



THURBER ENGINEERING LTD.

**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 DRIVE
MARKHAM, ONTARIO
G.W.P. 2930-02-00**

GEOCRES NO. 30M14-473

Report

to

WSP Canada Inc.

Date: February 16, 2018
File: 15786



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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted for detailed design of overhead sign (OHS), high occupancy toll sign (HOT), high occupancy message sign (HMS), and toll station sign (TS) support structures along Highway 404 from 0.5 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 sign locations along the highway alignment, and based on the data obtained, to provide a borehole location plan, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

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

For preparation of this report, reference has been made to a previous report:

- Foundation Investigation Report, Median Sewer, Highway 404 HOV Lane Expansion and Rehabilitation, Contract 1, From Stouffville Road to Major Mackenzie Drive, Markham, Ontario, G.W.P. 2930-02-00, prepared by Thurber Engineering Ltd., dated February 2018 (Reference 1)

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2. PROJECT AND SITE DESCRIPTION

The locations of overhead sign support structures covered in this report are staggered along Highway 404 from approximately 1 km north of Stouffville Road to Major Mackenzie Drive. The general locations of the proposed works are shown on the key plan on the Borehole Location Drawings in Appendices A to D.

The project limits are located within the physiographic region known as Peel Plain. The topography is flat and 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.

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.

3. SITE INVESTIGATION AND FIELD TESTING

The borehole investigation and field testing program for this project was carried out from November 7, 2017 to January 8, 2018, and consisted of drilling and sampling forty-five (45) boreholes to approximate depths ranging from 6.7 to 8.2 m below existing grade. Twenty (20) boreholes were drilled for the proposed overhead sign (OHS) supports, four (4) boreholes for the high occupancy toll sign (HOT) supports, fourteen (14) boreholes for the high occupancy message sign (HMS) supports, and seven (7) boreholes for the toll station sign (TS) supports. Three (3) boreholes drilled for the median sewer from Reference 1 have also been used to address HOT supports.

Lane closures and traffic control were carefully planned for drilling each borehole. Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

The approximate locations of the boreholes are shown on the Borehole Location Drawings included in Appendix E. Northing and easting co-ordinates 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 coordinates



and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendices A to D.

The boreholes were advanced using truck-mounted CME-75 and D-90 drill rigs. Solid stem augers were used to advance the boreholes, and soil samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with the Standard Penetration Test (SPT).

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

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Standpipe piezometers were installed in selected boreholes to permit monitoring of groundwater levels. The piezometers consisted of 25 mm PVC pipes with slotted screens. At the time of writing this report, the piezometers have not been decommissioned. Upon completion, the boreholes were abandoned in general accordance with Ontario Regulation 903 amended by Ontario Reg. 372 (O.Reg. 903). In general, groundwater level readings observed from boreholes drilled for other aspects of this Highway 404 project have been used. The details of borehole completion are summarized in Table 3.1.

Table 3.1 – Borehole Completion Details

Borehole No.	Borehole Depth / Base Elevation (m)	Piezometer Tip Elevation (m)	Completion Details
HMS 1-1	8.0/210.2	None installed	Borehole backfilled with bentonite holeplug, then dry mix concrete and cold patch asphalt to surface
HMS 1-2	8.2/209.7	None installed	Borehole backfilled with bentonite holeplug, then dry mix concrete to surface
HMS 2-1	7.9/215.6	None installed	Borehole backfilled with bentonite holeplug, then dry mix concrete and cold patch asphalt to surface



HMS 2-2	8.0/215.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 3-1	8.2/227.9	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 3-2	8.2/227.7	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 4-1	8.1/230.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 4-2	8.2/230.1	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 5-1	8.2/244.0	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 5-2	8.2/243.9	7.3/244.8	Borehole backfilled with sand filter from 7.6 m to 3.0 m, bentonite holeplug from 3.0 m to 0.3 m, then dry mix concrete to surface.
HMS 6-1	7.9/246.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 6-2	7.8/246.3	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 7-1	8.2/272.5	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HMS 7-2	8.2/272.3	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HOT-1	8.1/229.7	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HOT-2	8.1/231.4	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
HOT-3	8.1/238.9	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface

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HOT-4	8.1/243.4	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
MS-65	6.7/204.6	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
MS-42	6.7/226.7	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
MS-32	6.7/234.0	5.8 / 234.9	Borehole backfilled with sand filter from 5.8 m to 3.0 m, bentonite holeplug from 3.0 m to 0.6 m, then bentonite holeplug and auger cuttings from 0.6 m to surface.
OHS 1-1	8.2/207.4	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 1-2	8.2/207.1	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 2-1	8.2/212.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 2-2	8.1/212.0	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 3-1	7.7/213.8	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 3-2	7.7/213.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete to surface
OHS 4-1	7.7/218.7	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 4-2	8.1/217.7	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 5-1	7.8/226.6	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 5-2	8.2/226.0	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface

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OHS 6-1	8.2/228.5	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 6-2	8.2/228.2	7.0/229.4	Borehole backfilled with sand filter from 7.3 m to 3.4 m, bentonite holeplug and auger cuttings to surface.
OHS 7-1	7.7/247.5	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 7-2	7.7/247.6	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 8-1	6.7/253.5	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 8-2	8.2/252.1	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 9-1	8.2/259.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 9-2	7.8/259.4	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 10-1	8.0/264.0	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
OHS 10-2	8.2/263.6	7.3/264.6	Borehole backfilled with sand filter from 7.6 m to 3.0 m, bentonite holeplug and auger cuttings to 0.3m, then dry mix cement to surface.
TS-95	8.1/207.0	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
TS-105	8.2/215.1	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
TS-110	7.9/211.1	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
TS-125	7.8/226.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface



TS-135	8.2/229.9	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
TS-150	6.7/233.6	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface
TS-190	7.8/252.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings, then dry mix concrete and cold patch asphalt to surface

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 sign supports. Borehole location along Highway 404 are presented on the Borehole Location Drawings in Appendix E. These boreholes are identified by sections and station numbers in Table 5.1 below. Records of Borehole sheets and laboratory testing data relevant to each section are also included in the appendices.

Table 5.1
Longitudinal and Cross Sections

Identification	Approximate Hwy. 404 Station No.	Highway Section	Reference Boreholes
Section 1	11+000 to 24+700	From 1 km north of Stouffville Road to Stouffville Road	HMS 7-1, HMS 7-2, OHS-10-1, OHS 10-2, OHS 9-1, OHS-9-2
Section 2	24+700 to 22+400	From Stouffville Road to 19 th Avenue	OHS 8-1, OHS 8-2, TS-190, OHS 7-1, OHS-7-2, HMS 6-1, HMS 6-2, HMS 5-1, HMS 5-2, HOT-4, HOT-3
Section 3	22+400 to 20+300	From 19 th Avenue to Elgin Mills Road	MS-65, HOT-2, TS-150, HMS 4-1, HMS 4-2, TS-135, HOT-1, OHS 6-1, OHS 6-2, HMS 3-1, HMS 3-2, OHS 5-1, OHS 5-2, TS-125, MS-42
Section 4	20+300 to 18+300	From Elgin Mills Road to Major Mackenzie Drive	OHS 4-1, OHS 4-2, HMS 2-1, HMS 2-2, TS-105, OHS 3-1, OHS 3-2, OHS 2-1, OHS 2-2, TS-110, HMS 1-1, HMS 1-2, OHS 1-1, OHS 1-2, TS-95, MS-32

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 along those sections of Highway 404 consists of a pavement structure (asphalt on granular) and embankment fill overlying native, typically very stiff to hard silty clay to clayey silt till, and/or compact to very dense sandy silt to silty sand tills. Sand and silt interlayers and lenses are present between and/or within the glacial till deposits. Groundwater levels measured in installed standpipe piezometers typically range between 1.5 m and 4 m depths below existing grade. It is noted that these observations are short term and subject to seasonal fluctuations, and therefore do not necessarily represent the stabilized groundwater conditions.

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



5.1 Section 1 - From 1 km north of Stouffville Road to Stouffville Road (Stations 11+000 to 24+700)

5.1.1 Asphalt

Boreholes HMS 7-1, HMS 7-2, OHS 9-1, OHS 9-2, OHS 10-1, and OHS 10-2 were drilled through an approximately 100 mm thick layer of asphalt.

5.1.2 Sand Fill

Pavement granular fill consisting of sand with trace to some gravel, and trace silt and clay was encountered below the asphalt in Boreholes HMS 7-1, HMS 7-2, OHS 9-1, OHS 9-2, OHS 10-1, and OHS 10-2. The thickness of the sand fill at the boreholes varied between 0.6 m and 0.7 m. The base of the fill is encountered at 0.7 m (Elevations 280.0 m to 266.6 m).

The measured moisture contents of selected samples of this fill varied between 9 percent and 15 percent.

5.1.3 Clayey Silt Fill

Fill materials consisting of clayey silt was encountered below the existing granular fill in Boreholes HMS 7-1, OHS 9-1, and OHS 10-2. The thickness of the clayey silt fill varied between 0.7 m and 1.5 m. The base of this cohesive fill was encountered at 1.4 to 2.2 m depths (Elevations 278.5 m to 265.2 m)

SPT 'N' values recorded in the clayey silt fill ranged from 21 and 31 blows per 0.3 m penetration, indicating a very stiff to hard consistency. The measured moisture contents of samples of this layer varied between 10 percent and 12 percent.

5.1.4 Silty Clay to Clayey Silt Till

Layers of brown to grey native silty clay to clayey silt till with sand and trace gravel were encountered in all six boreholes. Where fully penetrated, the thickness of this till were 3.4 m and 6.5 m in Boreholes OHS 9-1 and HMS 7-2, respectively. The base of this cohesive till was at 4.1 m to 7.2 m (Elevations 273.4 m to 263.3 m). The remaining boreholes were terminated within this till at 7.8 to 8.2 m depths (Elevations 272.5 m to 259.4 m).



SPT 'N' values recorded in the silty clay to clayey silt till ranged from 8 blows for 0.3m of penetration to greater than 50 blows for less than 0.3 m of penetration, indicating a stiff to hard consistency. The measured moisture contents of selected samples of this till varied between 8 percent and 22 percent.

Grain size distribution results for the tested cohesive till samples are presented on the Record of Borehole sheets and on Figures A1 and A2 in Appendix A. Atterberg Limit test results are presented on Figures A4 in Appendix A.

The results of laboratory gradation and Atterberg Limits tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 17
Sand	23 to 41
Silt	27 to 62
Clay	15 to 31
Index Property	Percentage (%)
Liquid Limit	20 to 26
Plasticity Index	9 to 13

The above results show that the tills have low plasticity with a group symbol of CL.

Glacial tills inherently contain cobbles and boulders.

5.1.5 Sands and Silts

Layers of brown native sand to sand and silt with trace gravel and clay were encountered in Boreholes OHS 9-1 and HMS 7-2, which were terminated within these soils at 8.2 m depth (Elevations 259.2 m to 272.3 m).

SPT 'N' values recorded in the sands and silts ranged from 28 blows to 69 blows per 0.3m penetration, indicating a compact to very dense condition. The measured moisture contents of samples of this till varied between 7 percent and 15 percent.

The results of grain size distribution analyses carried out on representative samples of the cohesionless soils are presented on Record of Borehole Sheets and on Figure A3 in Appendix A. The results of laboratory gradation tests are summarized as follows:



Soil Particles	Percentage (%)	
Gravel	0 to 8	
Sand	38 to 92	
Silt	7	30 to 59
Clay		3 to 8

5.1.6 Water Levels

The groundwater level in open boreholes was observed and noted during and upon completion of drilling. One piezometer was installed in Borehole OHS 10-2. The water level in this piezometer could not be obtained at this time as the immediate areas is currently frozen. Attempts will be made again to obtain water level readings to be reported in the final report. The water levels measured in the previously installed piezometers in the area (Reference 1) are summarized in Table 5.2.

Table 5.2
Measured Groundwater Levels

Approximate Station	Borehole	Date	Water Level (m)	
			Depth	Elevation
10+392	MS-04	2017-09-24	4.0	264.1
		2017-10-23	3.9	264.2
10+290	MS-05	2017-09-24	3.7	263.5
		2017-10-24	3.9	263.3

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 – From Stouffville Road to 19th Avenue (Stations 24+700 to 22+400)

5.2.1 Asphalt

Boreholes HMS 5-1, HMS 5-2, HMS 6-2, HOT-3, HOT-4, OHS 7-1, OHS 7-2, OHS 8-1 and TS-190 were drilled through an approximately 100 mm to 150 mm thick layer of asphalt.

5.2.2 Sand Fill

Pavement granular fill consisting of sand with some gravel, trace silt and clay was encountered below the asphalt in Boreholes HMS 5-1, HMS 5-2, HMS 6-2, HOT-3, HOT-4, OHS 7-1, OHS 7-2, and OHS 8-1, and at ground surface in Borehole HMS 6-1. Gravelly sand fill was encountered in TS-190 below the asphalt. The thickness of the sand and gravelly sand fill at the boreholes was between 0.5 m and 2.4 m. The base of this cohesionless fill was encountered at 0.7 m to 2.5 m depths (Elevations 259.4 m to 246.2 m).

SPT 'N' values within the cohesionless fill ranged from 14 blows to 53 blows per 0.3 m penetration, indicating compact to very dense conditions. The measured moisture contents of samples of the cohesionless fill varied between 3 percent and 17 percent.

The results of grain size distribution analyses carried out on representative samples of the fill are presented on the Record of Borehole Sheets included in Appendix B and on Figure B1 of Appendix B. The results of the gradation testing from selected boreholes are summarized below:

Soil Particles	Percentage (%)
Gravel	13 to 25
Sand	70 to 73
Silt and Clay	5 to 14

5.2.1 Clayey to Sandy Silt Fill

Fill materials consisting of clayey to sandy silt was encountered below the existing granular fill in Boreholes HMS 5-1 and HOT-4, respectively. The thickness of this fill



was between 0.7 m and 2.0 m. The base of the fill varied between 1.4 m and 3.0 m depths (Elevations 249.3 to 250.1 m)

SPT 'N' values recorded in the clayey silt fill ranged from 22 and 58 blows per 0.3 m penetration, indicating a very stiff to hard consistency. An 'N' value of 27 blows per 0.3m penetration was recorded for the sandy silt fill indicating a compact condition. The measured moisture contents of samples of this fill varied between 7 percent and 13 percent.

The results of grain size distribution analyses carried out on a representative sample of the clayey silt fill are presented on the Record of Borehole Sheets included in Appendix B and on Figure B2 of Appendix B. The results of the gradation testing are summarized below:

Soil Particles	Percentage (%)
Gravel	6
Sand	41
Silt	35
Clay	18

5.2.2 Silty Clay to Clayey Silt Till

Grey native silty clay to clayey silt till with sand and trace gravel were encountered in Boreholes HMS 5-1, HMS 5-2, HMS 6-1, HMS 6-2, HOT-3, HOT-4, OHS 7-1, and OHS 7-2. Where fully penetrated in Boreholes HMS 5-2 and HOT-3, the thickness of this till varied between 2.4 m and 4.2 m. The base of the till was at 3.2 to 7.2 m depths (Elevations 244.9 m to 243.8 m). Boreholes HMS 5-1, HMS 6-1, HMS 6-2, HOT-3, HOT-4, OHS 7-1, and OHS 7-2 were terminated within this till at 7.8 to 8.2 m depths, or Elevations 238.9 to 247.5 m.

SPT 'N' values recorded in the silty clay to clayey silt till typically ranged from 16 blows to 90 blows per 0.3 m, indicating very stiff to hard consistency. Higher 'N' values of greater than 50 blows for less than 0.3 m penetration at the bottom of some boreholes indicate the presence of cobbles and boulders. Occasional 'N' values of 10 and 14 were measured in Borehole HOT-4 indicating a stiff zone. The measured moisture contents of selected samples of this 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 Figures B3 to B5 of Appendix B. Atterberg Limit test results are presented on Figures B9 and B10 of Appendix B.

The results of laboratory gradation and Atterberg Limits tests are summarized as follows:

Silty Clay Till

Soil Particles	Percentage (%)
Gravel	0 to 8
Sand	12 to 48
Silt	31 to 45
Clay	13 to 48
Index Property	Percentage (%)
Liquid Limit	17 to 28
Plasticity Index	6 to 14

Clayey Silt Till

Soil Particles	Percentage (%)
Gravel	0 to 20
Sand	10 to 54
Silt	27 to 63
Clay	13 to 27
Index Property	Percentage (%)
Liquid Limit	16 to 18
Plasticity Index	6 to 7

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

Glacial tills inherently contain cobbles and boulders.

5.2.3 Sand and Silt Till

Grey sand and silt till with trace to some gravel, and trace to some clay was encountered in Boreholes OHS 8-1 and OHS 8-2. The boreholes were terminated



within this till at 6.7 m and 8.2 m depths, respectively (Elevations 253.5 m and 252.1 m).

SPT 'N' values recorded in the cohesionless till ranged from 18 blows to 80 blows per 0.3 m penetration, indicating compact to very dense conditions. Higher 'N' values of greater than 50 blows for less than 0.3 m penetration were recorded in Borehole OHS 8-1 inferred the presence of cobbles and boulders. The measured moisture contents of the samples of this till varied between 8 percent and 13 percent.

Grain size distribution results for the samples of the sand and silt till are presented on the Record of Borehole sheets and on Figures B6 of Appendix B. The results of laboratory gradation tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 23
Sand	44 to 54
Silt	23 to 39
Clay	6 to 17

5.2.4 Sands and Silts

Layers of brown to grey native gravelly sand, sand, silty sand, and silt with trace to some gravel and clay were encountered in Boreholes HMS 5-2, HOT-3, OHS 8-2, and TS-190. Where fully penetrated in Borehole HOT-3 and OHS 8-2, the thickness of the cohesionless soils were 4.5 m and 4.7 m, respectively. The base of the cohesionless soils was at 7.7 m and 7.2 m depths (Elevations 239.3 m and 253.1 m). Boreholes HMS 5-2 and TS-190 were terminated within this soil at 7.9 to 8.2 m depths, or Elevations 252.2 m to 243.9 m.

SPT 'N' values recorded in the cohesionless soils typically ranged from 18 blows to 47 blows per 0.3 m penetration, indicating compact to dense conditions. An occasional 'N' value of 6 was measured in Borehole OHS 8-2, indicating a loose zone. Occasional 'N' values of greater than 50 blows for less than 0.3 m penetration in Borehole TS-190 inferred the presence of cobbles or boulders. The measured moisture contents of samples of this till varied between 10 percent and 21 percent.



Grain size distribution results for the tested cohesionless soil samples tested are presented on the Record of Borehole sheets and on Figures B7 and B8 of Appendix B. The results of laboratory gradation tests are summarized as follows:

Soil Particles	Percentage (%)	
Gravel	0 to 34	
Sand	60 to 91	
Silt	6	7 to 25
Clay		2 to 3

5.2.5 Water Levels

The groundwater level in open boreholes was observed and noted during and upon completion of drilling. One piezometer was installed in Borehole HMS 5-2. The water levels measured in the previously installed piezometers in the area (Reference 1) are also summarized in Table 5.3.

Table 5.3
Measured Groundwater Levels

Approximate Station	Borehole	Date	Water Level (m)	
			Depth	Elevation
24+277	MS-10	2017-09-24	1.9	259.7
		2017-10-23	1.8	259.8
23+740	MS-15	2017-09-24	3.2	252.9
		2017-10-24	3.8	252.3
23+679	MS-16	2017-09-24	3.0	252.2
		2017-10-23	2.8	252.4
23+400	HMS 5-2	2018-02-16	3.5	248.6
23+048	MS-21	2017-09-24	3.1	245.4
		2017-10-23	3.2	245.3
22+745	MS-24	2017-09-24	1.9	243.3
		2017-10-23	1.5	243.7



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 – From 19th Avenue to Elgin Mills Road (22+400 to 20+300)

5.3.1 Asphalt

Boreholes MS-32, HOT-2, TS-150, HMS 4-1, HMS 4-2, TS-135, HOT-1, OHS 6-1, OHS 6-2, HMS 3-1, HMS 3-2, OHS 5-1, OHS 5-2, TS-125, and MS-42 were drilled through an approximately 100 to 150 mm thick layer of asphalt.

5.3.2 Sand to Silty Sand Fill

Pavement granular fill materials consisting of sand to silty sand with some gravel, trace silt, and trace clay was encountered below the asphalt in Boreholes MS-32, HOT-2, TS-150, HMS 4-1, HMS 4-2, TS-135, HOT-1, OHS 6-1, OHS 6-2, HMS 3-1, HMS 3-2, OHS 5-1, OHS 5-2, TS-125, and MS-42. The thickness of the silty sand to sand fill at the boreholes was generally between 0.3 m and 1.2 m. The base of this cohesionless fill was encountered at 0.5 m to 1.4 m depths (Elevations 232.5 m to 239.9 m).

SPT 'N' values recorded in the sand fill typically ranged from 26 blows to 48 per 0.3m, indicating a compact to dense condition. A higher 'N' value of greater than 50 blows for less than 0.3 m penetration in Borehole HOT-2 inferred the presence of cobbles or boulders. The measured moisture contents of samples of fill ranged between 3 percent and 11 percent.

The results of grain size distribution analyses carried out on a representative sample sand fill are presented on the Record of Borehole Sheets and on Figure C1 of Appendix C. The results of the gradation testing are summarized below:

Soil Particles	Percentage (%)
Gravel	5
Sand	71
Silt	15
Clay	9



5.3.3 Clayey to Sandy Silt Fill

Fill materials consisting of clayey to sandy silt with trace to some sand and gravel was encountered below existing granular fill in Boreholes HMS 4-1, HMS 4-2, TS-135, HOT-1, OHS 6-1 and OHS 6-2, and MS-42. The thickness of this fill ranged from 0.8 to 1.6 m. The base of this fill ranged from 1.5 m to 2.2 m (Elevations 231.2 m and 236.9 m).

SPT 'N' values recorded in the clayey silt fill were 12 and 58 blows per 0.3 m penetration, indicating a stiff to hard consistency. An 'N' value of 19 blows for 0.3 m penetration was measured for the sandy silt fill, indicating a compact condition. A high 'N' value of greater than 100 blows for less than 0.3 m penetration in Borehole MS-42 inferred the presence of cobbles or boulders. The measured moisture contents of samples of this layer were 9 percent and 16 percent.

5.3.4 Silty Clay to Clayey Silt

A layer of native brown silty clay with some sand were encountered in Boreholes OHS 6-1 and MS-42. Where fully penetrated, the thickness of this cohesive soil was 1.9 m and 2.2 m in OHS 6-1 and MS-42, respectively, and the bases at 4.1 m and 4.4 m depths (Elevations 232.6 m and 229.0 m).

SPT 'N' values recorded in the silty clay were 8 blows and 14 blows for 0.3 m of penetration, indicating a stiff consistency. The measured moisture contents of selected samples of this cohesive soil were 12 percent and 20 percent.

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

The results of laboratory gradation are summarized as follows:

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

5.3.5 Silty Clay to Clayey Silt Till

Deposits of brown to grey native silty clay to clayey silt till with sand and trace to some gravel were encountered in Boreholes MS-32, HOT-2, TS-150, HMS 4-1, HMS 4-2, TS-135, HOT-1, OHS 6-1, OHS 6-2, HMS 3-1, HMS 3-2, TS-125, and MS-42. Where fully penetrated in Boreholes MS-32, TS-125, HOT-1, HMS 3-2, HMS 4-1, OHS 6-1, and OHS 6-2, the thickness of this till varied between 2.7 m and 5.8 m. The base of this cohesive till ranged from 4.1 m to 7.2 m depths (Elevations 228.4 m and 235.1 m). Boreholes HOT-2, TS-150, TS-135, HMS 3-1, and MS-42 were terminated within this till at 6.7 m to 8.2 m depths (Elevations 226.7 m to 233.6 m).

SPT 'N' values recorded in the silty clay to clayey silt till typically ranged from 8 blows to 69 blows per 0.3 m of penetration, indicating a stiff to hard consistency. Higher 'N' values of greater than 50 blows for less than 0.3 m penetration in Boreholes HMS 4-1, OHS 6-1, and HOT-1 inferred the presence of cobbles or boulders. Lower 'N' values of 6 blows per 0.3 m of penetration indicated firm zones. The measured moisture contents of samples of this till varied between 6 percent and 21 percent.

Grain size distribution results for the cohesive till samples tested are presented on the Record of Borehole sheets and on Figures C3 to C5 of Appendix C. Atterberg Limit test results are presented on Figures C10 and C13 of Appendix C.

The results of laboratory gradation and Atterberg Limits tests are summarized as follows:

Silty Clay Till

Soil Particles	Percentage (%)
Gravel	0 to 7
Sand	20 to 39
Silt	31 to 43
Clay	23 to 46
Index Property	Percentage (%)
Liquid Limit	17 to 39
Plasticity Index	7 to 23



The above results show that the silty clay till has typically low plasticity with a group symbol of CL, except for occasional zones of medium plasticity with a group symbol of CI.

Clayey Silt Till

Soil Particles	Percentage (%)
Gravel	0 to 8
Sand	36 to 43
Silt	33 to 43
Clay	15 to 23
Index Property	Percentage (%)
Liquid Limit	14 to 19
Plasticity Index	5 to 11

The above results show that the tills have low to slight plasticity with a group symbol of CL/CL-ML.

Glacial tills inherently contain cobbles and boulders.

5.3.6 Sand and Silt Till

A deposit of grey native sand and silt till with trace gravel and trace to some clay was encountered in Boreholes OHS 5-1, OHS 5-2, and TS-125, which terminated within this till at 7.8 to 8.2 m depths (Elevations 226.6 m to 226.0 m).

SPT 'N' values recorded in this sand and silt till ranged from 25 blows per 0.3 m penetration to greater than 50 blows for less than 0.3 m of penetration, indicating compact to very dense condition. The measured moisture contents of selected samples of this till varied between 7 percent and 13 percent.

Grain size distribution results for a sandy silt till sample are presented on the Record of Borehole sheets and on Figure C7 of Appendix C.

The results of laboratory gradation tests are summarized as follows:



Soil Particles	Percentage (%)
Gravel	4 to 8
Sand	37 to 53
Silt	37 to 48
Clay	5 to 11

Glacial tills inherently contain cobbles and boulders.

5.3.7 Sands and Silts

Layers of brown to grey native sand, silty sand, and sandy silt with trace to some gravel and clay were encountered in Boreholes HOT-7, HMS-3-2, HMS 4-1, HOT-1, HOT-2, OHS 5-2, OHS 6-1, OHS 6-2, TS-125 and TS-150. Where fully penetrated in Borehole HOT-2, TS-125, OHS 5-2, and TS-150, the thickness of this till were 1.5 m and 2.4 m. The base of this cohesionless soil ranged from 4.1 m and 5.6 m depths (Elevations 228.4 m and 234.7 m). Boreholes MS-32, HMS-3-2, HMS 4-1, HOT-1, OHS 6-1, and OHS 6-2 were terminated within this cohesionless soil at 6.7 m to 8.2 m depths (Elevations 227.2 m to 234.0 m).

SPT 'N' values recorded in the cohesionless soils typically ranged from 17 blows to 75 blows per 0.3 m of penetration, indicating compact to very dense conditions. Higher 'N' values of greater than 50 blows for less than 0.3 m penetration in Boreholes HOT-1, HOT-2, OHS 5-2, and TS-125 inferred the presence of cobbles or boulders. The measured moisture contents of this layer varied between 6 percent and 23 percent.

Grain size distribution results for samples of sands and silts are presented on the Record of Borehole sheets and on Figure C7 to C9 of Appendix C. The results of laboratory gradation test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 8
Sand	27 to 76
Silt	14 to 68
Clay	3 to 15



5.3.8 Water Levels

The groundwater level in open boreholes was observed and noted during and upon completion of drilling. One piezometer was installed in Borehole OHS 6-2. The water levels measured in the previously installed piezometers in the area (Reference 1) are also summarized in Table 5.4.

Table 5.4
Measured Groundwater Levels

Approximate Station	Borehole	Date	Water Level (m)	
			Depth	Elevation
21+975	MS-32	2017-09-24	3.0	237.7
		2017-10-23	2.9	237.8
21+586	MS-35	2017-09-24	4.1	234.9
		2017-10-23	4.1	234.9
21+330	OHS 6-2	2018-02-15	2.3	234.1
20+915	MS-40	2017-09-24	1.7	232.9
		2017-10-23	1.6	233.0

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 – From Elgin Mills Road to Major Mackenzie Drive (20+300 to 18+300)

5.4.1 Asphalt

Boreholes OHS 4-1, OHS 4-2, HMS 2-1, HMS 2-2, TS-105, OHS 3-1, OHS 2-1, OHS 2-2, TS-110, HMS 1-1, OHS 1-1, OHS 1-2, TS-95, and MS-65, were drilled through an approximately 100 mm to 280 mm thick layer of asphalt.

5.4.2 Sand to Silty Sand Fill

Pavement granular materials consisting of sand to silty sand with trace to some gravel and clay was encountered below the asphalt in Boreholes OHS 4-1, OHS 4-2, HMS



2-1, HMS 2-2, TS-105, OHS 3-1, OHS 2-1, OHS 2-2, TS-110, HMS 1-1, OHS 1-1, OHS 1-2, TS-95, and MS-65 and at ground surface in Boreholes HMS 1-2 and OHS 3-2. The thickness of the sand to silty sand fill at the boreholes varied between 0.2 m and 1.2 m. The base of this cohesionless fill ranged from 0.2 m to 1.5 m depths (Elevations 210.5 m to 225.7 m).

SPT 'N' values measured within the cohesionless fill ranged from 18 blows to 69 blows per 0.3 m of penetration indicating compact to very dense conditions. The measured moisture contents of selected samples of fill typically varied between 3 percent and 17 percent.

