FOUNDATION INVESTIGATION REPORT
HIGHWAY 406 GLENDALE AVENUE OVERPASS
TWIN BRIDGE REHABILITATION
SITES 18-170/1 & 2, W.P. 2365-09-01
CITY OF THOROLD, ONTARIO
G.W.P. 2348-09-00

GEOCRES No. 30M3-277

Report to

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TABLE OF CONTENTS

SECTION **PAGE**

Appendices

FOUNDATION INVESTIGATION REPORT
HIGHWAY 406 GLENDALE AVENUE OVERPASS
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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation carried out at the location of the proposed rehabilitation of the Glendale Avenue Overpass at Highway 406 in the City of St. Catharines, Ontario. This investigation was carried out as part of a consolidated assignment to rehabilitate or replace six (6) bridge structures at five (5) sites in Thorold and St. Catharines, Ontario.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide borehole location plans and soil strata drawings with stratigraphic profiles and cross-sections, records of boreholes, laboratory test results and written descriptions of the subsurface conditions. A model of the subsurface conditions was developed for the site based on the data obtained from the present investigation.

Thurber carried out the investigation as a foundation sub-consultant to McCormick Rankin, a member of MMM Group under MTO Purchase Order No. 2010-E-0073.

The following MTO GEOCRES documents have been referenced in the preparation of this report:

- Department of Highways Ontario (DHO) report titled "Foundation Investigation Report, Overpass Structure for Hwy. #58 Line 'B' at Glendale Ave. (Co. Rd. #8) – Dist. #4", W.J. 60-F-90, W.P. 295-60, dated May 1961, GEOCRES No. 30M3-51 (Reference 1).
- Ministry of Transportation and Communications (MTC) report titled "Foundation Investigation Report for N-EW Ramp, Glendale Ave., Site 18-170C, Hwy. #406, District #4, Hamilton, W.P. 90-74-02, dated November 1960, GEOCRES No. 30M3-177 (Reference 2).

2 PROJECT AND SITE DESCRIPTION

The existing Glendale Avenue Overpass structure consists of triple span twin bridges carrying the northbound and southbound lanes of Highway 406 over Glendale Avenue in the City of St. Catharines, Ontario. The lands adjacent to the northwest, northeast and southeast quadrants of the interchange are primarily occupied by light commercial/industrial buildings and parking lots. There is open space at the southwest quadrant of the interchange which is moderately vegetated with grass, some trees and shrubs. In this general vicinity, Highway 406 has been constructed over approach fills and the Glendale Avenue grade appears to be at or near the original ground surface.

From published geological information, the bridge site is located within the physiographic region known as the Iroquois Plain. The subject site is located within the strip of land between the Niagara Escarpment to the south and Lake Ontario to the north. In this area, glaciolacustrine deposits of clays and silts overlie glacial tills which are underlain by shale bedrock of the Queenston Formation.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project were carried out in two phases. The first phase involved drilling and sampling sixteen (16) boreholes located at Glendale Avenue grade (GD-NB-04 to GD-NB-10, GD-NB-13, GD-SB-02, and GD-SB-05 to GD-SB-11). The second phase consisted of drilling and sampling eleven (11) boreholes located at Highway 406 grade (GD-NB-01 to GD-NB-03, GD-NB-11, GD-NB-12, GD-NB-14, GD-SB-01, GD-SB-03, GD-SB-04, GD-SB-12, and GD-SB-14). The borehole depths ranged from 9.8 m to 36.6 m (Elevations 93.5 m to 120.7 m). The locations of these boreholes are shown on the borehole location plan included in Appendix C. Borehole GD-SB-13 was not drilled due to its centralized location on the median and the fact that its information can be shared between the twin bridges.

GEOCRES information (References 1 and 2) is available for the general vicinity of the bridge site. However, the exact locations of these previously drilled boreholes are difficult to establish as they were referenced to station numbers of the then proposed Highway 406 prior to its construction.

Hollow and solid stem augers, as well as rotary coring drilling techniques were used to advance the current boreholes through soil and bedrock, respectively. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT).

