SILT</b> , with sand, trace gravel<br>Hard<br>Brown<br>Moist<br>(FILL)  |            | 1       | SS   | 43            |                            | 254             |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            | 2       | SS   | 50            |                            | 253             |   |    |    |    |     |   |   |  |  | 5 | 42 31 22 |
| 252.6         |   |            |         |      |               |                            |                 |   |    |    |    |     |   |   |  |  |   |          |
| 2.2           | Clayey <b>SILT</b> , with sand, trace gravel,<br>occasional organics<br>Very Stiff to Hard<br>Dark Brown<br>Moist<br>(TILL)         |            | 3       | SS   | 24            |                            | 252             |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            | 4       | SS   | 37            |                            | 251             |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            |         |      |               |                            |                 |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            | 5       | SS   | 22            |                            | 250             |   |    |    |    |     |   |   |  |  | 3 | 48 34 15 |
|               | Grey<br>Wet   |            |         |      |               |                            | 249             |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            | 6       | SS   | 62/<br>0.125  |                            | 248             |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            |         |      |               |                            |                 |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            | 7       | SS   | 40/<br>0.100  |                            | 247             |   |    |    |    |     |   |   |  |  |   |          |
|               |   |            |         |      |               |                            | 246             |   |    |    |    |     |   |   |  |  |   |          |
| 245.5         |   |            | 8       | SS   | 100/<br>0.125 |                            |                 |   |    |    |    |     |   |   |  |  |   |          |
| 9.3           | END OF BOREHOLE AT 9.8m.<br>BOREHOLE OPEN TO 6.7m AND<br>WATER LEVEL AT 5.2m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND |            |         |      |               |                            |                 |   |    |    |    |     |   |   |  |  |   |          |

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

[illegible]

# RECORD OF BOREHOLE No MS-16

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION SB N 4 865 713.1 E 313 618.2 ORIGINATED BY TM  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.07.18 - 2017.07.18 CHECKED BY PP

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |   |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |    |    |    |               |    |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|----|---|---|--|---|---|----|----|----|---------------|----|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL      x LAB VANE |    |    |    | WATER CONTENT (%)<br>w <sub>P</sub> w      w <sub>L</sub>     |   |  |   | GR  | SA | SI | CL |               |    |
| 255.2         | GROUND SURFACE  |            |         |      |            |                            |                 | 20   | 40 | 60 | 80 | 100   |   |  |   |   |    |    |    |               |    |
| 0.0           | ASPHALT: (100mm)  |            |         |      |            |                            |                 |  |    |    |    |   |   |  |   |   |    |    |    |               |    |
| 0.1           | SAND, some silt, trace gravel<br>Brown<br>Moist<br>(FILL)   |            | 1       | GS   |            |                            | 255             |  |    |    |    |   | ○ |  |   |   |    | 13 | 65 | 22<br>(SI+CL) |    |
| 254.4         |   |            |         |      |            |                            |                 |  |    |    |    |   |   |  |   |   |    |    |    |               |    |
| 0.8           | Clayey SILT, with sand, trace gravel<br>Hard to Very Stiff<br>Brown<br>Moist<br>(TILL)  |            | 1       | SS   | 36         |                            | 254             |  |    |    |    |   | ○ |  |   |   |    |    |    |               |    |
|               |   |            | 2       | SS   | 67         |                            |                 |  |    |    |    |   | ○ |  |   |   |    |    |    |               |    |
|               |   |            | 3       | SS   | 32         |                            | 253             |  |    |    |    |   | ○ |  |   |   |    |    |    |               |    |
|               |   |            | 4       | SS   | 30         |                            | 252             |  |    |    |    |   | ○ |  |   |   |    |    |    |               |    |
|               |   |            |         |      |            |                            | 251             |  |    |    |    |   |   |  |   |   |    |    |    |               |    |
|               |   |            | 5       | SS   | 15         |                            | 250             |  |    |    |    |   | ○ |  |   |   |    | 4  | 45 | 33            | 18 |
|               |   |            |         |      |            |                            |                 |  |    |    |    |   |   |  |   |   |    |    |    |               |    |
|               |   |            | 6       | SS   | 45         |                            | 249             |  |    |    |    |   | ○ |  |   |   |    |    |    |               |    |
| 248.5         |   |            |         |      |            |                            |                 |  |    |    |    |   |   |  |   |   |    |    |    |               |    |
| 6.7           | END OF BOREHOLE AT 6.7m.<br>Piezometer installation consists of<br>25mm diameter Schedule 40 PVC pipe<br>with a 1.52m slotted screen.<br><br>WATER LEVEL READINGS<br>DATE      DEPTH(m)      ELEV.(m)<br>2017.09.24      3.0      252.2<br>2017.10.23      2.8      252.4 |            |         |      |            |                            |                 |  |    |    |    |   |   |  |   |   |    |    |    |               |    |


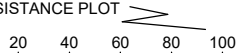





ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No MS-22

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 983.8 E 313 623.0 ORIGINATED BY TM  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.07.18 - 2017.07.18 CHECKED BY PP

| SOIL PROFILE  |   |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE  | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |     |   | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |             |
|---------------|---|---|---------|------|------------|---|--|---|----|----|-----|---|---|---|--|--|-------------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |   |  | SHEAR STRENGTH kPa                          |    |    |     |   |   |   |  |  |             |
| 247.5         | GROUND SURFACE  |   |         |      |            |  |  |   |    |    |     |  |   |   |  |  | GR SA SI CL |
| 0.0           | ASPHALT: (100mm)  |   |         |      |            |   | ○ UNCONFINED + FIELD VANE  |   |    |    |     | w <sub>p</sub> w w <sub>L</sub>   |   |   |  |  |             |
| 0.1           | SAND, trace to some silt, trace gravel<br>Brown<br>Moist<br>(FILL)  |    | 1       | GS   |            |   | ● QUICK TRIAXIAL × LAB VANE  |   |    |    |     | WATER CONTENT (%)   |   |   |  |  |             |
| 246.7         |   |   |         |      |            |   | 20   | 40  | 60 | 80 | 100 | 20  | 40  | 60  |  |  |             |
| 0.8           | Silty CLAY, with sand, trace gravel<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL)   |    | 1       | SS   | 17         |   |  |   |    |    |     |   | ○   |   |  |  |             |
|               |   |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |
|               |   |   | 2       | SS   | 49         |   |  |   |    |    |     |   | ○   |   |  |  |             |
|               |   |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |
|               |   |   | 3       | SS   | 27         |   |  |   |    |    |     |   | ○   |   |  |  |             |
| 244.5         |   |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |
| 3.0           | Sandy SILT, trace clay<br>Dense<br>Brown<br>Wet<br>(TILL)   |    | 4       | SS   | 40         |   |  |   |    |    |     | ○   |   |   |  |  |             |
|               |   |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |
|               |   |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |
|               |   |   | 5       | SS   | 47         |   |  |   |    |    |     | ○   |   |   |  |  |             |
|               |   |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |
| 241.9         |   |   |         |      |            |   | 242  |   |    |    |     |   |   |   |  |  |             |
| 5.6           | Clayey SILT, some sand, trace gravel<br>Hard<br>Grey<br>Wet<br>(TILL)   |  | 6       | SS   | 57         |   |  |   |    |    |     | ○   |   |   |  |  |             |
| 240.8         |   |   |         |      |            |   | 241  |   |    |    |     |   |   |   |  |  |             |
| 6.7           | END OF BOREHOLE AT 6.7m.<br>BOREHOLE CAVED TO 2.7m AND<br>WATER LEVEL AT 1.8m DEPTH<br>UPON COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG TO 0.5m,<br>DRY MIX CONCRETE TO 0.2m,<br>THEN COLD PATCH ASPHALT TO<br>SURFACE. |   |         |      |            |   |  |   |    |    |     |   |   |   |  |  |             |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 3/20/18



# RECORD OF BOREHOLE No MS-28

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 404.8 E 313 729.5 ORIGINATED BY TM  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.06.07 - 2017.06.07 CHECKED BY PP

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT   |  |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|---|---|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa  |  |  |  |  |   |   |  |
| 242.4         | GROUND SURFACE  |            |         |      |            |                            |                 | <div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div>  |  |  |  |  |   |   |  |
| 0.0           | ASPHALT: (100mm)  |            |         |      |            |                            |                 | <div>20406080100</div> <div>W<sub>P</sub> W W<sub>L</sub></div> <div>PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT</div> <div>WATER CONTENT (%)</div> |  |  |  |  |   |   |  |
| 0.1           | Gravelly <b>SAND</b> , trace silt<br>Dense<br>Brown<br>Moist<br>(FILL)  |            | 1       | SS   | 32         |                            | 242             |   |  |  |  |  |   |   |  |
| 241.6         |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
| 0.8           | Silty <b>CLAY</b> , with sand, trace gravel<br>Very Stiff to Hard<br>Brown to Grey<br>Moist<br>(TILL)   |            | 2       | SS   | 28         |                            | 241             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            | 3       | SS   | 18         |                            | 240             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            | 4       | SS   | 53         |                            | 239             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            | 5       | SS   | 20         |                            | 238             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            | 6       | SS   | 72         |                            | 237             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               | Trace sand  |            | 7       | SS   | 39         |                            | 236             |   |  |  |  |  |   |   |  |
| 235.7         |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
| 6.7           | END OF BOREHOLE AT 6.7m.<br>BOREHOLE CAVED TO 5.8m AND<br>WATER LEVEL AT 4.9m DEPTH<br>UPON COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND DRY<br>MIX CONCRETE, THEN COLD<br>PATCH ASPHALT TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

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10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No HOT-3

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 864 936.6 E 313 633.1 ORIGINATED BY ES  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.11.20 - 2017.11.20 CHECKED BY RD

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |   |
| 247.0         | GROUND SURFACE  |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 0.0           | ASPHALT (150mm)   |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 0.2           | SAND, trace gravel<br>Brown<br>Moist<br>(FILL)  |            |         | GS   |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 246.2         |   |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 0.8           | ClayeySILT, some sand<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL)   |            | 1       | SS   | 26         |                            | 246             | 20 40 60 80 100                             |  |  |  |   |   |
|               |   |            | 2       | SS   | 38         |                            | 245             | 20 40 60 80 100                             |  |  |  |   |   |
|               |   |            | 3       | SS   | 31         |                            | 244             | 20 40 60 80 100                             |  |  |  |   | 0 10 63 27  |
| 243.8         |   |            | 4       | SS   | 40         |                            | 243             | 20 40 60 80 100                             |  |  |  |   |   |
| 3.2           | SILT, some sand, some clay<br>Dense<br>Brown<br>Wet   |            |         |      |            |                            | 242             | 20 40 60 80 100                             |  |  |  |   | 0 20 68 12  |
|               |   |            | 5       | SS   | 36         |                            | 241             | 20 40 60 80 100                             |  |  |  |   | 0 77 20 3   |
| 241.2         |   |            | 6       | SS   | 22         |                            | 240             | 20 40 60 80 100                             |  |  |  |   |   |
| 5.8           | SAND, some silt, trace clay<br>Compact<br>Brown<br>Wet  |            |         |      |            |                            | 239             | 20 40 60 80 100                             |  |  |  |   |   |
| 239.3         |   |            | 7       | SS   | 75         |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 7.7           | ClayeySILT, with sand<br>Hard<br>Grey<br>Wet<br>(TILL)  |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 238.9         |   |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 8.1           | END OF BOREHOLE AT 8.1m.<br>BOREHOLE CAVED TO 5.2m AND<br>WATER LEVEL AT 3.4m UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG, AUGER<br>CUTTINGS, AND DRY MIX<br>CONCRETE, THEN COLD PATCH<br>ASPHALT TO SURFACE. |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |

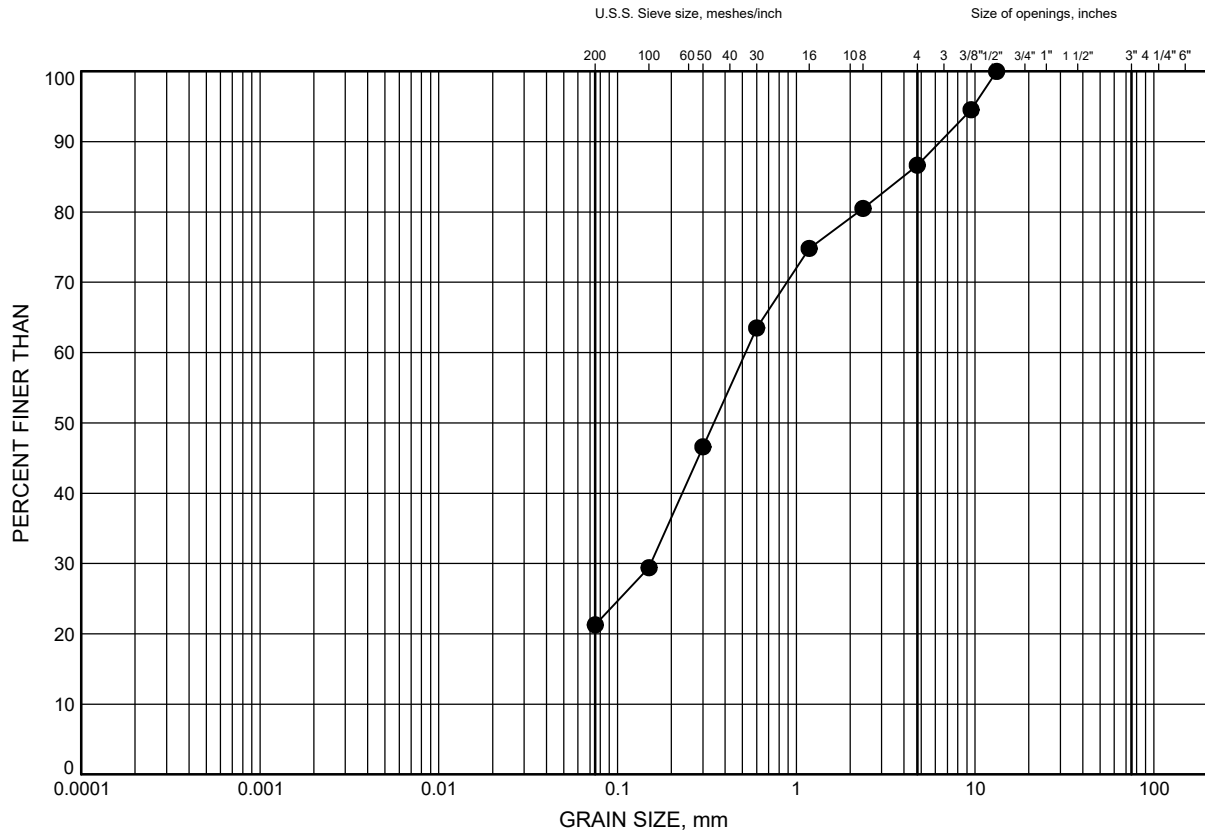
ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 3/20/18

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity 20  
15 10 5 10 (%) STRAIN AT FAILURE

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B1

## SAND FILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | MS-16    | 0.3       | 254.9     |

Date March 2018  
W.P. 2930-02-00

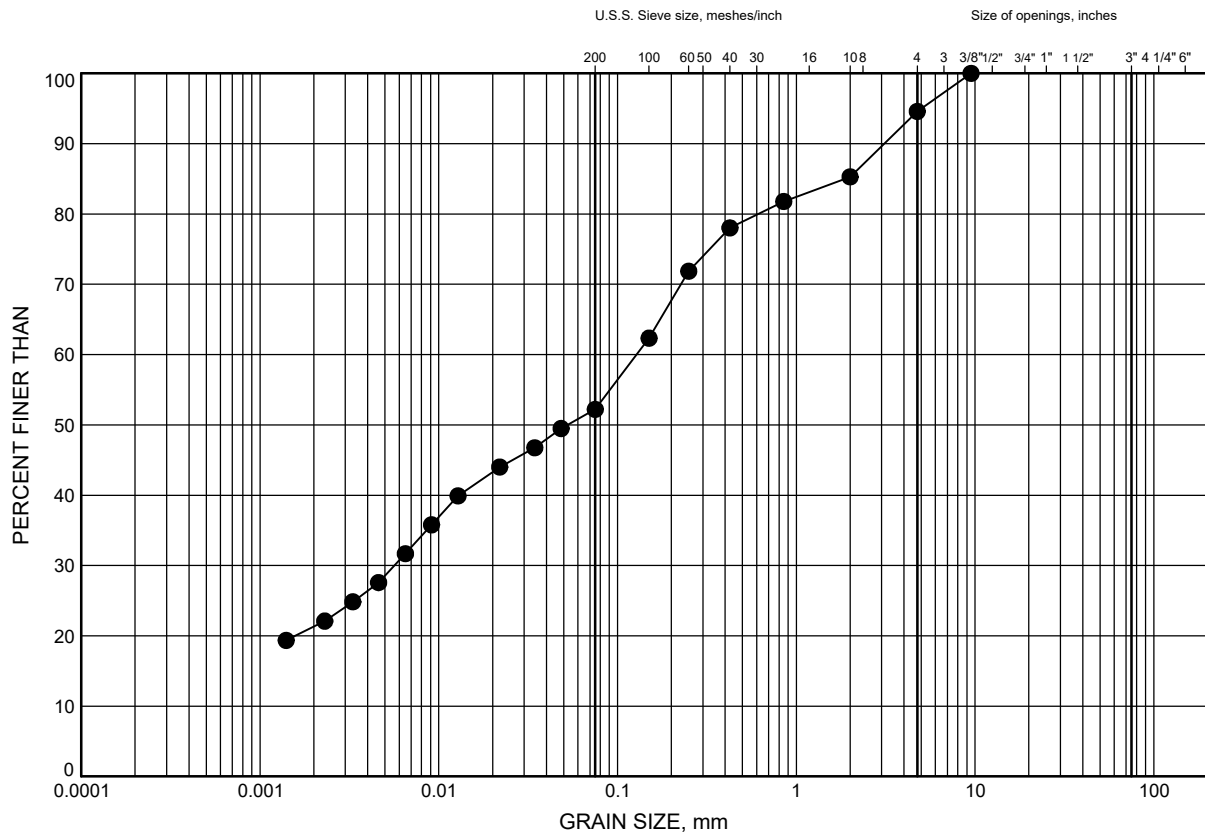


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B2

### Clayey SILT FILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-17    | 1.8       | 253.0     |

Date March 2018  
W.P. 2930-02-00

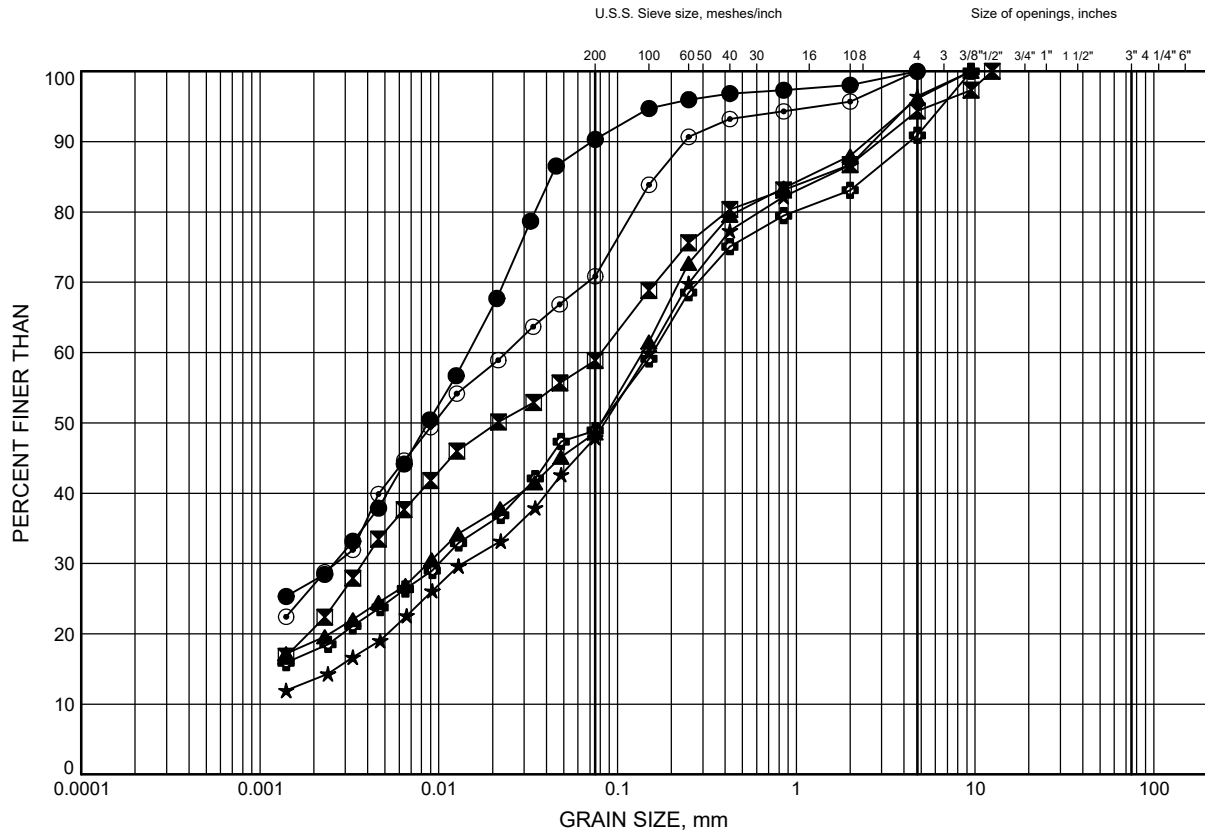


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Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B3

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | HOT-3    | 2.5       | 244.5     |
| ⊠      | LS-09    | 2.6       | 239.8     |
| ▲      | LS-10    | 1.8       | 252.9     |
| ★      | LS-10    | 4.9       | 249.8     |
| ⊙      | LS-10    | 7.9       | 246.8     |
| ⊕      | LS-11    | 2.6       | 251.9     |

Date March 2018  
W.P. 2930-02-00

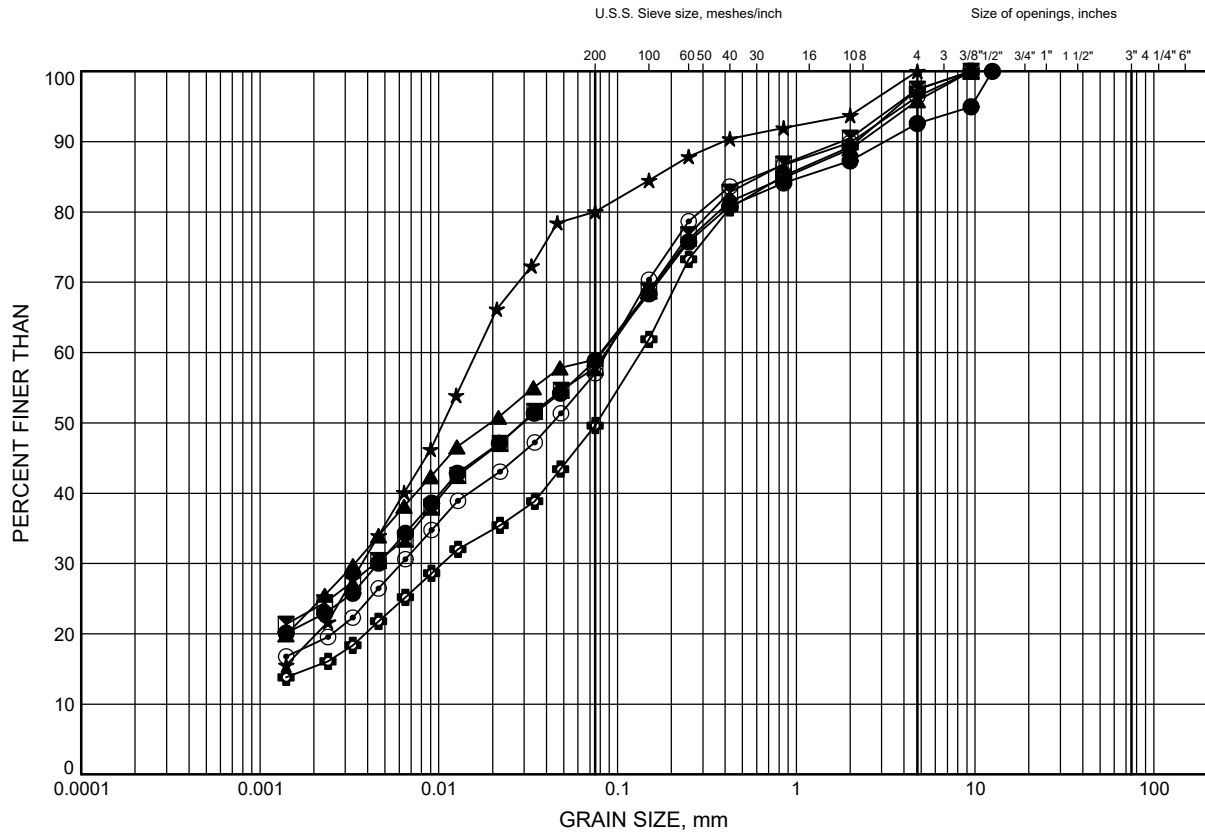


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B4

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-11    | 6.4       | 248.1     |
| ⊠      | LS-12    | 3.4       | 260.9     |
| ▲      | LS-12    | 6.4       | 257.9     |
| ★      | LS-13    | 4.9       | 259.0     |
| ⊙      | LS-16    | 4.9       | 262.1     |
| ⊕      | LS-17    | 4.9       | 249.9     |