5.4.3 Clayey Silt Fill

Fill materials consisting of clayey silt with trace to some sand and gravel was encountered below existing granular fill in Boreholes OHS-1-2 and TS-110. The thickness of the clayey silt fill was 0.5 and 1.4 m. The base of this cohesive fill was at 1.4 m to 1.7 m depths (Elevations 213.6 m to 217.5 m).

SPT 'N' values recorded in the clayey silt fill ranged from 7 and 42 blows per 0.3 m penetration, indicating a firm to hard consistency. The measured moisture contents of samples of this layer were between 12 percent and 15 percent.

5.4.4 Silty Clay to Clayey Silt Till

Deposits of brown to grey native silty clay to clayey silt till with sand and trace to some gravel were encountered in Boreholes OHS 4-1, OHS 4-2, HMS 2-1, HMS 2-2, TS-105, OHS 3-1, OHS 3-2, OHS 2-1, TS-110, HMS 1-1, HMS 1-2, OHS 1-1, OHS 1-2, TS-95, and MS-65. Where fully penetrated in Boreholes OHS 4-1, OHS 4-2, HMS 2-1, HMS 2-2, TS-105, OHS 3-1, OHS 3-2, OHS 2-1, HMS 1-1, HMS 1-2, OHS 1-1, and OHS 1-2, the thickness of this till varied between 1.3 m and 4.8 m. The base of this cohesive till ranged from 2.2 m to 5.6 m depths (Elevations 221.0 m to 209.6 m). Boreholes HMS 1-2, HMS 2-2, TS-95, TS-105, TS-110, and HOT-5 were terminated within this till at 6.7 m to 8.2 m depths (Elevations 204.6 m to 215.2 m).

SPT 'N' values recorded in the silty clay to clayey silt till typically ranged from 18 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m of penetration,



indicating very stiff to hard consistency. The measured moisture contents of samples of this till typically varied between 7 percent and 24 percent,

Grain size distribution results for the tested cohesive till samples are presented on the Record of Borehole sheets and on Figures D1 to D4 of Appendix D. Atterberg Limit test results are presented on Figures D10 to D12 of Appendix D.

The results of laboratory gradation and Atterberg Limits tests are summarized as follows:

Silty Clay Till

Soil Particles	Percentage (%)
Gravel	0 to 12
Sand	19 to 39
Silt	32 to 49
Clay	21 to 39

Index Property	Percentage (%)
Liquid Limit	17 to 39
Plasticity Index	8 to 17

The above results show that the silty clay tills have typically low plasticity with a group symbol of CL.

Clayey Silt Till

Soil Particles	Percentage (%)
Gravel	2 to 8
Sand	32 to 51
Silt	29 to 40
Clay	13 to 22
Index Property	Percentage (%)
Liquid Limit	16 to 19
Plasticity Index	6 to 8

The above results show that the clayey silt tills have low to slight plasticity with a group symbol of CL/CL-ML.



Glacial tills inherently contain cobbles and boulders.

5.4.5 Silty Sand Till

A deposit of grey native silty sand till with trace to some gravel and clay was encountered in Boreholes OHS 1-1 and OHS-1-2 which terminated within this till at 8.2 m depth (Elevations 207.1 m and 207.4 m).

SPT 'N' values recorded in the silty sand till ranged from 42 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 selected samples of this till varied between 7 percent and 10 percent.

Grain size distribution results for a silty sand sample are presented on the Record of Borehole sheets and on Figure D5 of Appendix C.

The results of laboratory gradation and Atterberg Limits tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	10 to 26
Sand	43 to 45
Silt	26 to 32
Clay	5 to 13

Glacial tills inherently contain cobbles and boulders.

5.4.6 Sands and Silts

Layers of brown to grey native gravelly sand, sand, silty sand, sandy silt, and silt with trace to some gravel and clay were encountered in Boreholes OHS 4-1, OHS 4-2, HMS 2-1, HMS 2-2, TS-105, OHS 3-1, OHS 3-2 OHS 2-1, OHS 2-2, TS-110, HMS 1-1, HMS 1-2, OHS 1-1, and OHS 1-2. Where fully penetrated in Boreholes HMS 1-2, HMS 2-2, TS-105 and TS-110, the thickness of the cohesionless soils ranged from 3.5 m to 5.8 m. The base of this cohesionless soil ranged from 6.2 to 7.2 m (Elevations 210.7 m to 217.1 m). Boreholes OHS 4-1, OHS 4-2, HMS 2-1, OHS 3-1, OHS 3-2



OHS 2-1, OHS 2-2, HMS 1-1, OHS 1-1, and OHS 1-2 were terminated within this native layer at 7.7 m to 8.2 m depths (Elevations 207.1 m to 218.7 m).

SPT 'N' values recorded in the cohesionless soils typically ranged from 16 blows to 98 blows per 0.3 m of penetration, indicating compact to very dense conditions. An occasional 'N' value of 8 was measured in Borehole HMS 1-2, indicating a loose zone. Intermittent 'N' values of greater than 50 blows for less than 0.3 m of penetration was measured in Boreholes HMS 1-1, HMS 1-2, OHS 2-2, OHS 3-1, OHS 3-2, OHS 4-1, and OHS 4-2 inferred the presence of cobbles or boulders. The measured moisture contents of this layer varied between 3 percent and 21 percent.

Grain size distribution results for selected cohesionless soil samples are presented on the Record of Borehole sheets and on Figures D6 to D9 of Appendix D. The results of laboratory gradation test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 31
Sand	7 to 90
Silt	10 to 62
Clay	0 to 15

5.4.7 Water Levels

The groundwater level in open boreholes was observed and noted during and upon completion of drilling. The water levels measured in the previously installed piezometers in the area (Reference 1) are summarized in Table 5.5.

Table 5.5
Measured Groundwater Levels

Approximate Station	Borehole	Date	Water Level (m)	
			Depth	Elevation
19+852	MS-50	2017-09-24	3.1	223.9
		2017-10-23	3.4	223.6
19+751	MS-51	2017-09-24	3.3	222.4
		2017-10-23	3.6	222.1
19+151	MS-57	2017-09-24	2.4	217.2



Approximate Station	Borehole	Date	Water Level (m)	
			Depth	Elevation
		2017-10-23	2.4	217.2
18+852	MS-60	2017-09-24	2.6	214.1
		2017-10-23	2.6	214.1
18+576	MS-63	2017-09-24	3.1	210.5
		2017-10-23	2.9	210.7

6. MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. 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.

Walker Drilling of Utopia, Ontario and DBW Drilling of Ajax, Ontario, supplied and operated a truck-mounted D-90 drill rig and a truck-mounted CME-75 drill rig, respectively, 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. Jilesh Patel, Mr. Saeed Bastan, and Ms. Eckie Siu 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 Rod de Castro, 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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SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

5. LEGEND FOR RECORDS OF BOREHOLES

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

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


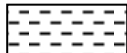



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

<u>ROCK WEATHERING CLASSIFICATION</u>		<u>SYMBOLS</u>	
Fresh (FR)	No visible signs of weathering.		
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL
Completely Weathered (CW)	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				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

<u>TERMS</u>	
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
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 11+000 to 24 +700 Stouffville Road)

RECORD OF BOREHOLE No HMS 7-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 868 070.4 E 313 416.0 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.08 - 2017.11.08 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
280.7	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (100mm)																	
0.1	SAND, some gravel, trace silt Brown Moist (FILL)		1	GS														
280.0							280											
0.7	Clayey SILT, trace gravel, trace sand, cobble pieces Hard to Very Stiff Grey Moist (FILL)		1	SS	30													
			2	SS	21		279											
278.5																		
2.2	Clayey SILT, with sand, trace gravel Stiff Brown Moist (TILL)		3	SS	8		278										9	35 39 17
277.7																		
3.0	Silty CLAY, with sand Stiff to Hard Brown Moist (TILL)		4	SS	11		277											
			5	SS	26		276										0	34 37 29
			6	SS	55/ 0.100		275											
							274											
			7	SS	80		273											
272.5																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 7.8m AND DRY TO BOTTOM. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMS 7-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 868 068.7 E 313 400.0 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.07 - 2017.11.07 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)					
280.5	GROUND SURFACE							20	40	60	80	100					
0.0	ASPHALT: (100mm)																
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)		1	GS			280										
279.9																	
0.7	Clayey SILT, with sand Very Stiff Brown Moist (TILL)		1	SS	16		279										
			2	SS	23												
278.3																	
2.2	Silty CLAY, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		3	SS	25		278									0	31 40 29
			4	SS	100/ 0.270		277										
			5	SS	66		276										
							275										
			6	SS	100/ 0.270		274									4	34 41 21
273.4																	
7.2	SAND and SILT, trace clay Very Dense Grey Moist		7	SS	69		273									0	38 59 3
272.3																	
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY TO BOTTOM. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																

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+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 10-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 867 607.2 E 313 475.6 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.08 - 2017.11.08 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
272.0	GROUND SURFACE							20	40	60	80	100					
0.0	ASPHALT: (100mm)																
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)			GS													
271.3			1	SS	39		271										
0.7	Silty CLAY, with sand, trace to some gravel Hard to Very Stiff Brown to Grey Moist (TILL)		2	SS	28		270										
			3	SS	22												
			4	SS	31		269										
							268										
			5	SS	25		267										
							266										
			6	SS	57		265										
264.0			7	SS	100/ 0.250		264										
8.0	END OF BOREHOLE AT 8.0m. BOREHOLE CAVED TO 7.0m AND WATER LEVEL AT 5.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																

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+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 10-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 867 604.5 E 313 458.5 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.07 - 2017.11.07 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
271.9	GROUND SURFACE							20 40 60 80 100					
0.0	ASPHALT: (100mm)							20 40 60 80 100					
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)			GS				20 40 60 80 100					
271.2	Clayey SILT, some sand, trace gravel Very Stiff Grey Moist (FILL)		1	SS	22		271	20 40 60 80 100					
0.7								20 40 60 80 100					
270.4	Silty CLAY, with sand, trace gravel, some organics at 1.5m± Very Stiff to Hard Brown to Grey Moist (TILL)		2	SS	26		270	20 40 60 80 100					
1.4								20 40 60 80 100					
			3	SS	23		269	20 40 60 80 100					
			4	SS	33		268	20 40 60 80 100					
								20 40 60 80 100					
			5	SS	25		267	20 40 60 80 100					7 34 35 24
								20 40 60 80 100					
			6	SS	100/ 0.270		266	20 40 60 80 100					
								20 40 60 80 100					
							265	20 40 60 80 100					
								20 40 60 80 100					
			7	SS	65		264	20 40 60 80 100					7 28 34 31
263.6	END OF BOREHOLE AT 8.2m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.1m slotted screen.												
8.2													
	WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.02.16 Frozen -												

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 9-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 867 090.4 E 313 570.2 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.09 - 2017.11.09 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
267.4	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT: (100mm)																		
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)		1	GS			267												
266.7																			
0.7	Clayey SILT, trace sand and gravel Very Stiff to Hard Grey Moist (FILL)		1	SS	26		266												
			2	SS	31														
265.2																			
2.2	Clayey SILT, trace gravel and sand, some organics at 2.3m Stiff to Very Stiff Brown Moist (TILL)		3	SS	17		265												
			4	SS	10		264												
263.3																			
4.1	SAND, trace gravel, trace silt and clay Dense Brown Wet		5	SS	40		263												
261.8							262												
5.6	Silty SAND, trace gravel, trace clay Compact to Dense Grey Wet		6	SS	28		261												
			7	SS	38		260												
259.2																			
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN TO 4.3m AND WATER LEVEL AT 3.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																		

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 9-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 867 085.8 E 313 545.1 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.07 - 2017.11.07 CHECKED BY RD

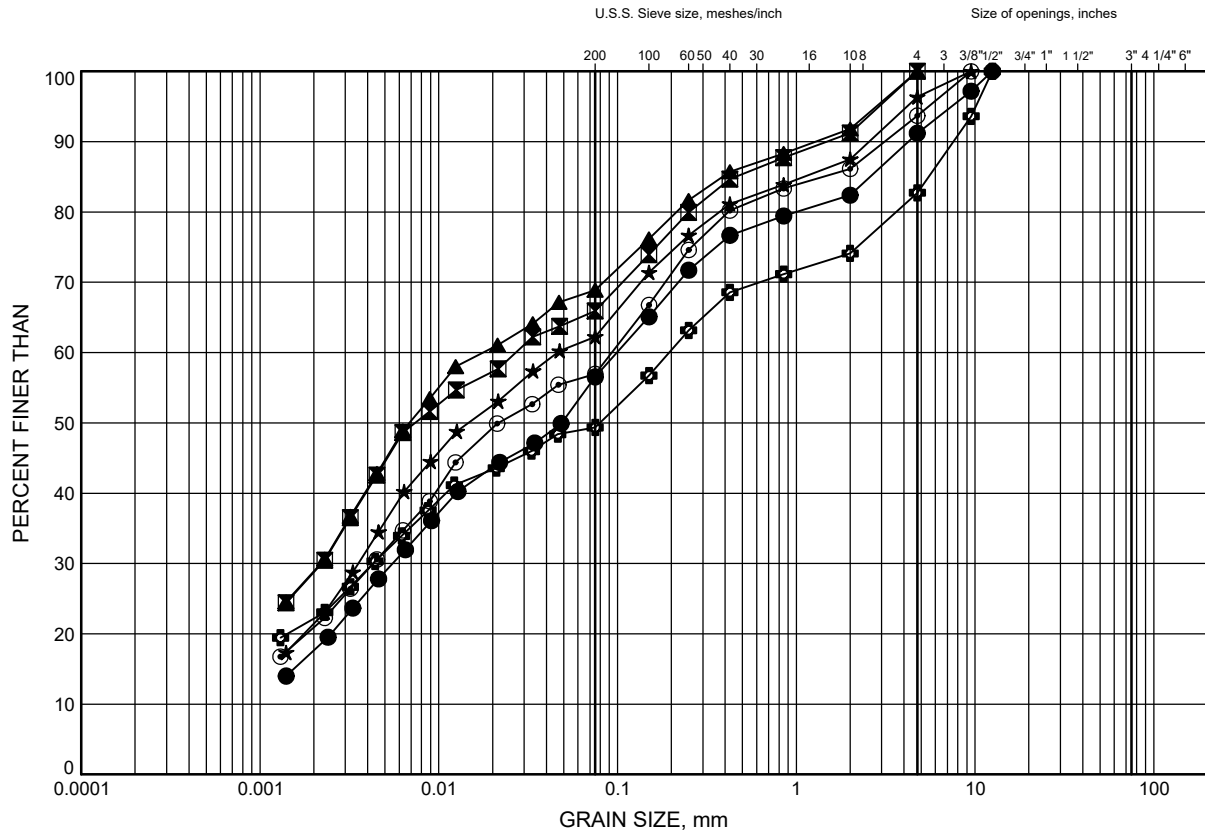
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
267.3	GROUND SURFACE												
0.0	ASPHALT: (100mm)												
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)		1	GS			267						
266.6													
0.7	Clayey SILT, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		1	SS	20		266						
			2	SS	17		265						
			3	SS	20		264						
			4	SS	30		263						
			5	SS	51		262						
			6	SS	49		261						
			7	SS	25/		260						
259.4													
7.8	END OF BOREHOLE AT 7.8m. BOREHOLE CAVED TO 6.7m AND WATER LEVEL AT 4.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.050								

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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)
●	HMS 7-1	2.6	278.1
⊠	HMS 7-1	4.9	275.8
▲	HMS 7-2	2.6	277.9
★	HMS 7-2	6.4	274.1
⊙	OHS 10-1	2.6	269.4
⊕	OHS 10-1	6.4	265.6

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

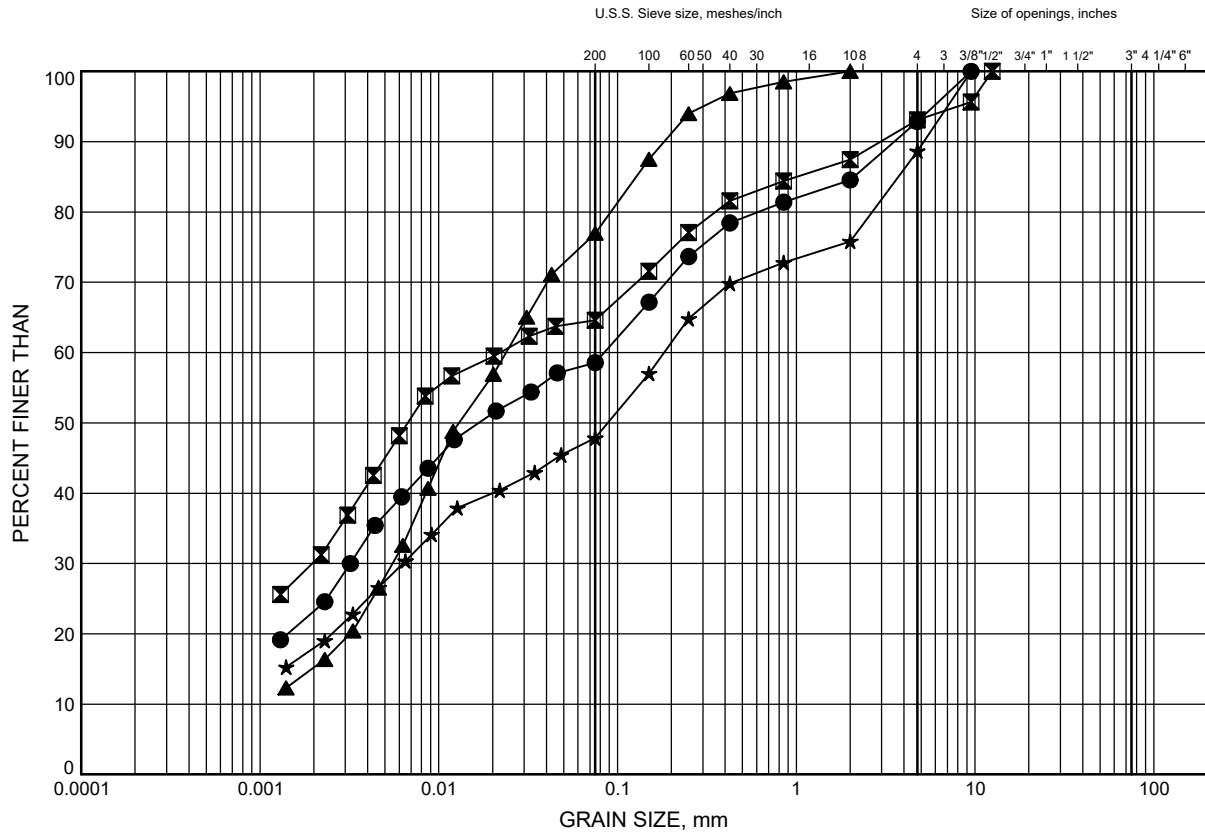


Prep'd MP
Chkd. RD

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)
●	OHS 10-2	4.9	267.0
⊠	OHS 10-2	7.9	263.9
▲	OHS 9-2	3.4	263.9
★	OHS 9-2	6.4	260.9

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

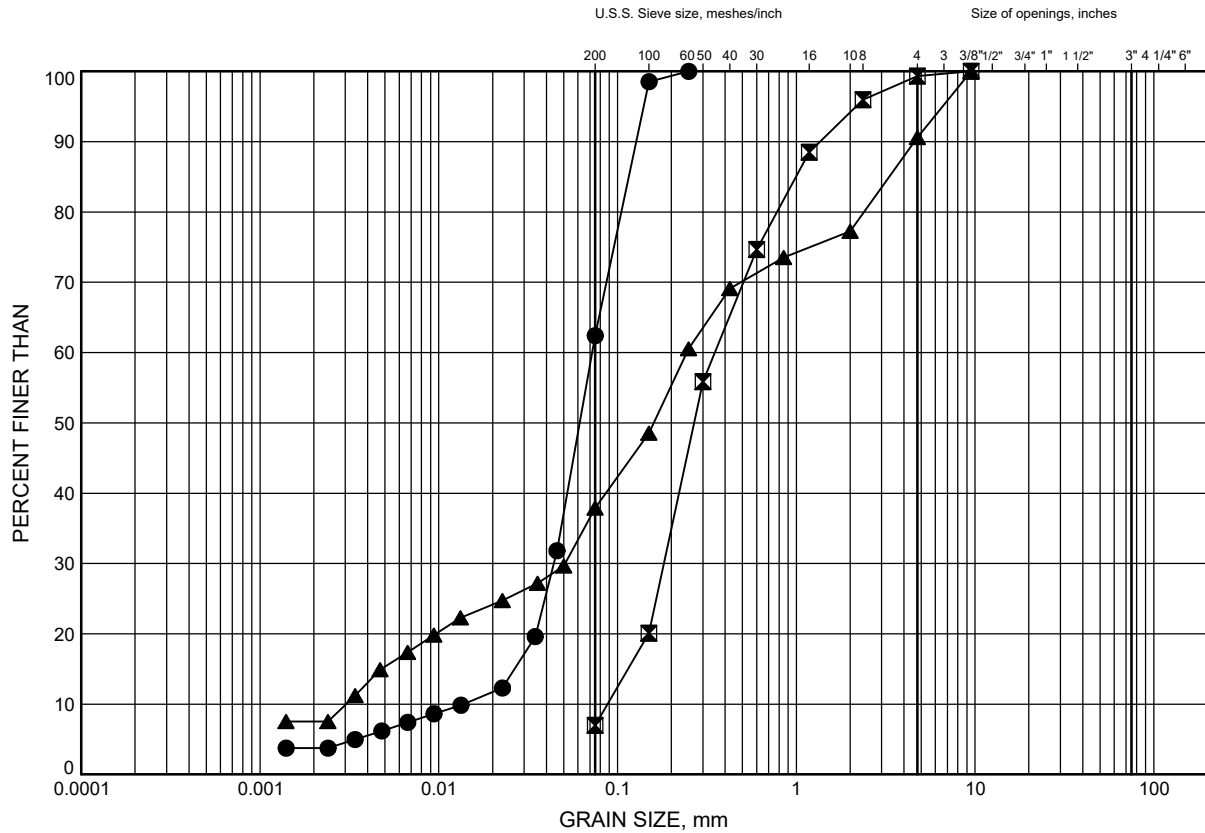


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE A3

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 7-2	7.9	272.6
⊠	OHS 9-1	4.9	262.5
▲	OHS 9-1	6.4	261.0

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

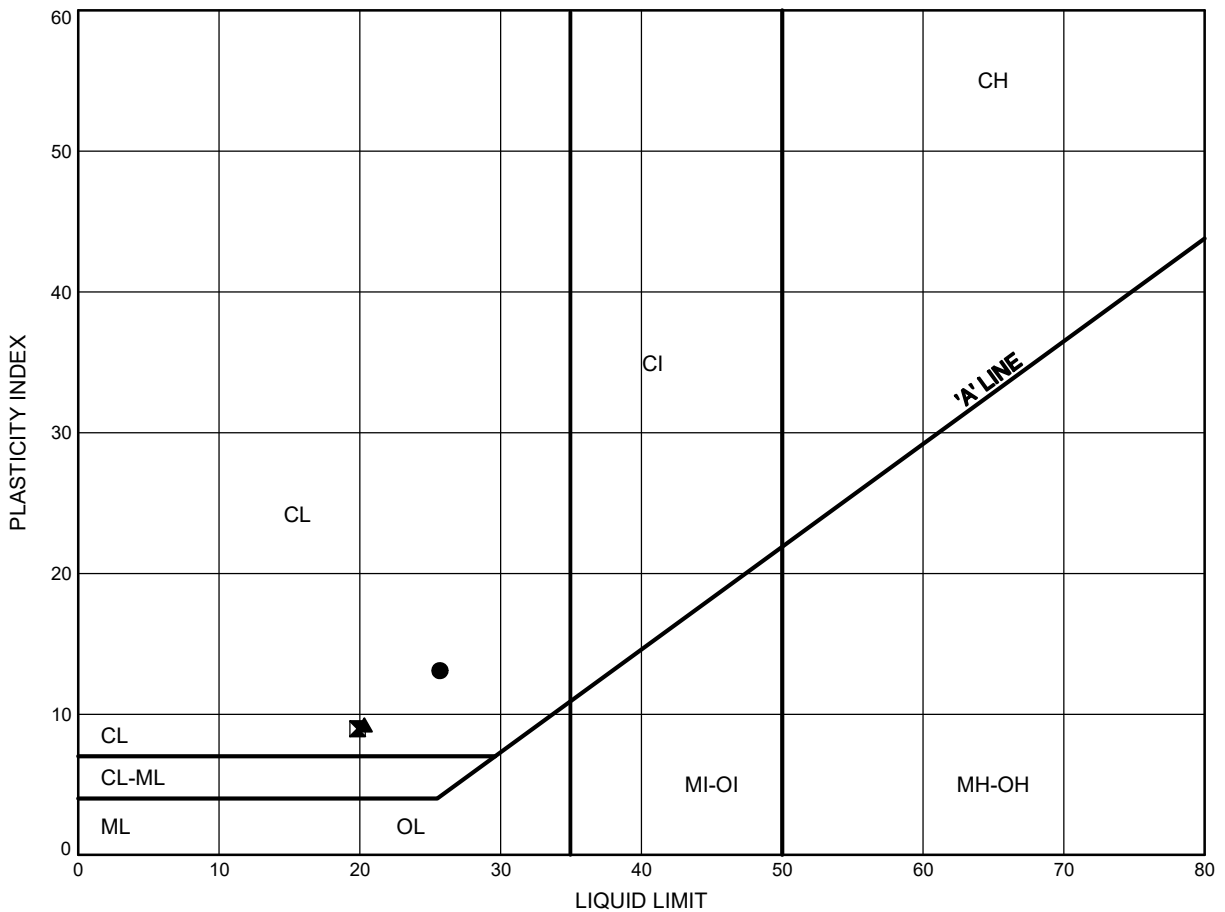


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE A4

Silty CLAY to Clayey SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 7-1	4.9	275.8
⊠	OHS 10-1	2.6	269.4
▲	OHS 10-2	4.9	267.0

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



Prep'd MP
Chkd. RD



Appendix B

Section 2 (Stations 24+700 Stouffville Road to 22+400 19th Avenue)

RECORD OF BOREHOLE No OHS 8-1 / MS-11

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION NB N 4 866 208.1 E 313 679.2 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%) PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L				
260.2	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (100mm)																	
0.1	SAND, some gravel, trace silt Dense Brown Moist (FILL)		1	SS	48		260							○				
259.4																		
0.8	SAND and SILT, trace to some gravel, trace to some clay Very Dense Grey Moist (TILL)		2	SS	50		259							○				0 44 39 17
			3	SS	73/ 0.100		258							○				
			4	SS	70		257							○				10 54 30 6
			5	SS	50/ 0.100		256							○				
			6	SS	80		255							○				
254.6	Compact						254							○				
5.6			7	SS	18													
253.5	END OF BOREHOLE AT 6.7m. BOREHOLE CAVED TO 5.5m AND WATER LEVEL AT 3.7m DEPTH UPON COMPLETION.. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	
6.7																		

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RECORD OF BOREHOLE No OHS 8-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 866 168.8 E 313 698.5 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.01.08 - 2018.01.08 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W _P	W	W _L				
260.3	GROUND SURFACE															GR SA SI CL		
0.0	ASPHALT: (100mm)																	
0.1	SAND , trace to some gravel Dense to Compact Brown Moist to Wet (FILL)		1	SS	46													
			2	SS	32													
			3	SS	28													
257.8																		
2.5	Gravelly SAND , trace gravel Loose Brown Wet		4	SS	24													
			5	SS	6													
256.2																		
4.1	SAND , some silt, trace gravel, trace clay, Dense Grey Moist		6	SS	34													
			7	SS	46													
253.1																		
7.2	SAND and SILT , with gravel, trace clay Dense Grey Moist (TILL)		8															
			8	SS	46													
252.1																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 0.9m AND WATER LEVEL AT 0.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

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

RECORD OF BOREHOLE No TS-190

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 866 179.1 E 313 678.7 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.14 - 2017.12.14 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _P W W _L						WATER CONTENT (%)					
260.0	GROUND SURFACE																
0.0	ASPHALT: (150mm)																
0.2	Gravelly SAND , trace silt Dense to Compact Brown Moist (FILL)		1	SS	34												
			2	SS	43												
			3	SS	14												
257.8																	
2.2	SAND , trace gravel, trace to some silt and clay Dense to Compact Grey Wet		4	SS	35												
			5	SS	20												
			6	SS	18												
254.4																	
5.6	Silty SAND , trace gravel, trace clay Dense to Very Dense Grey Moist		7	SS	47												
252.2			8	SS	50/												
7.8	END OF BOREHOLE AT 7.8m. BOREHOLE CAVED TO 3.1m AND WATER LEVEL AT 2.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.075												

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 7-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 717.8 E 313 638.3 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.10 - 2017.12.10 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)								
255.2	GROUND SURFACE							20	40	60	80	100	W _P	W	W _L	GR	SA	SI	CL	
0.0	ASPHALT: (150mm)							20	40	60	80	100								
0.2	SAND, some sand, trace gravel Compact to Dense Brown Wet (FILL)		1	SS	23		255						○							
			2	SS	37		254						○							
			3	SS	20								○							
253.0							253													
2.2	Silty CLAY, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		4	SS	19								⊕				2	44	34	20
			5	SS	37		252						○							
							251													
			6	SS	16								○							
							250													
							249						⊕				0	35	38	27
			7	SS	48															
							248													
247.5			8	SS	50/								○				8	48	31	13
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE CAVED TO 7.3m and WATER LEVEL AT 7.01m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.025															

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

RECORD OF BOREHOLE No OHS 7-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 748.5 E 313 654.9 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.15 - 2017.11.15 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
255.4	GROUND SURFACE							20	40	60	80	100		
0.0	ASPHALT: (100mm)							20	40	60	80	100		
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)		1	GS			255							
254.7														
0.7	Clayey SILT, with sand, trace to some gravel Hard Brown to Grey Moist (TILL)		1	SS	61		254							
			2	SS	41									
253.2														
2.2	Very Stiff		3	SS	19		253							20 37 27 16
			4	SS	24		252							
			5	SS	20		251							6 54 27 13
							250							
249.7														
5.6			6	SS	90		249							
							248							
247.6			7	SS	100/									3 43 32 22
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE CAVED TO 7.0m AND WATER LEVEL AT 6.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.125									

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMS 6-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 615.3 E 313 609.4 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.09 - 2017.11.09 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20 40 60 80 100					W P W W L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
254.1	GROUND SURFACE																
0.0	SAND , trace silt, trace gravel Brown Moist (FILL)			GS			254							○			
253.4														○			
0.7	Clayey SILT , with sand, some gravel Hard to Very Stiff Grey Moist (TILL)		1	SS	64		253							○			
			2	SS	58		252							○			
			3	SS	17		251							○			
			4	SS	28		250							○			
			5	SS	27		249							○			
			6	SS	40		248							○			
			7	SS	100/		247							○			
246.2					0.270												
7.9	END OF BOREHOLE AT 7.9m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 7.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, THEN DRY MIX CONCRETE TO SURFACE.																