Boreholes GD-NB-03, GD-NB-05, GD-NB-09, GD-SB-06 and GD-SB-10 were advanced a minimum of 2.9 m into bedrock by NXL size diamond coring. The remaining boreholes (with the exception of boreholes GD-NB-01, GD-NB-04, GD-NB-14, GD-SB-01, and GD-SB-14) were terminated upon auger refusal on probable bedrock or boulders, or split spoon refusal on bedrock. Boreholes GD-NB-01, GD-NB-14, GD-SB-01 and GD-SB-14 were terminated between 9.8 m and 11.3 m (Elevations 118.8 to 120.7). Borehole GD-NB-04 was terminated at a depth of 17.4 m (Elevation 106.0 m) due to encountering a methane gas pocket within the silt layer.

Groundwater conditions were observed in the open boreholes upon completion of drilling. A standpipe piezometer, consisting of a 19 mm diameter Schedule 40 PVC pipe with a 3.0 m long slotted screen, was installed in eleven (11) boreholes (GD-NB-02, GD-NB-05, GD-NB-06, GD-NB-08, GD-NB-11, GD-NB-13, GD-SB-02, GD-SB-04, GD-SB-05, GD-SB-08 and GD-SB-11). The installation details for the piezometers are summarized below along with the backfill details for other boreholes without piezometer installation.

Borehole Number	Piezometer Tip Depth / Elevation (m)	Completion Details
GD-NB-01	None installed	Backfilled with bentonite holeplug to 7.3 m, bentonite holeplug and cuttings from 7.3 m to 0.2 m, dry concrete from 0.2 m to 0.15 m, then asphalt cold patch to surface.
GD-NB-02	15.5 / 114.7	Filter sand from 15.5 m to 8.5 m, then bentonite holeplug from 8.5 m to 1.2 m, cuttings from 1.2 m to 0.6 m. Flush mount protector installed at surface.
GD-NB-03	None installed	Backfilled with bentonite holeplug to 2.1 m, bentonite holeplug and cuttings from 2.1 m to 0.9 m, bentonite holeplug from 0.9 m to 0.4 m, then concrete to surface.
GD-NB-04	None installed	Backfilled with bentonite holeplug to surface.
GD-NB-05	22.9 / 101.2	Filter sand from 27.4 m to 19.5 m, then bentonite holeplug from 19.5 m to 0.15 m. Flush mount protector installed at surface.
GD-NB-06	25.0 / 99.0	Filter sand from 25.0 m to 21.6 m, then bentonite holeplug from 21.6 m to 0.15 m. Flush mount protector installed at surface.
GD-NB-07	None installed	Borehole caved to 7.8 m. Backfilled with bentonite holeplug from 7.8 m to 6.1 m, bentonite holeplug and cuttings from 6.1 m to 0.3 m, dry concrete from 0.3 m to 0.1 m, then asphalt cold patch to surface.
GD-NB-08	25.5 / 98.6	Filter sand from 25.5 m to 21.0 m, then bentonite holeplug from 21.0 m to 0.5 m, sand from 0.5 m to 0.15. Flush mount protector installed at surface.
GD-NB-09	None installed	Backfilled with bentonite holeplug to 0.6 m, sand from 0.6 m to 0.3 m, dry concrete from 0.3 m to 0.1 m, then asphalt cold patch to surface.
GD-NB-10	None installed	Backfilled with bentonite holeplug to 6.1 m, bentonite holeplug and cuttings from 6.1 m to 1.2 m, dry concrete from 1.2 m to 0.1 m, then asphalt cold patch to surface.
GD-NB-11	12.8 / 118.4	Piezometer installed in shallow borehole adjacent to sampled borehole. Filter sand from 15.9 m to 1.7 m, then bentonite holeplug from 1.7 m to surface. Protector installed at surface.
GD-NB-12	None installed	Backfilled with bentonite holeplug and cuttings to 1.2 m, then dry concrete to surface.
GD-NB-13	25.9 / 98.3	Filter sand from 25.9 m to 22.6 m, then bentonite holeplug