Date March 2018  
W.P. 2930-02-00

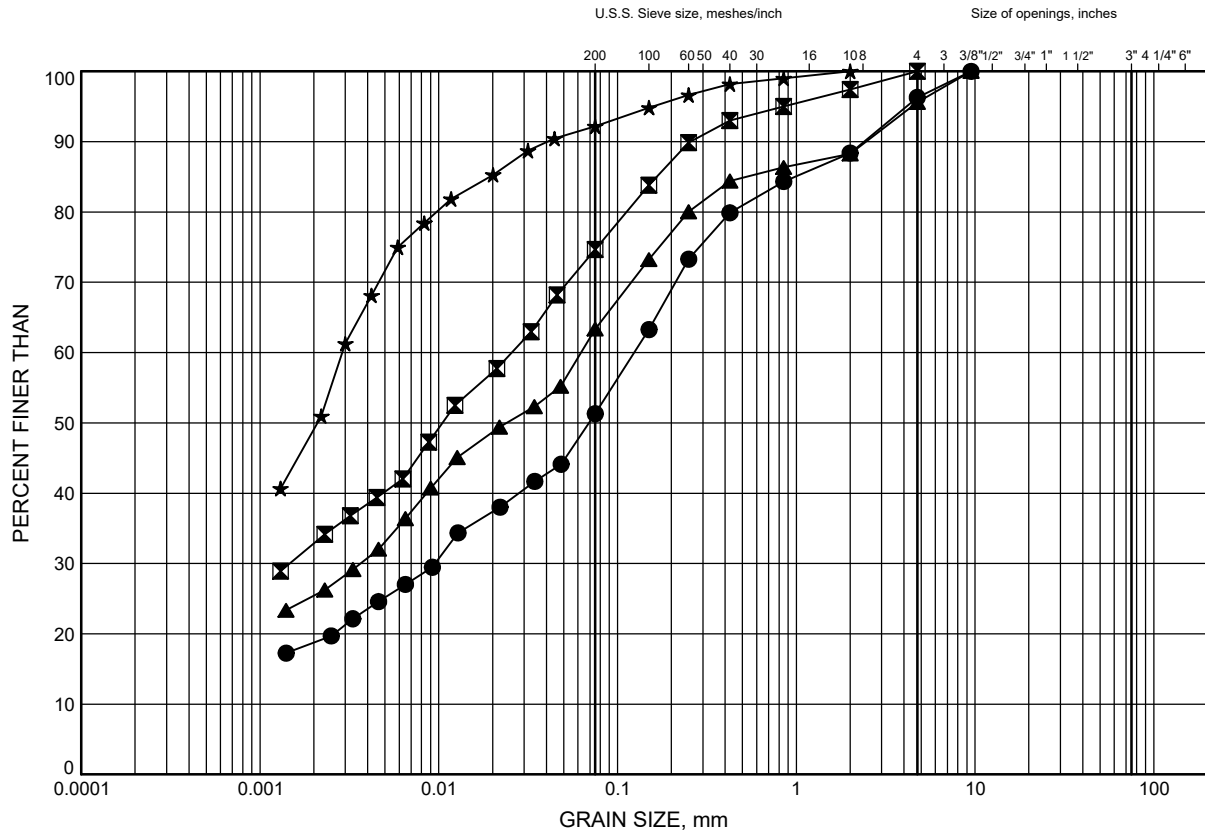


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B5

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | MS-16    | 4.9       | 250.3     |
| ⊠      | MS-22    | 2.6       | 244.9     |
| ▲      | MS-28    | 2.6       | 239.8     |
| ★      | MS-28    | 6.4       | 236.0     |

Date March 2018  
W.P. 2930-02-00



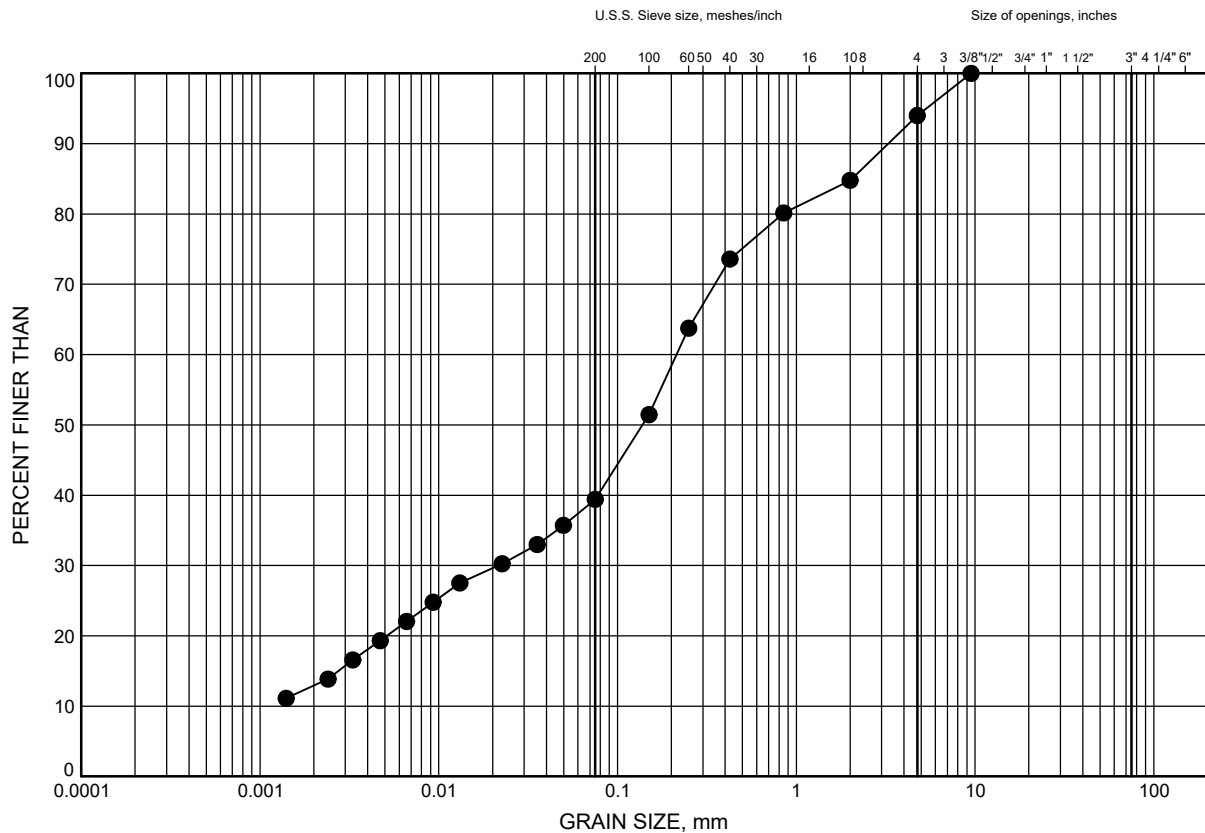
Prep'd AN  
Chkd. RPR

# HWY 404 Widening

## GRAIN SIZE DISTRIBUTION

FIGURE B6

Silty SAND



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-13    | 1.8       | 262.1     |

Date March 2018  
W.P. 2930-02-00



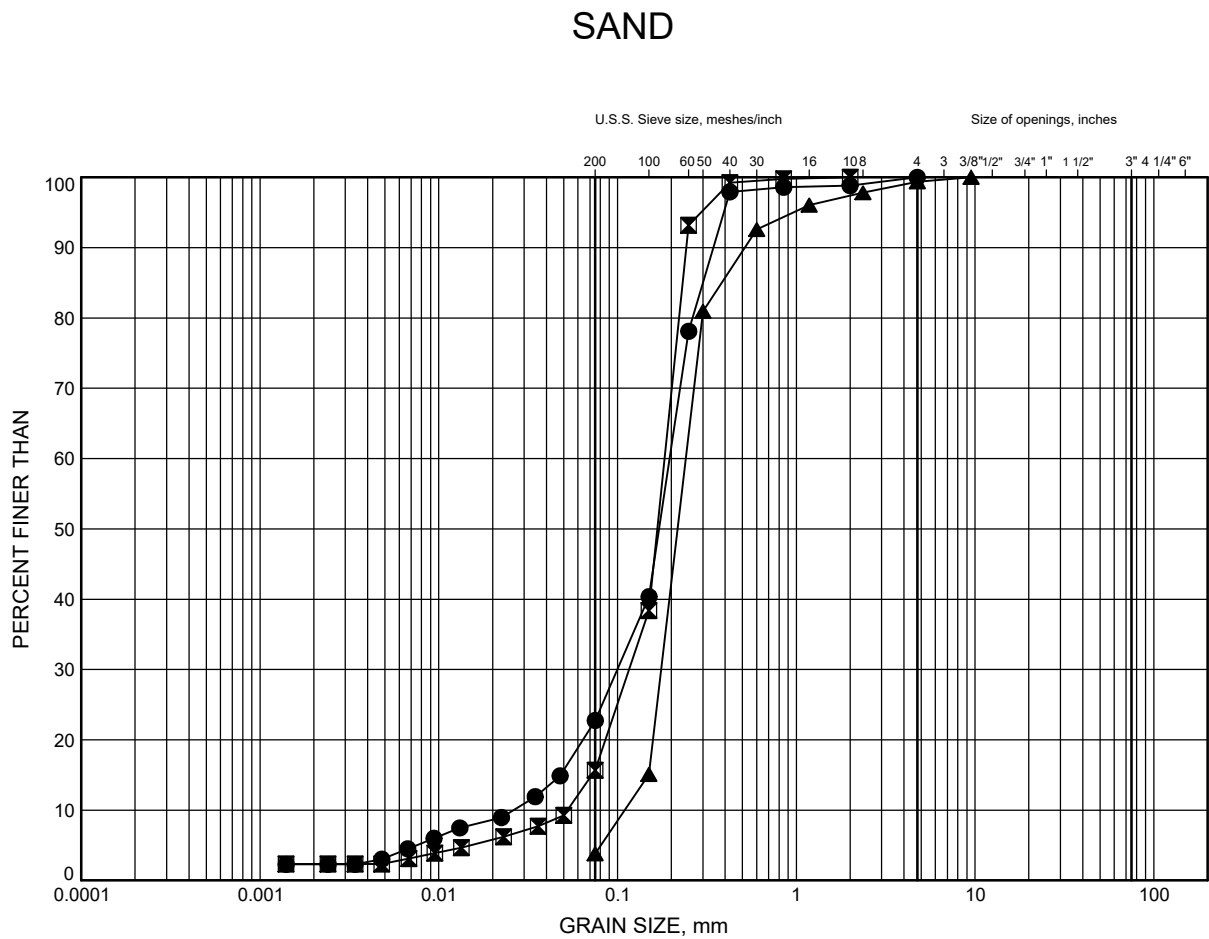
Prep'd AN  
Chkd. RPR



# HWY 404 Widening

## GRAIN SIZE DISTRIBUTION

FIGURE B7



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | HOT-3    | 6.3       | 240.7     |
| ⊠      | LS-09    | 7.9       | 234.5     |
| ▲      | LS-12    | 7.8       | 256.5     |

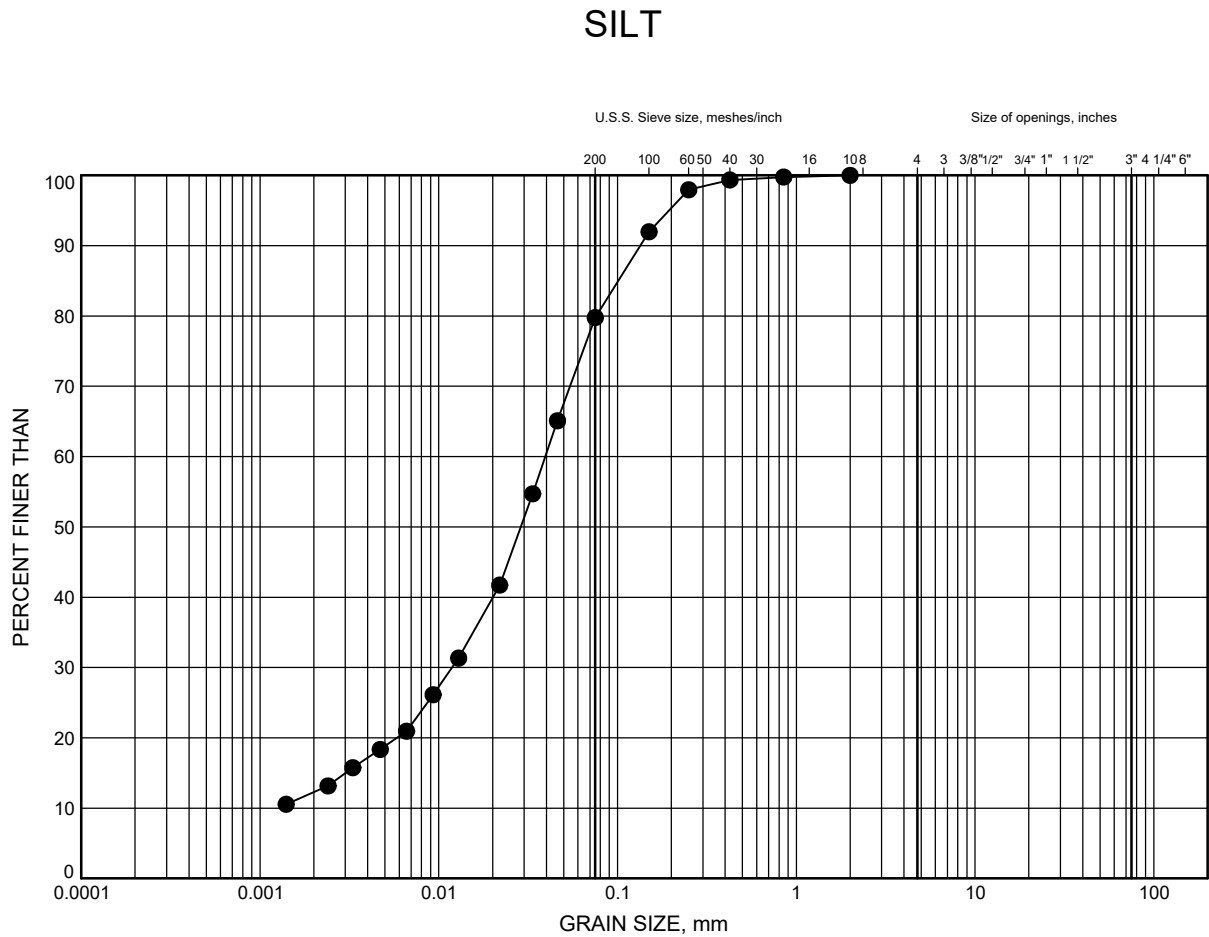
Date March 2018  
W.P. 2930-02-00



Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B8



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

## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | HOT-3    | 4.8       | 242.2     |

Date March 2018  
W.P. 2930-02-00

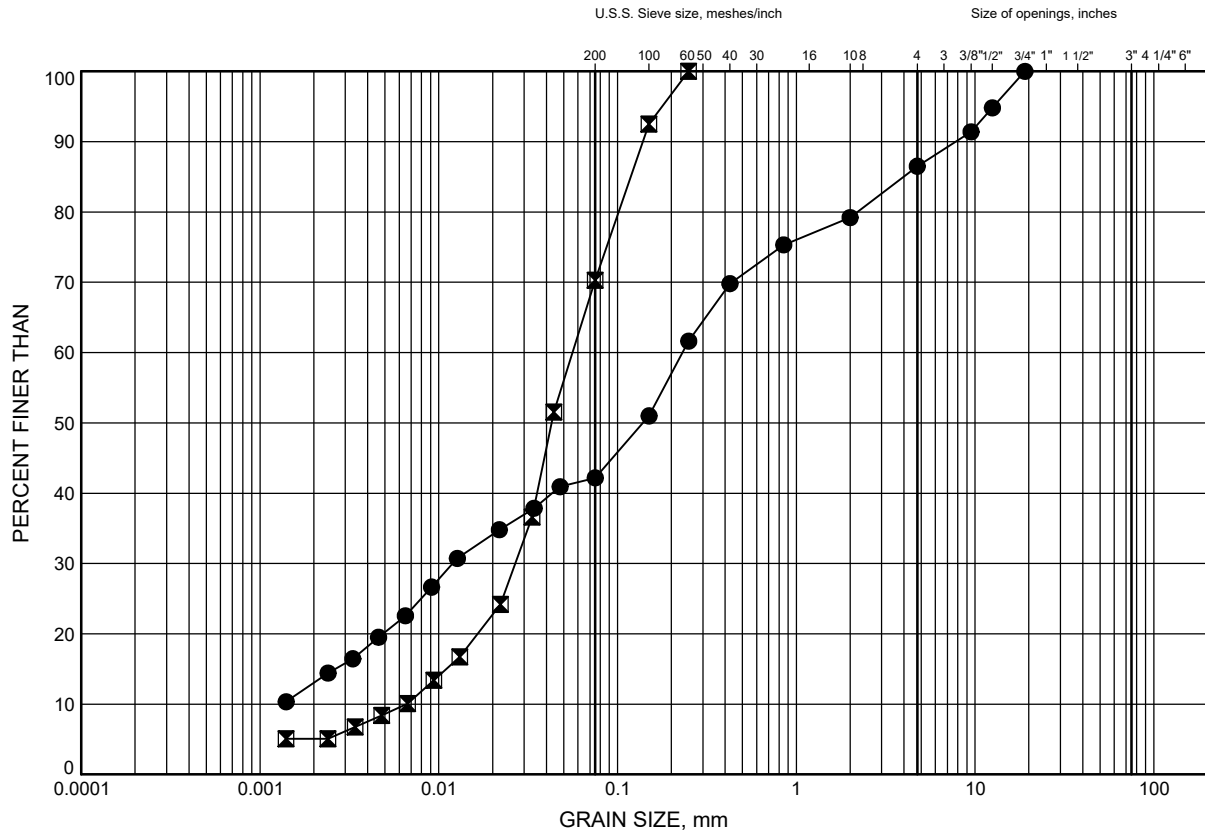


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B9

### 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) |
|--------|----------|-----------|-----------|
| ●      | LS-13    | 7.9       | 256.0     |
| ⊠      | MS-22    | 3.4       | 244.1     |

Date March 2018  
W.P. 2930-02-00

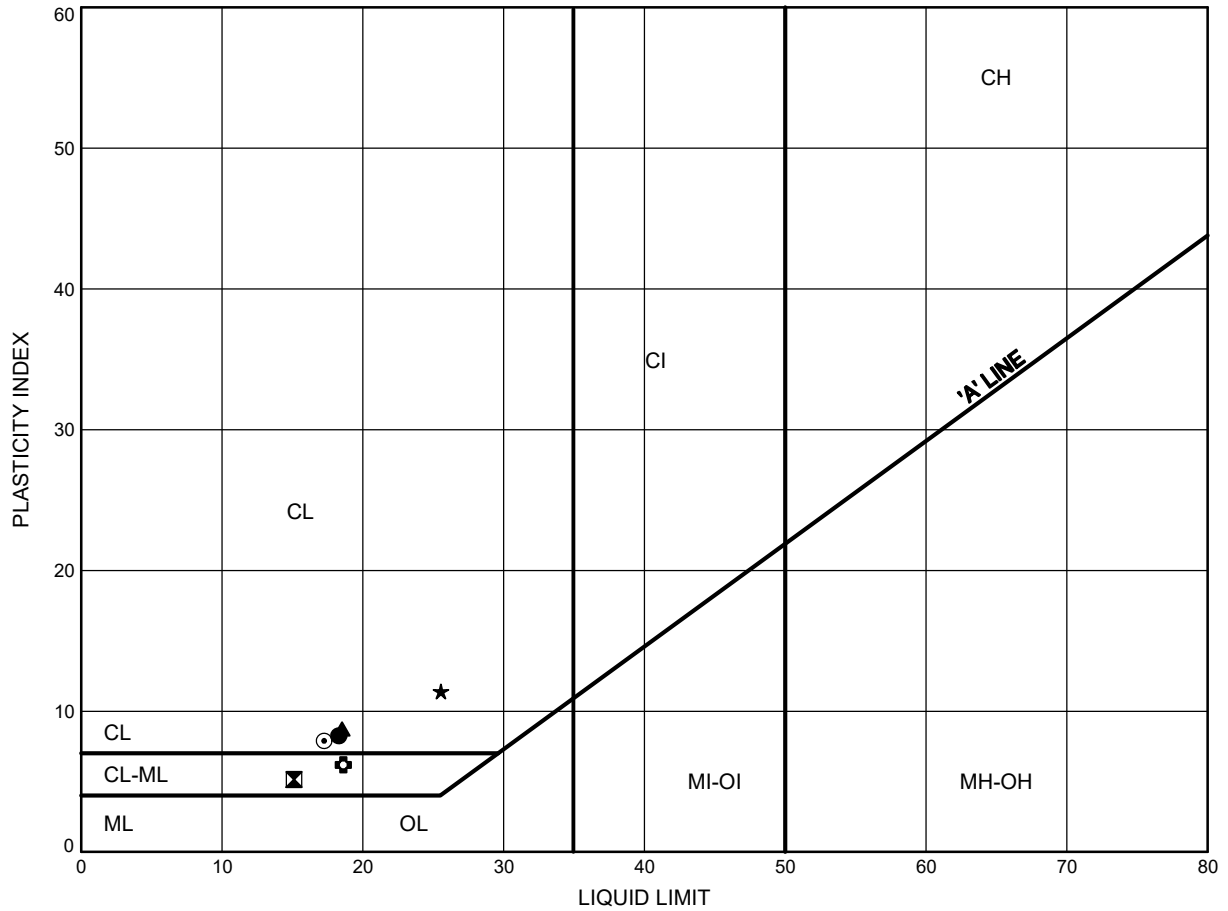


Prep'd AN  
Chkd. RPR

# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE B10

Silty CLAY to Clayey SILT TILL



### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-09    | 2.6       | 239.8     |
| ⊠      | LS-10    | 4.9       | 249.8     |
| ▲      | LS-11    | 6.4       | 248.1     |
| ★      | LS-12    | 3.4       | 260.9     |
| ⊙      | LS-12    | 6.4       | 257.9     |
| ⊕      | LS-13    | 4.9       | 259.0     |