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMS 6-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 617.5 E 313 594.5 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.17 - 2017.11.17 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
254.1	GROUND SURFACE							<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>					
0.0	ASPHALT: (100mm)							<div><div>204060</div><div>W P W W L</div><div>NATURAL MOISTURE CONTENT</div></div>					
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)			GS									
252.9			1	SS	53		254						
1.2	Clayey SILT, with sand, trace gravel, trace cobbles Hard Brown Moist (TILL)						253						
			2	SS	57		252						
			3	SS	33		251						
			4	SS	31		250						
250.0							249						
4.1	Very Stiff		5	SS	26		248						
248.5							247						
5.6			6	SS	51								
246.3			7	SS	100/								
7.8	END OF BOREHOLE AT 7.8m. BOREHOLE CAVED TO 7.0m AND WATER LEVEL AT 5.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.200								

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/1/18

RECORD OF BOREHOLE No HMS 5-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 415.1 E 313 615.8 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.10 - 2017.12.10 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
252.2	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (150mm)							20	40	60	80	100						
0.2	SAND, some gravel, trace to some silt Dense Brown Wet (FILL)		1	SS	43		252											13 73 14 (SI+CL)
251.2			2	SS	31													
1.0	Clayey SILT, with sand, trace gravel Hard to Very Stiff Brown Moist (FILL)						251											
			3	SS	58													
							250											6 41 35 18
			4	SS	22													
249.3																		
3.0	Silty CLAY, some sand, some organics at 3.0m± Very Stiff to Hard Brown to Grey Moist (TILL)		5	SS	34		249											
							248											
			6	SS	23													
							247											
			7	SS	35		246											0 15 37 48
							245											
			8	SS	27													
244.0																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY TO BOTTOM. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

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

RECORD OF BOREHOLE No HMS 5-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 431.8 E 313 629.1 ORIGINATED BY TM
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
DATUM Geodetic DATE 2017.11.15 - 2017.11.15 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
252.1	GROUND SURFACE							20 40 60 80 100						
0.0	ASPHALT: (100mm)						252							
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)			GS										
251.4														
0.7	Clayey SILT, with sand, trace gravel Hard to Very Stiff Brown Moist (FILL)		1	SS	50		251							
			2	SS	53		250							6 46 29 19
			3	SS	26									
249.1							249							
3.0	Silty CLAY, some sand, trace gravel, some organics at 3.0m± Hard Brown Moist (TILL)		4	SS	30									
							248							
			5	SS	33		247							1 12 45 42
							246							
244.9							245							
7.2	SILT, some clay, trace sand Dense Grey Wet		7	SS	45		244							0 3 85 12
243.9														
8.2	END OF BOREHOLE AT 8.2m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.02.16 3.5 248.6													

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/16/18

+ ³ , × ³ : Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HOT-4

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 865 362.5 E 313 594.9 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
251.4	GROUND SURFACE							20 40 60 80 100					
0.0	ASPHALT: (150mm)							20 40 60 80 100					
0.2	SAND, trace gravel Brown Moist (FILL)		1	GS			251						
250.8													
0.7	Sandy SILT, trace gravel, trace clay Compact Brown Moist (FILL)		1	SS	27		250						
250.1													
1.4	Clayey SILT, with sand, trace gravel, some organics at 1.5m± Very Stiff to Stiff Brown Moist (TILL)		2	SS	26		249						
			3	SS	10								3 42 35 20
			4	SS	14		248						
	Hard		5	SS	44		247						
245.9							246						
5.6	Silty CLAY, some sand Hard Grey Moist (TILL)		6	SS	39		245						0 20 37 43
			7	SS	43		244						
243.4													
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE OPEN AND WATER LEVEL AT 5.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.												

+³, ×³: Numbers refer to
Sensitivity

20
15
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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV 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 Brown Moist (FILL)			GS				20 40 60 80 100					
246.2								20 40 60 80 100					
0.8	Clayey SILT, some sand Very Stiff to Hard Brown Moist (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 Dense Brown Wet		5	SS	36		242	20 40 60 80 100					0 20 68 12
241.2			6	SS	22		241	20 40 60 80 100					0 77 20 3
5.8	SAND, some silt, trace clay Compact Brown Wet						240	20 40 60 80 100					
239.3			7	SS	75		239	20 40 60 80 100					
7.7	Clayey SILT, with sand Hard Grey Wet (TILL)							20 40 60 80 100					
238.9	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED TO 5.2m AND WATER LEVEL AT 3.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.												
8.1								20 40 60 80 100					

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/1/18

+³, ×³: Numbers refer to
Sensitivity

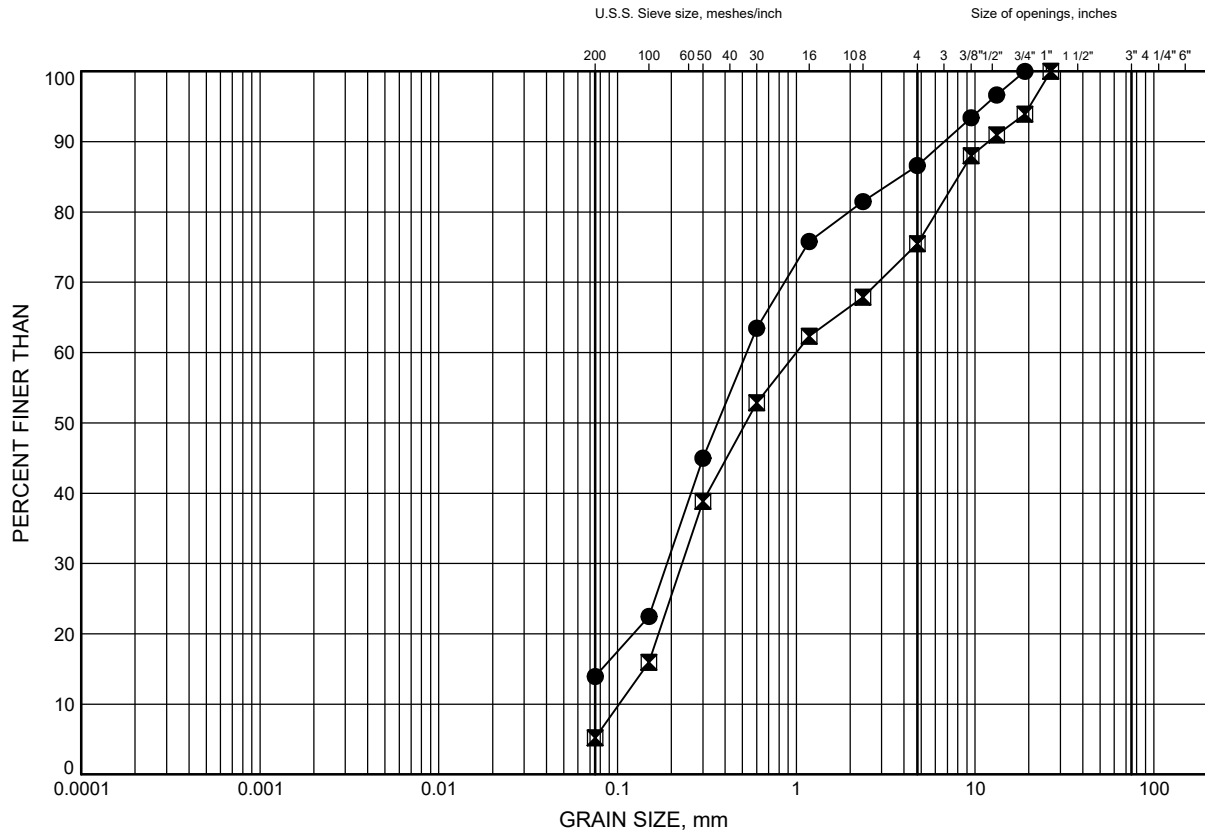
20
15
10

(%) 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)
●	HMS 5-1	0.5	251.8
⊠	TS-190	1.1	258.9

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

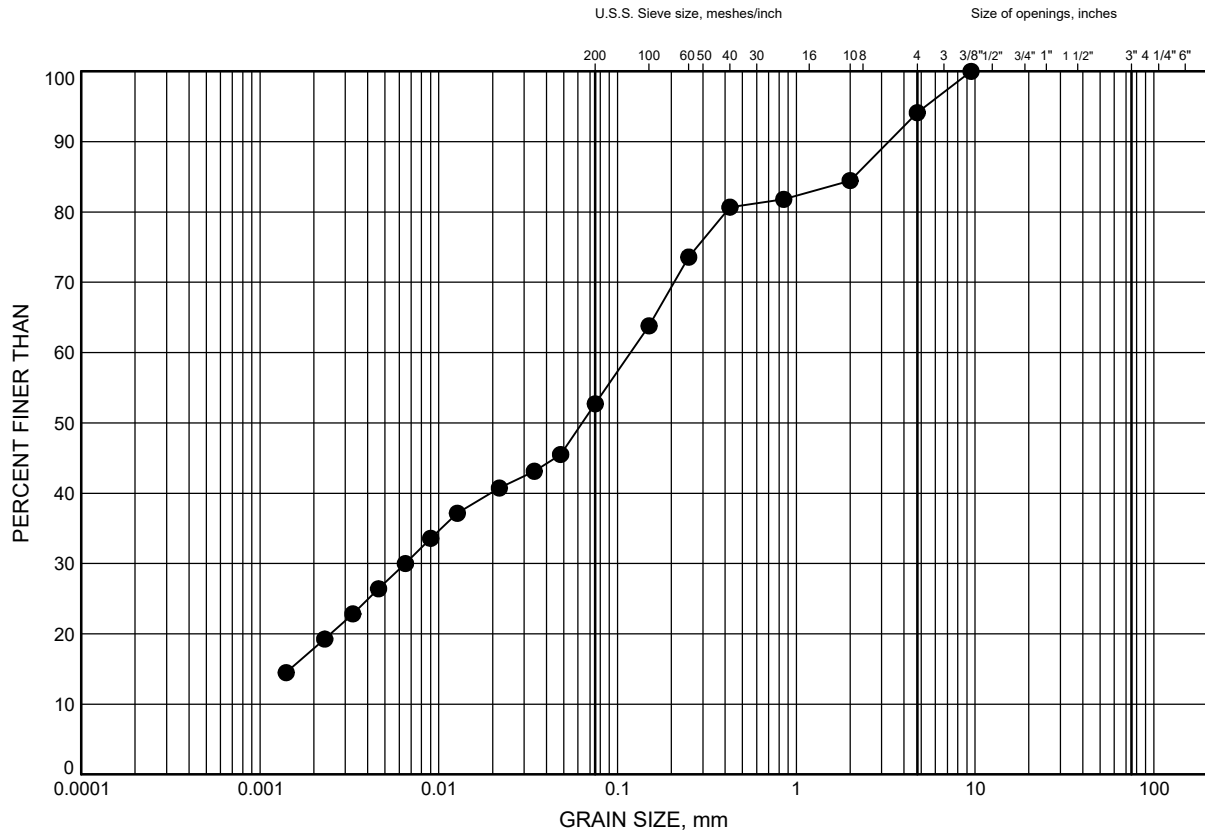


Prep'd MP
Chkd. RD

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)
●	HMS 5-1	2.6	249.6

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

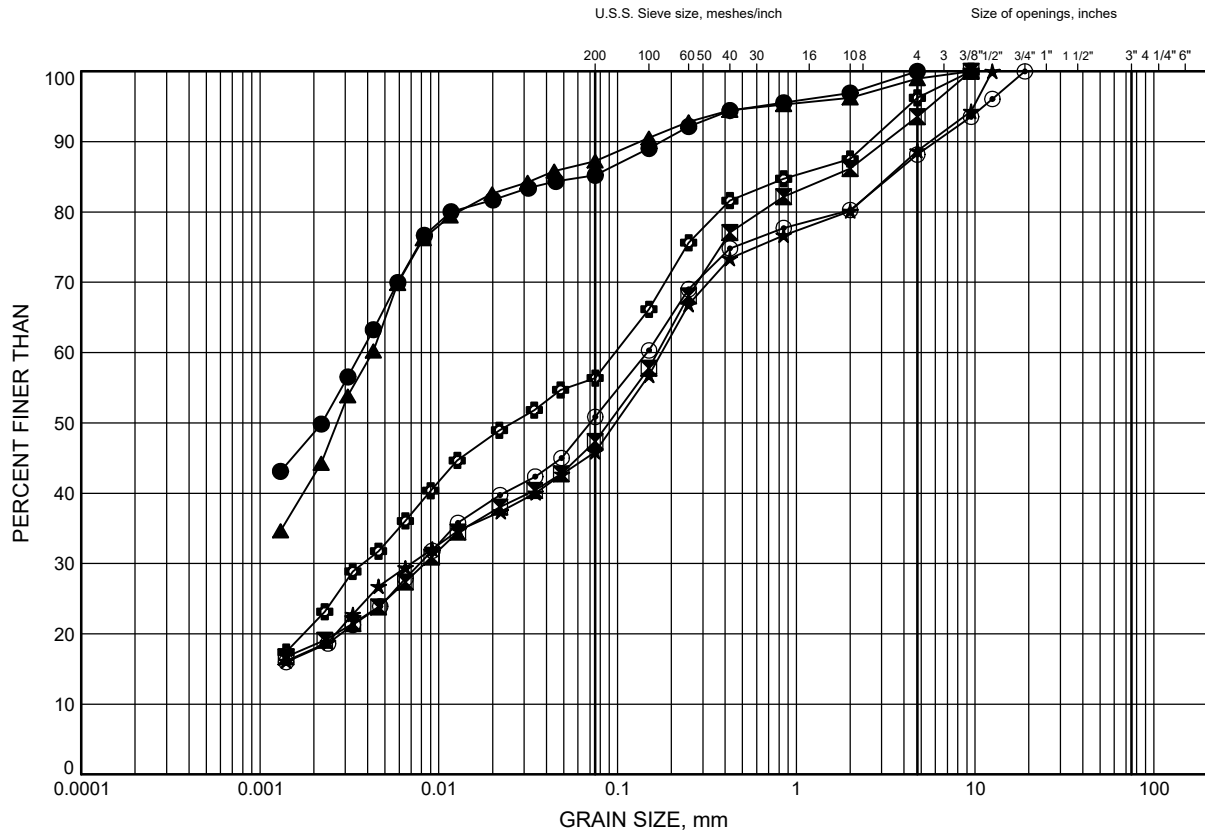


Prep'd MP
Chkd. RD

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)
●	HMS 5-1	6.4	245.8
⊠	HMS 5-2	1.8	250.3
▲	HMS 5-2	4.9	247.2
★	HMS 6-1	3.4	250.8
⊙	HMS 6-1	6.4	247.7
⊕	HMS 6-2	2.6	251.5

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

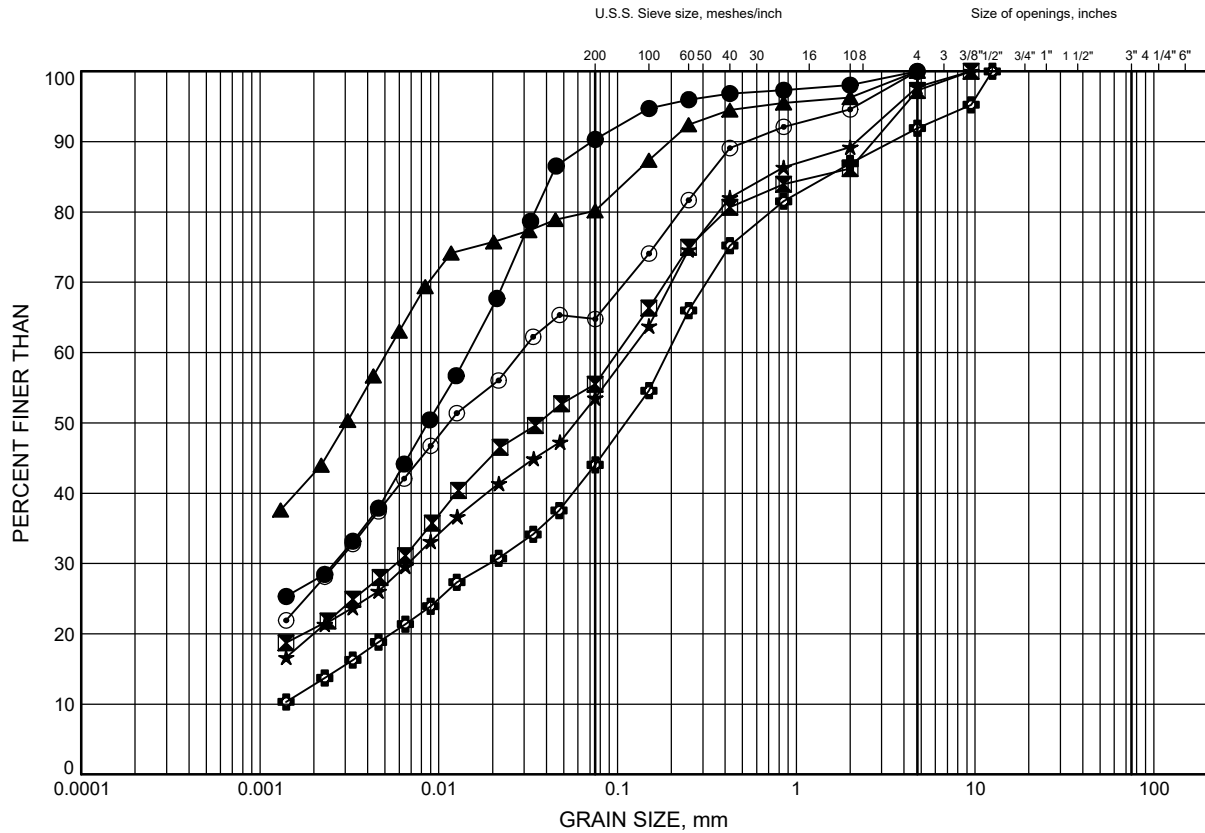


Prep'd MP
Chkd. RD

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)
●	HOT-3	2.5	244.5
⊠	HOT-4	2.5	248.9
▲	HOT-4	6.3	245.1
★	OHS 7-1	2.6	252.6
⊙	OHS 7-1	6.4	248.8
⊕	OHS 7-1	7.7	247.5

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

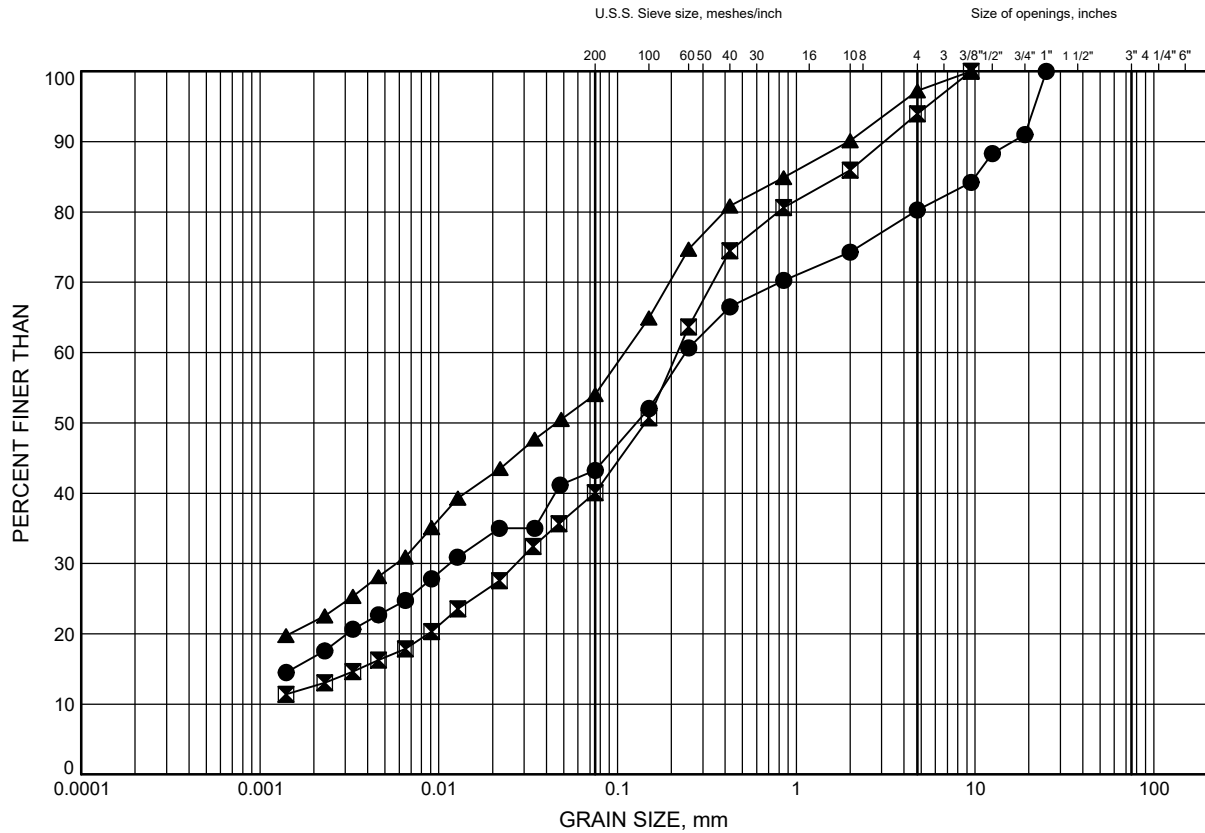


Prep'd MP
Chkd. RD

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)
●	OHS 7-2	2.6	252.8
⊠	OHS 7-2	4.9	250.5
▲	OHS 7-2	7.7	247.6

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

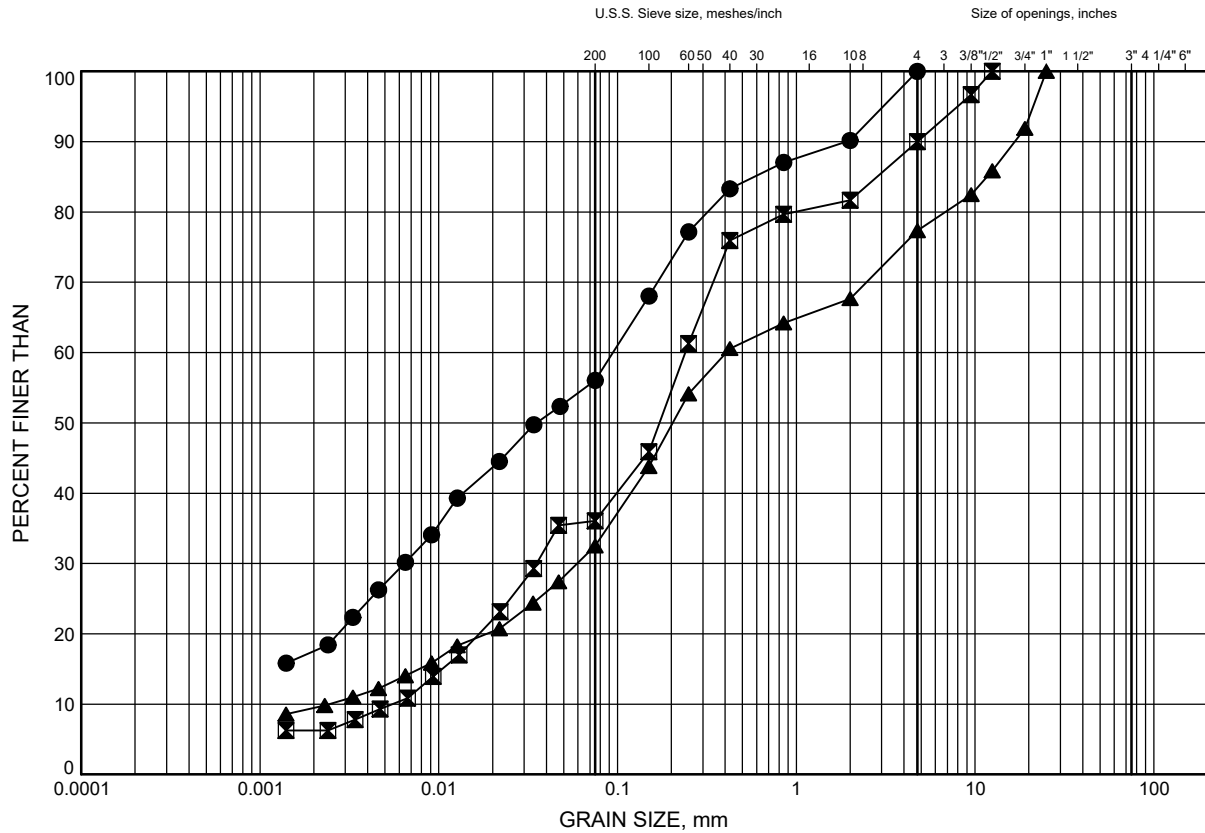


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B6

SAND and SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 8-1 / MS-11	1.1	259.1
⊠	OHS 8-1 / MS-11	3.2	257.0
▲	OHS 8-2	7.9	252.4

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

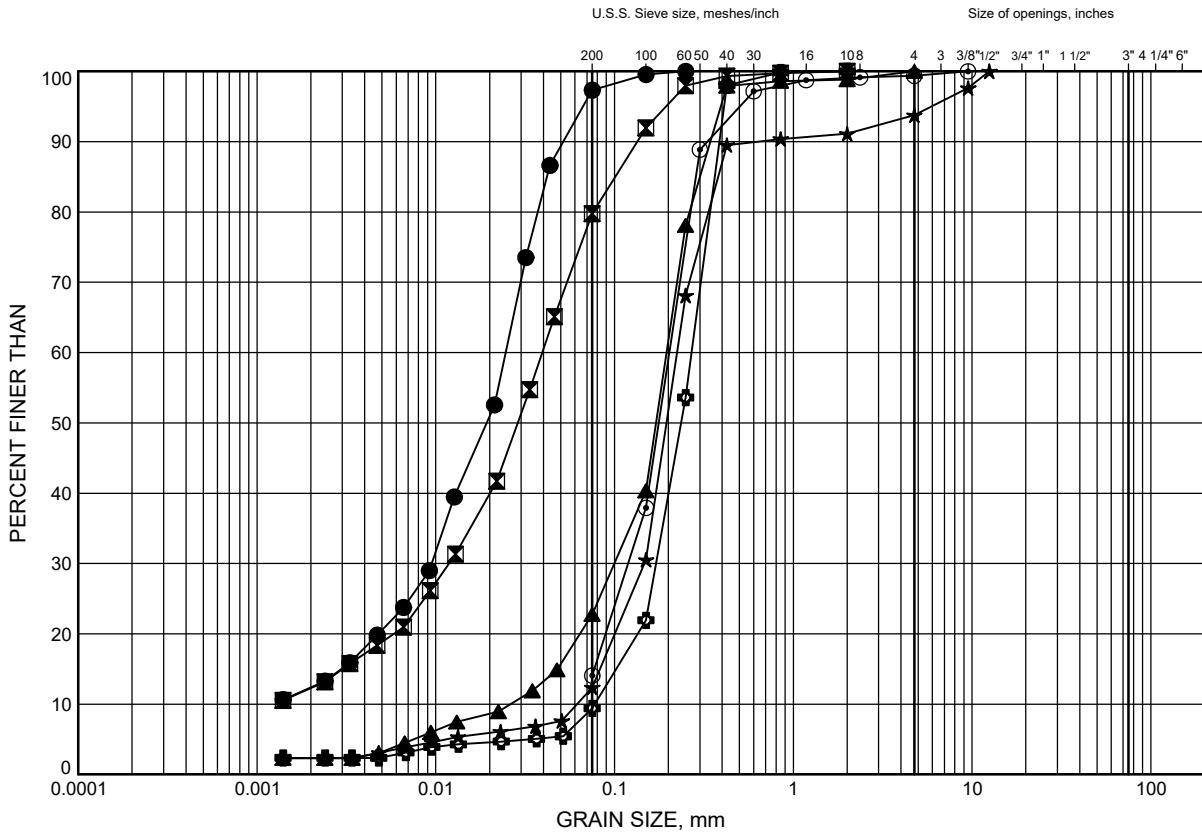


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B7

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 5-2	7.9	244.2
⊠	HOT-3	4.8	242.2
▲	HOT-3	6.3	240.7
★	OHS 8-2	4.9	255.4
⊙	TS-190	2.6	257.4
⊕	TS-190	4.9	255.1