Borehole Number	Piezometer Tip Depth / Elevation (m)	Completion Details
		from 22.6 m to surface. Above ground protector installed at surface.
GD-NB-14	None installed	Backfilled with bentonite holeplug and cuttings to 0.6 m, dry concrete from 0.6 m to 0.2 m, then asphalt cold patch to surface.
GD-SB-01	None installed	Backfilled with bentonite holeplug to 7.6 m, bentonite holeplug and cuttings from 7.6 m to 2.4 m, concrete from 2.4 m to 0.15 m, then asphalt cold patch to surface.
GD-SB-02	25.0 / 98.7	Filter sand from 25.0 m to 21.7 m, then bentonite holeplug from 21.7 m to surface. Protector installed at surface.
GD-SB-03	None installed	Backfilled with bentonite holeplug and cuttings to 7.6 m, bentonite holeplug from 7.6 m to 0.6 m, concrete from 0.6 m to 0.2 m, then asphalt cold patch to surface.
GD-SB-04	15.2 / 115.0	Filter sand from 15.2 m to 9.1 m, bentonite holeplug from 9.1 m to 1.5 m, cuttings from 1.5 m to 0.8 m, then concrete from 0.8 m to surface. Above ground protector installed at surface.
GD-SB-05	25.8 / 98.4	Filter sand from 26.4 m to 5.3 m, bentonite holeplug from 5.3 m to surface. Flush mount protector installed at surface.
GD-SB-06	None installed	Backfilled with bentonite holeplug to 1.5 m, sand from 1.5 m to 0.6 m, concrete from 0.6 m to 0.1 m, then asphalt cold patch to surface.
GD-SB-07	None installed	Backfilled with bentonite holeplug to 13.7 m, bentonite holeplug and cuttings from 13.7 m to 1.5m, bentonite holeplug from 1.5 m to 0.3 m, concrete from 0.3 m to 0.1 m, then asphalt cold patch to surface.
GD-SB-08	25.3 / 98.9	Filter sand from 25.4 m to 21.5 m, bentonite holeplug from 21.5 m to 0.15 m, sand from 0.15 m to 0.8 m, then concrete from 0.8 m to surface. Flush mount protector installed at surface.
GD-SB-09	None installed	Backfilled with bentonite holeplug to 0.5 m, sand from 0.5 m to 0.1 m, then asphalt cold patch to surface.
GD-SB-10	None installed	Backfilled with bentonite holeplug to 1.5 m, bentonite holeplug and cuttings from 1.5 m to 0.6 m, sand from 0.6 m to 0.1 m, then asphalt cold patch to surface.
GD-SB-11	25.9 / 98.8	Filter sand from 25.9 m to 19.8 m, then bentonite holeplug from 19.8 m to surface. Above ground protector installed at surface.
GD-SB-12	None installed	Backfilled with bentonite holeplug and cuttings to 22.9 m, bentonite holeplug from 22.9 m to 0.5 m, concrete from 0.5 m to 0.2 m, then asphalt cold patch to surface.
GD-SB-14	None installed	Backfilled with bentonite holeplug and cuttings to 6.4 m, bentonite holeplug from 6.4 m to 0.5 m, concrete from 0.5 m to 0.2 m, then asphalt cold patch to surface.

A methane gas pocket was encountered during drilling in borehole GD-NB-04 at a depth of 17.4 m within the silt deposit. The borehole was left open overnight to allow for dissipation of the gas. Once the bubbling subsided, the borehole was sealed to ground surface using bentonite holeplug.

A member of Thurber's technical staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, processed the soil and rock core samples in labelled containers and wooden core boxes, respectively, for transport to Thurber's laboratory for further examination and testing.

All rock cores were logged, and properties including Total Core Recovery (TCR), Rock Quality Designation (RQD) and Fracture Index (FI) were determined.

4 LABORATORY TESTING

All recovered soil samples were subjected to visual identification and to natural moisture content determination. At least 25% of the recovered soil samples were subjected to grain size distribution analysis. Atterberg Limits tests were carried out on selected samples of silty clay fill, silty clay and silty clay till to determine the plasticity characteristics. The results of the laboratory testing are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

Point load testing was carried out on selected rock cores retrieved from Boreholes GD-NB-03, GD-NB-05, GD-NB-09, GD-SB-06 and GD-SB-10. The results of these tests are presented on the Record of Borehole sheets (as estimated UCS) included in Appendix A.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference should be made to the Record of Borehole sheets included in Appendix A. Details of the encountered soil and rock stratigraphy are presented in these records and on the "Borehole Locations and Soil Strata" drawings included in Appendix C. General descriptions of the stratigraphy based on boreholes drilled during the current investigation are given in the following paragraphs. It should be noted that the factual information presented in the Record of Borehole sheets governs any interpretation of site conditions.

In general, the subsurface stratigraphy at the site consists of topsoil or a pavement structure of asphalt or concrete underlain by granular fill, and silty clay to clayey silt fill. The fill typically overlies native silty clay which is in turn underlain by silty clay till. The cohesive till is underlain by sandy silt to silty sand till and pockets of sand, silt, and gravel. The above soils are underlain by shale bedrock of the Queenston Formation.