Date March 2018  
W.P. 2930-02-00

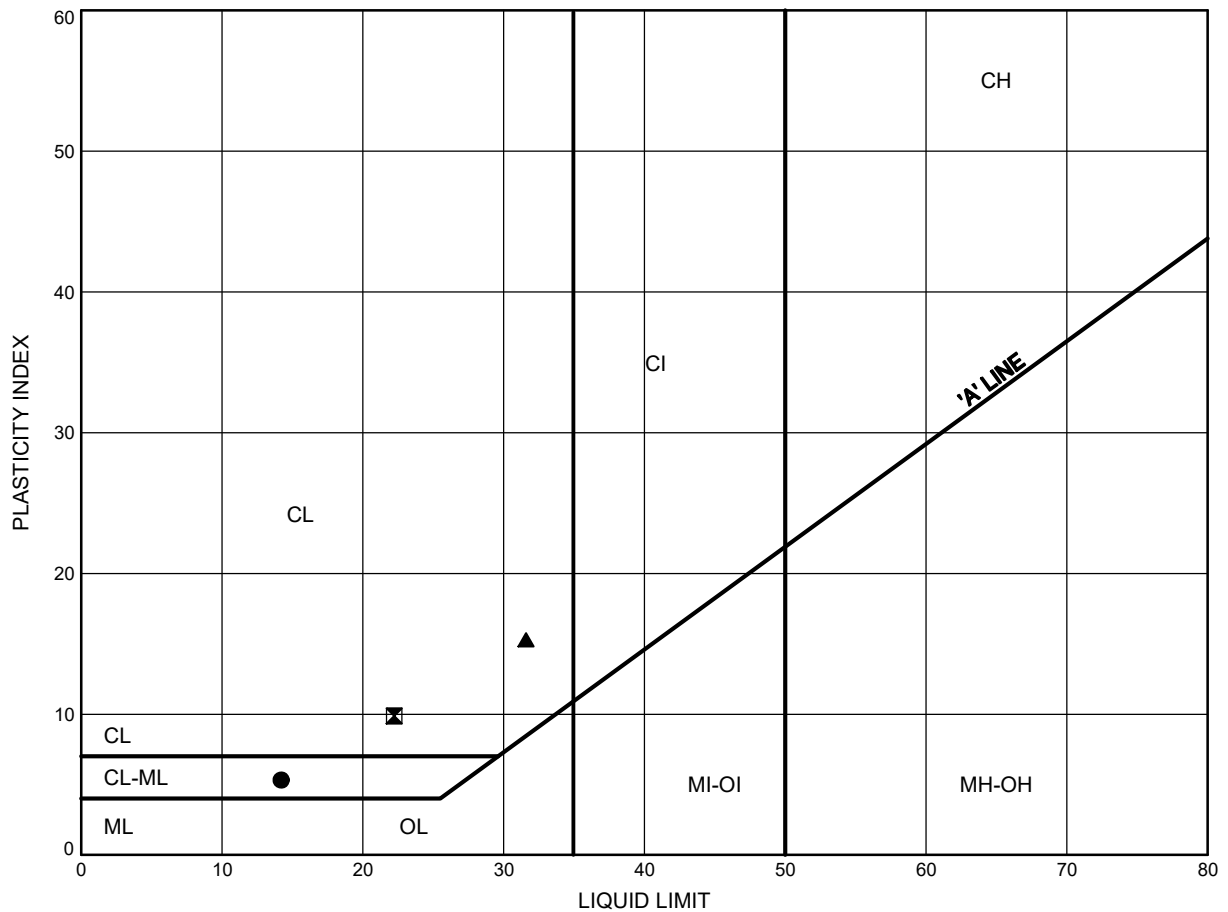


Prep'd AN  
Chkd. RPR

# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE B11

Silty CLAY to Clayey SILT TILL



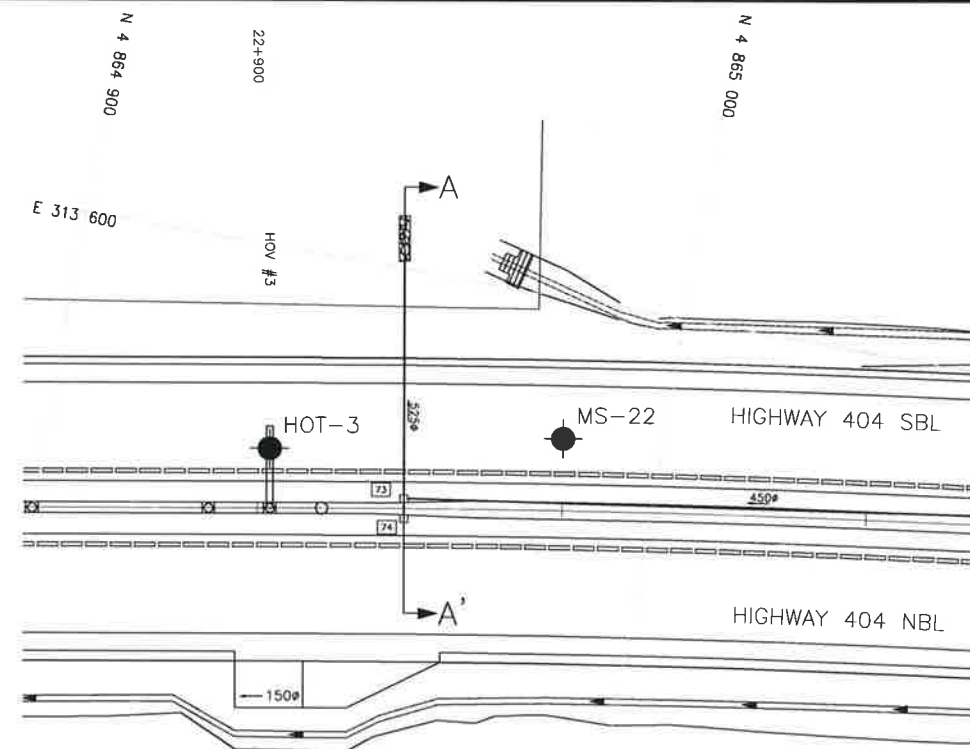
### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-17    | 4.9       | 249.9     |
| ⊠      | MS-22    | 2.6       | 244.9     |
| ▲      | MS-28    | 6.4       | 236.0     |

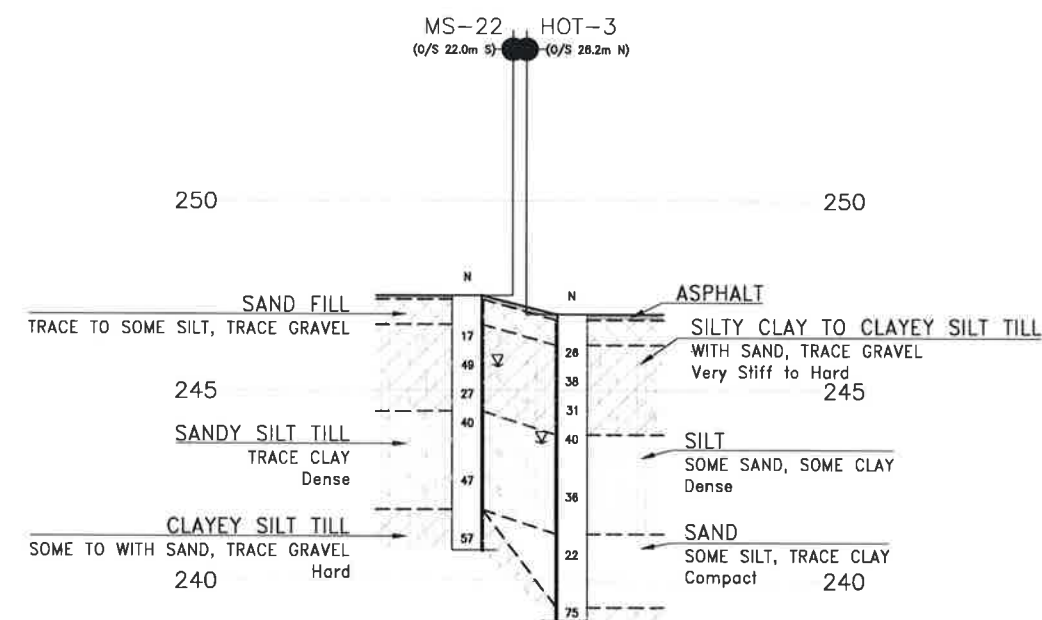
Date March 2018  
W.P. 2930-02-00



Prep'd AN  
Chkd. RPR

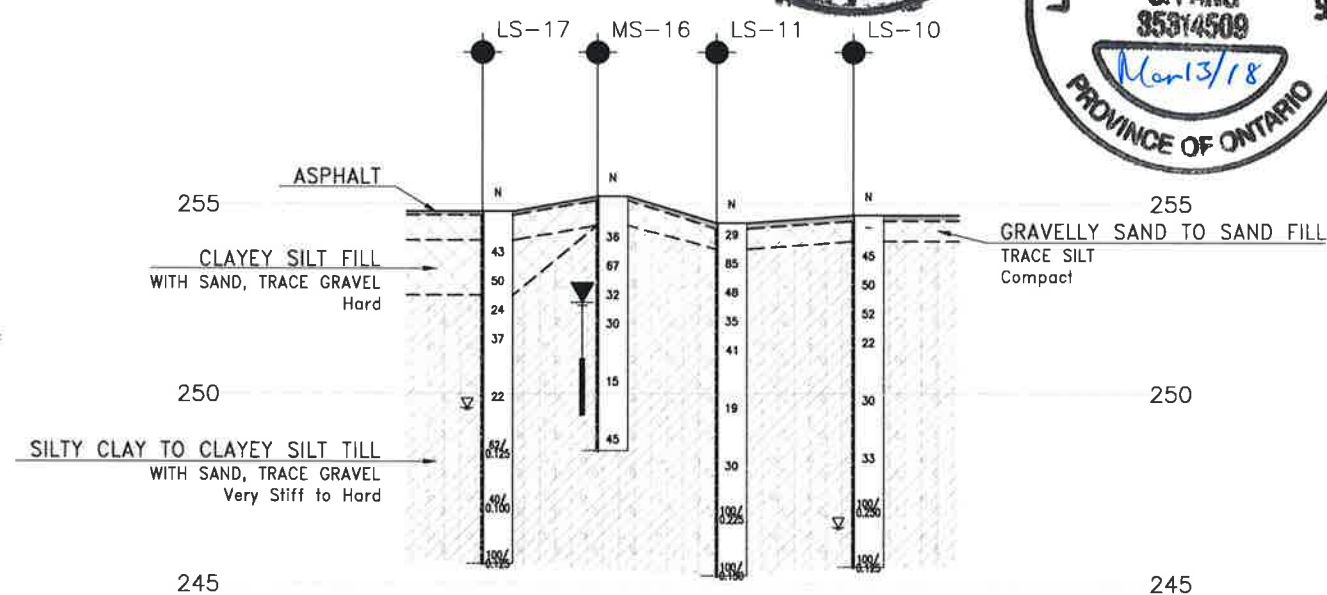
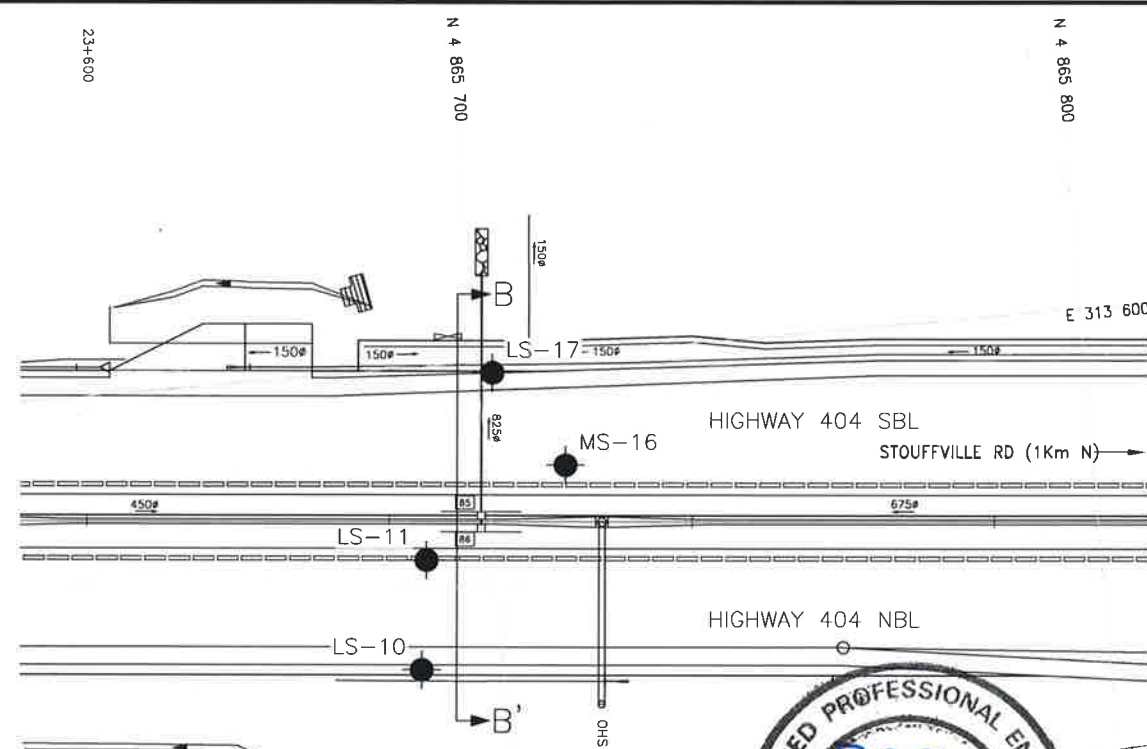


PLAN  
SCALE 1:1250



SECTION A-A'  
(SEWER LATERAL UPSTREAM ID 73)

20 0 20 40m  
4 0 4 8m  
H 1:1000  
V 1:200



SECTION B-B'  
(SEWER LATERAL UPSTREAM ID 85)

METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

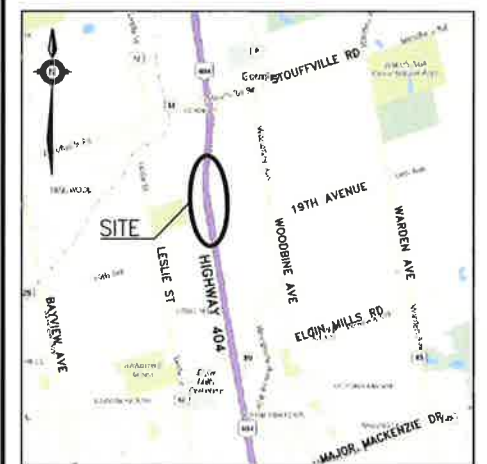
CONT No  
WP No 2930-02-00

HIGHWAY 404 WIDENING  
SEWER LATERALS  
STOUFFVILLE RD TO 19th AVE.  
BOREHOLE LOCATIONS AND SOIL STRATA

wsp



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

|      |                                       |
|------|---------------------------------------|
| ●    | Borehole                              |
| ⊙    | Borehole and Cone                     |
| N    | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE | Blows /0.3m (60' Cone, 475J/blow)     |
| PH   | Pressure, Hydraulic                   |
| ▽    | Water Level                           |
| ▽    | Head Artesian Water                   |
| — —  | Piezometer                            |
| 90%  | Rock Quality Designation (RQD)        |
| A/R  | Auger Refusal                         |

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| HOT-3 | 247.0     | 4 864 936.6 | 313 633.1 |
| LS-10 | 254.7     | 4 865 686.5 | 313 649.8 |
| LS-11 | 254.5     | 4 865 688.9 | 313 631.8 |
| LS-17 | 254.8     | 4 865 702.4 | 313 602.0 |
| MS-16 | 255.2     | 4 865 713.1 | 313 618.2 |
| MS-22 | 247.5     | 4 864 983.8 | 313 623.0 |

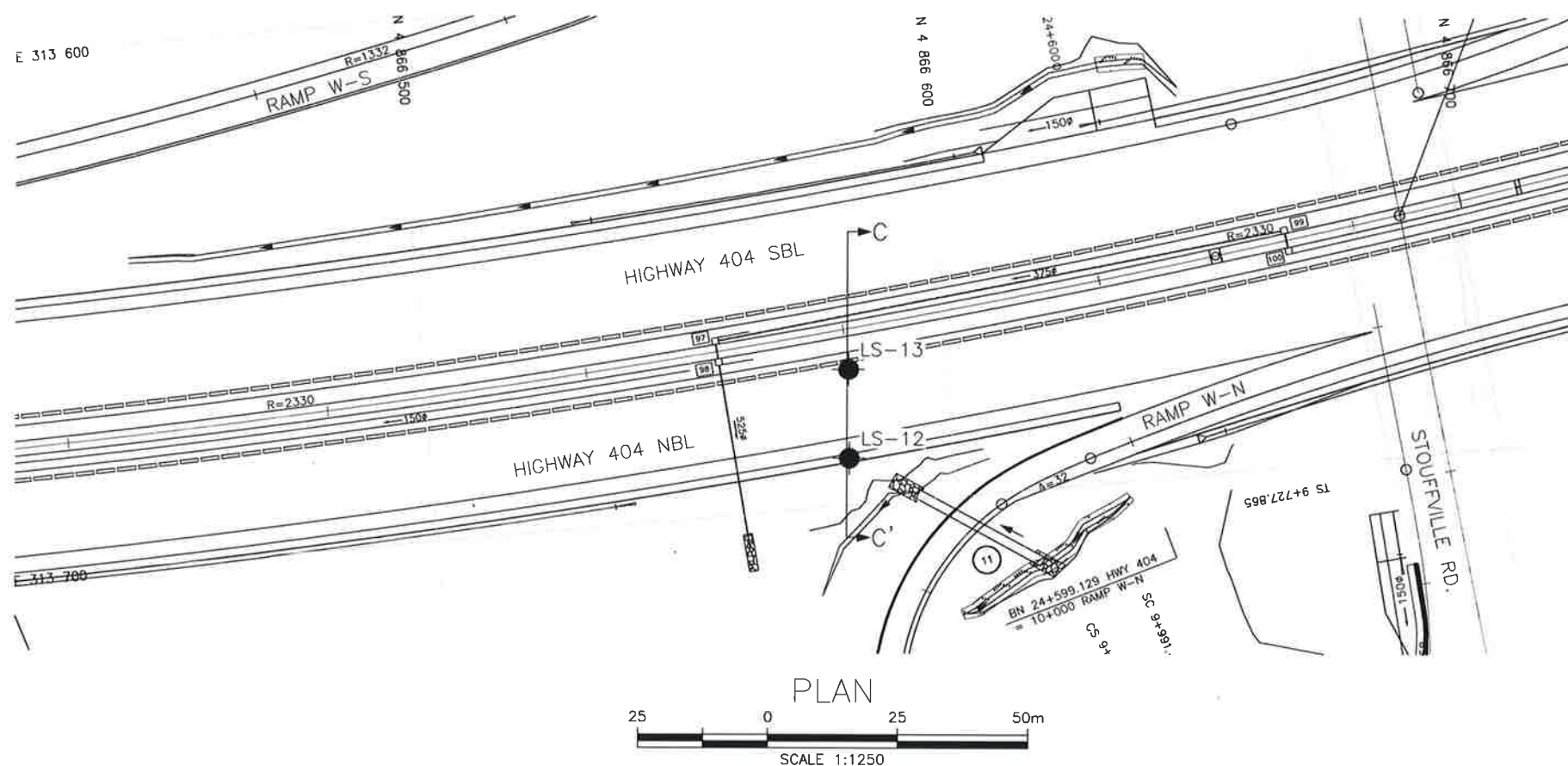
NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 30M14-472

| REVISIONS | DATE | BY       | DESCRIPTION |
|-----------|------|----------|-------------|
| DESIGN    | RPR  | CHK SKP  | CODE        |
| DRAWN     | AN   | CHK RPR  | SITE        |
| LOAD      | DATE | MAR 2018 |             |
| STRUCT    | DWG  | B1       |             |





METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 2930-02-00

HIGHWAY 404 WIDENING  
SEWER LATERALS  
STOUFFVILLE RD TO 19TH AVE.  
BOREHOLE LOCATIONS AND SOIL STRATA

115 |








**THURBER ENGINEERING LTD**



## KEYPLAN

LEGEND

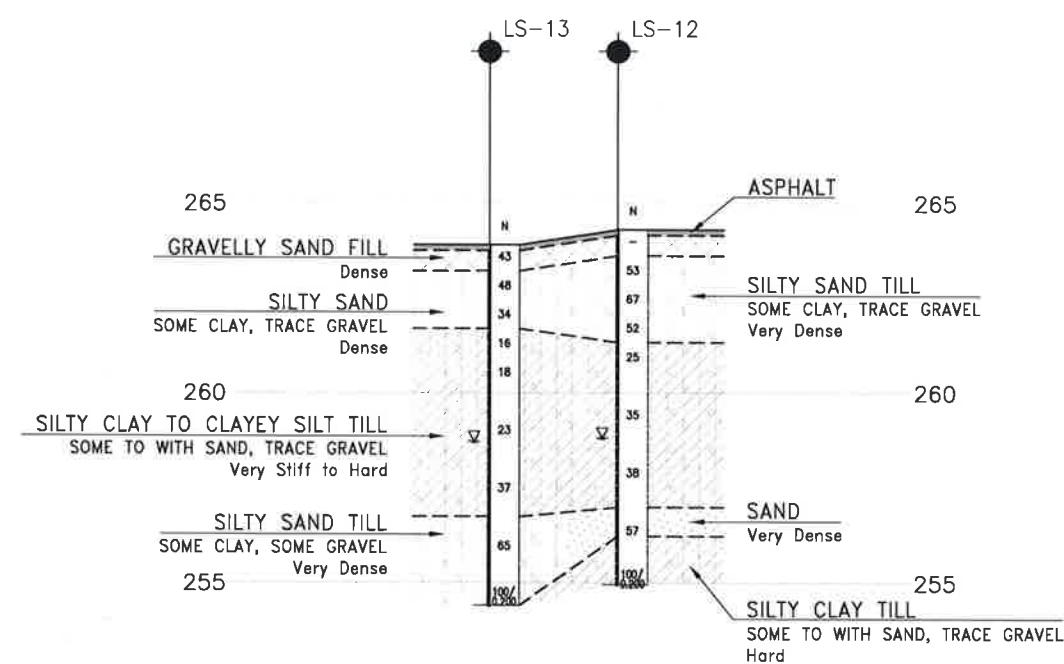
|   |                                       |
|---|---------------------------------------|
|  | Borehole                              |
|  | Borehole and Cone                     |
| N   | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE  | Blows /0.3m (60° Cone, 475J/blow)     |
| PH  | Pressure, Hydraulic                   |
|  | Water Level                           |
|  | Head Artesian Water                   |
|  | Piezometer                            |
| 90%   | Rock Quality Designation (RQD)        |
| A/R   | Auger Refusal                         |

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| LS-12 | 264.3     | 4 866 580.0 | 313 691.0 |
| LS-13 | 263.9     | 4 866 581.3 | 313 674.0 |

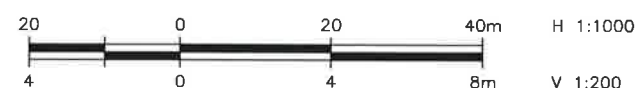
-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 30M14-472**



SECTION C-C'  
(SEWER LATERAL UPSTREAM ID 98)

[illegible]



## **Appendix C**

**Section 3 (Stations 22+400 to 20+300)  
From 19<sup>th</sup> Avenue to Elgin Mills Road  
Boreholes LS-03 to LS-08, MS-41, MS-44, OHS6-1 and OHS6-2**

- Record of Borehole Sheets
- Laboratory Test Results
- Drawings titled "Borehole Locations and Soil Strata"