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

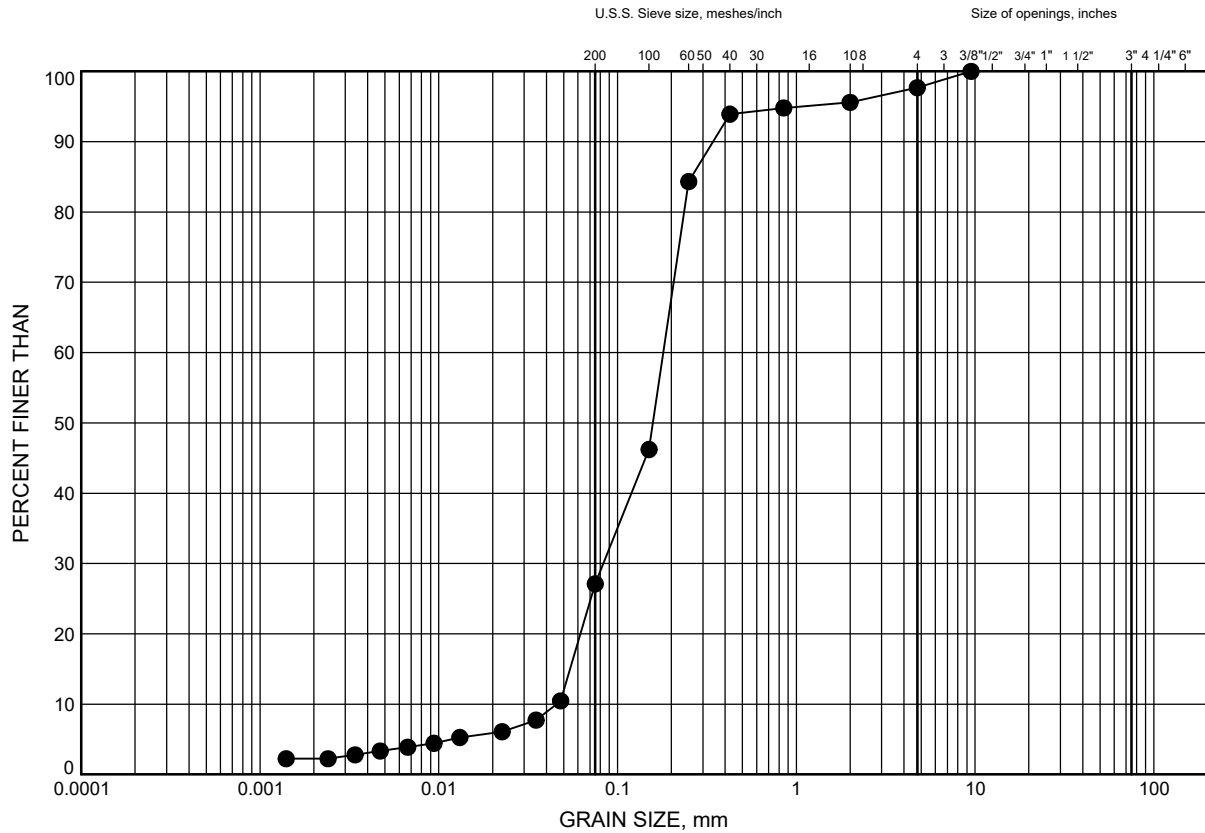


Prep'd AN
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE B8

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	TS-190	6.4	253.6

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

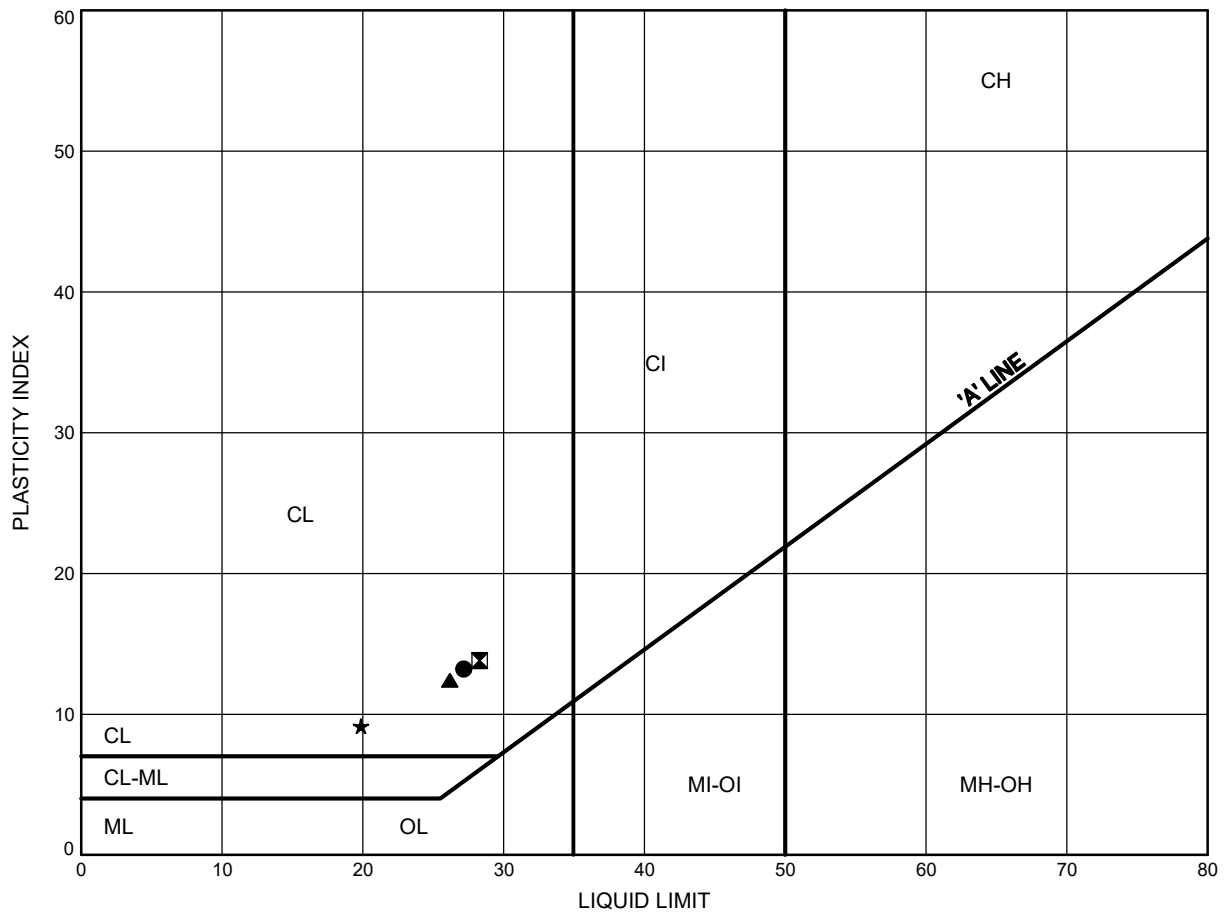


Prep'd AN
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE B9

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 5-1	6.4	245.8
⊠	HMS 5-2	4.9	247.2
▲	HOT-4	6.3	245.1
★	OHS 7-1	2.6	252.6

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

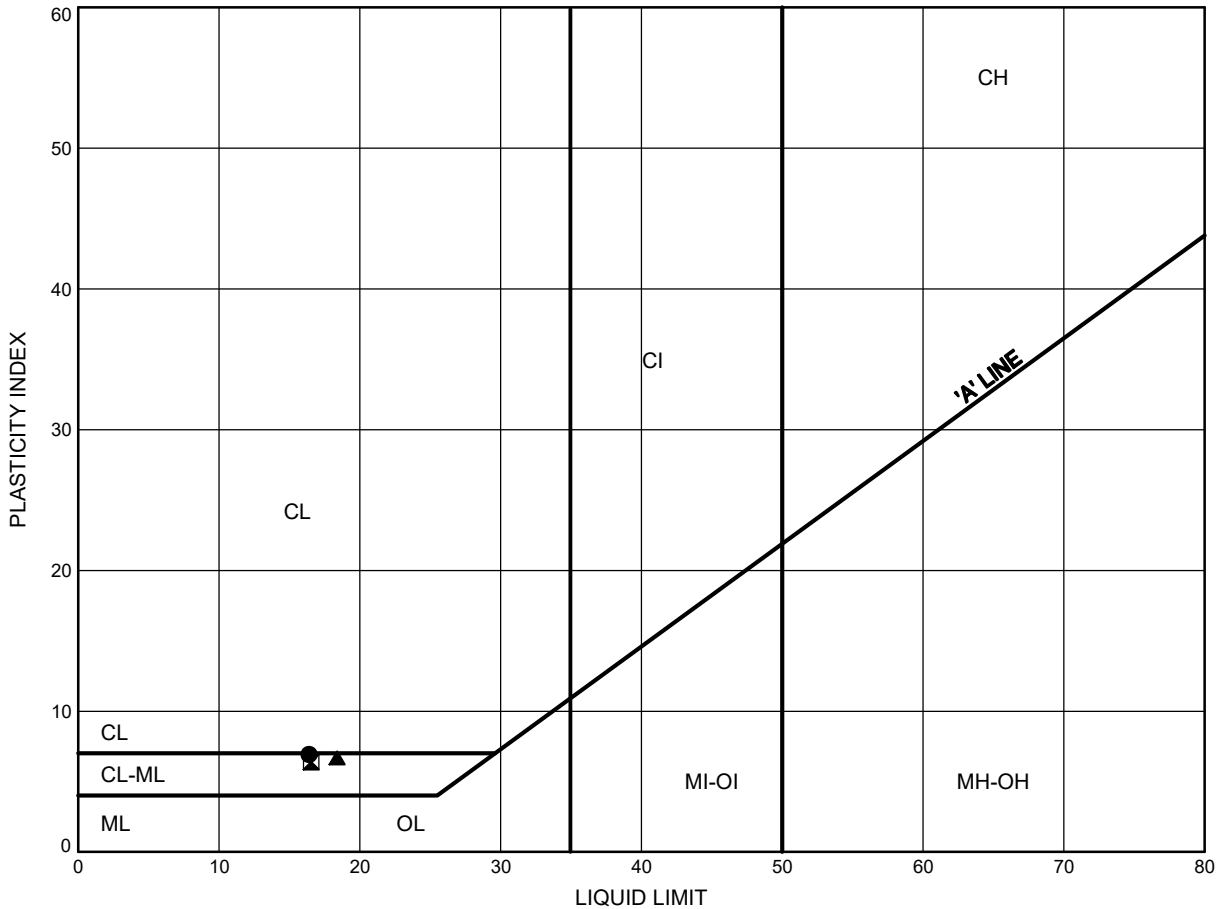


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE B10

Clayey SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 6-2	6.4	247.7
⊠	OHS 7-1	6.4	248.8
▲	OHS 7-2	4.9	250.5

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



Prep'd MP
Chkd. RD



Appendix C

Section 3 (Stations 22+400 19th Avenue to 20+300 Elgin Mills Road)

RECORD OF BOREHOLE No MS-32

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION SB N 4 864 023.5 E 313 794.6 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.08.11 - 2017.08.11 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
240.7	GROUND SURFACE													
0.0	ASPHALT: (100mm)													
0.1	Silty SAND, trace gravel Brown Moist (FILL)		1	GS										
239.9														
0.8	Silty CLAY, with sand, trace gravel Firm to Very Stiff Brown Moist (TILL)		1	SS	13									0 23 31 46
			2	SS	6									
			3	SS	22									
			4	SS	25									
			5	SS	23									
235.1														
5.6	Silty SAND, some clay, trace gravel Compact Grey Wet													
			6	SS	16									8 52 25 15
234.0														
6.7	END OF BOREHOLE AT 6.7m. WATER LEVEL AT 4.6m DEPTH UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.09.24 3.0 237.7 2017.10.23 2.9 237.8													

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

RECORD OF BOREHOLE No HOT-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 842.8 E 313 828.3 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
239.5	GROUND SURFACE												
0.0	ASPHALT: (150mm)												
0.2	SAND, some gravel, cobble pieces Very Dense Brown Moist (FILL)			GS			239						
			1	SS	50/								
238.4					0.025								
1.1	Clayey SILT, with sand, trace gravel Hard Brown to Grey Moist (TILL)		2	SS	50/		238						
					0.150								
			3	SS	44		237						
236.2			4	SS	100/		236						
3.3	Sandy SILT, trace gravel, trace clay Very Dense Brown Moist				0.250								
							235						
234.8			5	SS	38		234						2 69 25 4
4.7	Silty SAND, trace gravel, trace clay Dense Brown Wet												
233.9													
5.6	Silty CLAY, some sand Hard Grey Moist (TILL)		6	SS	44		233						0 20 43 37
			7	SS	34		232						
231.4													
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED TO 4.9m AND WATER LEVEL AT 4.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.												

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TS-150 / MS-33

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION NB N 4 863 842.5 E 313 846.3 ORIGINATED BY TM
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2017.07.17 - 2017.07.17 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
240.3	GROUND SURFACE													
0.0	ASPHALT: (100mm)													
0.1	Silty SAND , trace to some gravel Brown Moist (FILL)		1	GS			240							
239.6														
0.8	Silty CLAY , with sand, trace gravel, trace cobbles Hard to Very Stiff Brown Moist (TILL)		1	SS	42		239							
			2	SS	27									
			3	SS	25		238							
			4	SS	48		237							
236.2														
4.1	Silty SAND , trace gravel Compact Brown Wet		5	SS	26		236							
234.7							235							
5.6	Clayey SILT , some sand, trace gravel Very Stiff Grey Moist (TILL)		6	SS	28		234							
233.6														
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE CAVED TO 5.5m AND WATER LEVEL AT 3.0m DEPTH UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.5m, DRY MIX CONCRETE TO 0.2m, THEN COLD PATCH ASPHALT TO SURFACE.													

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RECORD OF BOREHOLE No HMS 4-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 674.2 E 313 859.3 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
238.3	GROUND SURFACE													
0.0	ASPHALT: (150mm)													
0.2	SAND, trace gravel Brown Moist (FILL)		1	SS			238							
237.4			1	SS	58									
1.0	Clayey SILT, some sand, trace gravel Stiff Brown Moist (FILL)		2	SS	12		237							
236.2														
2.1	Clayey SILT, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		3	SS	18		236							
			4	SS	32		235							
							234							
			5	SS	50/ 0.125		233							
232.8														
5.6	Silty SAND, trace clay Dense to Compact Brown Wet		6	SS	44		232							
							231							
230.2			7	SS	23									
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED TO 4.6m AND WATER LEVEL AT 3.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.													

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

RECORD OF BOREHOLE No HMS 4-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 673.5 E 313 845.2 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.29 - 2017.11.29 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
238.3	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (150mm)																	
0.1	SAND, some gravel, trace silt Compact Brown Moist (FILL)		1	SS	26		238											
237.6																		
0.7	Sandy SILT, some clay, trace gravel Compact Brown Moist (FILL)		2	SS	19		237											
236.9																		
1.4	Clayey SILT, with sand, trace gravel Very Stiff Brown Moist (TILL)		3	SS	16		236											
	cobble pieces		4	SS	16													
			5	SS	20		235											
							234											
			6	SS	25													
							233											
			7	SS	25		232											
231.1																		
7.2	Silty SAND, trace gravel, trace clay Very Dense Grey Moist		8	SS	75		231											
230.1																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 6.7m AND WATER LEVEL AT 5.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

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+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TS-135

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 627.1 E 313 862.4 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.05 - 2017.12.05 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20	40	60	80	100	W _P	W	W _L		
238.1	GROUND SURFACE																
0.0	ASPHALT: (150mm)																
0.2	SAND, some silt, trace gravel Dense Brown Moist (FILL)		1	SS	40											5 71 15 9	
237.2																	
1.0	Clayey SILT, some sand, trace gravel Hard Brown Moist (FILL)		2	SS	47												
			3	SS	46												
235.7																	
2.4	Clayey SILT, with sand, trace gravel Stiff to Hard Brown Wet (TILL)		4	SS	8												
			5	SS	10											3 43 33 21	
			6	SS	30												
			7	SS	44												
			8	SS	49												
229.9																	
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 4.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																

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

RECORD OF BOREHOLE No HOT-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 452.1 E 313 917.2 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.14 - 2017.12.14 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
237.7	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (150mm)							20	40	60	80	100						
0.2	SAND, trace gravel, trace silt Dense Brown Moist (FILL)		1	SS	44		237											
237.1																		
0.6	Clayey SILT, some sand, trace gravel Very Stiff to Hard Brown Moist (FILL)		2	SS	29													
			3	SS	47		236											
235.5																		
2.2	Silty CLAY, with sand, trace gravel, some organics at 2.3m± Very Stiff Brown Moist (TILL)		4	SS	21		235											
			5	SS	27													
							234											
			6	SS	16		233											
232.1																		
5.6	SAND, some silt, trace clay Dense to Very Dense Grey Wet		7	SS	49		232											
							231											
			8	SS	50/ 0.125		230											
229.7																		
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED TO 7.0m AND WATER LEVEL AT 5.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

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+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)						
236.8	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (150mm)																	
0.1	SAND, trace silt, trace gravel Dense Brown Moist (FILL)		1	SS	44									○				
236.1																		
0.7	Clayey SILT, some sand, trace gravel, cobble pieces Hard Brown Moist (FILL)		2	SS	43									○				
			3	SS	37									○				
234.5																		
2.2	Silty CLAY, some sand, some organics at 2.3m± Stiff Dark Brown to Brown Moist		4	SS	14									○				
			5	SS	8									○				0 18 30 52
232.6																		
4.1	Clayey SILT, with sand Hard Brown to Grey Moist (TILL)		6	SS	43									⊕				0 42 43 15
			7	SS	50/ 0.125									○				
229.6																		
7.2	SAND and SILT , trace clay Dense Grey Wet		8	SS	31									○				0 52 43 5
228.5																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED AT 6.7m and WATER LEVEL AT 5.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

+³, ×³: 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)											
ELEV 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 Brown Wet (FILL)		1	SS	31		236																	
235.9																								
0.5	Clayey SILT, trace gravel, trace sand Very Stiff Brown Wet (FILL)		2	SS	20		235																	
234.9	Clayey SILT, with sand, trace gravel Stiff to Hard Brown Moist to Wet (TILL)		3	SS	14		234																	
1.4																								
			4	SS	10		233																	
			5	SS	33		232																	
			6	SS	16		231																	
			7	SS	47		230																	
229.2							229																	
7.2	Silty SAND, trace gravel, trace clay Dense Brown Wet		8	SS	43																			
228.2																								
8.2	END OF BOREHOLE AT 8.2m. WATER LEVEL AT 5.5m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2016.02.15 2.3 234.1																							

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMS 3-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 162.1 E 313 970.0 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.12 - 2017.12.12 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
236.1	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT: (150mm)						236												
0.2	SAND, some gravel, trace silt Dense Brown Moist (FILL)		1	SS	40														
235.2																			
0.9	Silty CLAY, with sand, trace gravel Hard Brown Moist (TILL)		2	SS	51		235												
			3	SS	32														
233.9							234												
2.2	Very Stiff		4	SS	24														
233.1																			
3.0			5	SS	51		233												
							232												
			6	SS	30														
							231												
							230												
			7	SS	69														
							229												
	Stiff																		
			8	SS	12														
227.9							228												
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 6.7 m AND WATER LEVEL AT 5.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																		

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

RECORD OF BOREHOLE No HMS 3-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 863 165.8 E 313 987.1 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
235.9	GROUND SURFACE													
0.0	ASPHALT: (150mm)													
0.2	SAND, trace silt, some gravel Dense		1	SS	32									
235.3	Brown to Grey Moist (FILL)													
0.6	Clayey SILT, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		2	SS	20									
			3	SS	40									
			4	SS	36									
			5	SS	48									
			6	SS	52									
230.3														
5.6	SAND, some silt, trace gravel, trace clay Dense to Compact Grey Wet		7	SS	48									
			8	SS	17									
227.7														
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 7.0m AND WATER LEVEL AT 5.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 5-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 862 936.7 E 313 987.9 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
234.5	GROUND SURFACE												
0.0	ASPHALT: (150mm)												
0.2	SAND, some gravel, trace silt		1	SS	46								
233.9	Dense												
0.6	Brown		2	SS	88								
	Moist												
	(FILL)												
	SAND and SILT, trace gravel, trace clay		3	SS	54								5 53 37 5
	Very Dense to Dense												
232.3	Brown												
2.2	Moist		4	SS	25								
	(TILL)												
	Compact		5	SS	36								
231.5													
3.0			6	SS	50/ 0.100								4 37 48 11

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 5-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 862 934.0 E 313 968.9 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.29 - 2017.11.29 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
234.2	GROUND SURFACE													
0.0	ASPHALT: (150mm)													
0.1	SAND, some gravel, some silt Dense Grey Moist (FILL)		1	SS	48									
233.1			2	SS	23									
1.1	Sandy SILT, trace clay, trace gravel Compact to Dense Brown Moist													
			3	SS	38									
			4	SS	34									
			5	SS	28									
230.1														
4.1	SAND and SILT , trace gravel, trace to some clay Very Dense Grey Wet (TILL)		6	SS	60/ 0.100									

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

RECORD OF BOREHOLE No TS-125

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 862 844.4 E 314 000.2 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT					
							w P w w L								
							WATER CONTENT (%)								
							○ UNCONFINED + FIELD VANE								
							● QUICK TRIAXIAL × LAB VANE								
							20 40 60 80 100								
							20 40 60								
234.0	GROUND SURFACE						234								
0.0	ASPHALT: (150mm)														
0.2	SAND, some gravel, trace silt Dense to Compact Brown Moist (FILL)		1	SS	40		233								
			2	SS	27										
232.6															
1.4	Clayey SILT, trace sand, trace gravel, some organics at 1.5m Very Stiff to Stiff Dark Brown Moist (TILL)		3	SS	23		232								
			4	SS	25										
			5	SS	13		231								
229.9							230								
4.1	SAND, some silt, trace gravel, trace clay Very Dense Brown Wet		6	SS	54		229								
228.4															
5.6	SAND and SILT, trace gravel, trace clay, cobble pieces Very Dense Grey Wet (TILL)		7	SS	50/ 0.100		228								
			8	SS	50/ 0.075		227								
226.2															
7.8	END OF BOREHOLE AT 7.8m. BOREHOLE CAVED TO 4.3m AND WATER LEVEL AT 3.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.														

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MS-42

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION SB N 4 862 711.9 E 314 027.8 ORIGINATED BY SLL
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.08.15 - 2017.08.15 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						WATER CONTENT (%) PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L			
233.4	GROUND SURFACE							20	40	60	80	100					
0.0	ASPHALT: (100mm)																
0.1	Silty SAND, trace gravel Brown Moist (FILL)		1	GS			233										
232.5	Clayey SILT, trace gravel Very Stiff Brown Moist (FILL)		1	SS	20		232										
232.0	Sandy SILT, trace gravel, occasional cobbles Very Dense Brown Moist (FILL)		2	SS	100/ 0.250												
231.2	Clayey SILT, some sand, with organics stained and rootlets Very Stiff Dark Brown Moist		3	SS	18		231										
2.2			4	SS	18		230										
229.0							229										
4.4	Clayey SILT, with sand, trace gravel Very Stiff to Firm Brown Moist (TILL)		5	SS	16		228										
			6	SS	6		227										
226.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 5.8m AND WATER LEVEL AT 5.0m DEPTH UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.8m, DRY CEMENT TO 0.2m, THEN COLD PATCH ASPHALT TO SURFACE.																
6.7																	

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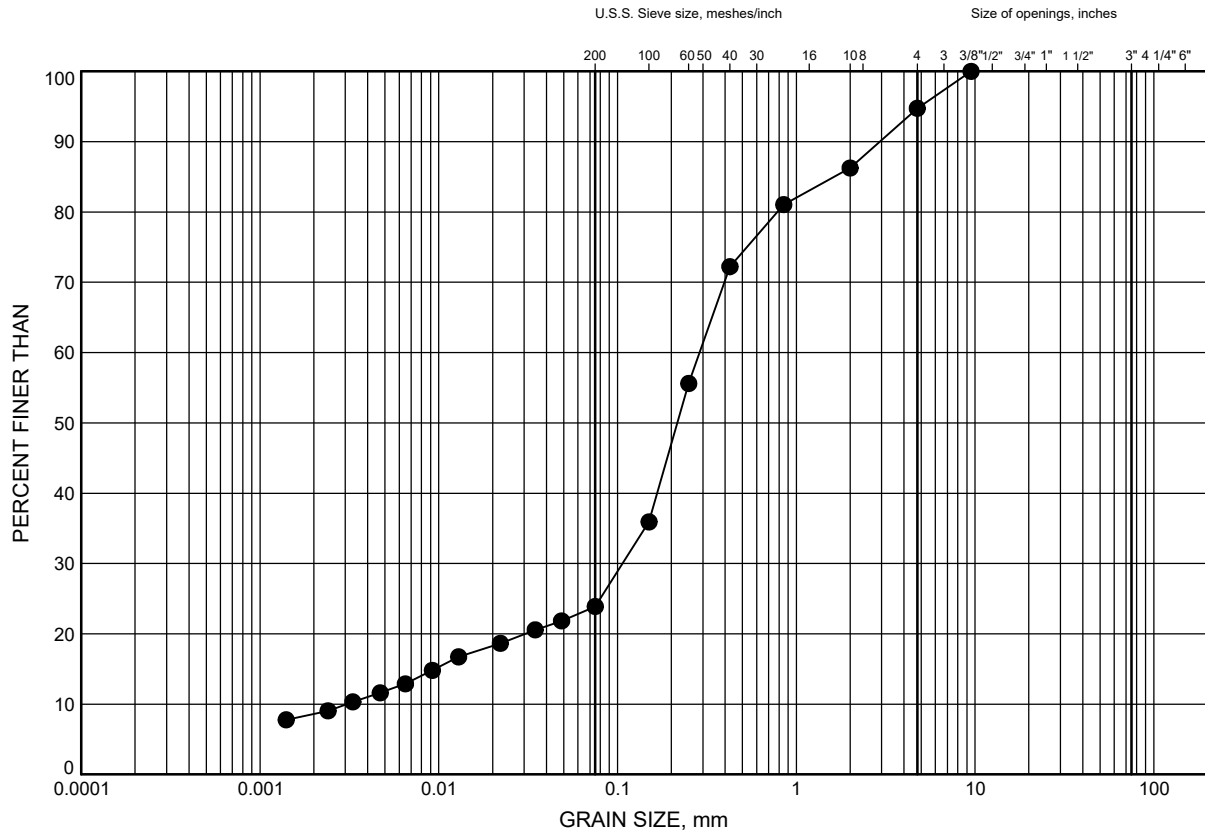
+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) 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)
●	TS-135	0.5	237.7

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

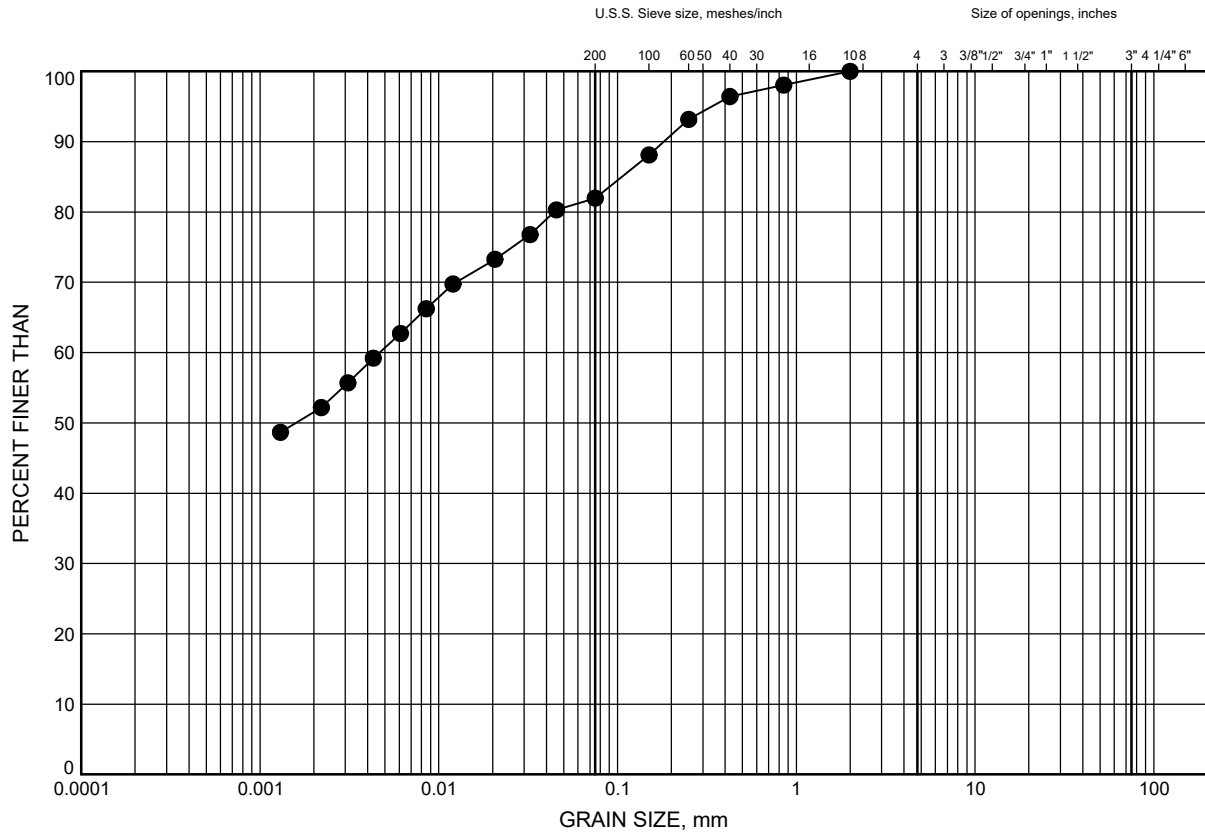


Prep'd MP
Chkd. RD

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 February 2018
W.P. 2930-02-00