5.1 Topsoil

Topsoil was encountered at the surface in Boreholes GD-NB-02, GD-NB-04, GD-NB-11, GD-NB-13, GD-SB-02, GD-SB-04, and GD-SB-11. The thickness of the topsoil ranged from 50 to 300 mm. The topsoil thickness may vary between borehole locations and in other areas of the site.

5.2 Pavement Structure

Pavement structure consisting of asphalt (and concrete at some locations) overlying granular fill materials was encountered in boreholes drilled on Glendale Avenue (Boreholes GD-NB-05 to GD-NB-10 and GD-SB-05 to GD-SB-10) and on Highway 406 (Boreholes GD-NB-01, GD-NB-03, GD-NB-12, GD-NB-14, GD-SB-01, GD-SB-03, GD-SB-12 and GD-SB-14). The thickness of the asphalt ranged from 75 to 275 mm.

A layer of concrete was encountered below the asphalt in six of the boreholes drilled on Highway 406 (Boreholes GD-NB-01, GD-NB-03, GD-NB-12, GD-NB-14, GD-SB-01, and GD-SB-03). The concrete was 200 to 300 mm thick in these six boreholes.

The granular fill consisted of sand with some gravel and occasional cobbles in all boreholes which encountered a pavement structure. The thickness of the granular fill ranged from 0.6 to 7.5 m, with the lower boundary of the granular fill encountered at depths of 0.9 to 8.0 m (Elevations 130.0 m to 121.8 m). A clayey silt/silty clay layer 300 to 600 mm thick was encountered within the granular fill in Boreholes GD-NB-03 and GD-SB-01. A layer of concrete 225 mm thick was encountered within the layer of clayey silt fill in borehole GD-SB-01.

SPT 'N' values recorded in the granular fill ranged from 6 to over 100 blows for 0.3 m penetration, indicating a variable density ranging from loose to very dense. The moisture content of samples of the fill ranged from 3 to 26%.

Three samples of the sand fill were subjected to laboratory gradation analysis. The results of these tests are summarized in the table below as well as on the Record of Borehole sheets included in Appendix A. Figure B1 presents the grain size distribution curves for these samples.

Soil Particles	Percentage
Gravel	3 to 32
Sand	48 to 82
Silt and Clay	15 to 39

5.3 Clayey Silt/Silty Clay Fill

Clayey silt/silty clay fill was encountered below the sand fill in Boreholes GD-NB-02, GD-NB-08, GD-NB-10, GD-NB-11, GD-NB-14, GD-SB-01, GD-SB-03, GD-SB-08,

GD-SB-12 and GD-SB-14. Borehole GD-SB-04 encountered clayey silt fill below the topsoil. This cohesive fill typically contained trace to some sand, trace gravel and trace organics, and was brown to reddish brown in colour.

The thickness of the cohesive fill ranged from 0.2 to 8.2 m. The lower boundary of this layer was encountered at depths of 1.5 to 9.1 m (Elevations 124.2 to 121.3 m).

SPT N values recorded in the clayey silt/silty clay fill ranged from 5 to 42 blows for 0.3 m penetration, indicating a firm to hard consistency. The measured moisture content of samples of the clayey silt/silty clay fill ranged from 12 to 22%.

Five samples of clayey silt/silty clay fill were subjected to gradation analysis and one sample was also subjected to Atterberg Limits testing. The results of these tests are summarized in the tables below as well as on the Record of Borehole sheets included in Appendix A. Figure B2 presents the grain size distribution curves for these samples, and Figure B26 illustrates the results of the Atterberg Limits tests on a plasticity chart.

Soil Particles	Percentage
Gravel	0 to 2
Sand	3to 23
Silt	37 to 51
Clay	26 to 60

Soil Particles	Percentage
Liquid Limit	47
Plasticity Index	24

The results of the Atterberg Limits tests indicate that the silty clay fill has an intermediate plasticity (CI).

5.4 Sandy Silt/Silty Sand Fill

Sandy silt to silty sand fill was encountered below the pavement structure in Borehole GD-NB-01, below the topsoil in Borehole GD-NB-11, and interlayered with other fills in Borehole GD-NB-14. A sand layer was also encountered in the clayey silt fill in Borehole GD-SB-03 at a depth of 5.5 m. This cohesionless fill typically contained trace to some clay and trace to some gravel and was brown in colour.