# RECORD OF BOREHOLE No LS-03

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 862 512.6 E 314 043.2 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.15 - 2017.10.15 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|---------------|----------------------------|-----------------|---|--|--|--|---|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |  |
| 231.4         | GROUND SURFACE   |            |         |      |               |                            |                 |   |  |  |  |   |  |
| 0.0           | ASPHALT (150mm)  |            |         |      |               |                            |                 |   |  |  |  |   |  |
| 0.2           | SAND, trace to some gravel, trace silt<br>Brown<br>Moist<br>(FILL)   |            | 1       | GS   | -             |                            | 231             |   |  |  |  |   |  |
| 230.7         |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
| 0.7           | ClayeySILT, some sand, some gravel<br>Very Stiff<br>Brown<br>Moist<br>(FILL)                                 |            | 1       | SS   | 29            |                            | 230             |   |  |  |  |   |  |
| 229.9         |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
| 1.5           | SAND, some gravel, trace to some<br>silt, trace clay<br>Dense to Very Dense<br>Brown<br>Moist                |            | 2       | SS   | 47            |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
|               |  |            | 3       | SS   | 100/<br>0.150 |                            | 229             |   |  |  |  |   |  |
| 228.4         |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
| 3.0           | Silty SAND to sandy SILT, trace to<br>some gravel, some clay<br>Very Dense<br>Grey<br>Moist to wet<br>(TILL) |            | 4       | SS   | 100/<br>0.200 |                            | 228             |   |  |  |  |   | 17 41 28 14  |
|               |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |               |                            | 227             |   |  |  |  |   |  |
|               |  |            | 5       | SS   | 100/<br>0.150 |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |               |                            | 226             |   |  |  |  |   |  |
|               |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
|               |  |            | 6       | SS   | 100/<br>0.200 |                            | 225             |   |  |  |  |   | 0 32 57 11   |
|               |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |               |                            | 224             |   |  |  |  |   |  |
|               |  |            | 7       | SS   | 100/<br>0.250 |                            |                 |   |  |  |  |   |  |
|               |  |            |         |      |               |                            | 223             |   |  |  |  |   |  |
|               |  |            |         |      |               |                            |                 |   |  |  |  |   |  |
| 222.0         |  |            | 8       | SS   | 100/<br>0.275 |                            | 222             |   |  |  |  |   |  |
| 9.4           | END OF BOREHOLE AT 9.4m.<br>BOREHOLE OPEN AND WATER<br>LEVEL AT 6.1m.<br>BOREHOLE BACKFILLED WITH            |            |         |      |               |                            |                 |   |  |  |  |   |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-03

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 862 512.6 E 314 043.2 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.15 - 2017.10.15 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page                         |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

RECORD OF BOREHOLE No LS-04

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 862 872.9 E 313 977.7 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.15 - 2017.10.15 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE OPEN AND WATER<br>LEVEL AT 3.0m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

RECORD OF BOREHOLE No LS-05

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 863 528.7 E 313 885.6 ORIGINATED BY OA  
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
DATUM Geodetic DATE 2017.10.17 - 2017.10.17 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |            |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|------------|----|-----|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |            |    |     |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 | 20  | 40 | 60         | 80 | 100 |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 | ○ UNCONFINED                                | +  | FIELD VANE |    |     |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 | ● QUICK TRIAXIAL                            | ×  | LAB VANE   |    |     |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 | 20  | 40 | 60         | 80 | 100 |                                    | 20                                  | 40                                | 60                                       |  |
|               | Continued From Previous Page<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |    |            |    |     |                                    |                                     |                                   |  |  |

# RECORD OF BOREHOLE No LS-06

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 863 526.0 E 313 870.6 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.16 - 2017.10.16 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |  |  |  |                                    |                                     |                                   |  |  |
| 237.2         | GROUND SURFACE                                     |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.0           | ASPHALT (150mm)                                    |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.2           | SAND, trace to some silt, trace gravel, trace clay |            | 1       | SS   | 28         |                            |                 |  |  |  |  | ○                                  |                                     |                                   |  |  |
| 236.5         | Compact  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.7           | Brown Moist (FILL)                                 |            | 2       | SS   | 43         |                            |                 |  |  |  |  | ○                                  |                                     |                                   |  |  |
|               | Clayey SILT, some sand, trace gravel               |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Hard   |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Brown Moist (FILL)                                 |            | 3       | SS   | 30         |                            |                 |  |  |  |  | ○                                  |                                     |                                   |  |  |
| 235.0         |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 2.2           | ORGANICS   |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Compact  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Black Moist  |            | 4       | SS   | 18         |                            |                 |  |  |  |  | ○                                  |                                     |                                   |  |  |
| 234.2         |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 3.0           | Clayey SILT, with sand, trace gravel               |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Stiff  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Brown Moist (TILL)                                 |            | 5       | SS   | 9          |                            |                 |  |  |  |  | ○                                  |                                     |                                   |  | 7 41 34 18   |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 232.7         |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 4.5           | Silty SAND, trace gravel, trace clay               |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Very Dense to Dense                                |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Grey Moist (TILL)                                  |            | 6       | SS   | 73         |                            |                 |  |  |  |  | ○                                  |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-06

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 863 526.0 E 313 870.6 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.16 - 2017.10.16 CHECKED BY RPR

| SOIL PROFILE |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
|              | Continued From Previous Page  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              | BOREHOLE OPEN TO 8.9m AND WATER LEVEL AT 6.4m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE. |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18



# RECORD OF BOREHOLE No LS-07

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 182.0 E 313 769.5 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.17 - 2017.10.17 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    |     | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |   |  |  |
|---------------|--|------------|---------|------|---------------|----------------------------|-----------------|--|----|----|----|-----|---|--|---|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED    + FIELD VANE<br>● QUICK TRIAXIAL    x LAB VANE |    |    |    |     |   |  | PLASTIC<br>LIMIT<br>w <sub>P</sub><br>NATURAL<br>MOISTURE<br>CONTENT<br>w<br>LIQUID<br>LIMIT<br>w <sub>L</sub><br>WATER CONTENT (%) |  |  |
| 241.4         | GROUND SURFACE   |            |         |      |               |                            |                 | 20   | 40 | 60 | 80 | 100 |   |  |   |  |  |
| 0.0           | ASPHALT (150mm)  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
| 0.2           | SAND, trace to some silt, trace gravel<br>Very Dense<br>Brown                          |            | 1       | SS   | 71            |                            | 241             |  |    |    |    |     |   | ○  |   |  |  |
| 240.7         | Moist<br>(FILL)  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
| 0.7           | Clayey SILT, with sand, trace gravel<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL) |            | 2       | SS   | 32            |                            | 240             |  |    |    |    |     |   | ○  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            | 3       | SS   | 19            |                            | 239             |  |    |    |    |     |   | ○  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            | 4       | SS   | 26            |                            | 238             |  |    |    |    |     |   | ○  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            | 5       | SS   | 57            |                            | 237             |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            | 6       | SS   | 42            |                            | 236             |  |    |    |    |     |   | ○  |   |  |  |
|               | Grey<br>Wet  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            | 7       | SS   | 38            |                            | 235             |  |    |    |    |     |   | ○  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
| 234.2         |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
| 7.2           | SAND and SILT, trace clay, trace<br>gravel<br>Compact to Very Dense<br>Grey<br>Wet     |            | 8       | SS   | 18            |                            | 234             |  |    |    |    |     |   | ○  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            | 9       | SS   | 105/<br>0.150 |                            | 233             |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
|               |  |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |
| 231.6         |  |            |         |      |               |                            | 232             |  |    |    |    |     |   | ○  |   |  |  |
| 9.8           | END OF BOREHOLE AT 9.8m.   |            |         |      |               |                            |                 |  |    |    |    |     |   |  |   |  |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-07

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 182.0 E 313 769.5 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.17 - 2017.10.17 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE OPEN AND WATER<br>LEVEL AT 4.6m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No LS-08

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 180.3 E 313 753.4 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.16 - 2017.10.16 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|---------------|----------------------------|--------------------|---|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                    | SHEAR STRENGTH kPa                          |  |  |  |   |   |
| 241.3         | GROUND SURFACE  |            |         |      |               |                            |                    |   |  |  |  |   |   |
| 0.0           | ASPHALT (150mm)   |            |         |      |               |                            |                    |   |  |  |  |   |   |
| 0.2           | SAND, trace to some silt, trace gravel<br>Compact<br>Brown<br>Moist<br>(FILL)                                   |            | 1       | SS   | 19            |                            | 241                |   |  |  |  |   |   |
| 240.6         |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
| 0.7           | Clayey SILT, with sand, trace to some<br>gravel, silt pockets<br>Very Stiff to Hard<br>Brown<br>Moist<br>(TILL) |            | 2       | SS   | 25            |                            | 240                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            | 3       | SS   | 25            |                            | 239                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            | 4       | SS   | 46            |                            | 238                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            | 5       | SS   | 100/<br>0.250 |                            | 237                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            | 6       | SS   | 100/<br>0.250 |                            | 236                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            | 7       | SS   | 54            |                            | 235                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            | 8       | SS   | 100/<br>0.200 |                            | 234                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
|               |   |            |         |      |               |                            | 233                |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
| 232.5         | Silty SAND, trace gravel, trace clay<br>Compact<br>Grey<br>Wet  |            |         |      |               |                            | 232                |   |  |  |  |   |   |
| 8.8           |   |            | 9       | SS   | 15            |                            |                    |   |  |  |  |   |   |
| 231.5         |   |            |         |      |               |                            |                    |   |  |  |  |   |   |
| 9.8           | END OF BOREHOLE AT 9.8m.  |            |         |      |               |                            |                    |   |  |  |  |   |   |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-08

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 180.3 E 313 753.4 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.16 - 2017.10.16 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BOREHOLE OPEN AND WATER<br>LEVEL AT 6.1m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No MS-41

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION NB N 4 862 885.1 E 314 018.0 ORIGINATED BY TM  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.07.12 - 2017.07.12 CHECKED BY PP

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT   |  |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|---|---|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa  |  |  |  |  |   |   |  |
| 234.5         | GROUND SURFACE  |            |         |      |            |                            |                 | <div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>                                     |  |  |  |  |   |   |  |
| 0.0           | ASPHALT: (100mm)  |            |         |      |            |                            |                 | <div><div>20406080100</div><div>W P W W L</div><div>PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT</div><div>WATER CONTENT (%)</div></div> |  |  |  |  |   |   |  |
| 0.1           | Silty SAND, trace gravel<br>Brown<br>Moist<br>(FILL)  |            | 1       | GS   |            |                            | 234             |   |  |  |  |  |   |   |  |
| 233.7         |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
| 0.8           | Clayey SILT, with sand, trace gravel<br>Very Stiff<br>Brown<br>Moist<br>(TILL)  |            | 1       | SS   | 21         |                            | 233             |   |  |  |  |  |   |   |  |
|               |   |            | 2       | SS   | 16         |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            | 3       | SS   | 16         |                            | 232             |   |  |  |  |  |   |   |  |
| 231.5         |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
| 3.0           | Silty SAND<br>Dense to Compact<br>Brown<br>Wet  |            | 4       | SS   | 37         |                            | 231             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            | 5       | SS   | 23         |                            | 230             |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |
|               |   |            |         |      |            |                            | 229             |   |  |  |  |  |   |   |  |
|               |   |            | 6       | SS   | 34         |                            |                 |   |  |  |  |  |   |   |  |
| 227.8         |   |            |         |      |            |                            | 228             |   |  |  |  |  |   |   |  |
| 6.7           | END OF BOREHOLE AT 6.7m.<br>BOREHOLE CAVED TO 3.0m AND<br>WATER LEVEL AT 2.7m DEPTH<br>UPON COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND DRY<br>CEMENT TO 0.2m, THEN COLD<br>PATCH ASPHALT TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |   |   |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

# RECORD OF BOREHOLE No MS-44

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION SB N 4 862 515.2 E 314 063.3 ORIGINATED BY SLL  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.08.16 - 2017.08.16 CHECKED BY PP

| SOIL PROFILE  |  |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    | PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT                   |  |   | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |    |    |                   |
|---------------|--|------------|---------|------|---------------|----------------------------|-----------------|--|----|----|----|---|--|---|---|---|----|----|-------------------|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED   + FIELD VANE<br>● QUICK TRIAXIAL   × LAB VANE |    |    |    | WATER CONTENT (%)<br>w <sub>P</sub> w                      w <sub>L</sub> |  |   |   | GR  | SA | SI | CL                |
| 232.4         | GROUND SURFACE   |            |         |      |               |                            |                 | 20   | 40 | 60 | 80 | 100   |  |   |   |   |    |    |                   |
| 0.0           | ASPHALT: (100mm)   |            |         |      |               |                            |                 |  |    |    |    |   |  |   |   |   |    |    |                   |
| 0.1           | SAND, some gravel, some silt, trace clay<br>Brown<br>Moist<br>(FILL)   |            | 1       | GS   |               |                            | 232             |  |    |    |    |   |  | ○ |   |   |    |    | 13   58   19   10 |
| 231.3         |  |            | 1       | SS   | 30            |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    |                   |
| 1.1           | Clayey SILT, trace gravel<br>Hard<br>Brown<br>Moist<br>(FILL)  |            |         |      |               |                            | 231             |  |    |    |    |   |  | ○ |   |   |    |    |                   |
| 231.0         |  |            | 2       | SS   | 33            |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    |                   |
| 1.4           | SAND and SILT, trace to some gravel, trace clay<br>Dense to Very Dense<br>Brown<br>Moist<br>(TILL)<br><br>Occasional cobbles   |            | 3       | SS   | 50/<br>0.075  |                            | 230             |  |    |    |    |   |  | ○ |   |   |    |    |                   |
|               |  |            | 4       | SS   | 100/<br>0.250 |                            | 229             |  |    |    |    |   |  | ○ |   |   |    |    | 11   41   38   10 |
|               |  |            |         |      |               |                            | 228             |  |    |    |    |   |  |   |   |   |    |    |                   |
|               |  |            | 5       | SS   | 100/<br>0.225 |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    |                   |
|               |  |            |         |      |               |                            | 227             |  |    |    |    |   |  |   |   |   |    |    |                   |
| 226.0         |  |            | 6       | SS   | 100/<br>0.275 |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    |                   |
| 6.4           | END OF BOREHOLE AT 6.4m.<br>BOREHOLE OPEN AND WATER LEVEL AT 5.2m DEPTH UPON COMPLETION.<br>BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.9m, DRY CEMENT TO 0.2m, THEN COLD PATCH ASPHALT TO SURFACE. |            |         |      |               |                            |                 |  |    |    |    |   |  |   |   |   |    |    |                   |

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No OHS 6-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 403.4 E 313 900.4 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.11.30 - 2017.11.30 CHECKED BY RD

| SOIL PROFILE  |   |            | SAMPLES |      |              | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |  |  |  |  |
|---------------|---|------------|---------|------|--------------|----------------------------|-----------------|---|----|----|----|-----|---|---|--|--|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES   |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |     |   |   |  |  |  |  |  |  |
| 236.8         | GROUND SURFACE  |            |         |      |              |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |  |  |  |  |  |  |
| 0.0           | ASPHALT (150mm)   |            |         |      |              |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |  |  |  |  |  |  |
| 0.1           | SAND, trace silt, trace gravel<br>Dense<br>Brown<br>Moist<br>(FILL)   |            | 1       | SS   | 44           |                            | 236             |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 236.1         |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 0.7           | ClayeySILT, some sand, trace<br>gravel, cobble pieces<br>Hard<br>Brown<br>Moist<br>(FILL)   |            | 2       | SS   | 43           |                            | 235             |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            | 3       | SS   | 37           |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 234.5         |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 2.2           | Silty CLAY, some sand, some<br>organics at 2.3m±<br>Stiff<br>Dark Brown to Brown<br>Moist   |            | 4       | SS   | 14           |                            | 234             |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            | 5       | SS   | 8            |                            | 233             |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 232.6         |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 4.1           | ClayeySILT, with sand<br>Hard<br>Brown to Grey<br>Moist<br>(TILL)   |            | 6       | SS   | 43           |                            | 232             |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            | 7       | SS   | 50/<br>0.125 |                            | 231             |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            | 230             |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 229.6         |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 7.2           | SAND and SILT , trace clay<br>Dense<br>Grey<br>Wet  |            | 8       | SS   | 31           |                            | 229             |   |    |    |    |     |   |   |  |  |  |  |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 228.5         |   |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |
| 8.2           | END OF BOREHOLE AT 8.2m.<br>BOREHOLE CAVED AT 6.7m and<br>WATER LEVEL AT 5.5m UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG, AUGER<br>CUTTINGS, AND DRY MIX<br>CONCRETE, THEN COLD PATCH<br>ASPHALT TO SURFACE. |            |         |      |              |                            |                 |   |    |    |    |     |   |   |  |  |  |  |  |  |

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No OHS 6-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 383.5 E 313 896.0 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.12.07 - 2017.12.07 CHECKED BY RD

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |  |  |  |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|---|---|--|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |   |   |  |  |  |  |  |
| 236.4         | GROUND SURFACE   |            |         |      |            |                            |                 | 20  | 40 | 60 | 80 | 100   |   |  |  |  |  |  |
| 0.0           | ASPHALT (150mm)  |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |
| 0.2           | SAND, some gravel, trace silt<br>Brown<br>Wet<br>(FILL)  |            | 1       | SS   | 31         |                            | 236             |   |    |    |    |   |   |  |  |  |  |  |
| 235.9         |  |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |
| 0.5           | Clayey SILT, trace gravel, trace sand<br>Very Stiff<br>Brown<br>Wet<br>(FILL)  |            | 2       | SS   | 20         |                            | 235             |   |    |    |    |   |   |  |  |  |  |  |
| 234.9         | Clayey SILT, with sand, trace gravel<br>Stiff to Hard<br>Brown<br>Moist to Wet<br>(TILL)   |            | 3       | SS   | 14         |                            | 234             |   |    |    |    |   |   |  |  |  |  |  |
| 1.4           |  |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |
|               |  |            | 4       | SS   | 10         |                            | 234             |   |    |    |    |   |   |  |  |  |  |  |
|               |  |            | 5       | SS   | 33         |                            | 233             |   |    |    |    |   |   |  |  |  |  |  |
|               |  |            |         |      |            |                            | 232             |   |    |    |    |   |   |  |  |  |  |  |
|               |  |            | 6       | SS   | 16         |                            | 231             |   |    |    |    |   |   |  |  |  |  |  |
|               |  |            |         |      |            |                            | 230             |   |    |    |    |   |   |  |  |  |  |  |
|               |  |            | 7       | SS   | 47         |                            | 229             |   |    |    |    |   |   |  |  |  |  |  |
| 229.2         | Silty SAND, trace gravel, trace clay<br>Dense<br>Brown<br>Wet  |            | 8       | SS   | 43         |                            | 229             |   |    |    |    |   |   |  |  |  |  |  |
| 7.2           |  |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |
| 228.2         | END OF BOREHOLE AT 8.2m.<br>WATER LEVEL AT 5.5m.<br>Piezometer installation consists of<br>25mm diameter Schedule 40 PVC pipe<br>with a 3.0m slotted screen. |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |
| 8.2           |  |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |
|               | WATER LEVEL READINGS<br>DATE            DEPTH(m)    ELEV.(m)<br>2018.02.15        2.3            234.1   |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |

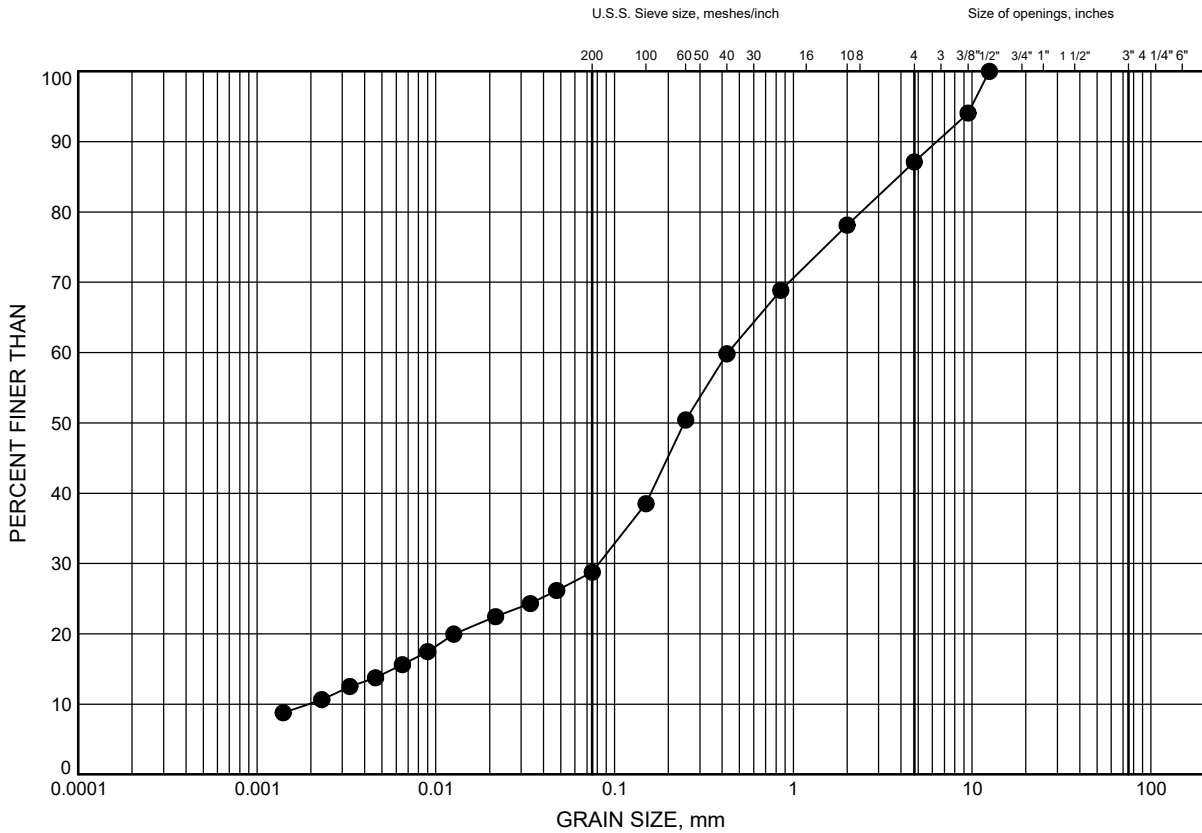
+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE



# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C1

## SAND FILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | MS-44    | 0.4       | 232.0     |

Date March 2018  
W.P. 2930-02-00

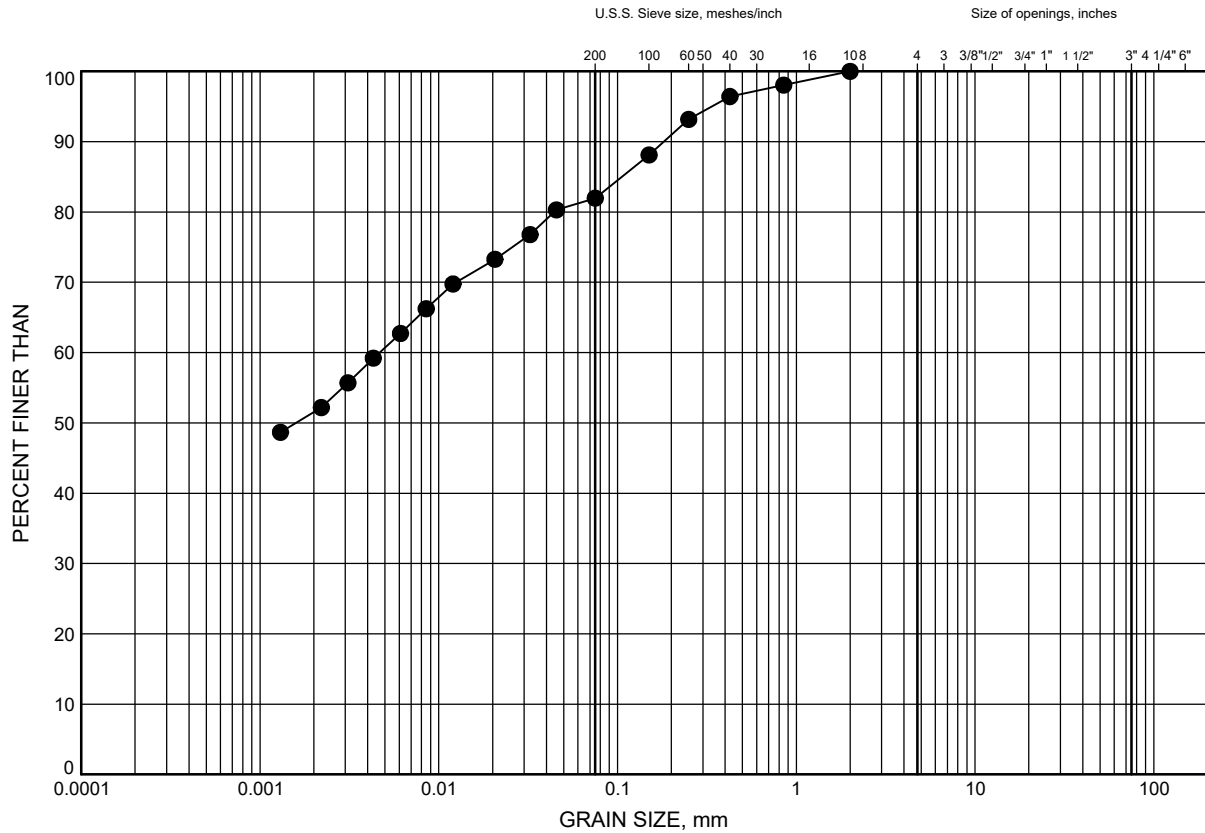


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C2

Silty CLAY



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

## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | OHS 6-1  | 3.4       | 233.4     |