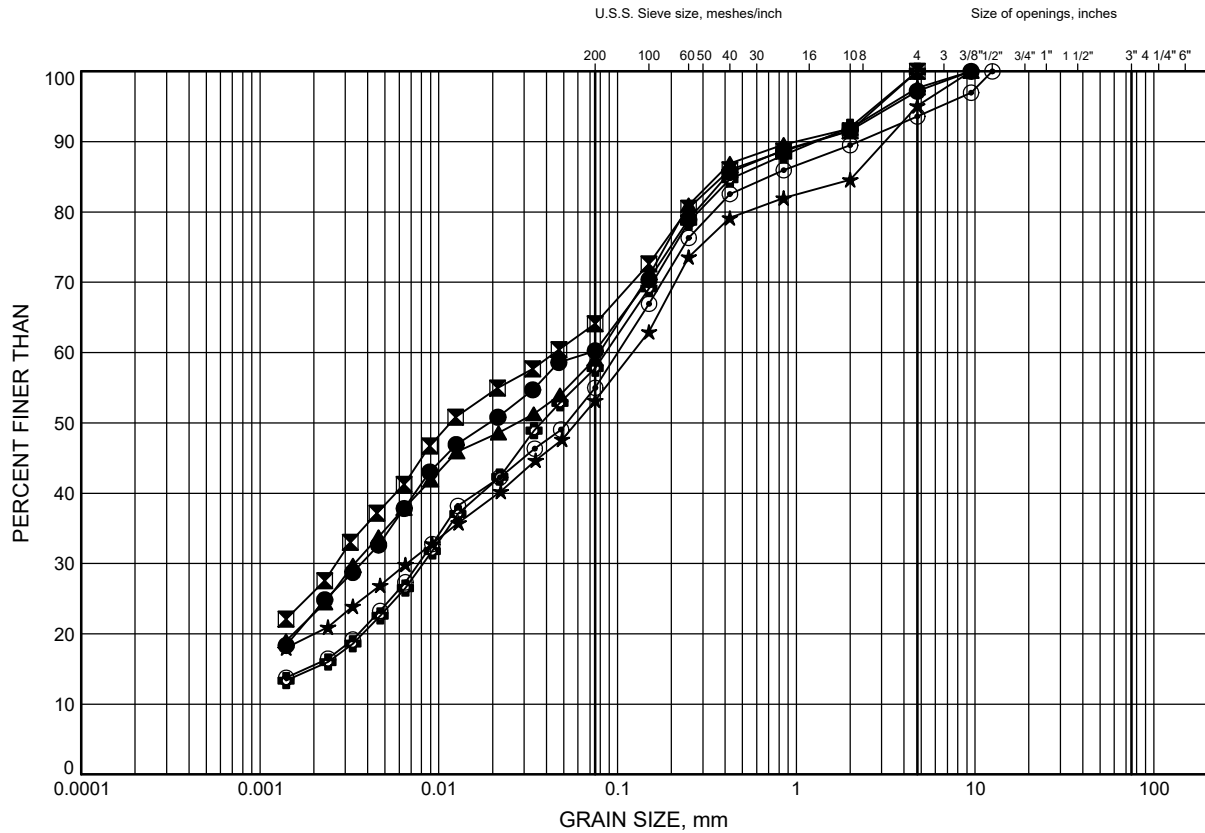


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C3

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)
●	HMS 3-1	1.8	234.3
⊠	HMS 3-1	2.6	233.5
▲	HMS 3-1	6.4	229.7
★	HMS 4-1	2.5	235.8
⊙	HMS 4-2	2.6	235.7
⊕	OHS 6-1	4.9	231.9

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



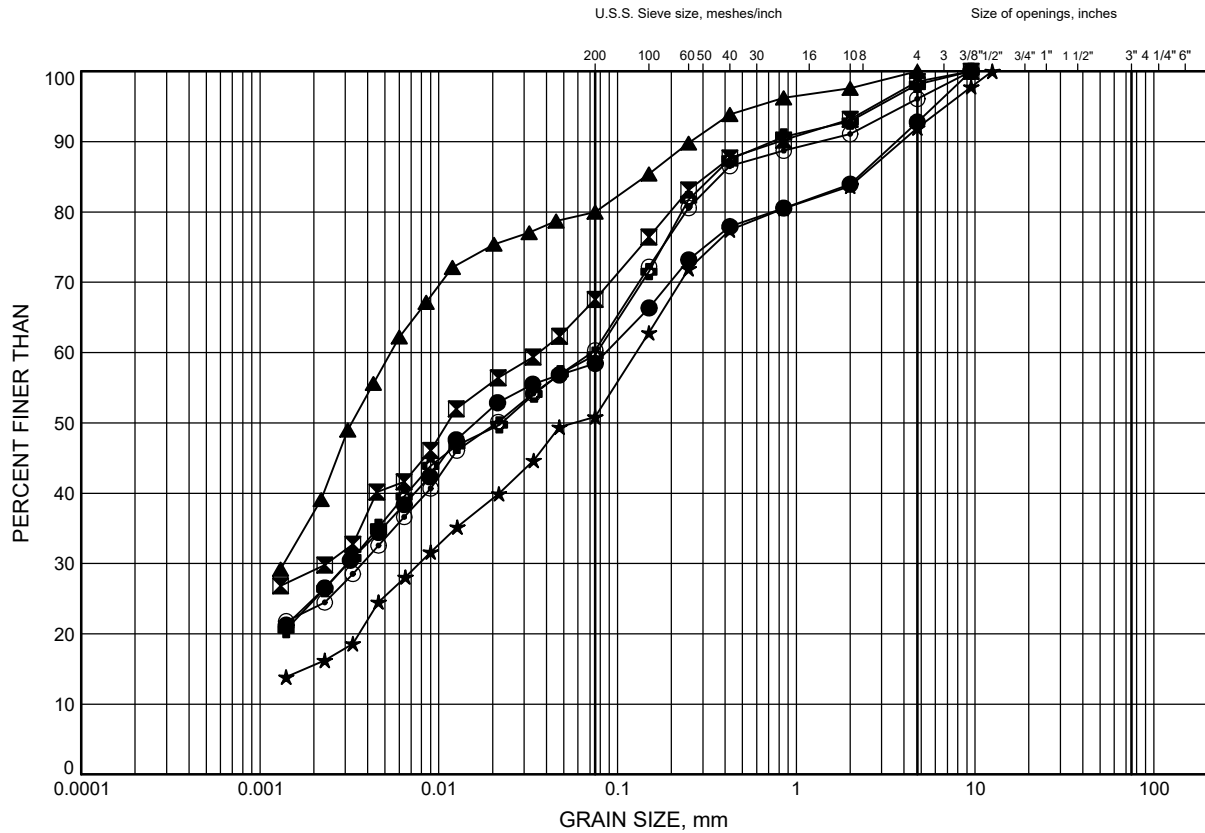
Prep'd MP
Chkd. RD

HWY 404 Widening

GRAIN SIZE DISTRIBUTION

FIGURE C4

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-1	2.6	235.1
⊠	HOT-1	4.9	232.9
▲	HOT-2	6.3	233.2
★	OHS 6-2	2.6	233.8
⊙	OHS 6-2	6.4	230.0
⊕	TS-150 / MS-33	2.6	237.7

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

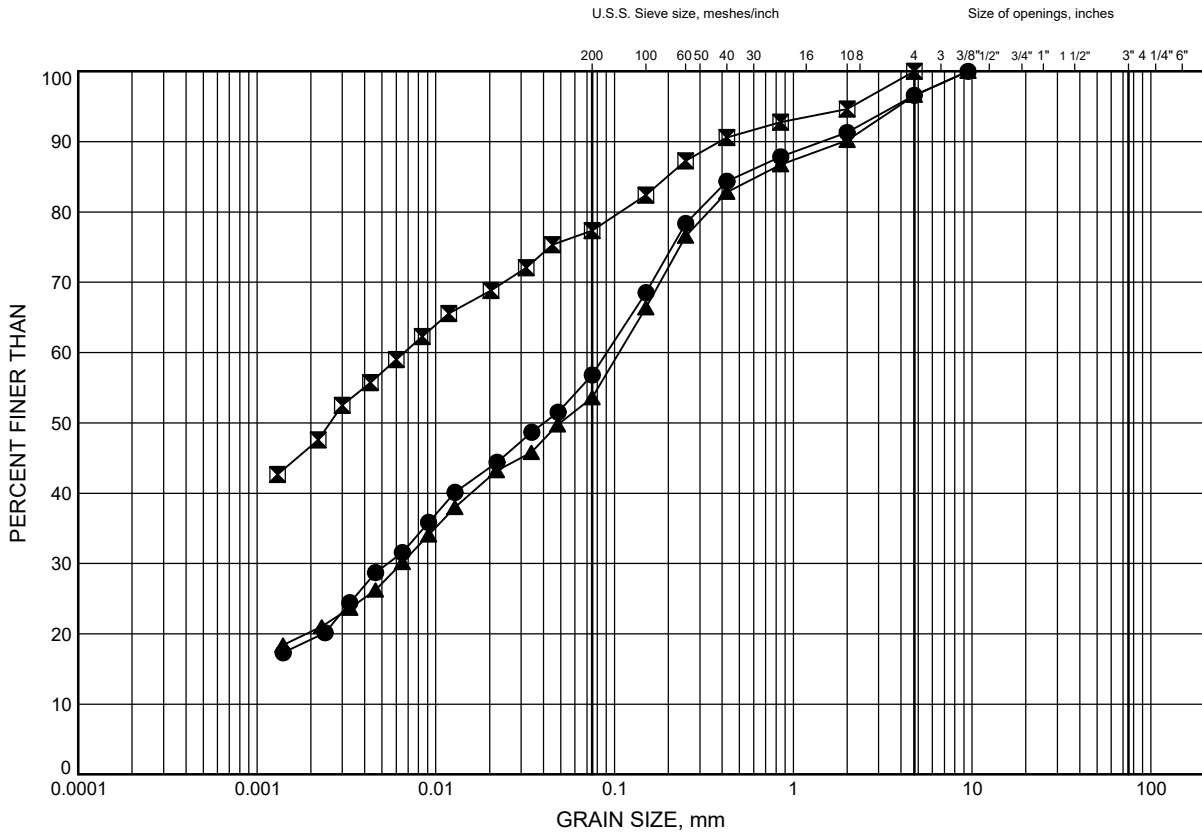


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C5

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-42	4.9	228.5
⊠	MS-32	1.1	239.6
▲	TS-135	3.4	234.8

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

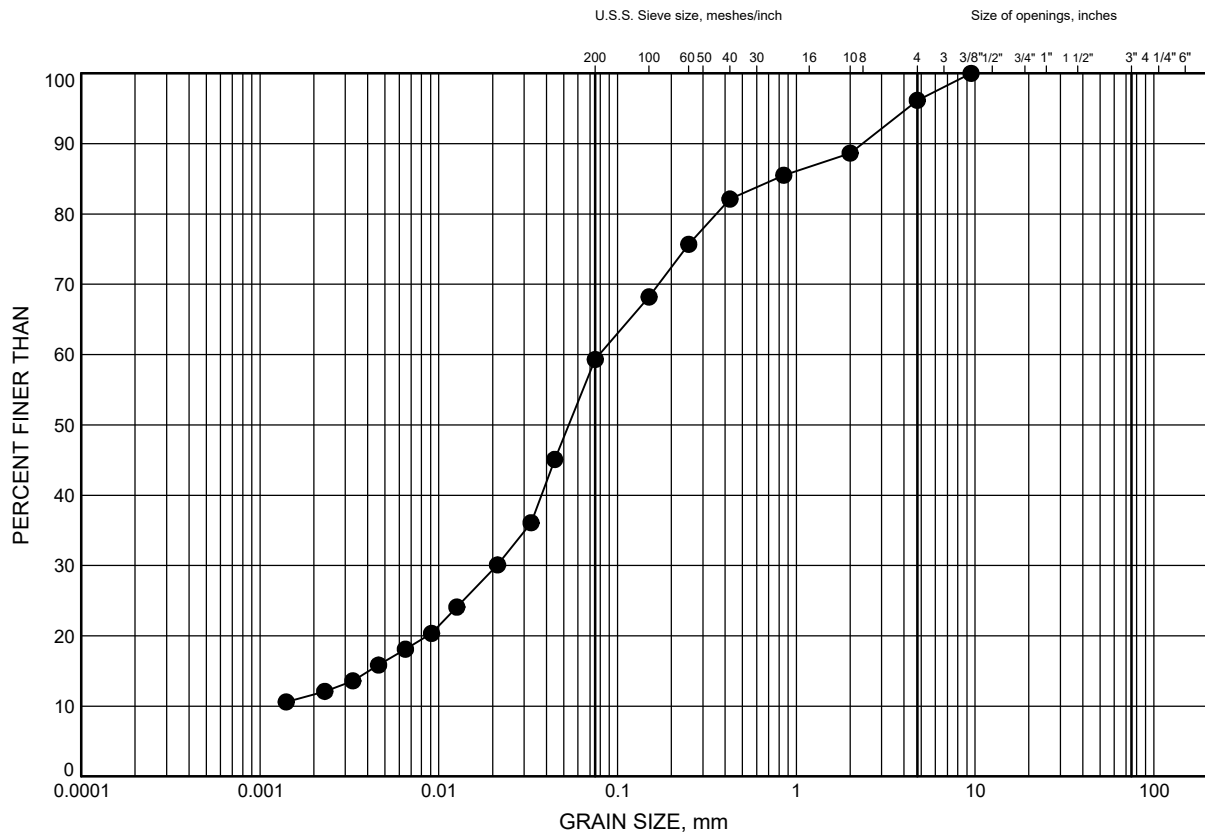


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C6

Sandy SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 5-1	4.7	229.8

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

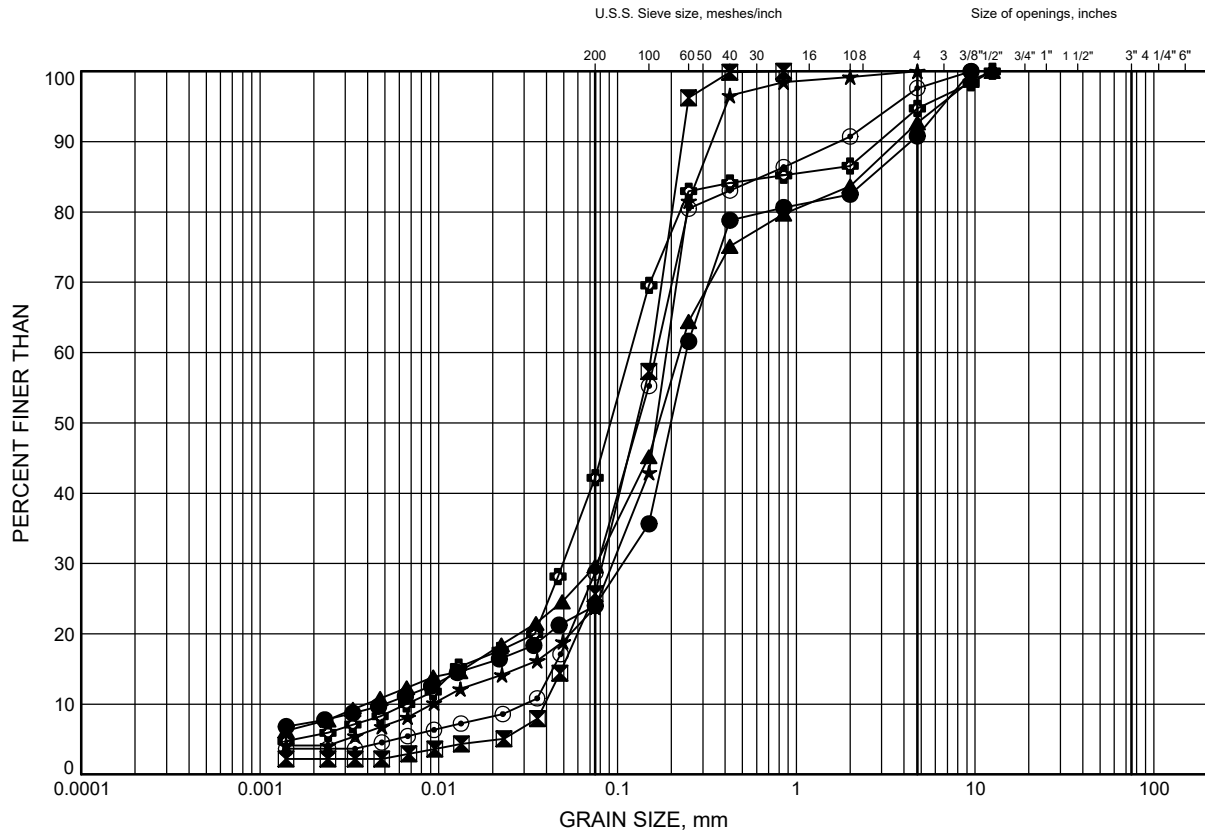


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C7

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 3-2	6.4	229.5
⊠	HMS 4-1	6.3	232.0
▲	HMS 4-2	7.9	230.4
★	HOT-1	6.4	231.3
⊙	HOT-2	4.8	234.7
⊕	OHS 5-1	1.8	232.7

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

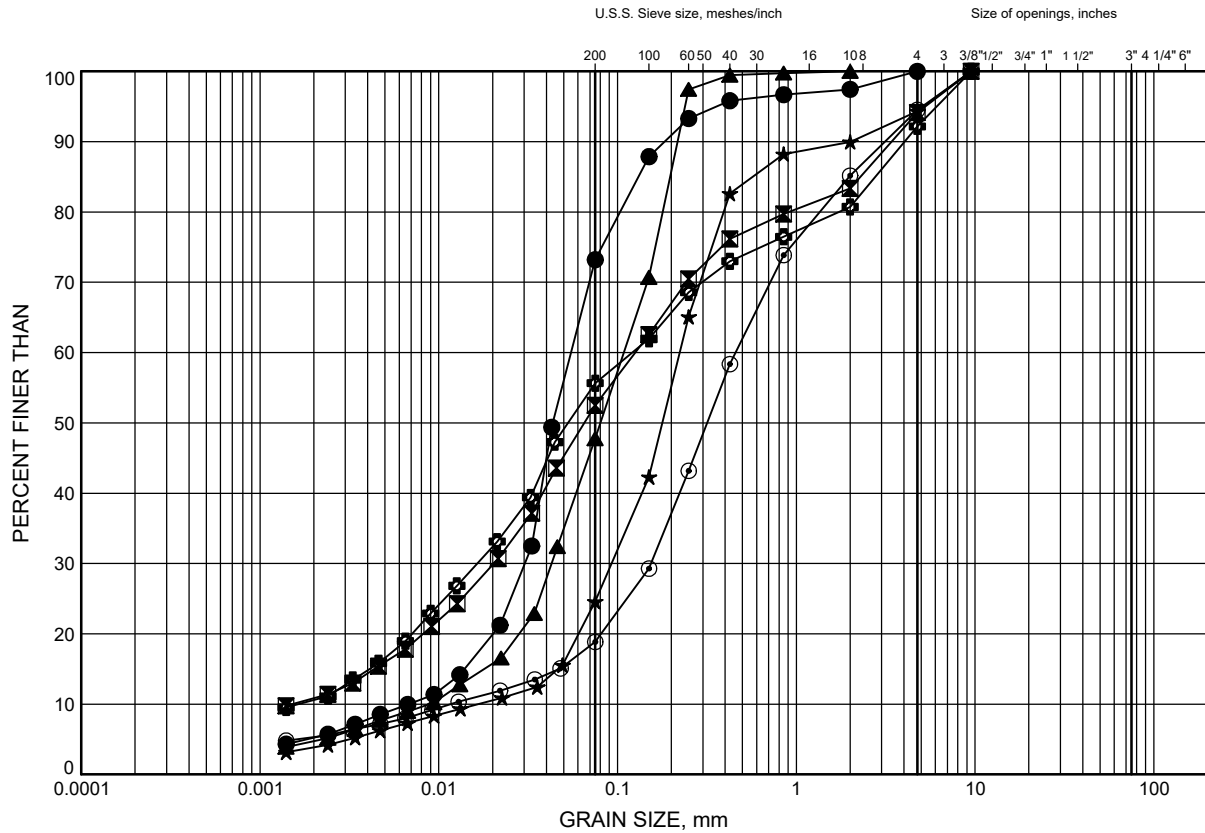


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C8

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 5-2	3.4	230.8
⊠	OHS 5-2	4.8	229.4
▲	OHS 6-1	7.9	228.8
★	OHS 6-2	7.9	228.5
⊙	TS-125	4.9	229.2
⊕	TS-125	7.7	226.3

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

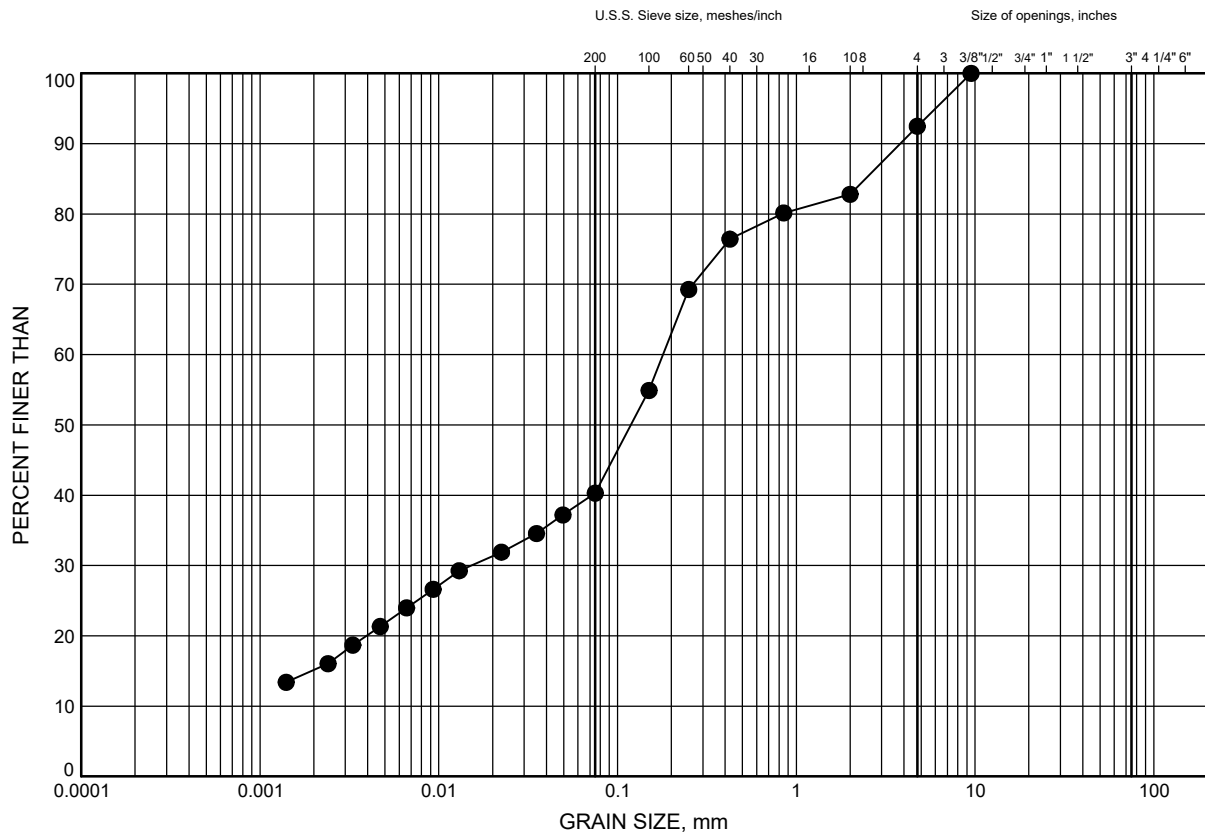


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE C9

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	MS-32	6.4	234.3

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

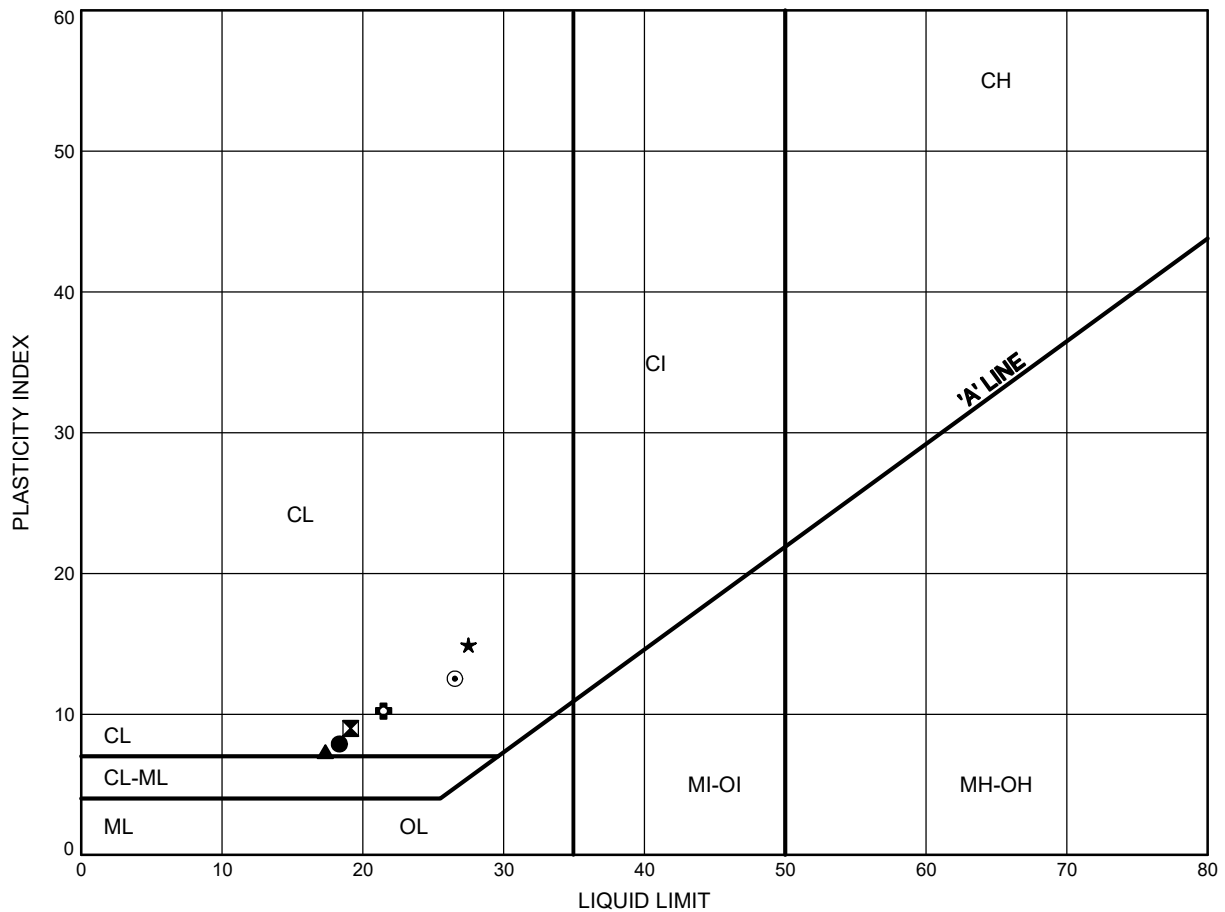


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE C10

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 3-1	2.6	233.5
⊠	HMS 4-1	2.5	235.8
▲	HMS 4-2	2.6	235.7
★	HOT-1	4.9	232.9
⊙	HOT-2	6.3	233.2
⊕	TS-150 / MS-33	2.6	237.7