The thickness of this cohesionless fill ranged from 0.4 to 4.8 m. The lower boundary of this layer was encountered at depths of 0.6 to 7.8 m (Elevations 130.6 to 122.7 m).

SPT N values recorded in the cohesionless fill ranged from 6 to 16 blows for 0.3 m of penetration indicating a loose to compact state. The moisture content of the samples from this layer ranged from 10 to 24%.

One sample of sandy silt fill and one sample of the sand fill were subjected to gradation analysis. The results of these tests are summarized in the table below as well as on the Record of Borehole sheets included in Appendix A. Figure B3 presents the grain size distribution curves for these samples.

Soil Particles	Sandy Silt	Sand
Gravel (%)	2	0
Sand (%)	19	86
Silt (%)	65	-
Clay (%)	14	-
Silt & Clay (%)	-	14

5.5 Silty Clay

Silty clay was encountered below the fill or topsoil in all boreholes. Boreholes GD-NB-06, GD-NB-07, GD-NB-10, GD-NB-13, GD-SB-06, GD-SB-07 and GD-SB-11 also encountered a lower silty clay layer below the silty clay till. The silty clay typically contained trace sand and was brown to reddish brown to grey in colour. A 2.6 m thick layer of sandy silt was encountered within the silty clay in Borehole GD-NB-09 at a depth of 12.2 m (Elevation 111.9 m).

The silty clay was not fully penetrated in Boreholes GD-NB-01, GD-NB-14, GD-SB-01 and GD-SB-14, which were terminated within the silty clay at depths of 9.8 to 11.3 m (Elevations 118.8 to 120.7 m). Borehole GD-NB-13 did not fully penetrate the lower silty clay layer and was terminated at a depth of 25.9 m (Elevation 98.3 m) within the lower silty clay. Where the silty clay was fully penetrated, the base of the silty clay was encountered at depths of 7.2 to 27.0 m (Elevations 119.6 to 97.0 m). The base of the lower silty clay layer was encountered at a depth of 18.6 to 25.6 m (Elevations 105.4 to 100.8 m). Where fully penetrated, the silty clay measured 2.2 to 25.8 m in thickness.

SPT 'N' values recorded in the silty clay typically ranged from 9 to greater than 100 blows for 0.3 m penetration, indicating a stiff to hard consistency. The lower clay layer was hard in consistency. In Borehole GD-SB-02, a firm to stiff zone exists below the upper weathered crust as indicated by 'N' values ranging between 6 and 8 blows. Field vane shear tests indicated that the shear strength of the firm to stiff part of the silty clay ranged from 40 to 76 kPa. The measured moisture content of samples of the silty clay ranged from 10 to 30%.

Fifty-two samples of silty clay were subjected to gradation analysis and thirty-six samples also underwent Atterberg Limits testing. The results of these tests are summarized in the tables below as well as on the Record of Borehole sheets included in Appendix A. Figures B4 to B14 present the grain size distribution curves for the silty clay samples, and Figures B27 to B33 illustrate the results of the Atterberg Limits tests on plasticity charts.

Soil Particles	Percentage
Gravel	0 to 4
Sand	0 to 22
Silt	28 to 72
Clay	14 to 72

Soil Particles	Percentage
Liquid Limit	24 to 52
Plasticity Index	8 to 28

The results of the Atterberg Limits tests indicate that the silty clay typically is of intermediate plasticity (CI), with occasional low plastic (CL) and high plastic (CH) zones.

5.6 Silty Clay Till

Silty clay till was encountered below the silty clay in all boreholes except Boreholes GD-NB-01, GD-NB-05, GD-NB-09, GD-NB-10, GD-NB-14, GD-SB-01 and GD-SB-14. The silty clay till was brown to reddish brown to grey in colour and contained some sand and trace gravel.

The measured thickness of the silty clay till ranged from 4.3 to 15.2 m where fully penetrated. Boreholes GD-NB-12 and GD-SB-09 were terminated within the silty clay till at depths of 32.0 and 17.5 m (Elevations 99.6 and 106.6 m). In all other boreholes that encountered silty clay till, the base of the silty clay till ranged from 14.8 to 28.7 m (Elevations 109.5 to 101.5 m).

SPT 'N' values recorded in the silty clay till ranged from 15 to greater than 100 blows for 0.3 m penetration (typically between 15 and 80 blows per 0.3 m of penetration), indicating a very stiff to hard consistency. The SPT 'N' values recorded in the till layer generally increase with depth. The measured moisture content of samples of the silty clay till ranged from 5 to 30%, typically around 20%.