Date March 2018  
W.P. 2930-02-00

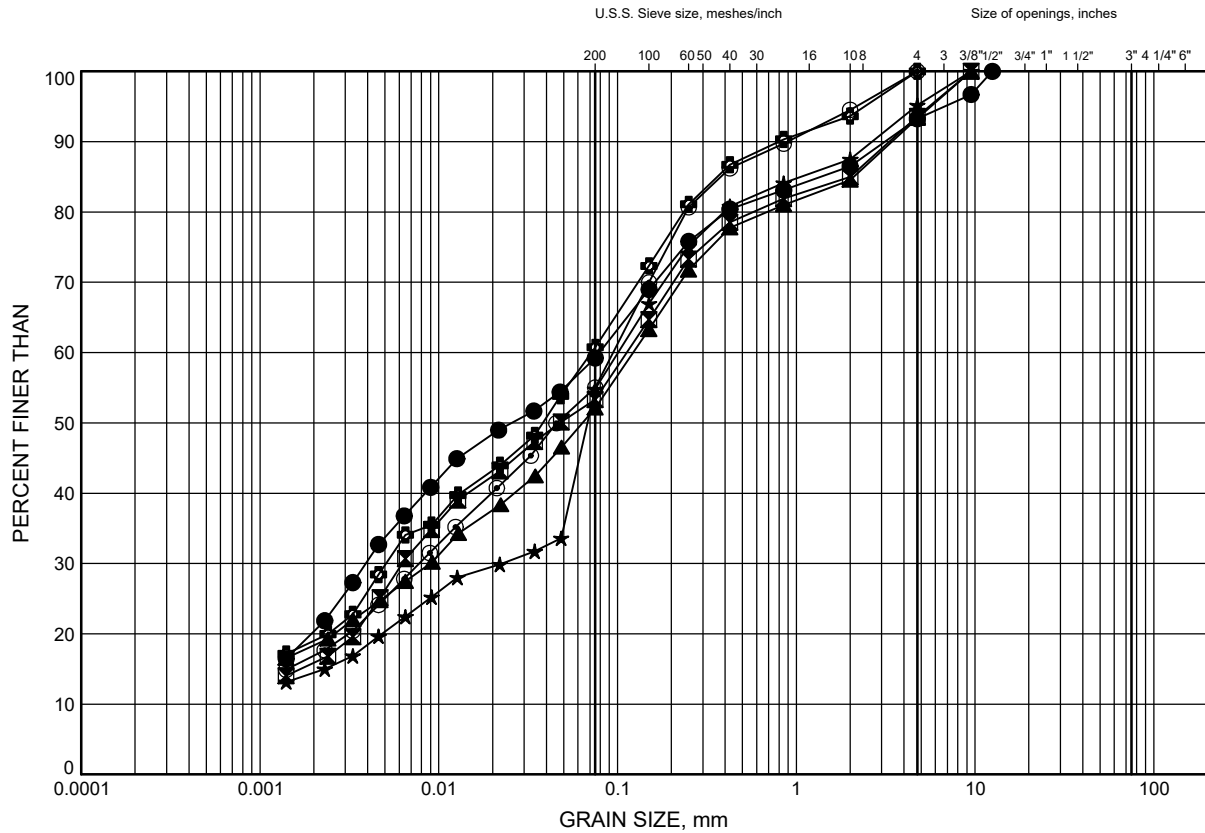


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Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C3

## Silty CLAY TILL to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-04    | 3.4       | 230.4     |
| ⊠      | LS-05    | 3.4       | 233.9     |
| ▲      | LS-06    | 3.4       | 233.8     |
| ★      | LS-07    | 2.6       | 238.8     |
| ⊙      | LS-08    | 3.4       | 237.9     |
| ⊕      | MS-41    | 2.6       | 231.9     |

Date March 2018  
W.P. 2930-02-00

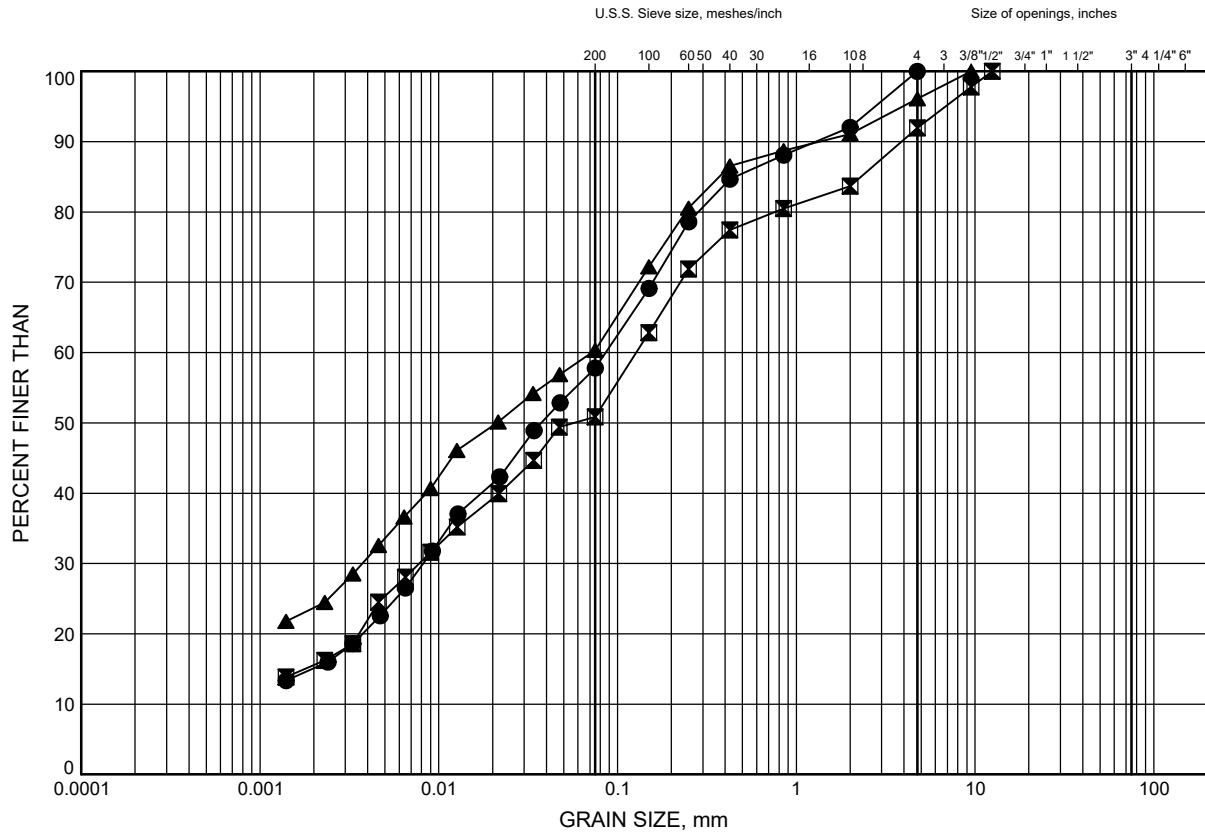


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C4

## Silty CLAY TILL to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | OHS 6-1  | 4.9       | 231.9     |
| ⊠      | OHS 6-2  | 2.6       | 233.8     |
| ▲      | OHS 6-2  | 6.4       | 230.0     |

Date March 2018  
W.P. 2930-02-00

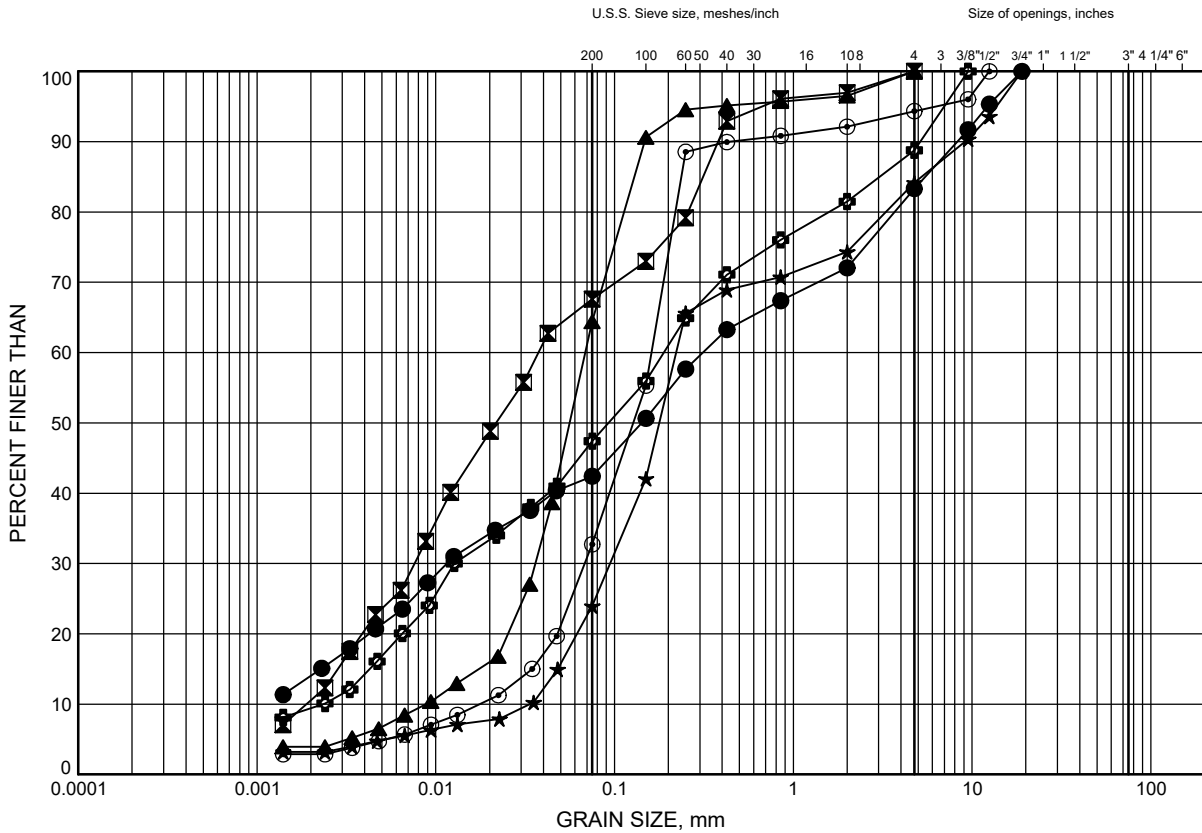


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C5

## 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) |
|--------|----------|-----------|-----------|
| ●      | LS-03    | 3.4       | 228.0     |
| ⊠      | LS-03    | 6.4       | 225.0     |
| ▲      | LS-04    | 4.9       | 228.9     |
| ★      | LS-05    | 6.4       | 230.9     |
| ⊙      | LS-06    | 7.9       | 229.3     |
| ⊕      | MS-44    | 3.4       | 229.0     |

Date March 2018  
W.P. 2930-02-00

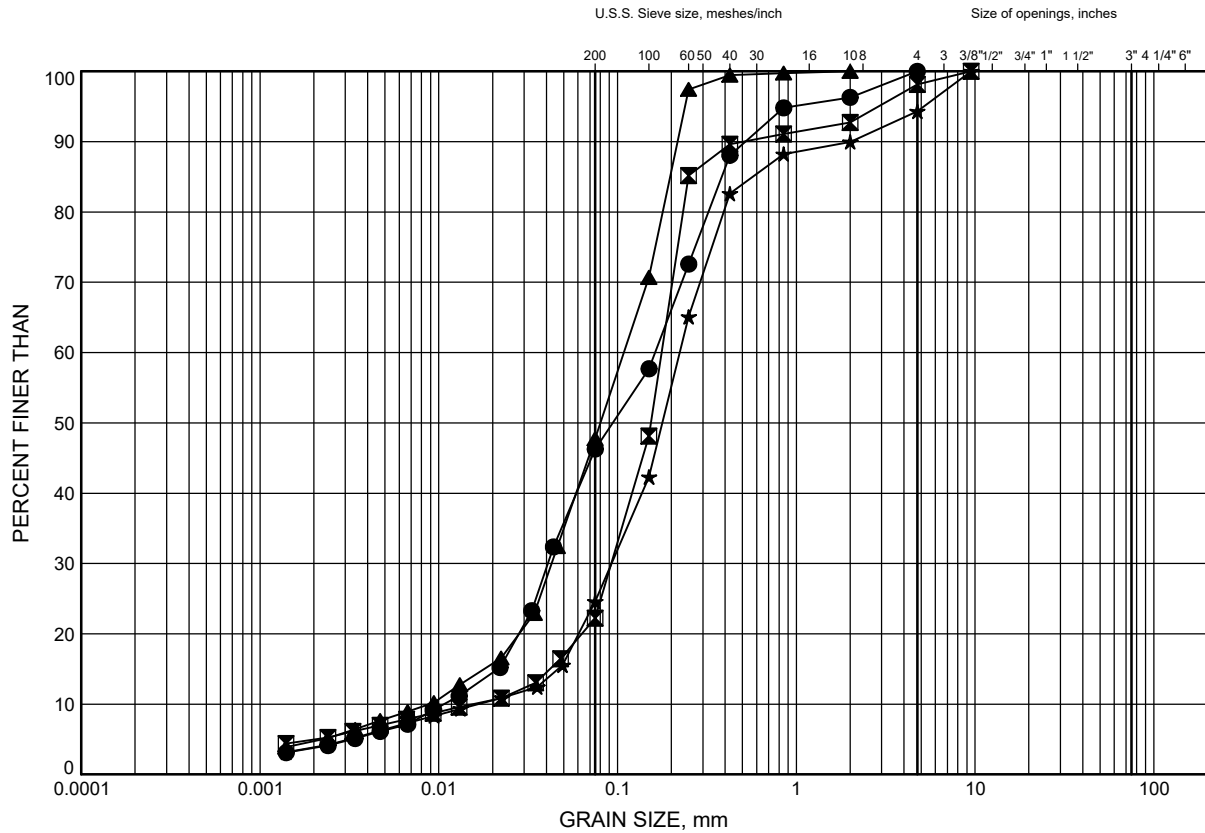


Prep'd AN  
Chkd. RPR

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C6

## Silty 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) |
|--------|----------|-----------|-----------|
| ●      | LS-07    | 7.9       | 233.5     |
| ⊠      | LS-08    | 9.4       | 231.9     |
| ▲      | OHS 6-1  | 7.9       | 228.8     |
| ★      | OHS 6-2  | 7.9       | 228.5     |

Date March 2018  
W.P. 2930-02-00

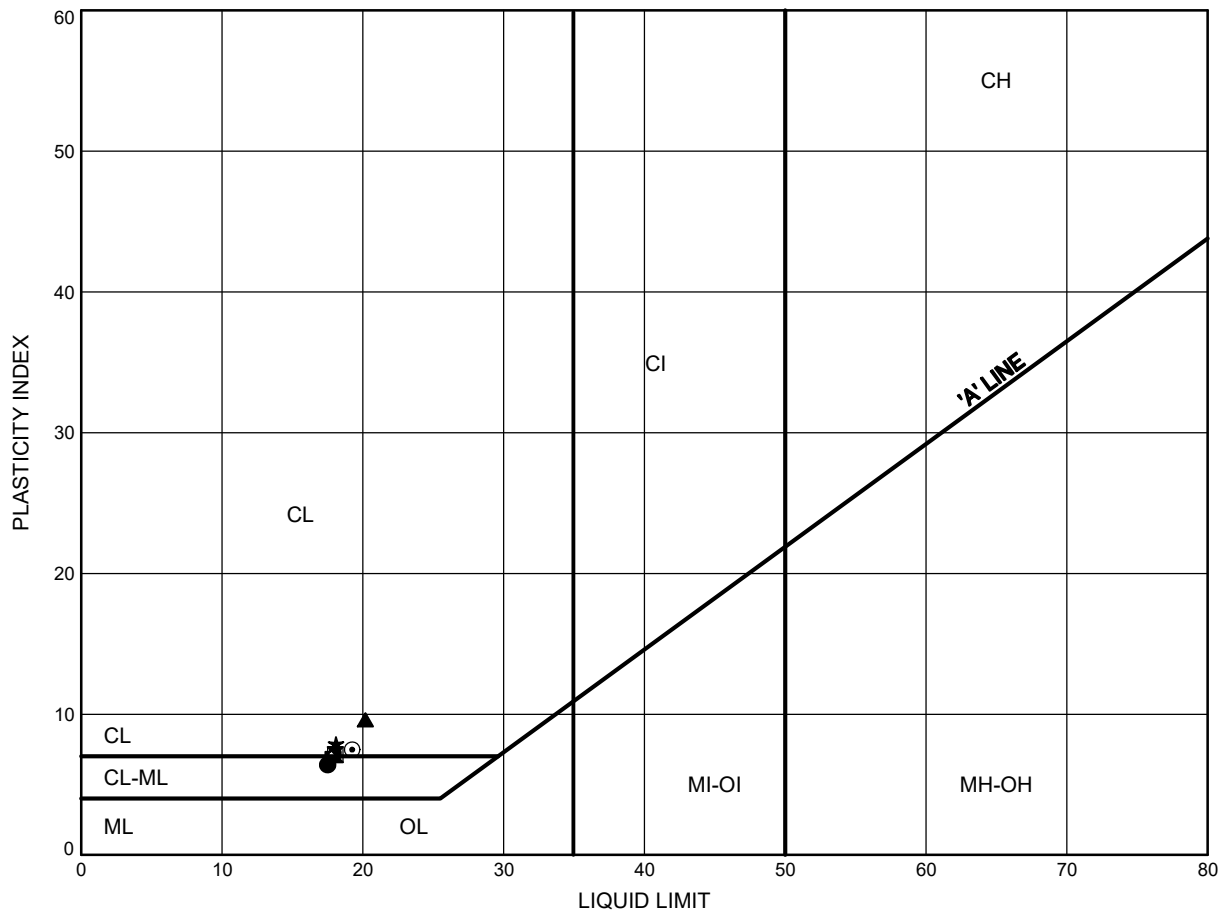


Prep'd AN  
Chkd. RPR

# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE C7

Silty CLAY TILL to Clayey SILT TILL



## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-05    | 3.4       | 233.9     |
| ⊠      | LS-06    | 3.4       | 233.8     |
| ▲      | LS-07    | 2.6       | 238.8     |
| ★      | LS-08    | 3.4       | 237.9     |
| ⊙      | MS-41    | 2.6       | 231.9     |
| ⊕      | OHS 6-1  | 4.9       | 231.9     |