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

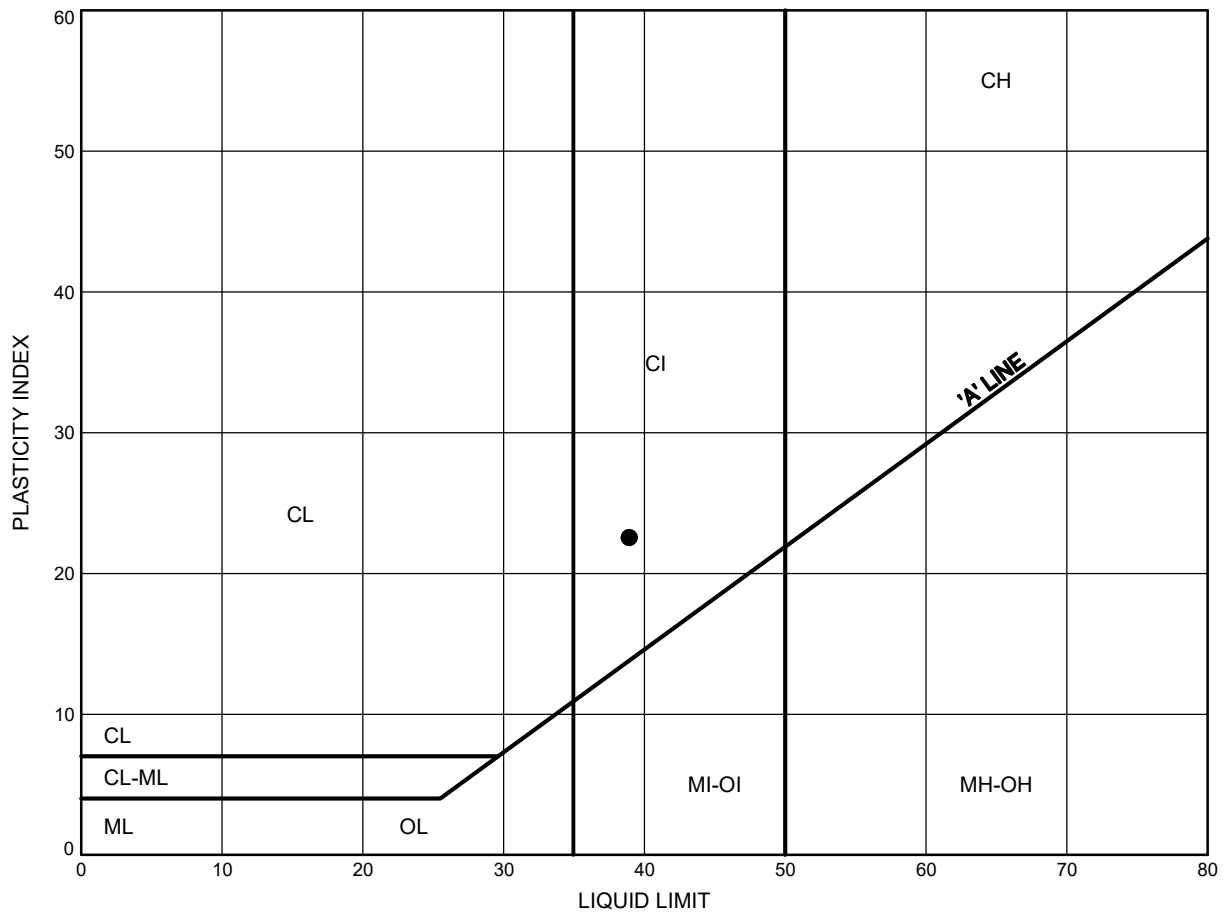


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE C11

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	MS-32	1.1	239.6

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

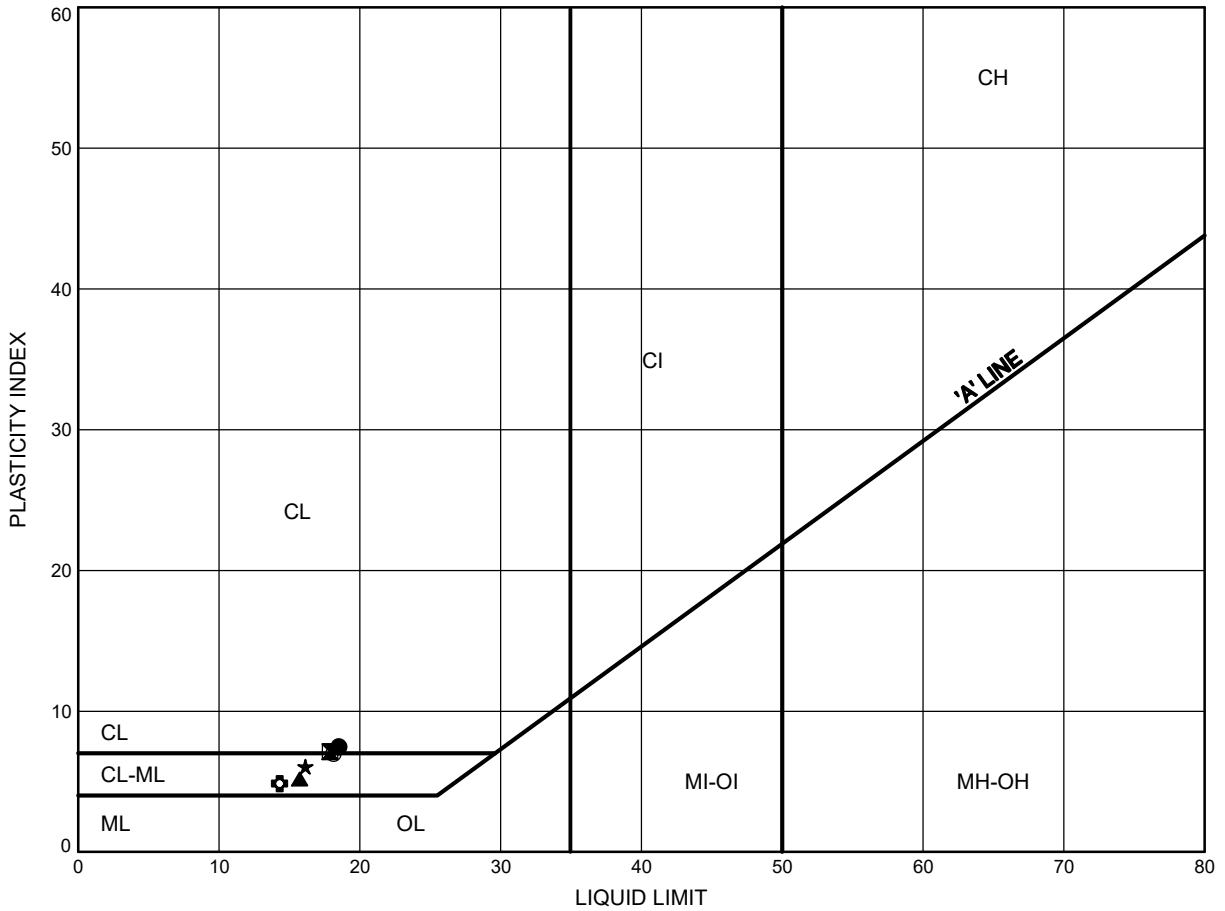


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE C12

Clayey SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 3-2	3.4	232.6
⊠	OHS 6-1	4.9	231.9
▲	OHS 6-2	2.6	233.8
★	OHS 6-2	6.4	230.0
⊙	TS-135	3.4	234.8
⊕	TS-135	6.4	231.7

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

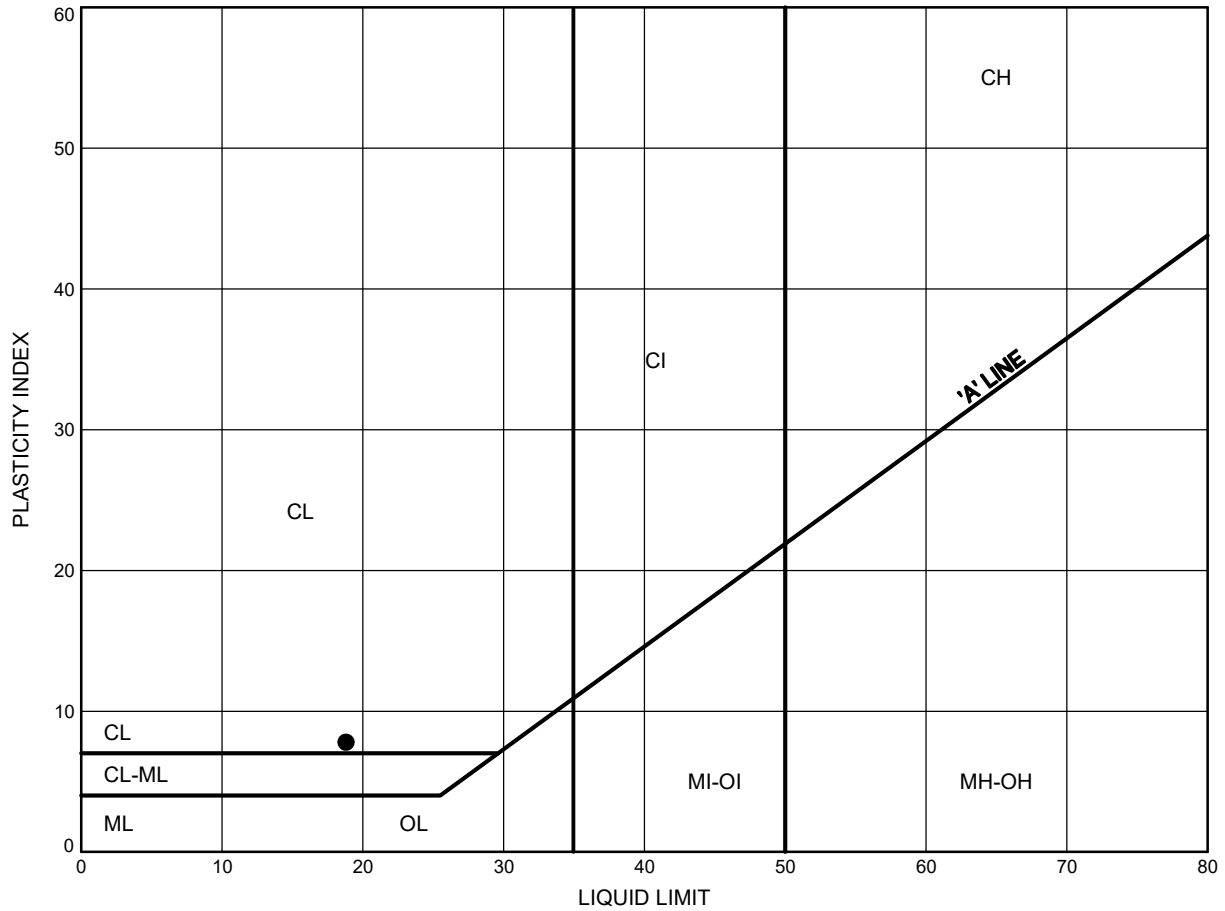


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE C13

Clayey SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	MS-42	4.9	228.5

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



Prep'd MP
Chkd. RD



Appendix D

Section 4 (Stations 20+300 Elgin Mills Road to 18+300 Major Mackenzie Drive)

RECORD OF BOREHOLE No OHS 4-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 880.6 E 314 196.8 ORIGINATED BY TM
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
DATUM Geodetic DATE 2017.11.14 - 2017.11.14 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
226.4	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT: (100mm)																		
0.1	SAND, some gravel, trace silt Brown Moist (FILL)			GS			226												
225.7																			
0.7	Clayey SILT, with sand, trace gravel Very Stiff to Hard Grey Moist (TILL)		1	SS	21		225												
			2	SS	19		224												
			3	SS	32		223												
			4	SS	100/ 0.270		222												
			5	SS	100/ .250		221												
220.9																			
5.5	Silty SAND, trace gravel, trace to some clay Very Dense Brown Moist		6	SS	100/ 0.050		220												
218.7			7	SS	100/ 0.075		219												
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE CAVED TO 6.7m AND WATER LEVEL AT 6.6m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																		

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+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 4-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 838.1 E 314 227.0 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 CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
225.7	GROUND SURFACE							<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					<div>PLASTIC LIMIT</div> <div>NATURAL MOISTURE CONTENT</div> <div>LIQUID LIMIT</div> <div>W_P W W_L</div> <div>WATER CONTENT (%)</div> <div>204060</div>		
0.0	ASPHALT: (150mm)														
0.2	SAND, some gravel, trace silt Dense to Compact Brown to Grey Wet (FILL)		1	SS	38		225								
			2	SS	18										
224.3															
1.4	Clayey SILT, with sand, trace gravel Hard Brown to Grey Moist (TILL) cobble pieces		3	SS	41		224								
			4	SS	60/ 0.125		223							8 45 31 16	
			5	SS	85		222								
			6	SS	50/ 0.050		221							6 44 34 16	
220.3															
5.4	Silty SAND, trace gravel, trace clay Very Dense Grey Wet		7	SS	77		220							9 61 25 5	
							219								
			8	SS	50/ 0.125		218								
217.7															
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED TO 7.3m AND WATER LEVEL AT 6.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.														

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMS 2-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 580.0 E 314 229.3 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.03 - 2017.12.03 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
223.5	GROUND SURFACE													
0.0	ASPHALT: (150mm)													
0.2	SAND, some gravel, trace silt Dense Brown Moist (FILL)		1	SS	48		223							
222.7														
0.8	Silty CLAY, with sand, trace gravel Hard Brown Moist (TILL)		2	SS	31		222							
			3	SS	74		221							5 31 33 31
			4	SS	44		221							
220.5														
3.0	Sandy SILT, some clay Very Dense Brown Wet		5	SS	55		220							
219.4														
4.1	SAND, trace gravel, trace silt, trace clay Dense Brown Wet		6	SS	35		219							2 86 10 2
							218							
217.0			7	SS	46		217							
6.4	Silty SAND, some clay, some gravel Dense to Very Dense Grey Moist													
							216							
215.6			8	SS	50/									11 51 26 12
7.9	END OF BOREHOLE AT 7.9m. BOREHOLE OPEN AND WATER LEVEL AT 4.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.125									

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMS 2-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 571.2 E 314 217.2 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.06 - 2017.12.06 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
223.2	GROUND SURFACE												
0.0 223.0	ASPHALT: (250mm)												
0.3 222.3	SAND, some gravel, trace silt Dense Brown Moist (FILL)		1	SS	44		223						
0.9 221.0	Clayey SILT, with sand, trace gravel Hard Brown Wet (TILL)		2	SS	40		222						
			3	SS	46		221						
2.2 219.1	Sandy SILT, trace gravel, trace clay Dense to very dense Brown Wet		4	SS	44		220						
			5	SS	51		219						
4.1 216.9	SAND, some silt, trace gravel, trace clay Compact Brown Wet		6	SS	27		218						
6.3 215.2	Clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)		7	SS	69		217						
			8	SS	50/ 0.075		216						
8.0	END OF BOREHOLE AT 7.9m. BOREHOLE CAVED TO 6.7m AND WATER LEVEL AT 4.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.												

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

RECORD OF BOREHOLE No TS-105

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 568.9 E 314 233.1 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.03 - 2017.12.03 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								<div><div><div>20406080100</div><div></div></div></div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div>							
223.3	GROUND SURFACE														
0.0	ASPHALT: (150mm)														
0.2	SAND, some gravel, trace silt Dense Brown Moist (FILL)		1	SS	31		223								
222.4															
0.9	Clayey SILT, with sand, trace gravel Hard Brown Moist (TILL)		2	SS	44		222								
			3	SS	68		221								
220.6			4	SS	63										3 22 62 13
2.7	Sandy SILT, trace clay Very Dense Brown Moist		5	SS	59		220								0 33 62 5
219.2															
4.1	Silty SAND, trace gravel Dense Brown Wet		6	SS	39		219								
							218								
217.1															
6.2	Clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)		7	SS	35		217								5 51 29 15
			8	SS	35		216								
215.1															
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN TO BOTTEM AND WATER LEVEL AT 4.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.														

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 3-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 428.1 E 314 276.6 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.14 - 2017.11.14 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
221.5	GROUND SURFACE							20	40	60	80	100			
0.0	ASPHALT: (100mm)														
0.1	SAND, some gravel, trace silt Brown Moist (FILL)		1	GS			221								
220.8															
0.7	Silty CLAY, with sand Hard Grey Moist (TILL)		1	SS	66		220								
			2	SS	56										
219.3															
2.2	SAND, trace silt, trace clay Very Dense to Dense Brown to grey Moist		3	SS	90		219								
			4	SS	40		218								0 26 49 25
			5	SS	37		217								
							216								
			6	SS	93		215								
213.8							214								
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE CAVED TO 4.0m AND WATER LEVEL AT 3.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.		7	SS	100										
					0.075										

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 3-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 381.5 E 314 303.8 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.27 - 2017.11.27 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
220.9	GROUND SURFACE													
0.0	Silty SAND , some clay, some gravel Compact Brown Wet (FILL)		1	SS	21									
220.2														
0.7	Silty CLAY , some sand, trace gravel Very Stiff to Hard Grey Moist (TILL)		2	SS	20		220							
			3	SS	60		219							
			4	SS	27		218							3 19 39 39
			5	SS	29		217							
216.8														
4.1	Silty SAND , some gravel, some clay Compact to Very Dense Grey Wet		6	SS	16		216							12 45 33 10
			7	SS	50/ 0.100		215							
							214							
213.2			8	SS	50/ 0.125									
7.7	END OF BOREHOLE AT 7.7m. WATER LEVEL AT 4.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, THEN DRY MIX CONCRETE TO SURFACE.													

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RECORD OF BOREHOLE No OHS 2-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 283.9 E 314 283.0 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.27 - 2017.11.28 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
220.3	GROUND SURFACE													
0.0	ASPHALT: (150mm)													
0.1	SAND, some gravel, trace silt Very Dense Brown Moist (FILL)		1	SS	52	▽	220							
219.2			2	SS	50									
1.2	SAND and SILT, some gravel, some clay Compact to Dense Brown Moist to Wet		3	SS	27		219							
			4	SS	39		218							
217.4	Clayey SILT, with sand, trace gravel Hard Grey Moist to Wet (TILL)		5	SS	31		217							
			6	SS	82		216							
			7	SS	72		215							
213.2	SAND, some gravel, trace silt, trace clay Compact Grey Wet		8	SS	17		214							
212.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED TO 7.0m AND WATER LEVEL AT 1.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.													

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/1/18

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

RECORD OF BOREHOLE No OHS 2-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 277.1 E 314 272.9 ORIGINATED BY JHP
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
DATUM Geodetic DATE 2017.12.06 - 2017.12.06 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
220.1	GROUND SURFACE					▽	220								9 46 40 5
0.0	ASPHALT: (280mm)						219								
219.8															
0.3	SAND, some gravel, trace silt Compact Brown Wet (FILL)		1	SS	28										
			2	SS	26										
218.8															
1.3	SAND and SILT, trace clay, trace gravel Very Dense Brown Wet		3	SS	51										
217.5			4	SS	31										
2.6	Silty SAND, trace clay Dense Brown Wet		5	SS	33										
215.4							216								
4.6	Gravelly SAND, some silt, some clay Very Dense Grey Moist		6	SS	50/ 0.125		215								
			7	SS	79		214								
							213								
			8	SS	50/ 0.125										
212.0															
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED AT 6.1m AND WATER LEVEL AT 4.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.														

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

METRIC

SOIL PROFILE			SAMPLES		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
219.0	GROUND SURFACE				
0.0	ASPHALT: (150mm)				
0.2	SAND, some silt, trace gravel, occasional cobbles Very Dense Brown Wet (FILL)	[Pattern]	1	SS	69
218.1			2	SS	42
0.9	Clayey SILT, trace sand, trace gravel Hard Brown Moist (FILL)	[Pattern]	3	SS	59
217.5			4	SS	77
1.4	Gravelly SAND, trace to some silt and clay Very Dense to Dense Brown Moist to Wet	[Pattern]	5	SS	55
			6	SS	44
			7	SS	49
211.8	Silty CLAY, with sand, trace gravel Hard Grey Moist (TILL)	[Pattern]	8	SS	50/
7.2					
211.1	END OF BOREHOLE AT 7.9m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 4.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.				0.125
7.9					

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No HMS 1-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 106.9 E 314 334.8 ORIGINATED BY TM
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.14 - 2017.11.14 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
218.3	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT: (100mm)																		
0.1	SAND, trace silt, trace gravel Brown Moist (FILL)			GS			218												
217.6																			
0.7	Silty CLAY, with sand, trace gravel Hard Brown Moist (TILL)		1	SS	52		217												
			2	SS	50/ 0.125		216												
			3	SS	55		215												
			4	SS	83		214												
214.1																			
4.1	SILT, some clay, trace sand Very Dense Brown Wet		5	SS	60/ 0.125		213												
212.3																			
5.9	SAND, trace gravel, trace silt and clay Very Dense Brown Wet		6	SS	82		212												
							211												
210.2			7	SS	59/ 0.100														
8.0	END OF BOREHOLE AT 8.0m. BOREHOLE OPEN TO 6.7m AND WATER LEVEL AT 4.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																		

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/1/18

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

RECORD OF BOREHOLE No HMS 1-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 861 084.5 E 314 357.4 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.27 - 2017.11.27 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)							
								○ UNCONFINED + FIELD VANE		● QUICK TRIAXIAL × LAB VANE									
217.9	GROUND SURFACE						20	40	60	80	100	W _P	W	W _L	GR	SA	SI	CL	
0.0	SAND , some gravel Compact Brown Moist (FILL)		1	SS	13	▽													
0.2	Silty CLAY , some gravel, some sand Hard Brown Moist (TILL)																		
			2	SS	38		217												
			3	SS	40		216												
			4	SS	61		215												
	cobble pieces	5	SS	45	214														
214.5																			
3.5	Silty SAND , some gravel Dense Brown Wet																		
		6	SS	36	213														
		7	SS	8	212														
	Loose																		
210.7																			
7.2	Silty CLAY , with sand Hard Grey Moist (TILL)																		
		8	SS	46	210														
209.7																			
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN TO 5.8m AND WATER LEVEL AT 3.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, THEN DRY MIX CONCRETE TO SURFACE.																		

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/1/18

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 1-1

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 860 840.3 E 314 362.9 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.11.28 - 2017.11.28 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
215.6	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (150mm)																	
0.1	SAND, some gravel, trace silt Dense Brown Moist (FILL)		1	SS	44		215											
214.6			2	SS	47													
1.0	Clayey SILT, with sand, trace gravel Hard to Very Stiff Brown Moist to Wet (TILL)		3	SS	51		214											
			4	SS	28		213										7	45 32 16
			5	SS	20		212											
211.5																		
4.1	Silty SAND, some gravel, some clay Dense to Very Dense Brown to Grey Moist to Wet (TILL)		6	SS	42		211											
							210											
			7	SS	100/ 0.250		209										10	45 32 13
							208											
207.4			8	SS	76													
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND WATER LEVEL AT 3.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																	

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OHS 1-2

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 860 834.7 E 314 344.8 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.06 - 2017.12.09 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
215.3	GROUND SURFACE															
0.0	ASPHALT: (100mm)															
214.9	GRANULAR: (200mm)															
0.3	Clayey SILT , trace gravel, trace sand Firm to Very Stiff Brown Wet (FILL)		1	SS	7		215									
			2	SS	26		214									
213.6																
1.7	Clayey SILT , with sand, trace gravel Hard Brown to Grey Moist (TILL)		3	SS	30		213									
			4	SS	60											
	pieces of cobbles		5	SS	77		212									
							211									
			6	SS	63		210									
209.6																
5.6	Silty SAND , with gravel, trace clay Very Dense Grey Wet (TILL)		7	SS	78		209									
							208									
	pieces of cobbles		8	SS	98											
207.1																
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED AT 6.4m AND WATER LEVEL AT 4.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.															

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

RECORD OF BOREHOLE No TS-95

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION N 4 860 783.2 E 314 370.9 ORIGINATED BY JHP
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.05 - 2017.12.05 CHECKED BY RD

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20 40 60 80 100							PLASTIC LIMIT w _P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L
215.1	GROUND SURFACE																
0.0	ASPHALT: (150mm)																
0.2	SAND, some silt, trace to some gravel Compact Brown Wet (FILL)		1	SS	22												
214.0			2	SS	31												
1.1	Silty CLAY, with sand, trace gravel Hard Brown Wet (TILL)		3	SS	43										12 34 33 21		
			4	SS	47												
			5	SS	37												
210.9																	
4.1			6	SS	25										10 20 37 33		
209.4																	
5.6			7	SS	57												
207.0			8	SS	50/ 0.125												
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 5.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, AUGER CUTTINGS, AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.																

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MS-65

1 OF 1

METRIC

W.P. 2930-02-00 LOCATION NB N 4 860 457.6 E 314 452.0 ORIGINATED BY SB
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.07.24 - 2017.07.24 CHECKED BY PP

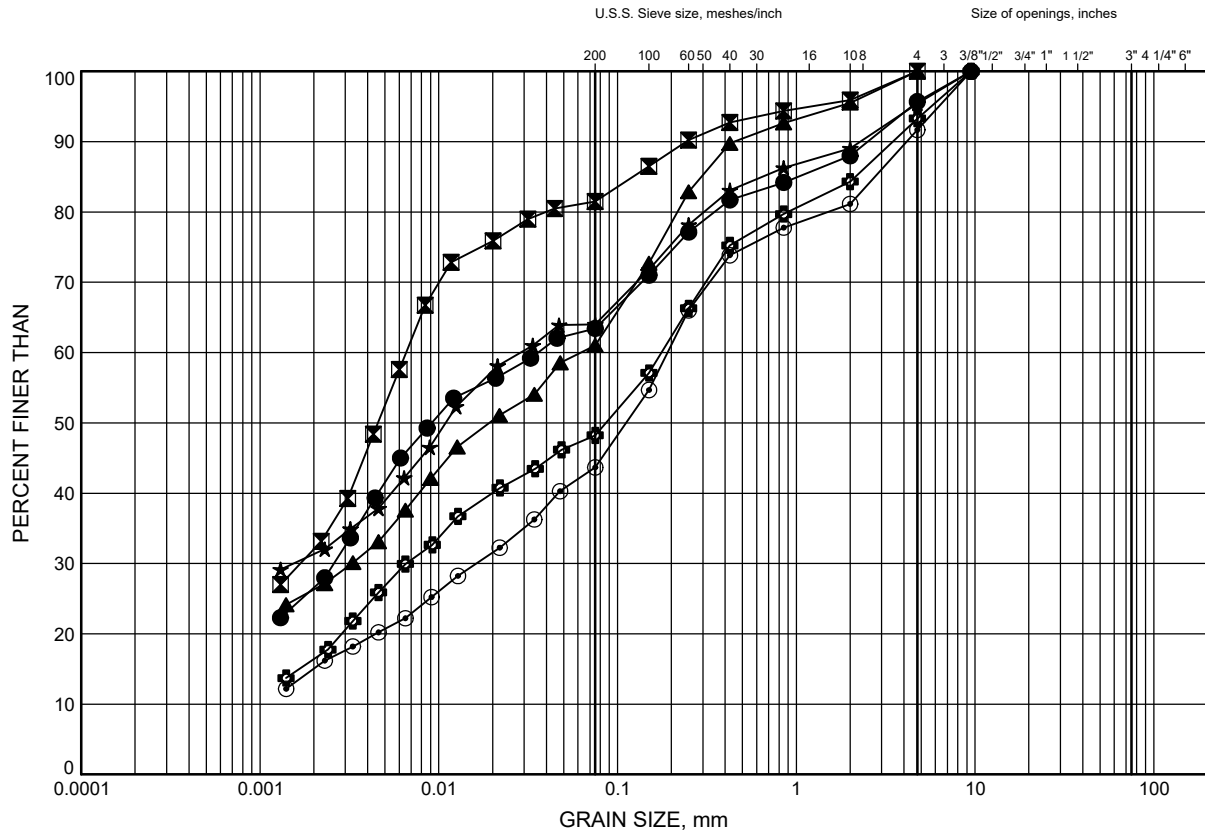
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W P W W L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)				
211.3	GROUND SURFACE						20	40	60	80	100					
0.0	ASPHALT: (100mm)															
0.1	Silty SAND, trace gravel Brown Moist (FILL)		1	GS												
210.5																
0.8	Silty CLAY, with sand, trace gravel Stiff to Hard Brown Moist (TILL)		1	SS	18											8 27 32 33
			2	SS	25											
			3	SS	41											
			4	SS	39											
			5	SS	47											
			6	SS	26											0 38 38 24
204.6																
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND DRY MIX CONCRETE, THEN COLD PATCH ASPHALT TO SURFACE.															