Date March 2018  
W.P. 2930-02-00

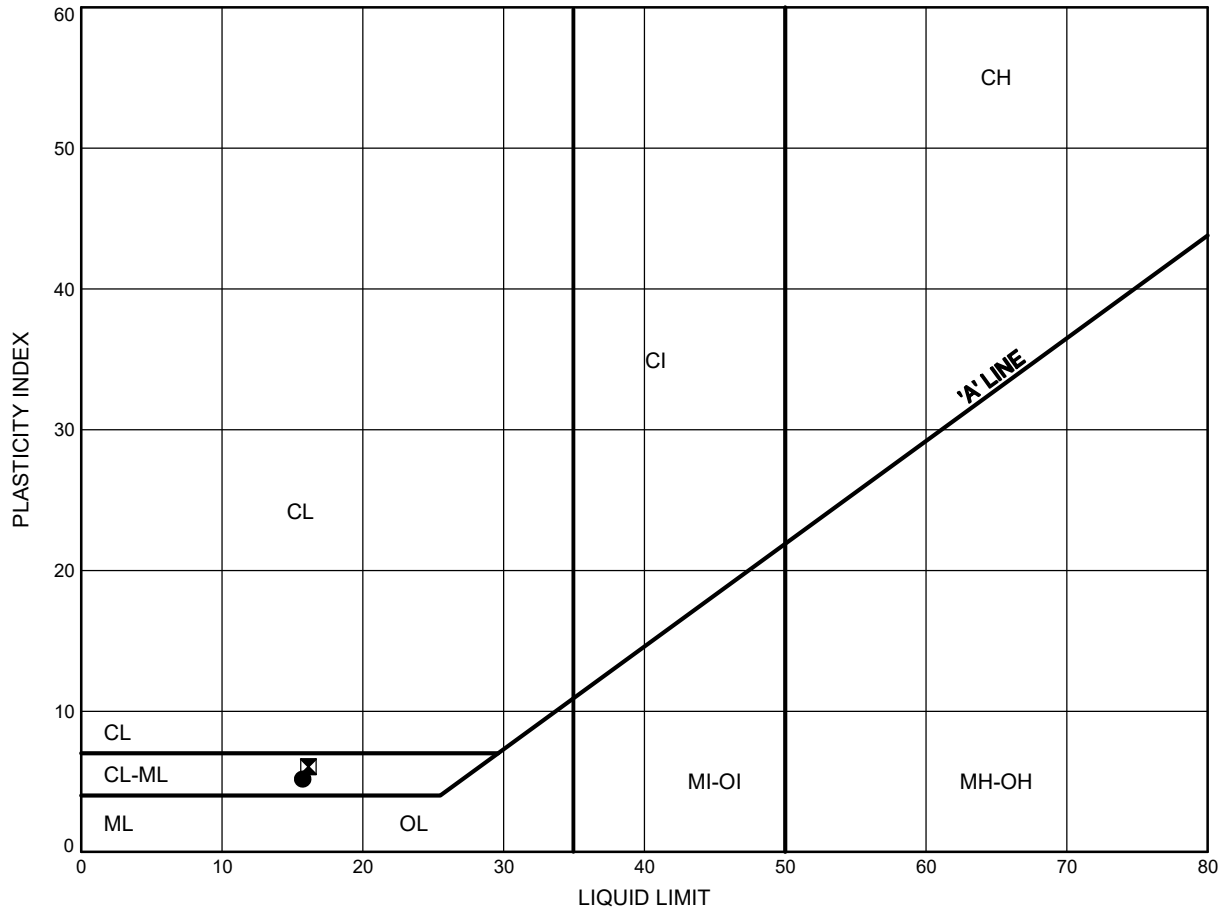


Prep'd AN  
Chkd. RPR

# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE C8

Silty CLAY TILL to Clayey SILT TILL



### LEGEND

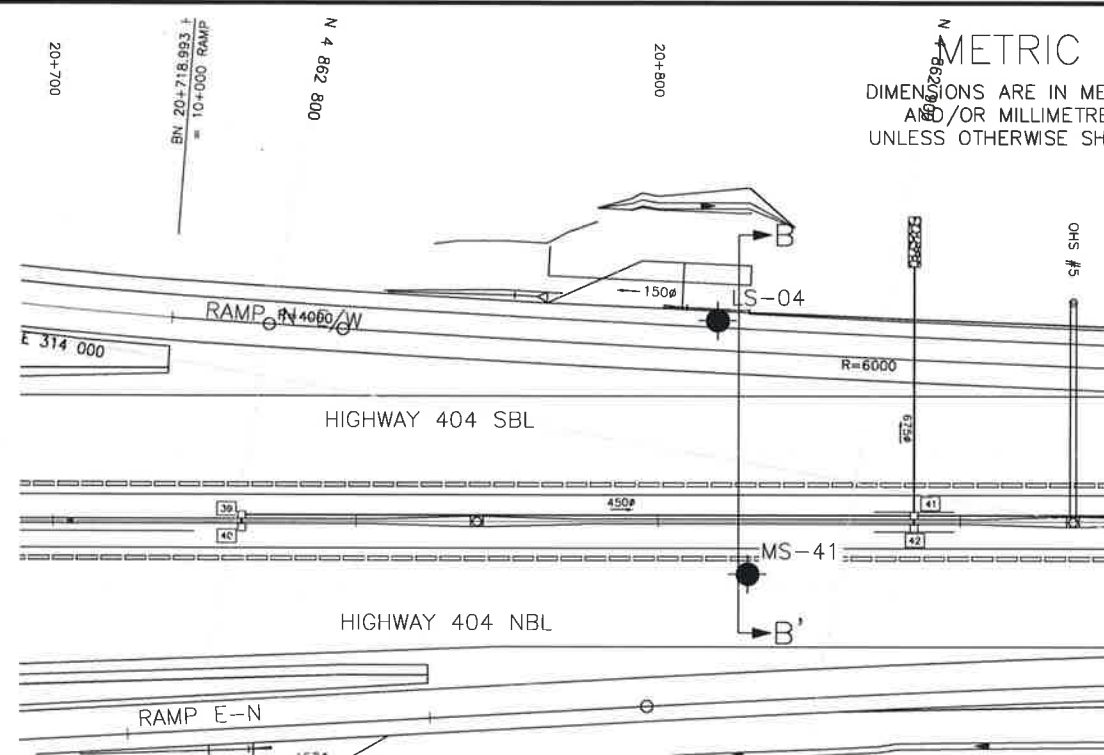
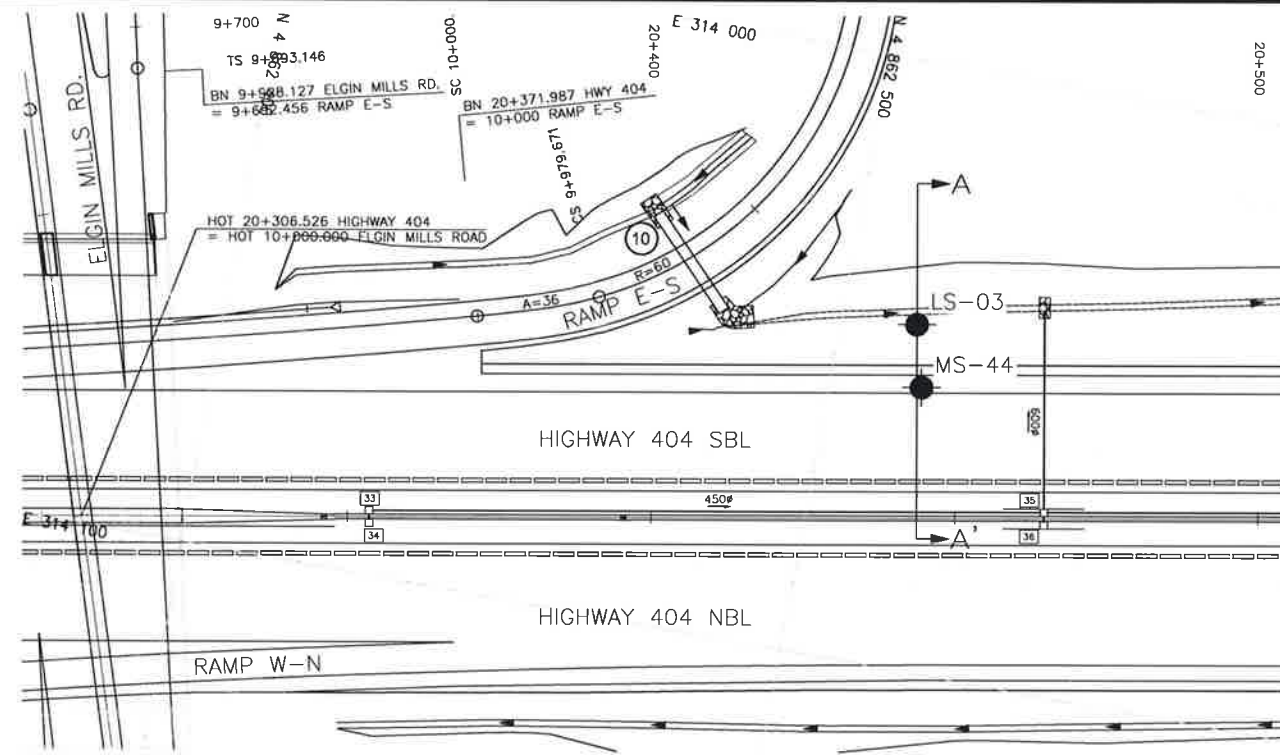
| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | OHS 6-2  | 2.6       | 233.8     |
| ⊗      | OHS 6-2  | 6.4       | 230.0     |

Date March 2018  
W.P. 2930-02-00



Prep'd AN  
Chkd. RPR





METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN



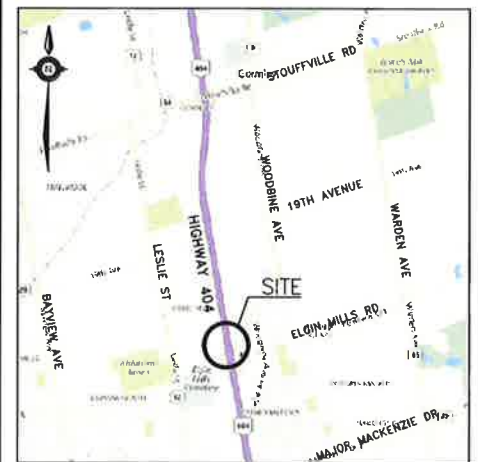
CONT No  
WP No 2930-02-00

HIGHWAY 404 WIDENING  
SEWER LATERALS  
19TH AVE. TO ELGIN MILLS RD  
BOREHOLE LOCATIONS AND SOIL STRATA

wsp



THURBER ENGINEERING LTD



KEYPLAN

LEGEND

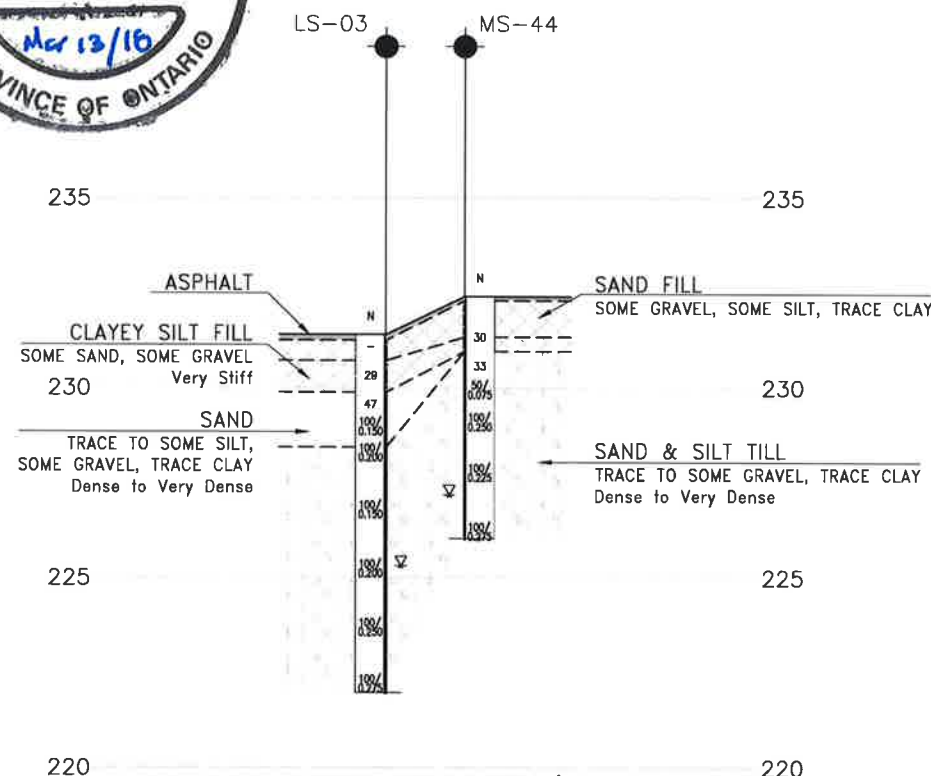
|      |                                       |
|------|---------------------------------------|
| ●    | Borehole                              |
| ⊙    | Borehole and Cone                     |
| N    | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE | Blows /0.3m (60' Cone, 475J/blow)     |
| PH   | Pressure, Hydraulic                   |
| ▽    | Water Level                           |
| ▽    | Head Artesian Water                   |
| ▽    | Piezometer                            |
| 90%  | Rock Quality Designation (RQD)        |
| A/R  | Auger Refusal                         |

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| LS-03 | 231.4     | 4 862 512.6 | 314 043.2 |
| LS-04 | 233.8     | 4 862 872.9 | 313 977.7 |
| MS-41 | 234.5     | 4 862 885.1 | 314 018.0 |
| MS-44 | 232.4     | 4 862 515.2 | 314 053.3 |

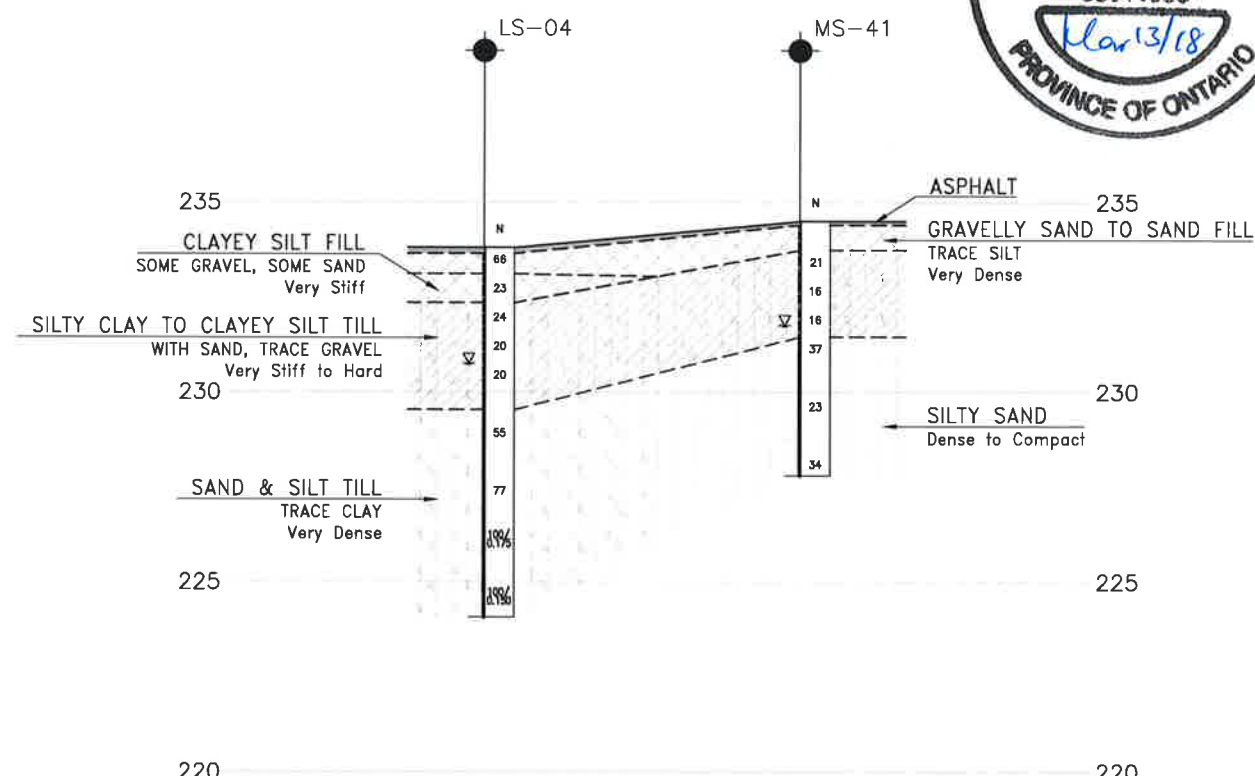
-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 30M14-472



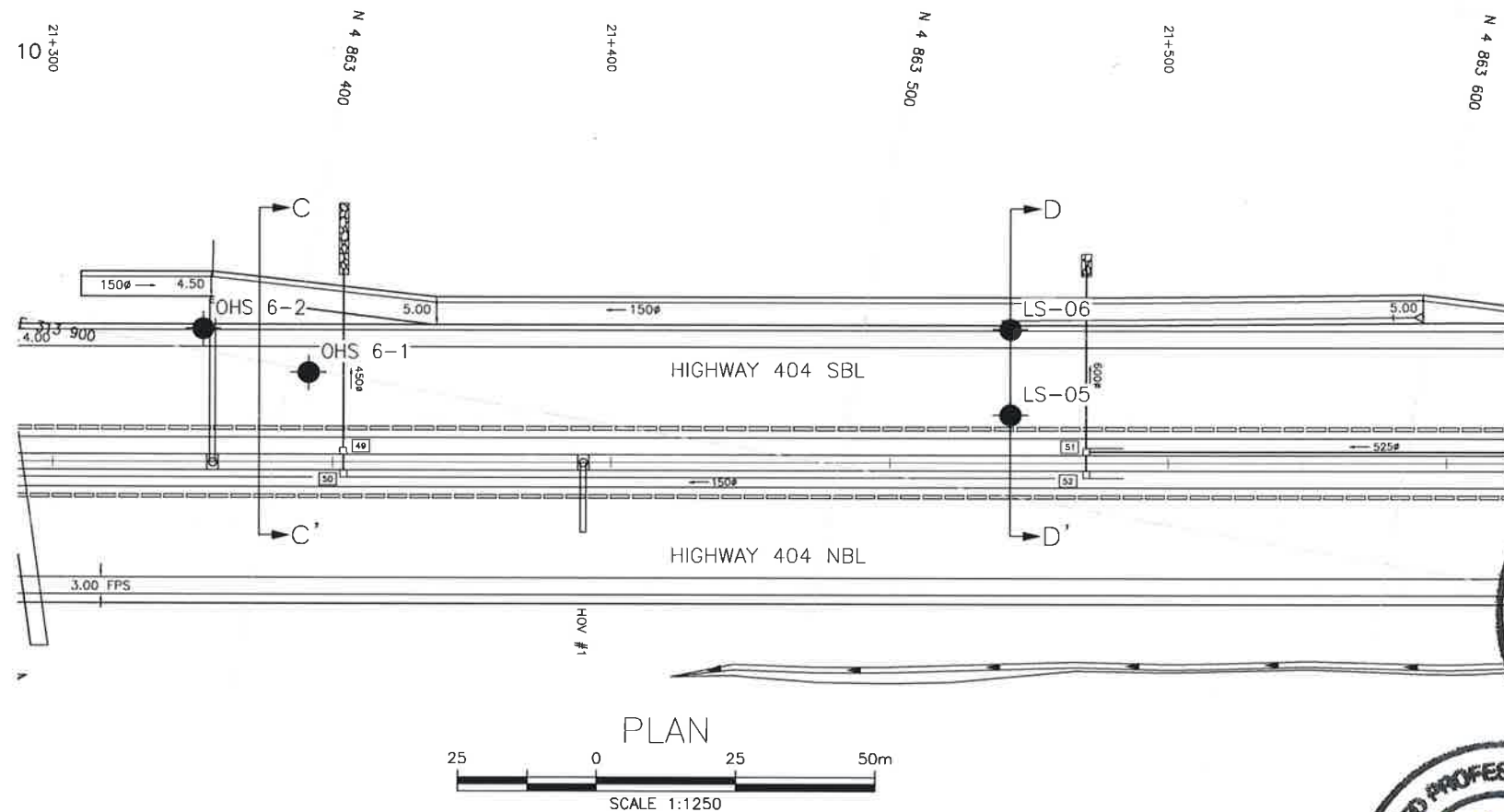
SECTION A-A'  
(SEWER LATERAL UPSTREAM ID 35)



SECTION B-B'  
(SEWER LATERAL UPSTREAM ID 41)



| REVISIONS | DATE | BY      | DESCRIPTION |
|-----------|------|---------|-------------|
| DESIGN    | RPR  | CHK SKP | CODE        |
| DRAWN     | AN   | CHK RPR | SITE        |
|           |      |         | LOAD        |
|           |      |         | DATE        |
|           |      |         | MAR 2018    |
|           |      |         | STRUCT      |
|           |      |         | DWG C1      |



METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

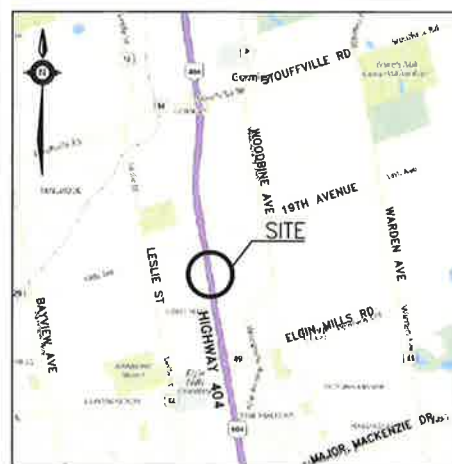
CONT No  
WP No 2930-02-00

HIGHWAY 404 WIDENING  
SEWER LATERALS  
19TH AVE. TO ELGIN MILLS RD  
BOREHOLE LOCATIONS AND SOIL STRATA

wsp



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

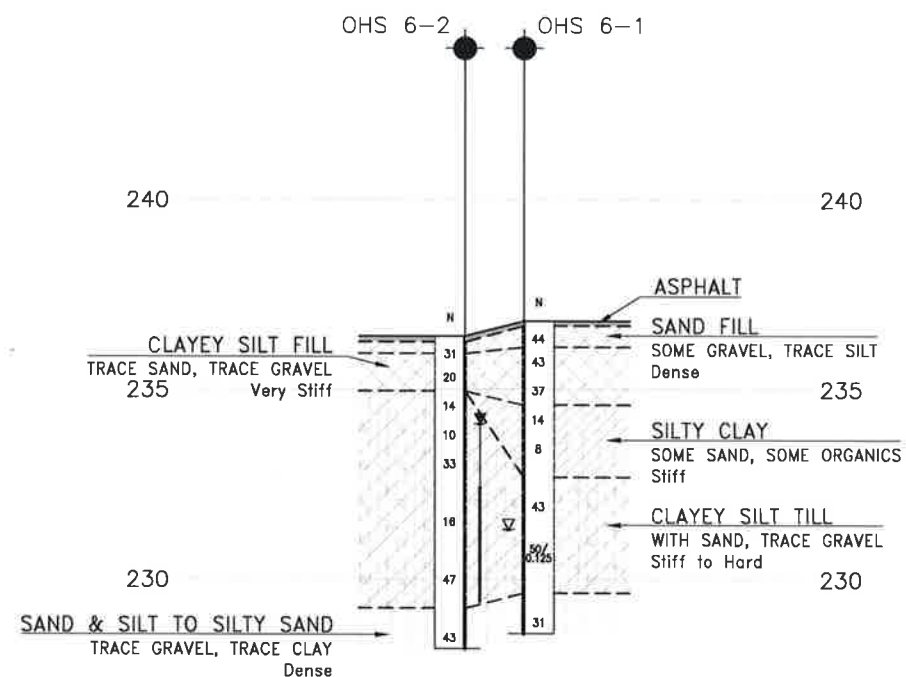
|      |                                       |
|------|---------------------------------------|
|      | Borehole                              |
|      | Borehole and Cone                     |
| N    | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE | Blows /0.3m (60' Cone, 475J/blow)     |
| PH   | Pressure, Hydraulic                   |
|      | Water Level                           |
|      | Head Artesian Water                   |
|      | Piezometer                            |
| 90%  | Rock Quality Designation (RQD)        |
| A/R  | Auger Refusal                         |

| NO      | ELEVATION | NORTHING    | EASTING   |
|---------|-----------|-------------|-----------|
| LS-05   | 237.3     | 4 863 528.7 | 313 885.6 |
| LS-06   | 237.2     | 4 863 526.0 | 313 870.6 |
| OHS 6-1 | 236.8     | 4 863 403.4 | 313 900.4 |
| OHS 6-2 | 236.4     | 4 863 383.5 | 313 896.0 |

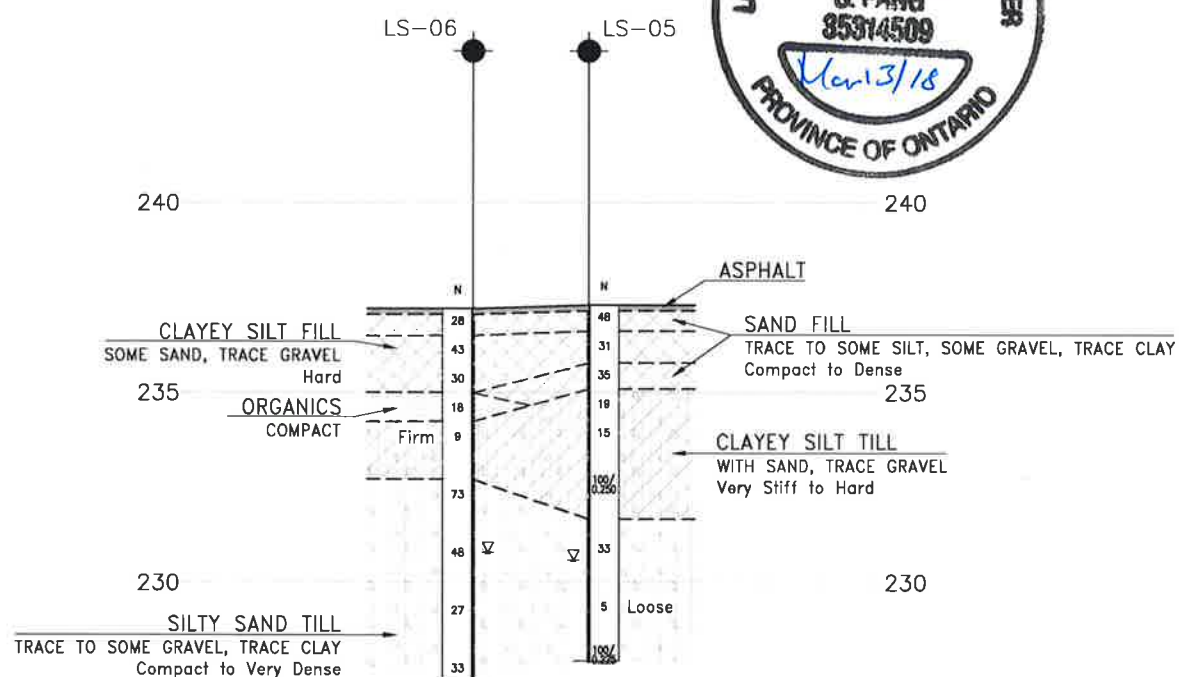
-NOTES-

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- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