ONTMT4S MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 2/13/18

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D1

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)
●	HMS 1-1	3.3	214.9
⊠	HMS 1-2	2.6	215.3
▲	HMS 1-2	7.9	210.0
★	HMS 2-1	1.8	221.7
⊙	HMS 2-2	7.8	215.4
⊕	OHS 1-1	2.6	213.0

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

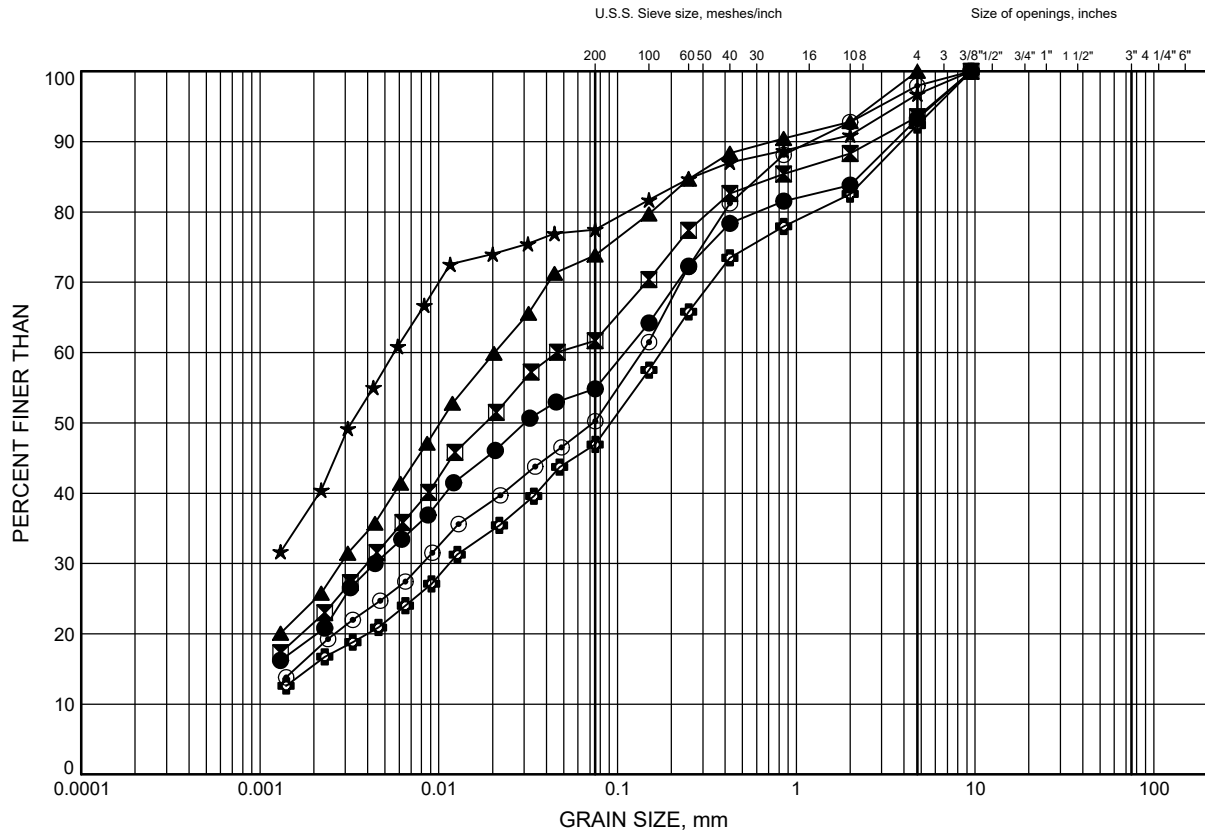


Prep'd AN
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D2

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)
●	OHS 1-2	2.6	212.7
⊠	OHS 2-1	3.4	217.0
▲	OHS 3-1	1.8	219.6
★	OHS 3-2	2.6	218.3
⊙	OHS 4-1	2.6	223.8
⊕	OHS 4-2	2.4	223.3

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

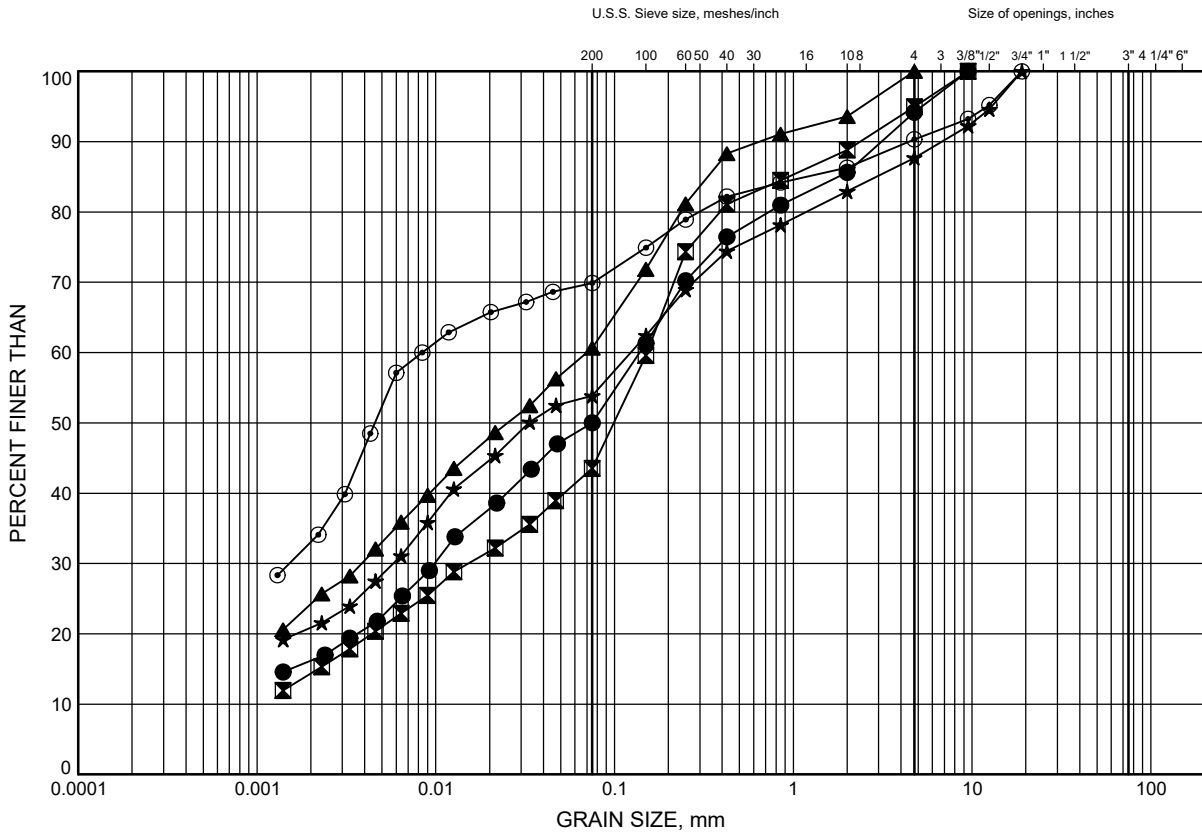


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Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D3

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)
●	OHS 4-2	4.7	221.0
⊠	TS-105	6.4	216.9
▲	TS-110	7.8	211.2
★	TS-95	1.8	213.2
⊙	TS-95	4.9	210.2

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

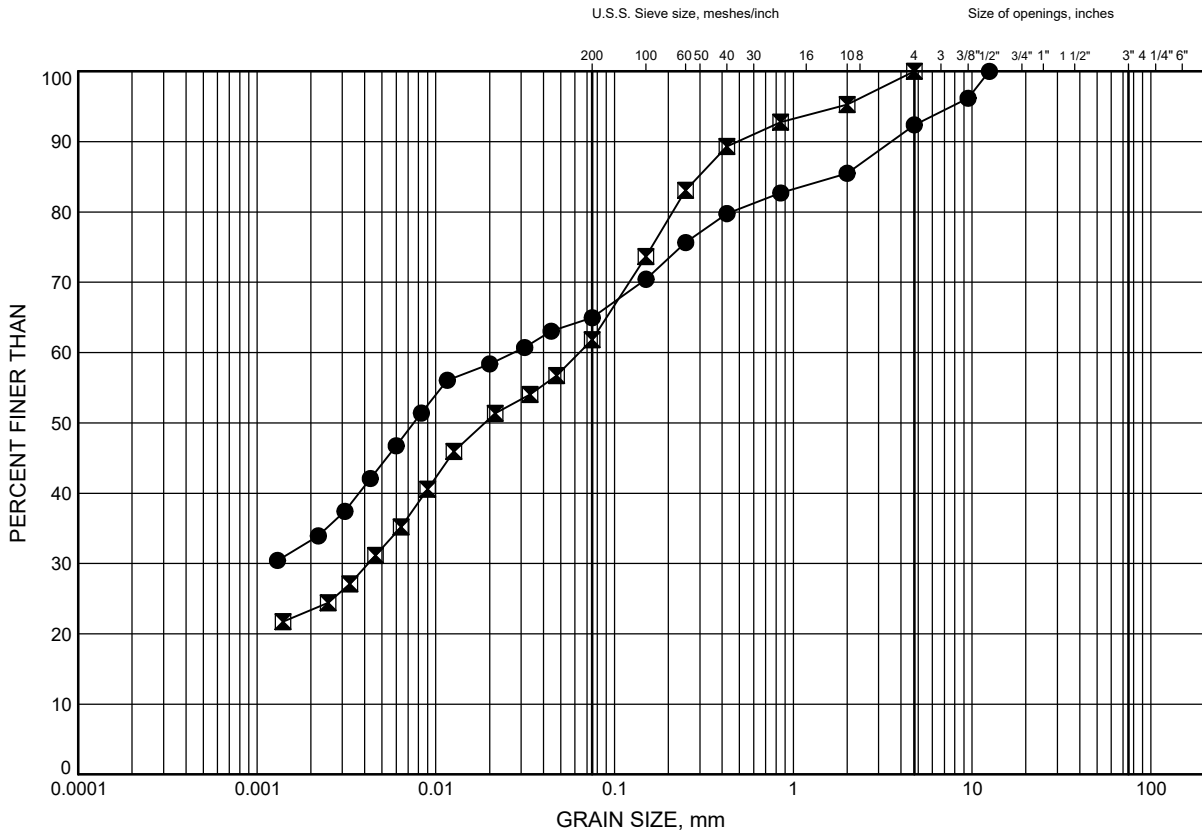


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Chkd. RD

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)
●	MS-65	1.1	210.2
⊠	MS-65	6.4	204.9

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

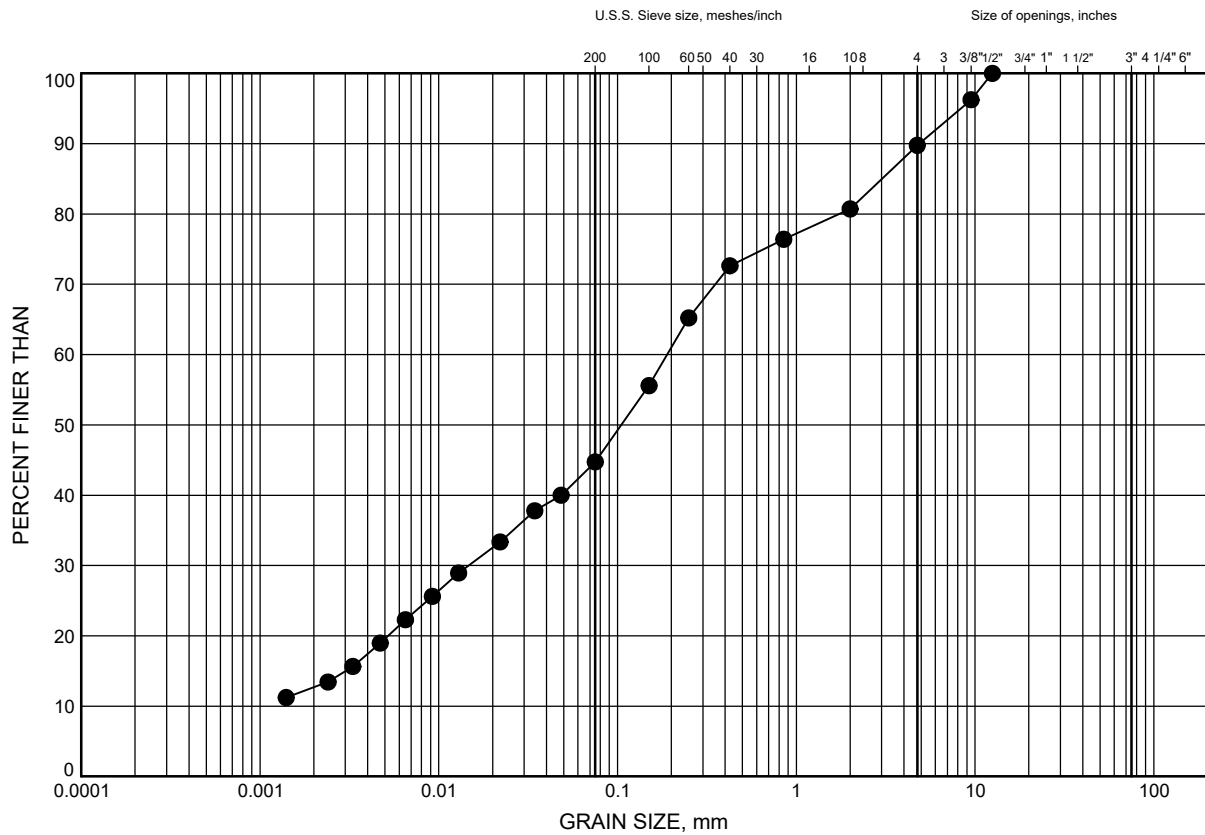


Prep'd MP
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D5

Silty SAND TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 1-1	6.3	209.3

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

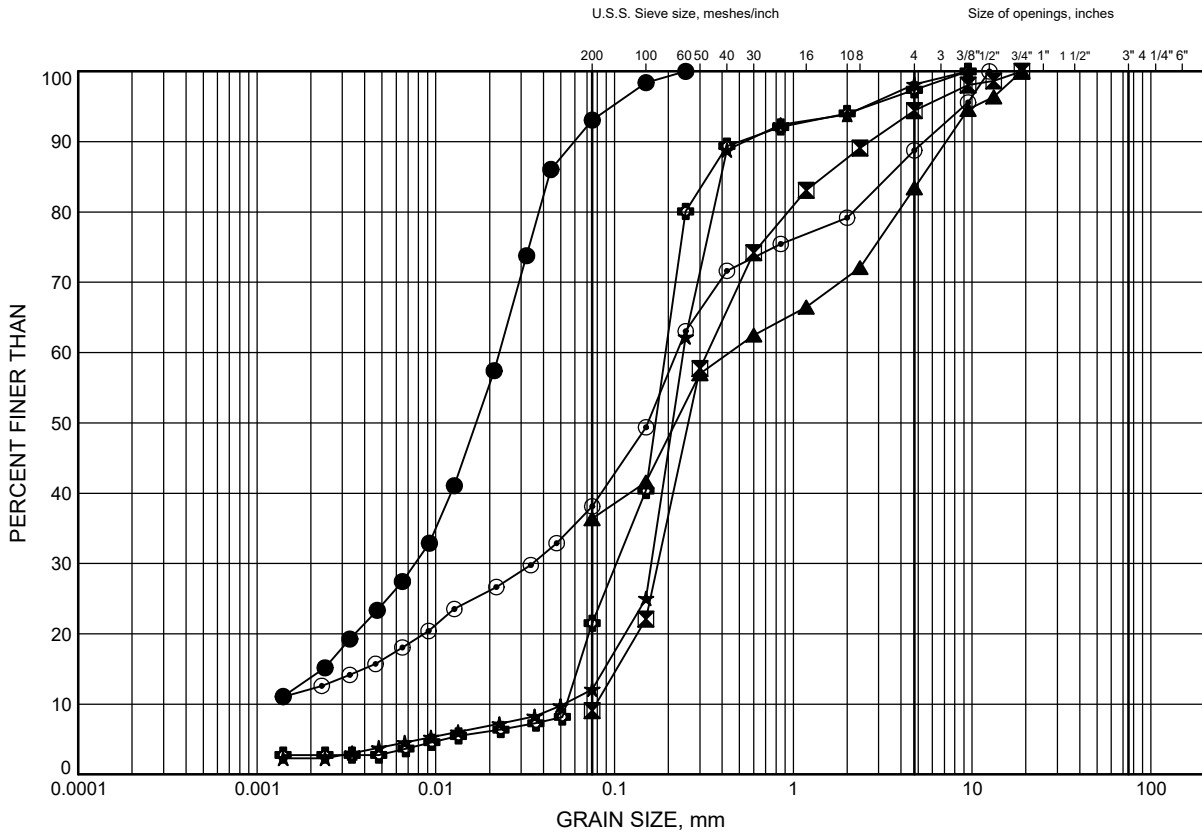


Prep'd AN
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D6

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 1-1	4.8	213.4
⊠	HMS 1-1	7.8	210.4
▲	HMS 1-2	4.9	213.0
★	HMS 2-1	4.9	218.6
⊙	HMS 2-1	7.8	215.7
⊕	HMS 2-2	4.9	218.3

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

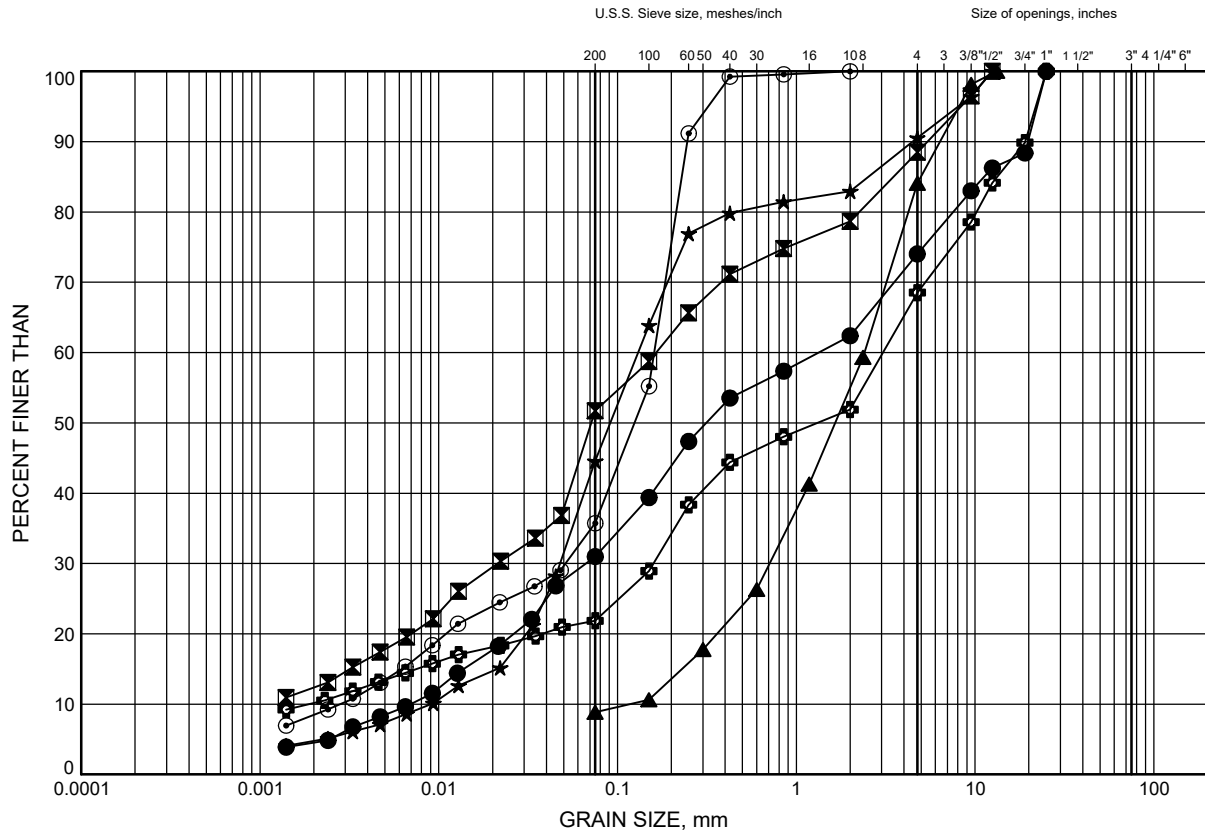


Prep'd AN
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D7

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 1-2	6.4	208.9
⊠	OHS 2-1	2.6	217.7
▲	OHS 2-1	7.9	212.4
★	OHS 2-2	1.8	218.3
⊙	OHS 2-2	3.4	216.7
⊕	OHS 2-2	4.7	215.4

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

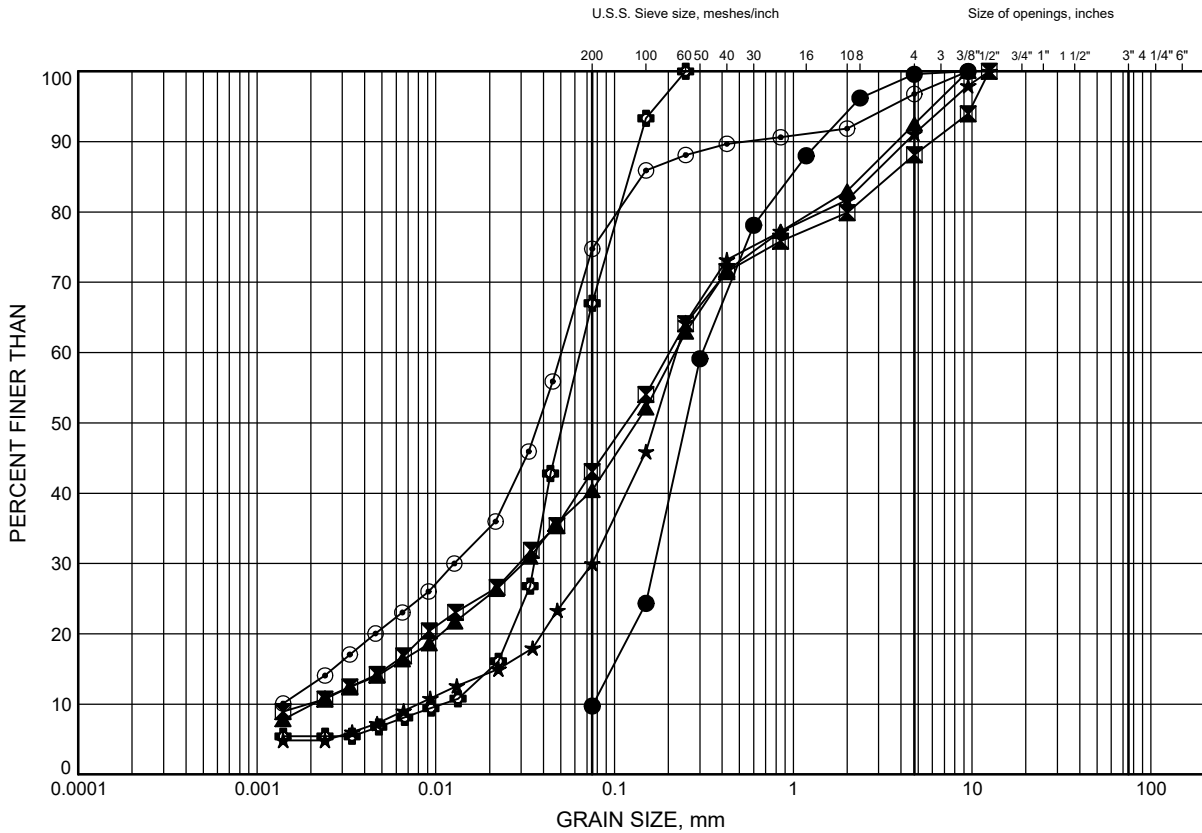


Prep'd AN
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D8

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 3-1	3.4	218.1
⊠	OHS 3-2	4.9	216.1
▲	OHS 4-1	7.7	218.7
★	OHS 4-2	6.4	219.3
⊙	TS-105	2.6	220.7
⊕	TS-105	3.4	220.0

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

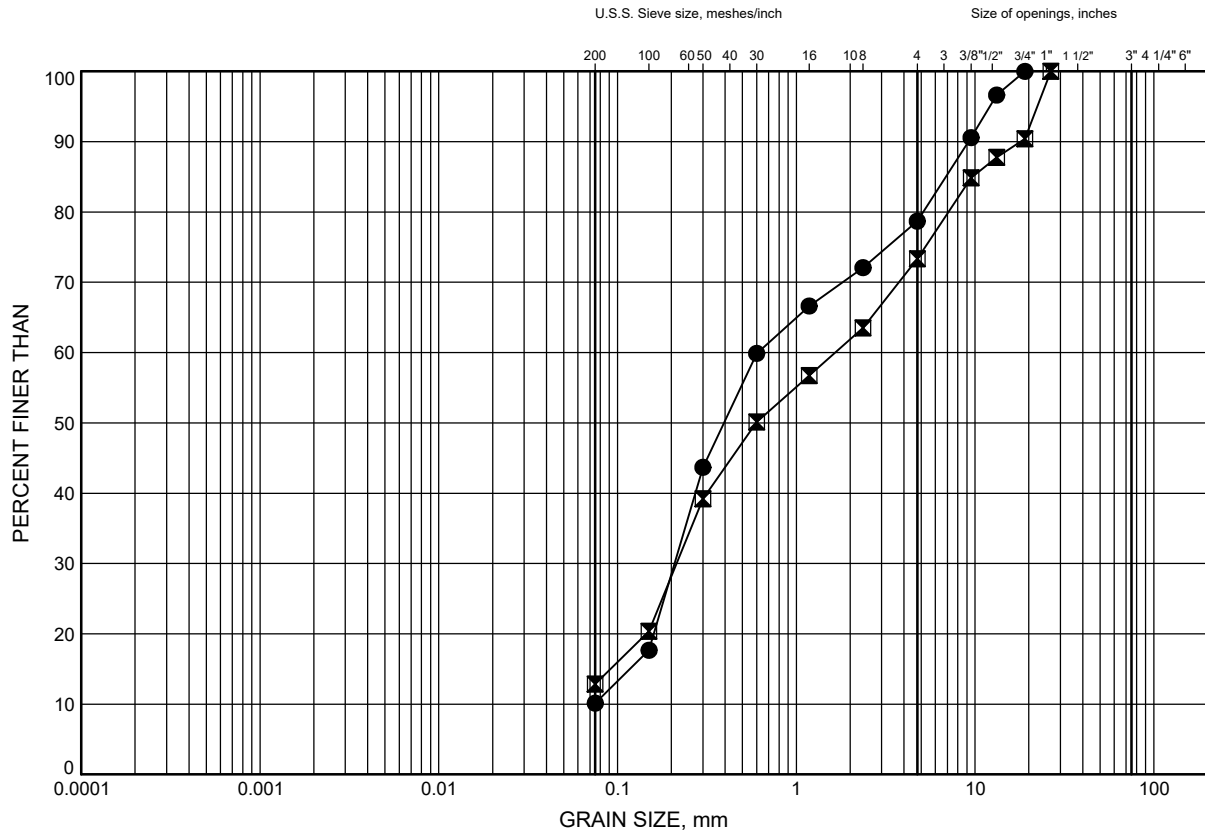


Prep'd AN
Chkd. RD

HWY 404 Widening GRAIN SIZE DISTRIBUTION

FIGURE D9

SANDS and SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	TS-110	1.8	217.2
⊠	TS-110	6.4	212.6

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

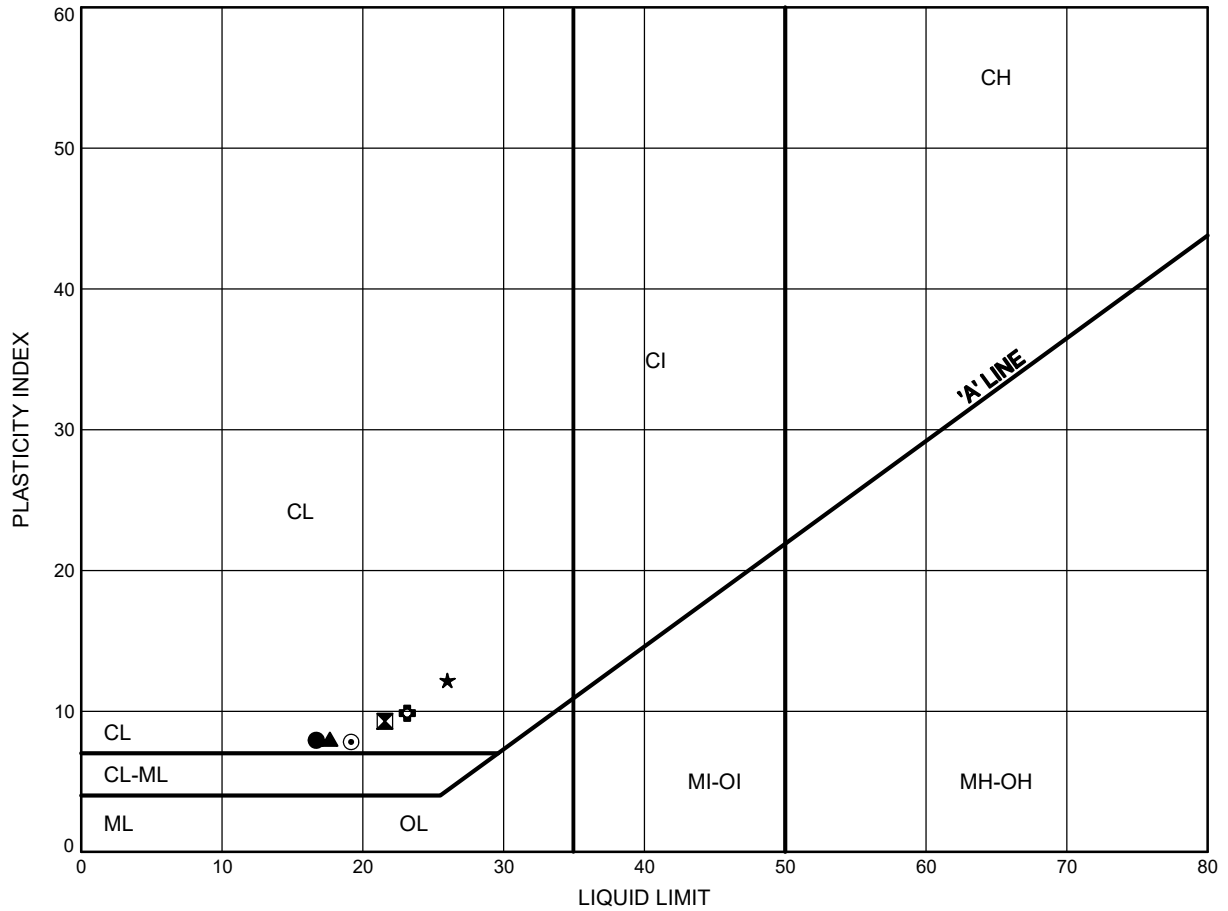


Prep'd AN
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE D10

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMS 1-2	7.9	210.0
⊠	HMS 2-1	1.8	221.7
▲	OHS 1-1	2.6	213.0
★	OHS 3-2	2.6	218.3
⊙	OHS 4-1	2.6	223.8
⊕	TS-95	4.9	210.2

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

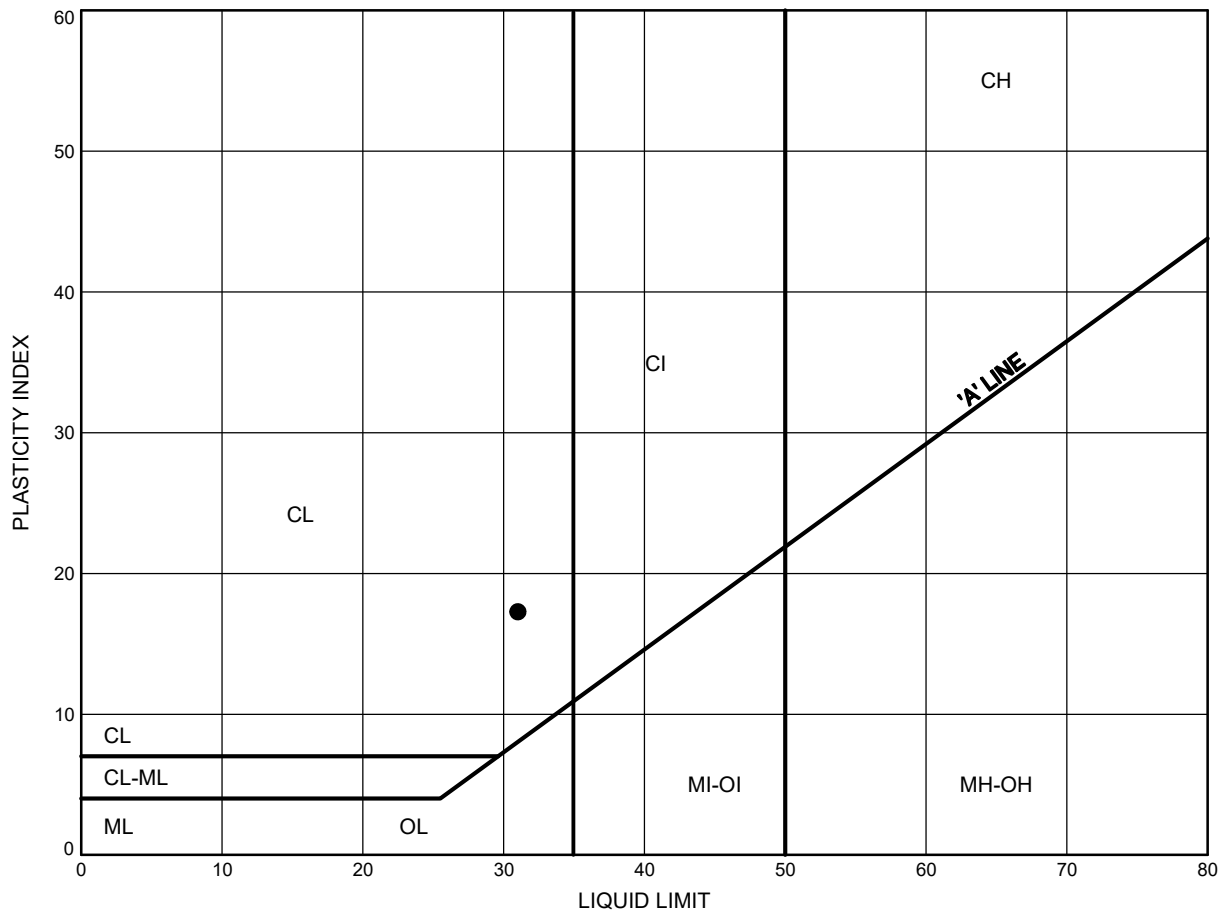


Prep'd AN
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE D11

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	MS-65	1.1	210.2

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

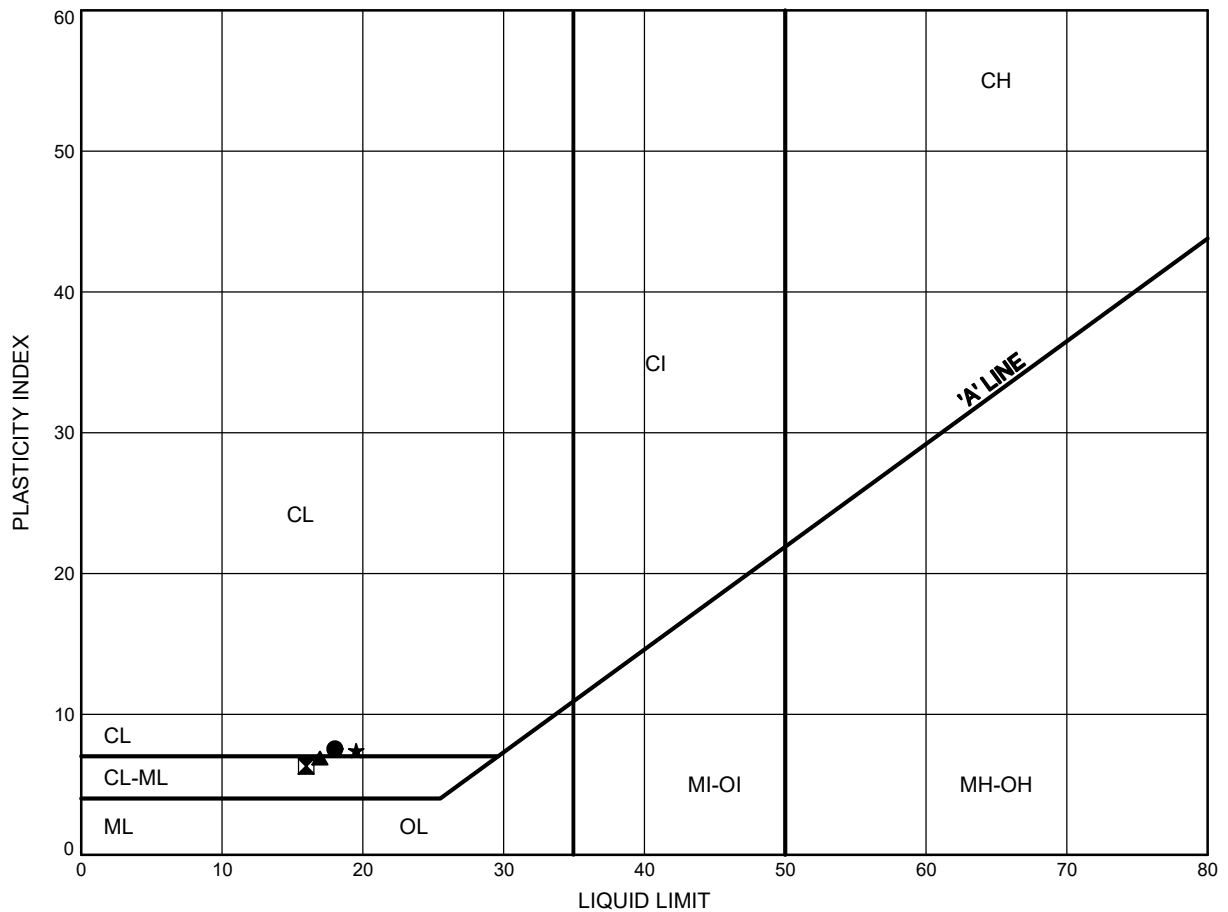


Prep'd MP
Chkd. RD

HWY 404 Widening ATTERBERG LIMITS TEST RESULTS

FIGURE D12

Clayey SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	OHS 1-2	2.6	212.7
⊠	OHS 2-1	3.4	217.0
▲	TS-110	7.8	211.2
★	TS-95	1.8	213.2

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

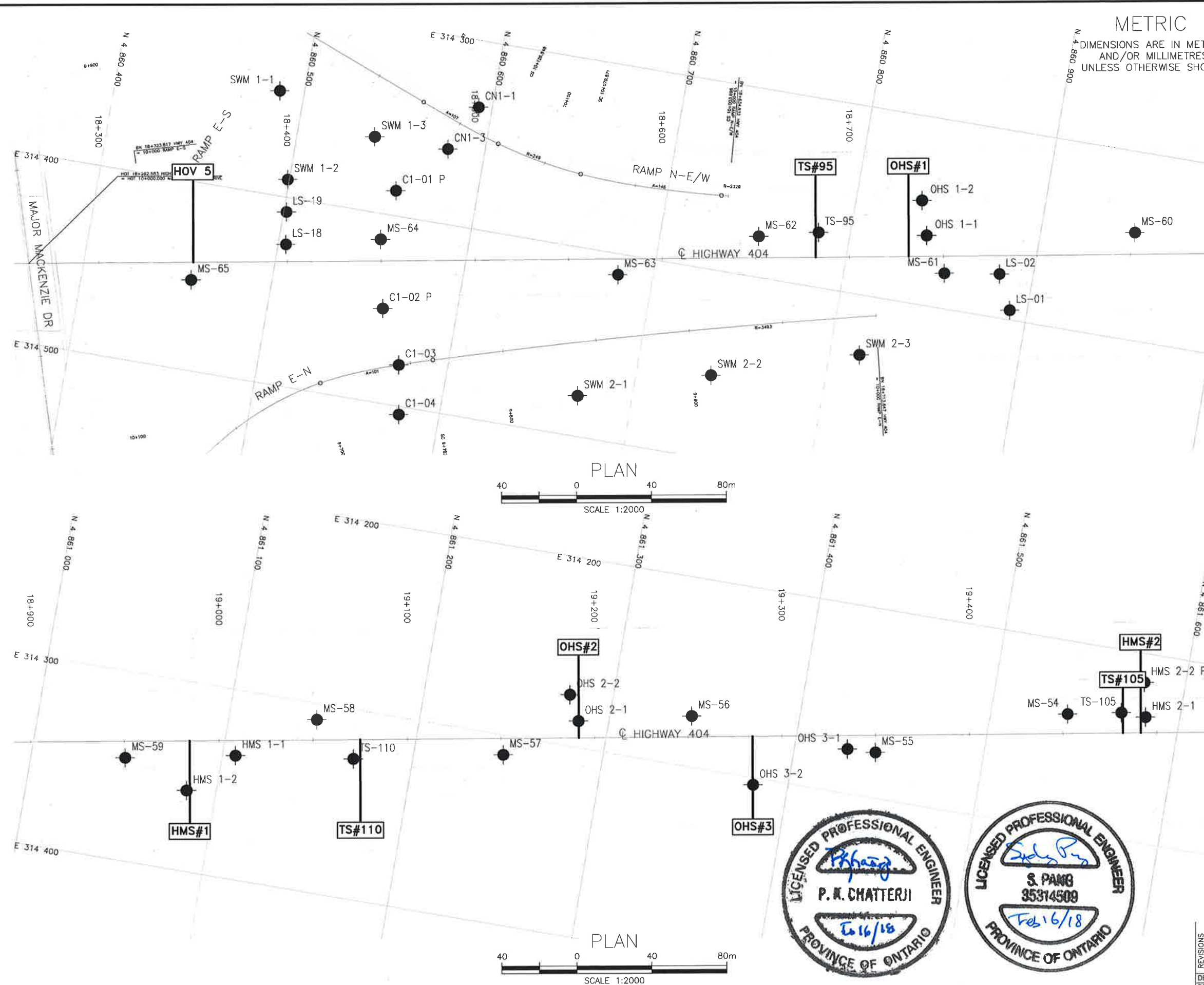


Prep'd AN
Chkd. RD



Appendix E

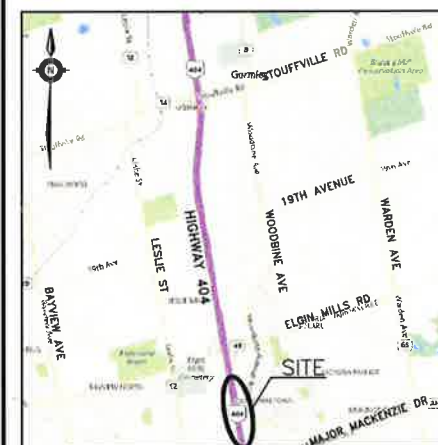
Borehole Location Drawings

CONT No 2017-2045
WP No 2930-02-00HIGHWAY 404
WIDENING
SIGN SUPPORTS
BOREHOLE LOCATIONS PLAN

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)

NO	ELEVATION	NORTHING	EASTING
HMS 1-1	218.3	4 861 106.9	314 334.8
HMS 1-2	217.9	4 861 084.5	314 357.4
HMS 2-1	223.5	4 861 581.9	314 233.4
HMS 2-2 P	223.2	4 861 578.2	314 215.3
MS-65	211.3	4 860 457.6	314 452.0
OHS 1-1	215.6	4 860 840.3	314 362.9
OHS 1-2	215.3	4 860 834.7	314 344.9
OHS 2-1	220.3	4 861 283.9	314 285.9
OHS 2-2	220.1	4 861 277.1	314 272.9
OHS 3-1	221.5	4 861 428.1	314 276.6
OHS 3-2	220.9	4 861 381.5	314 303.8
TS-95	215.1	4 860 783.2	314 370.9
TS-105	223.3	4 861 568.9	314 233.1
TS-110	219.0	4 861 169.1	314 325.9

-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. 30M14-473

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RD	CHK SKP	CODE
DRAWN	AN	CHK RD	SITE
			LOAD
			STRUCT
			DWG 1
			DATE FEB 2018

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

CONT No 2017-2045
WP No 2930-02-00



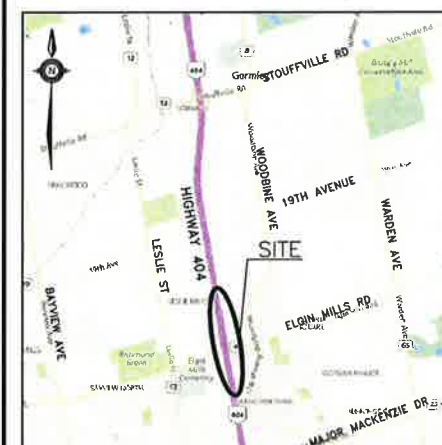
SHEET

HIGHWAY 404
WIDENING
SIGN SUPPORTS
BOREHOLE LOCATIONS PLAN

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)

NO	ELEVATION	NORTHING	EASTING
HMS 3-1	236.1	4 863 162.1	313 968.0
HMS 3-2	235.9	4 863 167.8	313 986.1
MS-42	233.4	4 862 711.9	314 027.8
OHS 4-1	226.4	4 861 880.6	314 196.8
OHS 4-2	225.7	4 861 838.1	314 227.0
OHS 5-1	234.5	4 862 936.7	313 987.9
OHS 5-2	234.2	4 862 934.0	313 968.9
TS-125	234.0	4 862 844.4	314 000.2

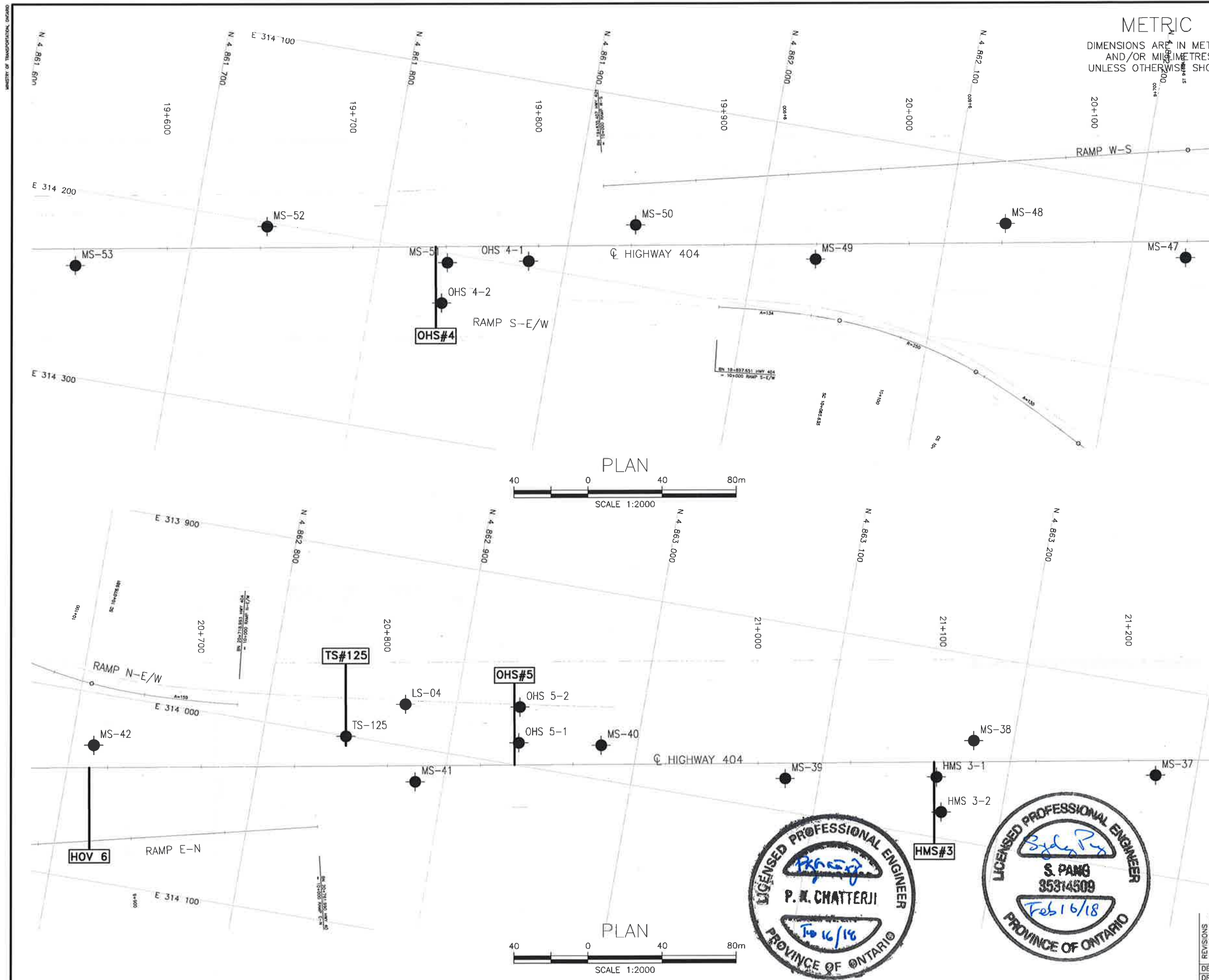
-NOTES-

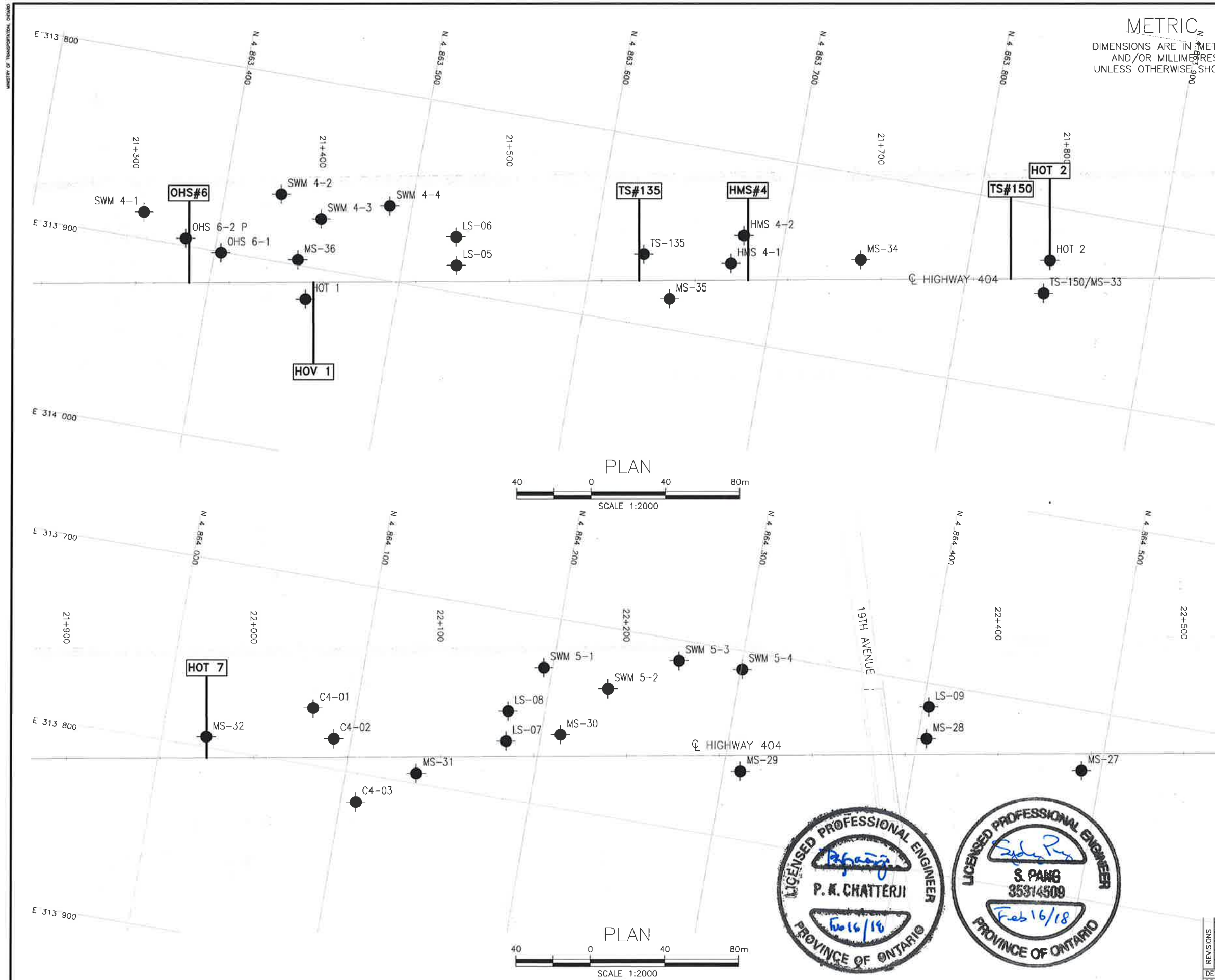
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GEOCRES No. 30M14-473

DATE	BY	DESCRIPTION
DESIGN RD	CHK SKP CODE	LOAD DATE FEB 2018
DRAWN AN	CHK RD SITE	STRUCT DWG 2

FILENAME: H:\Drafting\15000\15786\BHP-15796-BHP-15796.dwg
PLOTDATE: 2/14/2018 7:59 PM





METRIC
DIMENSIONS ARE IN METRES
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CONT No 2017-2045
WP No 2930-02-00

HIGHWAY 404
WIDENING
SIGN SUPPORTS
BOREHOLE LOCATIONS PLAN

wsp

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)

NO	ELEVATION	NORTHING	EASTING
HMS 4-1	238.3	4 863 674.2	313 859.3
HMS 4-2	238.3	4 863 678.5	313 843.3
HOT 1	237.7	4 863 452.1	313 917.2
HOT 2	239.5	4 863 842.8	313 828.3
MS-32	240.7	4 864 023.5	313 794.6
OHS 6-1	236.8	4 863 403.4	313 900.4
OHS 6-2 P	266.4	4 863 383.5	313 896.0
TS-135	238.1	4 863 627.1	313 862.4
TS-150/MS-33	240.3	4 863 842.5	313 846.3

-NOTES-

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GEOCRES No. 30M14-473

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Feb 16/18
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
35314509
Feb 16/18
PROVINCE OF ONTARIO

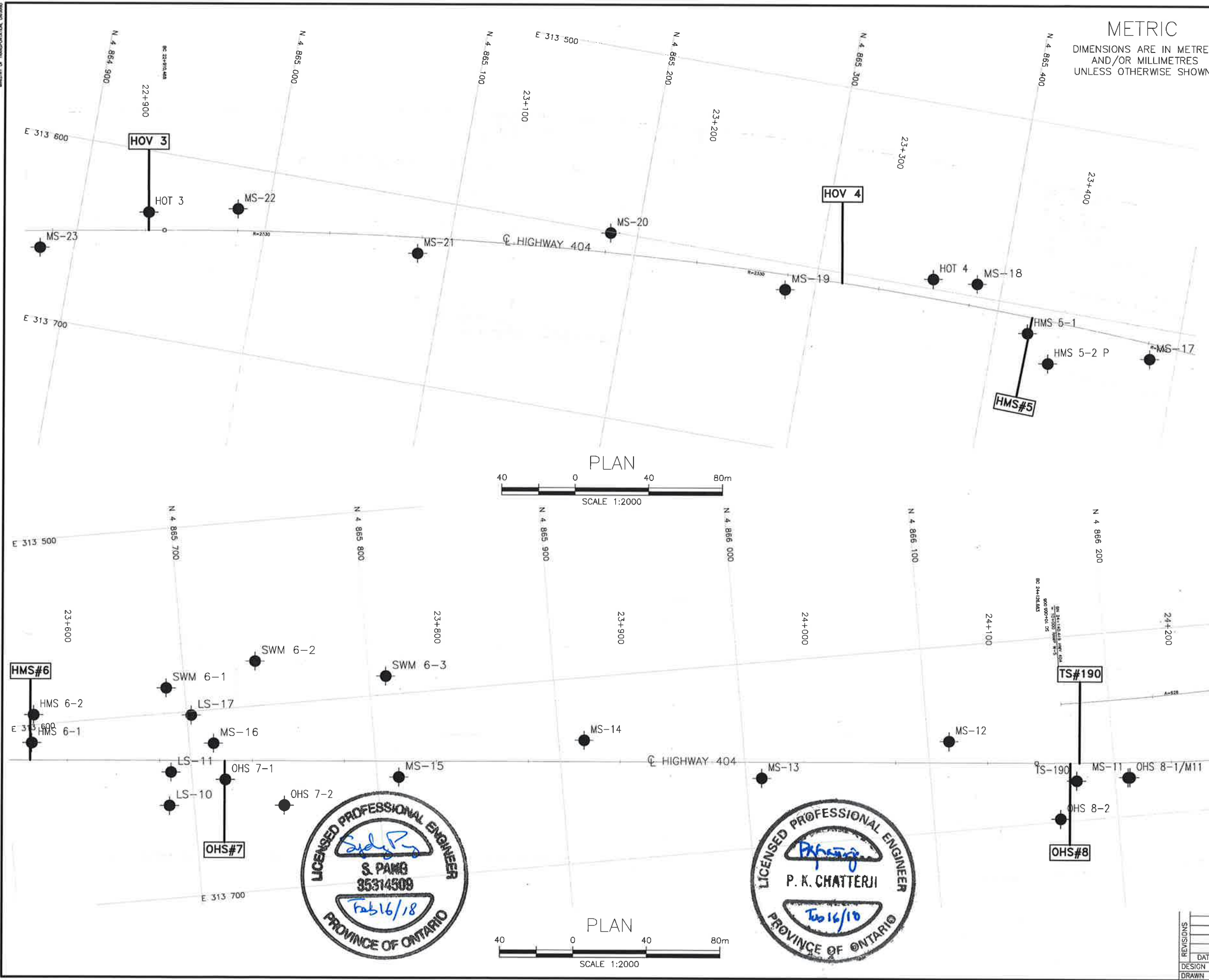
REVISIONS

DATE	BY	DESCRIPTION
DESIGN RD	CHK SKP	CODE
DRAWN AN	CHK RD	SITE
	STRUCT	DWG 3

DATE FEB 2018

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PLOTDATE: 2/14/2018 8:11 PM

MINISTRY OF TRANSPORTATION, ONTARIO



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

CONT No 2017-2045
WP No 2930-02-00

HIGHWAY 404
WIDENING
SIGN SUPPORTS
BOREHOLE LOCATIONS PLAN

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)

-NOTES-

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GEOCRES No. 30M14-473

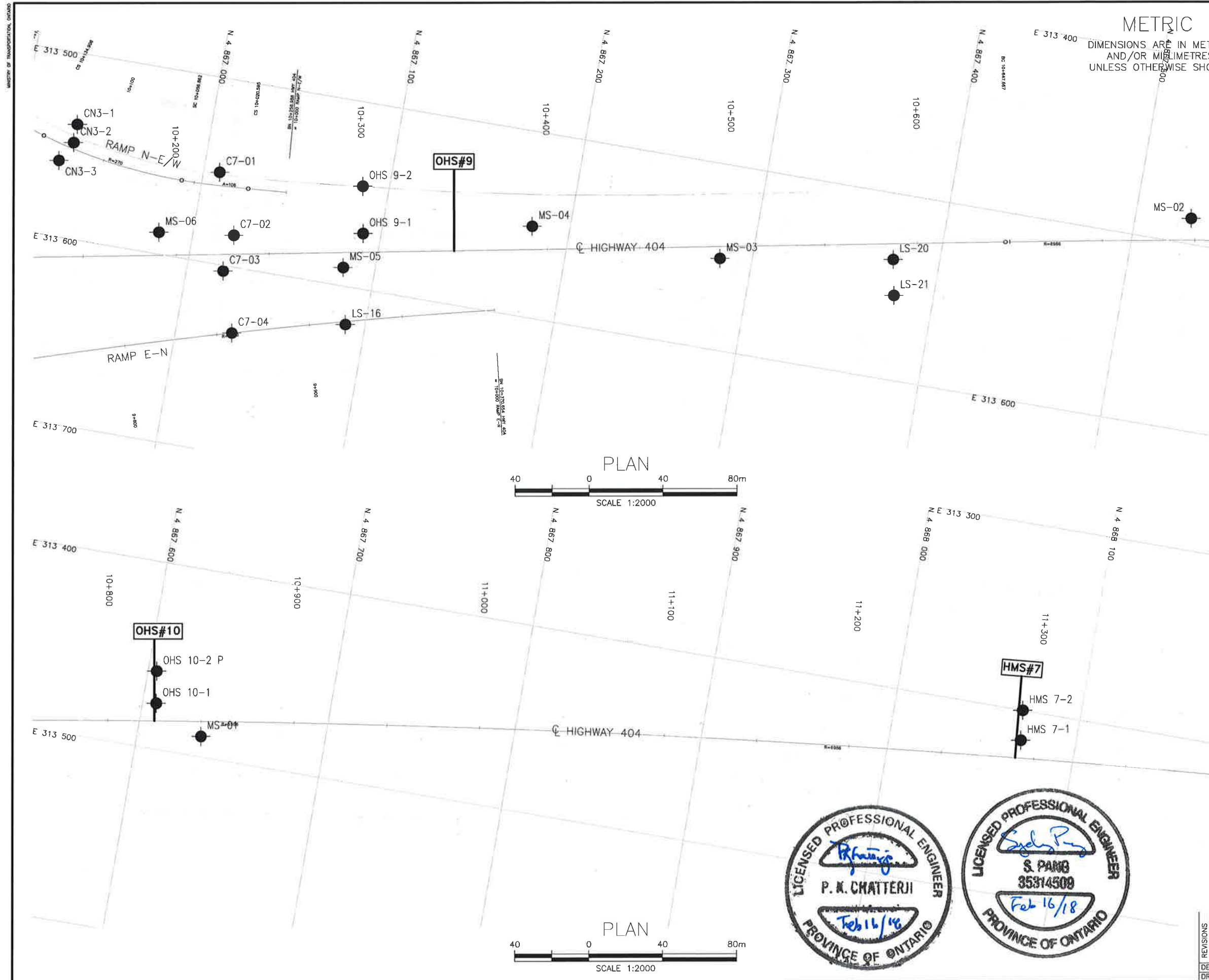
REVISIONS

NO	DATE	BY	DESCRIPTION
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2			
3			
4			

DESIGN RD CHK SKP CODE LOAD DATE FEB 2018

DRAWN AN CHK RD SITE STRUCT DWG 4

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PLOTDATE: 2/14/2018 2:21 PM



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No 2017-2045
WP No 2930-02-00

HIGHWAY 404
WIDENING
SIGN SUPPORTS
BOREHOLE LOCATIONS PLAN

WS|D








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) |

[illegible]

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GEOCRES No. 30M14-473

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