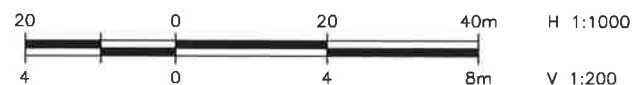
GEOCRES No. 30M14-472



SECTION C-C'  
(SEWER LATERAL UPSTREAM ID 49)

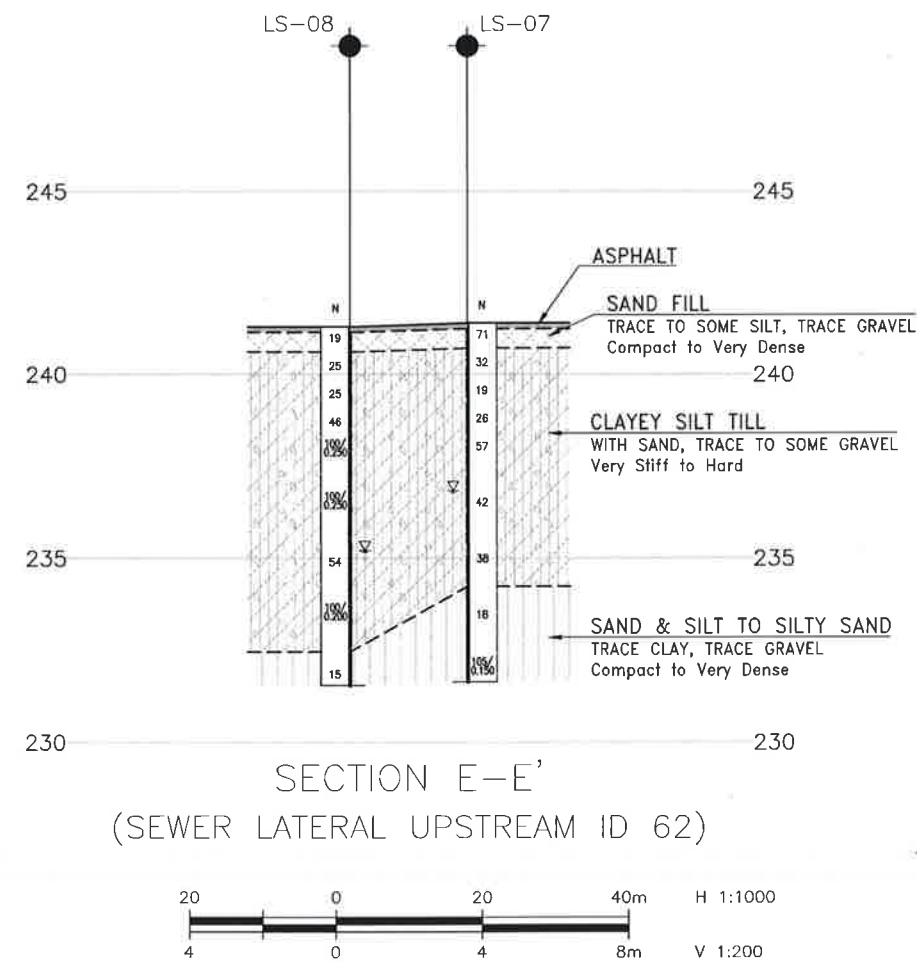
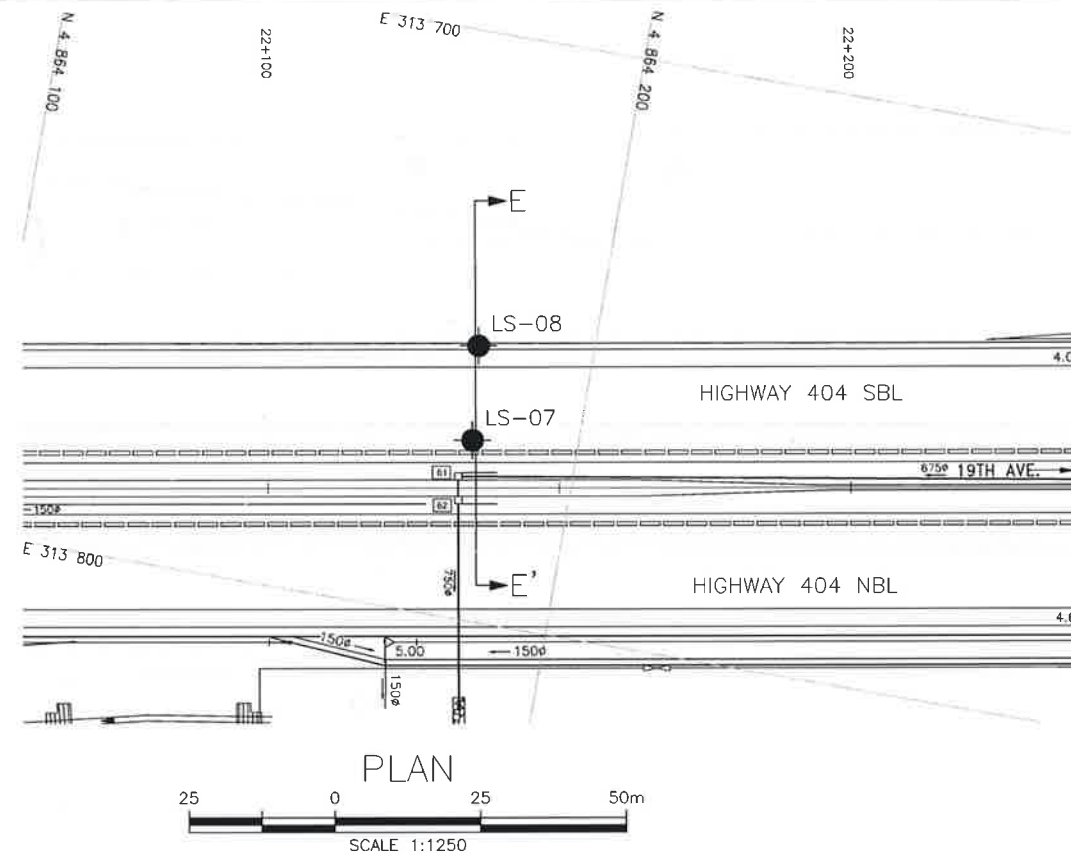


SECTION D-D'  
(SEWER LATERAL UPSTREAM ID 51)



| REVISIONS | DATE | BY       | DESCRIPTION |
|-----------|------|----------|-------------|
| DESIGN    | RPR  | CHK SKP  | CODE        |
| DRAWN     | AN   | CHK RPR  | SITE        |
| LOAD      | DATE | MAR 2018 |             |
| STRUCT    | DWG  | C2       |             |





METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 2930-02-00

HIGHWAY 404 WIDENING  
SEWER LATERALS  
19TH AVE. TO ELGIN MILLS RD  
BOREHOLE LOCATIONS AND SOIL STRATA






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**THURBER ENGINEERING LTD.**



KEYPLAN  
LEGEND

|   |                                       |
|---|---------------------------------------|
|  | Borehole                              |
|  | Borehole and Cone                     |
| N   | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE  | Blows /0.3m (60° Cone, 475J/blow)     |
| PH  | Pressure, Hydraulic                   |
|  | Water Level                           |
|  | Head Artesian Water                   |
|  | Piezometer                            |
| 90%   | Rock Quality Designation (RQD)        |
| A/R   | Auger Refusal                         |

[illegible]

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 30M14-472

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## **Appendix D**

### **Section 4 (Stations 20+300 to 18+300) From Elgin Mills Road to Major Mackenzie Drive Boreholes LS-01, LS-02, LS-18, LS-19**

- Record of Borehole Sheets
- Laboratory Test Results
- Drawings titled "Borehole Locations and Soil Strata"

# RECORD OF BOREHOLE No LS-01

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 860 890.8 E 314 394.9 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.22 - 2017.10.22 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                                    |  |  |  | PLASTIC<br>LIMIT<br>w <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|---------------|----------------------------|-----------------|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |  |  |  |                                    |                                     |                                   |  |  |
| 215.8         | GROUND SURFACE   |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.0           | ASPHALT (150mm)  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.2           | SAND, trace to some silt, trace gravel<br>Brown<br>Moist<br>(FILL)                                     |            | 1       | GS   | -             |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 215.1         |  |            |         |      |               |                            | 215             |  |  |  |  |                                    |                                     |                                   |  |  |
| 0.7           | Silty CLAY, trace sand, trace gravel,<br>occasional organics<br>Stiff<br>Dark Brown<br>Moist<br>(TILL) |            | 1       | SS   | 13            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 214.3         |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 1.5           | SAND and SILT, some clay, trace<br>gravel<br>Dense to Very Dense<br>Brown<br>Moist<br>(TILL)           |            | 2       | SS   | 33            |                            | 214             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 3       | SS   | 54            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 212.8         |  |            |         |      |               |                            | 213             |  |  |  |  |                                    |                                     |                                   |  | 0 54 35 11   |
| 3.0           | SAND, some silt, trace gravel, trace<br>to some clay<br>Dense to compact<br>Brown to Grey<br>Wet       |            | 4       | SS   | 35            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |               |                            | 212             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 5       | SS   | 39            |                            | 211             |  |  |  |  |                                    |                                     |                                   |  | 9 74 17 (SI+CL)  |
|               |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |               |                            | 210             |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Some gravel  |            | 6       | SS   | 13            |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 209.2         |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 6.6           | Silty CLAY, with sand, some gravel<br>Stiff to Hard<br>Grey<br>Wet<br>(TILL)                           |            |         |      |               |                            | 209             |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 7       | SS   | 100/<br>0.225 |                            | 208             |  |  |  |  |                                    |                                     |                                   |  | 15 35 31 19  |
|               |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 207.1         |  |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 8.7           | Sandy SILT, trace gravel<br>Very Dense<br>Grey<br>Wet<br>(TILL)  |            |         |      |               |                            | 207             |  |  |  |  |                                    |                                     |                                   |  |  |
| 206.4         |  |            | 8       | SS   | 100/<br>0.225 |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |
| 9.4           | END OF BOREHOLE AT 9.4m.<br>WATER LEVEL AT 3.7m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE HOLEPLUG AND |            |         |      |               |                            |                 |  |  |  |  |                                    |                                     |                                   |  |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

ONTMT4S MTO-15786 GPJ 2017TEMPLATE(MTO).GDT 1/16/18

## METRIC

[illegible]

# RECORD OF BOREHOLE No LS-02

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 860 882.1 E 314 376.7 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.17 - 2017.10.17 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |  |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|---------------|----------------------------|--------------------|--|--|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                    | SHEAR STRENGTH kPa   |  |  |  |  |   |   |
| 215.9         | GROUND SURFACE  |            |         |      |               |                            |                    | <div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>                                |  |  |  |  |   |   |
| 0.0           | ASPHALT (150mm)   |            |         |      |               |                            |                    | <div><div>204060</div><div>W P W W L</div><div>PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT</div><div>WATER CONTENT (%)</div></div> |  |  |  |  |   |   |
| 0.2           | SAND, trace to some silt, trace gravel<br>Dense<br>Brown  |            | 1       | SS   | 50            |                            | 215                |  |  |  |  |  |   |   |
| 215.2         | Moist<br>(FILL)   |            |         |      |               |                            |                    |  |  |  |  |  |   |   |
| 0.7           | Silty CLAY, some sand, trace to some<br>gravel<br>Very Stiff<br>Grey                              |            | 2       | SS   | 21            |                            |                    |  |  |  |  |  |   |   |
| 214.4         | Moist<br>(TILL)   |            |         |      |               |                            |                    |  |  |  |  |  |   |   |
| 1.5           | Silty SAND, trace to some gravel,<br>some clay<br>Dense to Very Dense<br>Brown<br>Moist<br>(TILL) |            | 3       | SS   | 49            |                            | 214                |  |  |  |  |  |   | 15 48 21 16                                       |
|               | Silty SAND, trace to some gravel,<br>some clay<br>Dense to Very Dense<br>Brown<br>Moist<br>(TILL) |            | 4       | SS   | 100/<br>0.200 |                            |                    |  |  |  |  |  |   |   |
|               | Grey  |            | 5       | SS   | 100/<br>0.125 |                            | 213                |  |  |  |  |  |   |   |
| 211.8         |   |            |         |      |               |                            |                    |  |  |  |  |  |   |   |
| 4.1           | SAND, trace gravel, some silt, trace<br>clay<br>Dense<br>Grey<br>Wet                              |            | 6       | SS   | 44            |                            | 211                |  |  |  |  |  |   | 8 77 12 3   |
| 209.9         |   |            |         |      |               |                            |                    |  |  |  |  |  |   |   |
| 6.0           | Silty CLAY, with sand, trace gravel<br>Hard<br>Grey<br>Wet<br>(TILL)                              |            | 7       | SS   | 100/<br>0.200 |                            | 210                |  |  |  |  |  |   |   |
|               |   |            |         |      |               |                            |                    |  |  |  |  |  |   |   |
|               |   |            | 8       | SS   | 100/<br>0.225 |                            | 209                |  |  |  |  |  |   |   |
| 207.4         |   |            |         |      |               |                            |                    |  |  |  |  |  |   |   |
| 8.5           | Gravelly SAND<br>Very Dense<br>Grey<br>Wet  |            |         |      |               |                            | 208                |  |  |  |  |  |   | 7 39 31 23  |
| 206.6         |   |            | 9       | SS   | 100/<br>0.125 |                            | 207                |  |  |  |  |  |   |   |
| 9.3           | END OF BOREHOLE AT 9.3m.<br>BOREHOLE OPEN AND WATER<br>LEVEL AT 4.6m.<br>BOREHOLE BACKFILLED WITH |            |         |      |               |                            |                    |  |  |  |  |  |   |   |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-02

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION NB N 4 860 882.1 E 314 376.7 ORIGINATED BY OA  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.10.17 - 2017.10.17 CHECKED BY RPR

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page                         |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | BENTONITE HOLEPLUG AND<br>AUGER CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |



# RECORD OF BOREHOLE No LS-18

1 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 860 504.0 E 314 424.9 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.12.05 - 2017.12.05 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS                               | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |     |                   |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|--|-----------------|---|----|-----|-------------------|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |  |                 | SHEAR STRENGTH kPa                          |    |     |                   |    |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |                 |   |    |     | WATER CONTENT (%) |    |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            | 20   | 40              | 60  | 80 | 100 | 20                | 40 | 60                                 |                                     |                                   |  |  |
| 211.9         | GROUND SURFACE  |            |         |      |            |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
| 0.0           | ASPHALT: (125mm)  |            |         |      |            |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
| 0.2           | SAND, some silt, trace gravel<br>Dense<br>Brown<br>Moist<br>(FILL)                                |            | 1       | SS   | 36         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
| 211.1         | Silty CLAY, some sand and gravel<br>Very Stiff to Hard<br>Brown to Grey<br>Moist to Wet<br>(TILL) |            | 2       | SS   | 27         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
| 0.8           | Occasional cobbles  |            | 3       | SS   | 42         |  |                 |   |    |     |                   |    |                                    |                                     |                                   | 4 20 29 47                               |  |
|               |   |            | 4       | SS   | 31         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
|               |   |            | 5       | SS   | 50         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
|               |   |            | 6       | SS   | 49         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
|               |   |            | 7       | SS   | 38         |  |                 |   |    |     |                   |    |                                    |                                     |                                   | 10 36 32 22                              |  |
|               |   |            | 8       | SS   | 42         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
|               | Occasional cobbles  |            | 9       | SS   | 75         |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
| 202.2         | END OF BOREHOLE AT 9.70m.<br>BOREHOLE OPEN AND WATER  |            |         |      |            |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |
| 9.7           |   |            |         |      |            |  |                 |   |    |     |                   |    |                                    |                                     |                                   |  |  |

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No LS-18

2 OF 2

METRIC

W.P. 2930-02-00 LOCATION SB N 4 860 504.0 E 314 424.9 ORIGINATED BY JHP  
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2017.12.05 - 2017.12.05 CHECKED BY RPR

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |  |  |
|               | Continued From Previous Page  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |
|               | LEVEL AT 5.1m.<br>BOREHOLE BACKFILLED WITH<br>BENTONITE BOREPLUG AND<br>AUGER CUTTINGS TO 0.3m, THEN<br>CONCRETE AND ASPHALT TO<br>SURFACE. |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |  |  |

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/18

## METRIC

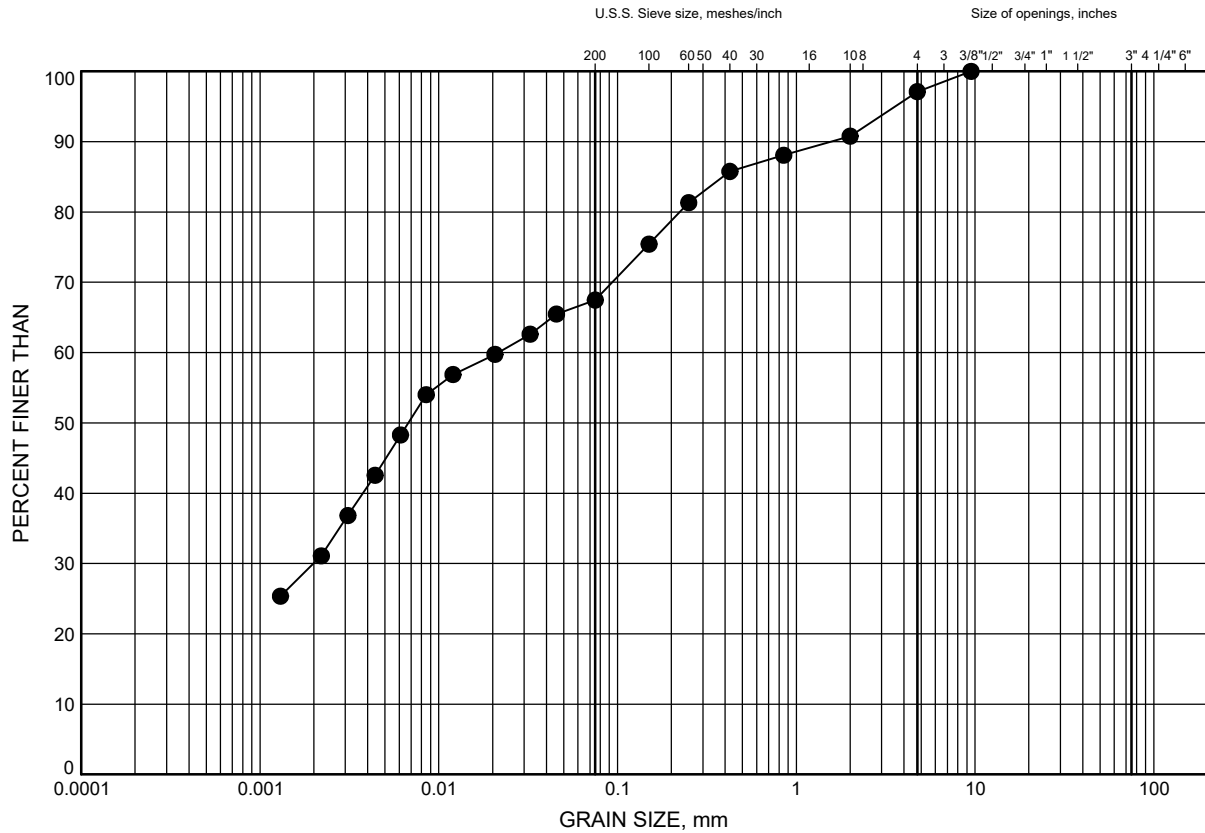
| SOIL PROFILE  |                                      |            | SAMPLES |      |              |
|---------------|--------------------------------------|------------|---------|------|--------------|
| ELEV<br>DEPTH | DESCRIPTION                          | STRAT PLOT | NUMBER  | TYPE | "N" VALUES   |
| 211.6         | GROUND SURFACE                       |            |         |      |              |
| 0.0           | ASPHALT: (100mm)                     | A          |         |      |              |
| 0.1           | CONCRETE: (150mm)                    | B          |         |      |              |
| 211.3         | Silty CLAY, trace sand, trace gravel | C          | 1       | SS   | 22           |
| 0.3           | Very Stiff                           | D          |         |      |              |
|               | Brown                                | E          | 2       | SS   | 16           |
|               | Moist                                | F          |         |      |              |
|               | (FILL)                               | G          |         |      |              |
| 209.9         | Clayey SILT, with sand, trace gravel | H          | 3       | SS   | 52           |
| 1.7           | Hard                                 | I          |         |      |              |
|               | Brown to Grey                        | J          |         |      |              |
|               | Moist                                | K          | 4       | SS   | 98           |
|               | (TILL)                               | L          |         |      |              |
|               |                                      | M          |         |      |              |
|               |                                      | N          | 5       | SS   | 50/<br>0.100 |
|               |                                      | O          |         |      |              |
|               |                                      | P          |         |      |              |
|               |                                      | Q          |         |      |              |
|               |                                      | R          |         |      |              |
|               |                                      | S          |         |      |              |
|               |                                      | T          | 6       | SS   | 84           |
|               |                                      | U          |         |      |              |
|               |                                      | V          |         |      |              |
|               |                                      | W          |         |      |              |
|               |                                      | X          |         |      |              |
|               |                                      | Y          |         |      |              |
|               |                                      | Z          |         |      |              |
|               |                                      | AA         |         |      |              |
|               |                                      | AB         |         |      |              |
|               |                                      | AC         |         |      |              |
|               |                                      | AD         |         |      |              |
|               |                                      | AE         |         |      |              |
|               |                                      | AF         |         |      |              |
|               |                                      | AG         |         |      |              |
|               |                                      | AH         |         |      |              |
|               |                                      | AI         |         |      |              |
|               |                                      | AJ         |         |      |              |
|               |                                      | AK         |         |      |              |
|               |                                      | AL         |         |      |              |
|               |                                      | AM         |         |      |              |
|               |                                      | AN         |         |      |              |
|               |                                      | AO         |         |      |              |
|               |                                      | AP         |         |      |              |
|               |                                      | AQ         |         |      |              |
|               |                                      | AR         |         |      |              |
|               |                                      | AS         |         |      |              |
|               |                                      | AT         |         |      |              |
|               |                                      | AU         |         |      |              |
|               |                                      | AV         |         |      |              |
|               |                                      | AW         |         |      |              |
|               |                                      | AX         |         |      |              |
|               |                                      | AY         |         |      |              |
|               |                                      | AZ         |         |      |              |
|               |                                      | BA         |         |      |              |
|               |                                      | BB         |         |      |              |
|               |                                      | BC         |         |      |              |
|               |                                      | BD         |         |      |              |
|               |                                      | BE         |         |      |              |
|               |                                      | BF         |         |      |              |
|               |                                      | BG         |         |      |              |
|               |                                      | BH         |         |      |              |
|               |                                      | BI         |         |      |              |
|               |                                      | BJ         |         |      |              |
|               |                                      | BK         |         |      |              |
|               |                                      | BL         |         |      |              |
|               |                                      | BM         |         |      |              |
|               |                                      | BN         |         |      |              |
|               |                                      | BO         |         |      |              |
|               |                                      | BP         |         |      |              |
|               |                                      | BQ         |         |      |              |
|               |                                      | BR         |         |      |              |
|               |                                      | BS         |         |      |              |
|               |                                      | BT         |         |      |              |
|               |                                      | BU         |         |      |              |
|               |                                      | BV         |         |      |              |
|               |                                      | BW         |         |      |              |
|               |                                      | BX         |         |      |              |
|               |                                      | BY         |         |      |              |
|               |                                      | BZ         |         |      |              |
|               |                                      | CA         |         |      |              |
|               |                                      | CB         |         |      |              |
|               |                                      | CC         |         |      |              |
|               |                                      | CD         |         |      |              |
|               |                                      | CE         |         |      |              |
|               |                                      | CF         |         |      |              |
|               |                                      | CG         |         |      |              |
|               |                                      | CH         |         |      |              |
|               |                                      | CI         |         |      |              |
|               |                                      | CJ         |         |      |              |
|               |                                      | CK         |         |      |              |
|               |                                      | CL         |         |      |              |
|               |                                      | CM         |         |      |              |
|               |                                      | CN         |         |      |              |
|               |                                      | CO         |         |      |              |
|               |                                      | CP         |         |      |              |
|               |                                      | CQ         |         |      |              |
|               |                                      | CR         |         |      |              |
|               |                                      | CS         |         |      |              |
|               |                                      | CT         |         |      |              |
|               |                                      | CU         |         |      |              |
|               |                                      | CV         |         |      |              |
|               |                                      | CW         |         |      |              |
|               |                                      | CX         |         |      |              |
|               |                                      | CY         |         |      |              |
|               |                                      | CZ         |         |      |              |
|               |                                      | DA         |         |      |              |
|               |                                      | DB         |         |      |              |
|               |                                      | DC         |         |      |              |
|               |                                      | DD         |         |      |              |
|               |                                      | DE         |         |      |              |
|               |                                      | DF         |         |      |              |
|               |                                      | DG         |         |      |              |
|               |                                      | DH         |         |      |              |
|               |                                      | DI         |         |      |              |
|               |                                      | DJ         |         |      |              |
|               |                                      | DK         |         |      |              |
|               |                                      | DL         |         |      |              |
|               |                                      | DM         |         |      |              |
|               |                                      | DN         |         |      |              |
|               |                                      | DO         |         |      |              |
|               |                                      | DP         |         |      |              |
|               |                                      | DQ         |         |      |              |
|               |                                      | DR         |         |      |              |
|               |                                      | DS         |         |      |              |
|               |                                      | DT         |         |      |              |
|               |                                      | DU         |         |      |              |
|               |                                      | DV         |         |      |              |
|               |                                      | DW         |         |      |              |
|               |                                      | DX         |         |      |              |
|               |                                      | DY         |         |      |              |

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D1

## Silty CLAY FILL



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

## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-19    | 1.1       | 210.5     |

Date January 2018  
W.P. 2930-02-00

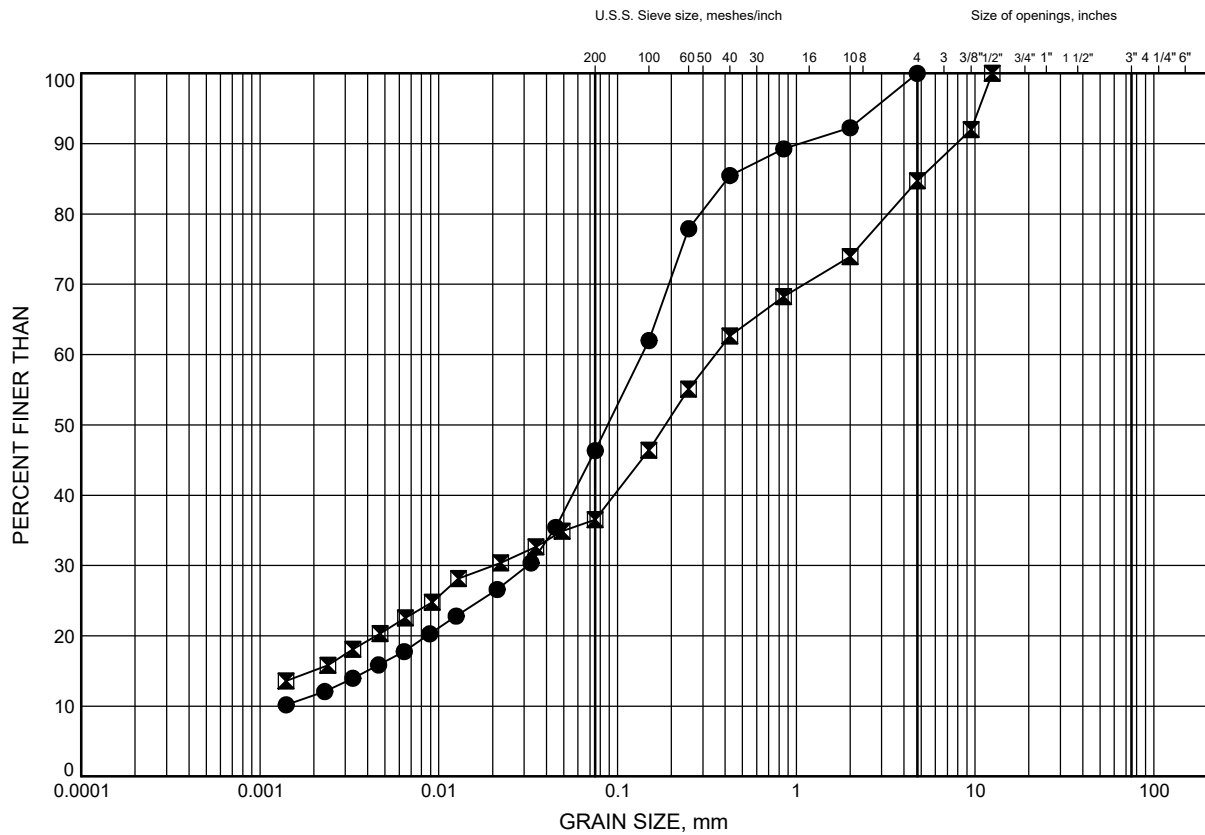


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# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D2

## Silty SAND TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-01    | 2.6       | 213.2     |
| ⊠      | LS-02    | 1.8       | 214.1     |

Date January 2018  
W.P. 2930-02-00



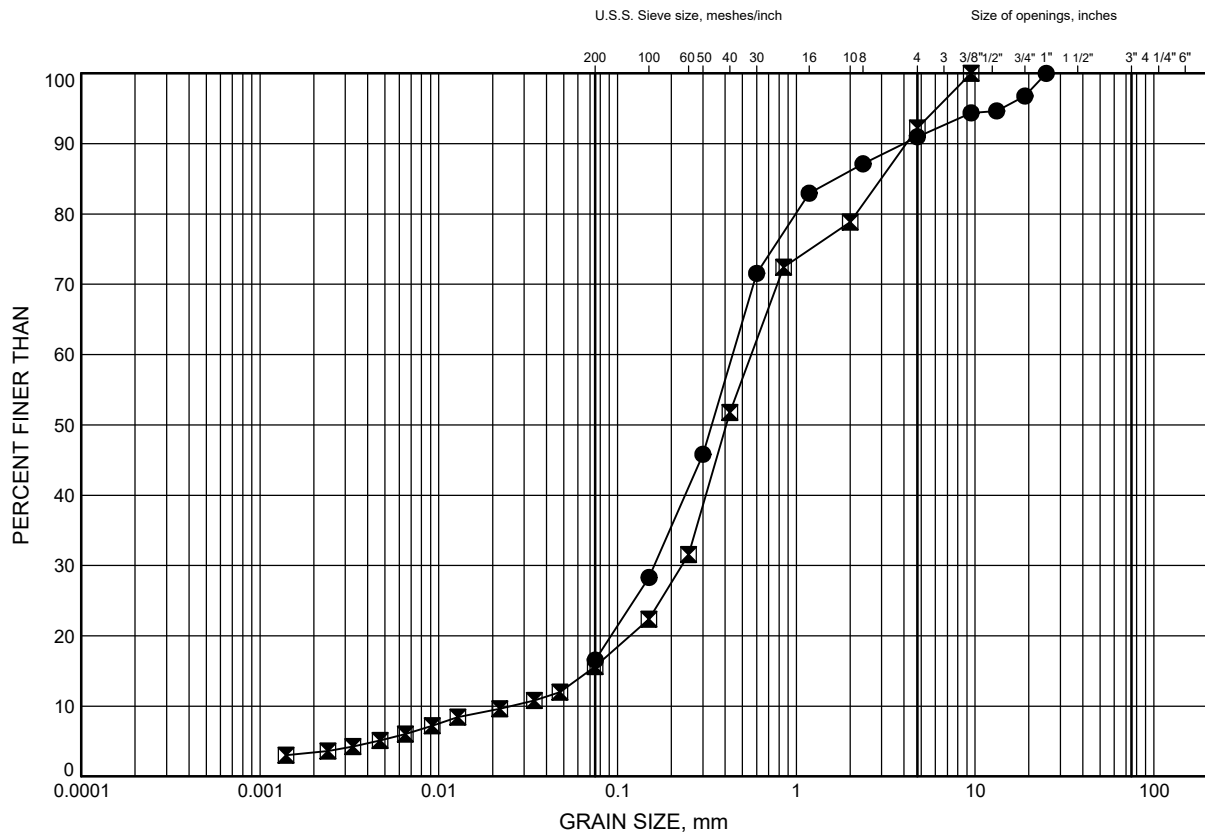
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# HWY 404 Widening

## GRAIN SIZE DISTRIBUTION

FIGURE D3

### SAND



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-01    | 4.9       | 210.9     |
| ⊠      | LS-02    | 4.9       | 211.0     |

Date January 2018  
W.P. 2930-02-00

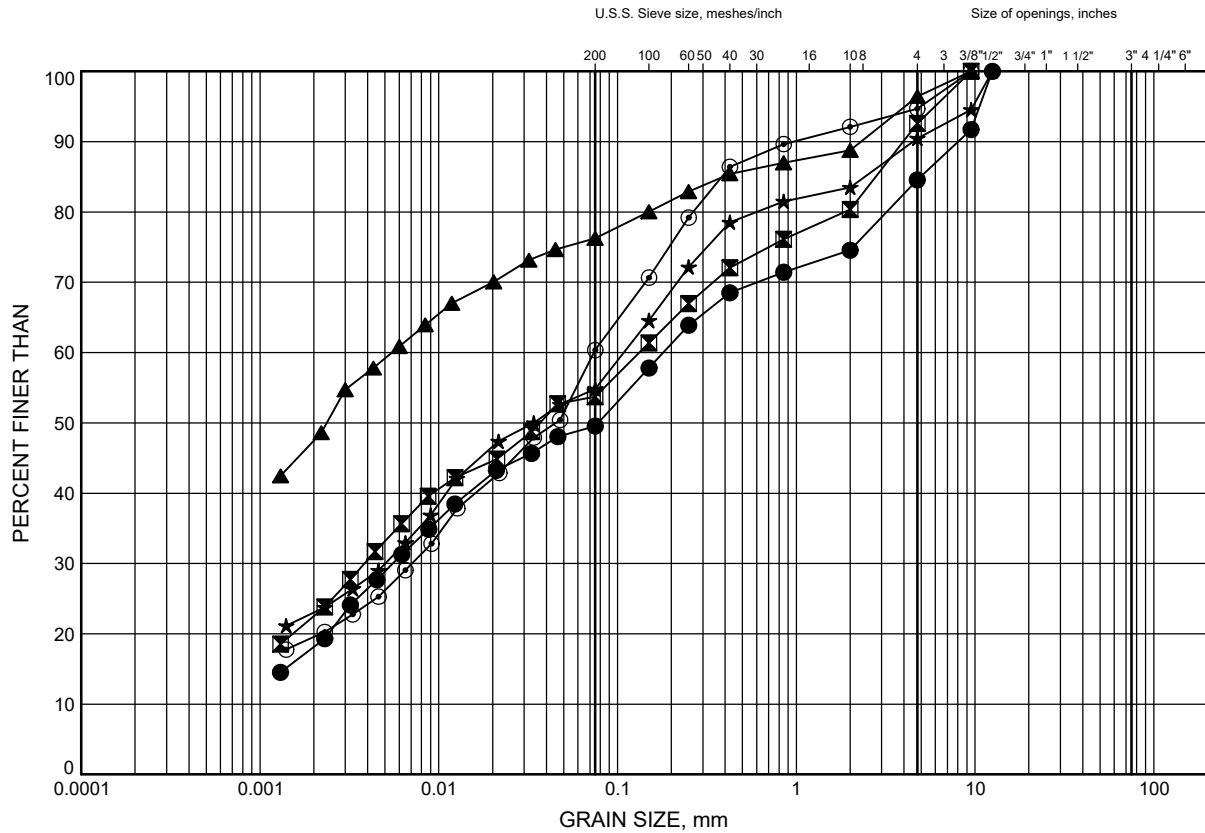


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# HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D4

## Silty CLAY to Clayey SILT TILL



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

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-01    | 7.9       | 207.9     |
| ⊠      | LS-02    | 7.9       | 208.0     |
| ▲      | LS-18    | 1.8       | 210.1     |
| ★      | LS-18    | 6.4       | 205.5     |
| ⊙      | LS-19    | 3.3       | 208.3     |

Date January 2018  
W.P. 2930-02-00

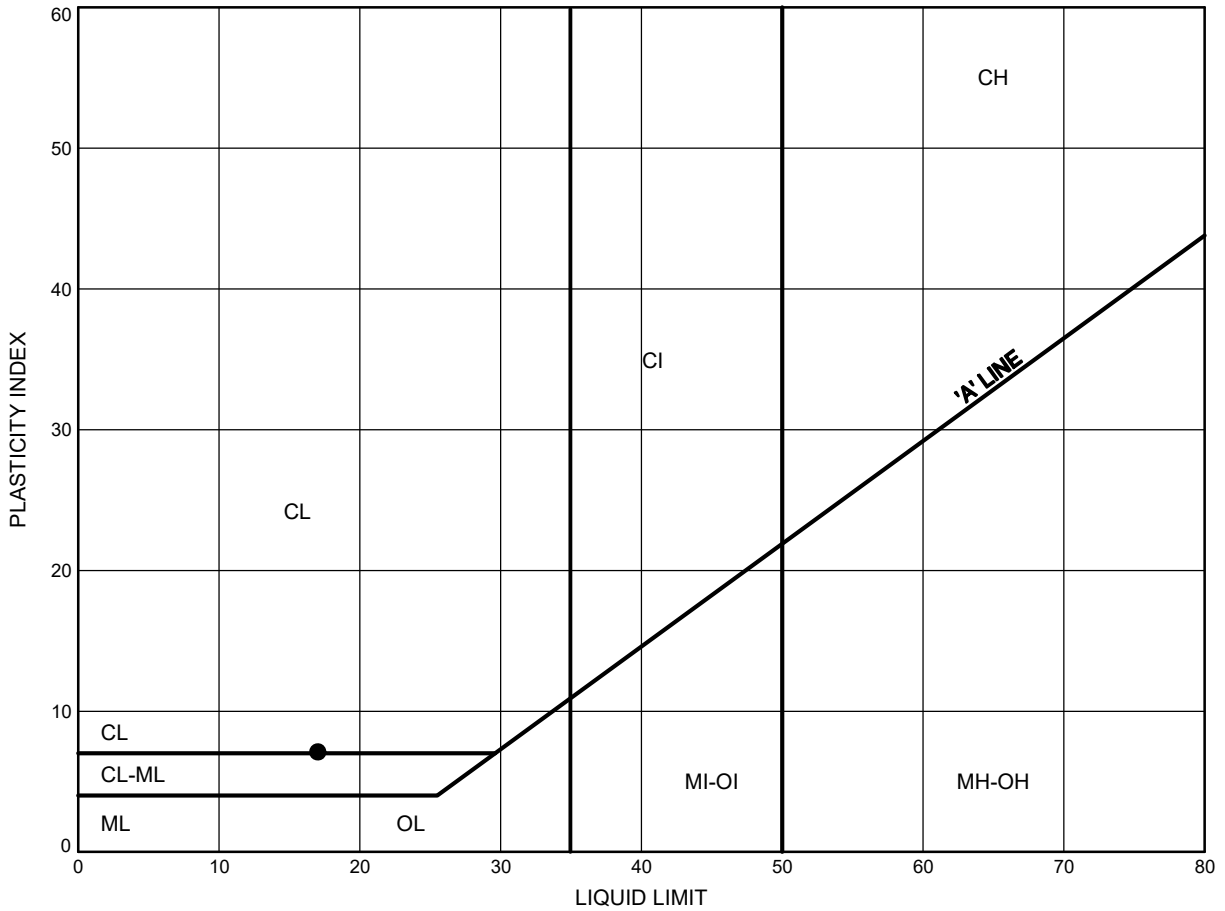


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# HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE D5

Silty CLAY to Clayey SILT TILL



### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | LS-18    | 6.4       | 205.5     |

Date January 2018  
W.P. 2930-02-00



Prep'd AN  
Chkd. SKP



|                  |
|------------------|
| CONT No          |
| WP No 2930-02-00 |



SHEET

|  |  |
|--|--|
| <p>HIGHWAY 404 WIDENING<br/>SEWER LATERALS<br/>ELGIN MILLS RD TO MAJOR MACKENZIE DR<br/>BOREHOLE LOCATIONS AND SOIL STRATA</p> |  |
|--|--|

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**THURBER** ENGINEERING LTD.



## KEYPLAN

### LEGEND

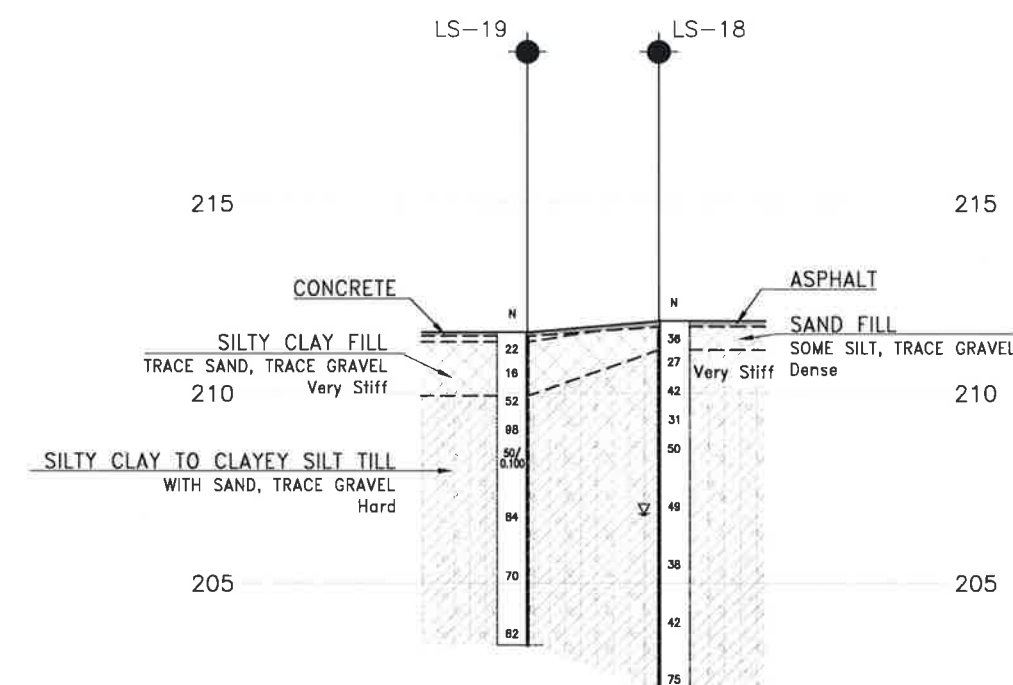
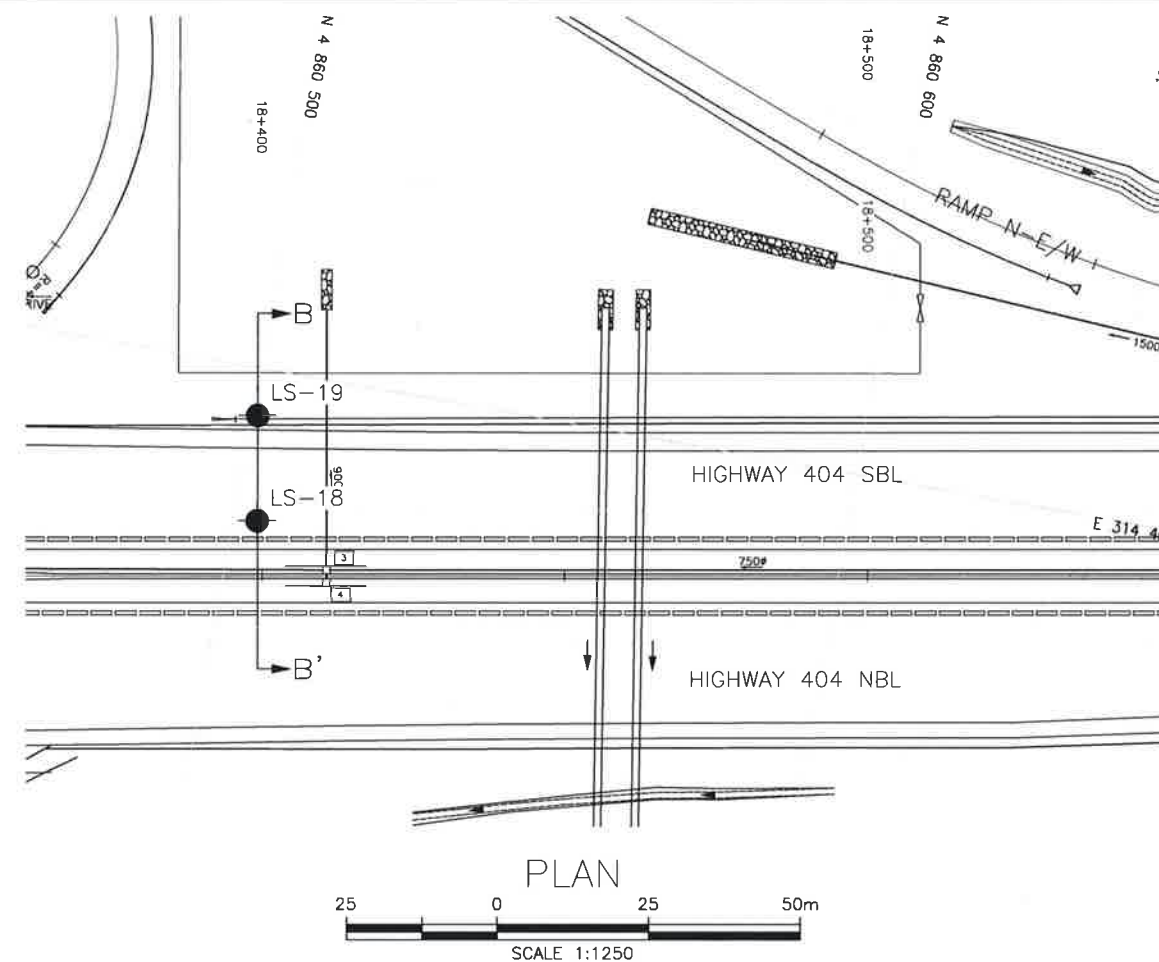
|   |                                       |
|---|---------------------------------------|
|  | Borehole                              |
|  | Borehole and Cone                     |
| N   | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE  | Blows /0.3m (60° Cone, 475J/blow)     |
| PH  | Pressure, Hydraulic                   |
|  | Water Level                           |
|  | Head Artesian Water                   |
|  | Piezometer                            |
| 90%   | Rock Quality Designation (RQD)        |
| A/R   | Auger Refusal                         |

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| LS-18 | 211.9     | 4 860 504.0 | 314 424.9 |
| LS-19 | 211.6     | 4 860 501.0 | 314 407.8 |

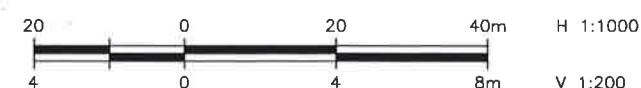
-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 30M14-472**



SECTION B-B'  
(SEWER LATERAL UPSTREAM ID 3)



|           |      |     |             |      |        |      |          |  |  |  |
|-----------|------|-----|-------------|------|--------|------|----------|--|--|--|
| REVISIONS |      |     |             |      |        |      |          |  |  |  |
|           |      |     |             |      |        |      |          |  |  |  |
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|           |      |     |             |      |        |      |          |  |  |  |
|           | DATE | BY  | DESCRIPTION |      |        |      |          |  |  |  |
| DESIGN    | RPR  | CHK | SKP         | CODE | LOAD   | DATE | MAR 2018 |  |  |  |
| DRAWN     | AN   | CHK | RPR         | SITE | STRUCT | DWG  | D1       |  |  |  |