Thirty-one samples of silty clay till were subjected to gradation analysis and nine samples also underwent Atterberg Limits testing. The results of these tests are summarized in the tables below as well as on the Record of Borehole sheets included in Appendix A. Figures

B15 to B20 present the grain size distribution curves for these samples, and Figures B34 and B35 illustrate the results of the Atterberg Limits tests on plasticity charts.

Soil Particles	Percentage
Gravel	0 to 7
Sand	11 to 27
Silt	44 to 63
Clay	10 to 32

Soil Particles	Percentage
Liquid Limit	22 to 25
Plasticity Index	8 to 11

The results of the Atterberg Limits tests indicate that the silty clay till has a low plasticity (CL).

It should be noted that glacial tills inherently contain cobbles and boulders.

5.7 Sands/Silts

Sands/silts were encountered below the topsoil in Borehole GD-SB-02, below the silty clay in Boreholes GD-NB-07, GD-NB-10, GD-SB-06, GD-SB-07, and GD-SB-11, and below the silty clay till in Boreholes GD-NB-03, GD-NB-04, GD-NB-06, GD-NB-07, GD-SB-02, GD-SB-03, GD-SB-05, GD-SB-07, GD-SB-08, GD-SB-10, GD-SB-11, and GD-SB-12. The sands and silts were brown/grey to reddish brown in colour and contained trace gravel and occasional cobbles.

Where fully penetrated, the measured thickness of the sands/silts ranged from 1.1 to 7.3 m and the base of the sands/silts ranged from depths of 17.4 to 30.7 m (Elevations 106.0 to 97.2 m).

SPT 'N' values recorded in the sands/silts ranged from 14 to greater than 100 blows for less than 0.3 m penetration, indicating a compact to very dense state. These layers are generally in a dense state. The measured moisture content of samples of the sand/silt ranged from 8 to 19%.

Nine samples of sand/silt were subjected to gradation analysis testing. The results of these tests are summarized in the tables below as well as on the Record of Borehole sheets included in Appendix A. Figures B21 to B23 present the grain size distribution curves for these samples.

Soil Particles	Silt to Sandy Silt Figs. B21 & B22	Sand Fig. B23
Gravel (%)	0 to 2	0 to 4
Sand (%)	0 to 24	80 to 86
Silt (%)	63 to 93	-
Clay (%)	4 to 14	-
Silt & Clay (%)	-	14 to 16

5.8 Gravelly Sand to Gravel

Layers of reddish brown gravelly sand to sandy gravel were encountered at various elevations in boreholes GD-NB-02, GD-NB-05, GD-NB-08, GD-NB-11, GD-SB-03, GD-SB-04, GD-SB-08, and GD-SB-10.

The thickness of these layers ranged from 0.2 to 2.1 m.

SPT 'N' values recorded in these layers ranged from 57 to greater than 100 blows for 0.3 m penetration, indicating a very dense state. In Borehole GD-NB-05 coring techniques were used to advance the borehole through the gravel layer. The measured moisture content of samples of the gravelly sand to gravel ranged from 8 to 12%.

One sample of the sand and gravel was subjected to gradation analysis testing. The results of this test are summarized below and are presented on the corresponding Record of Borehole sheet included in Appendix A. Figure B24 shows the grain size distribution for this sample.

Soil Particles	Percentage
Gravel	38
Sand	43
Silt & Clay	19

5.9 Sandy Silt/Silty Sand Till

Sandy silt/silty sand till was encountered below the silty clay in Boreholes GD-NB-05, GD-NB-06, and GD-NB-10, below the silty clay till in Boreholes GD-NB-02, GD-NB-11, GD-SB-02, and GD-SB-04, and below the sands/silts in Borehole GD-NB-03. The sandy silt to silty sand till was reddish brown/brown to grey in colour and contained some clay. A 2.0 m thick layer of gravelly sand was encountered at a depth of 27.0 m (Elevation 104.2 m) within the sandy silt till layer in Borehole GD-NB-11.

The sandy silt/silty sand till was 2.1 to 15.5 m thick with a lower boundary encountered at depths between 17.8 and 32.9 m (Elevations 106.1 to 98.1 m).

SPT N values recorded in the sandy silt to silty sand till ranged from 25 to greater than 100 blows for 0.3 m penetration, indicated a compact to very dense state. Most of the cohesionless till is in a dense to very dense state. The moisture content of the samples from this layer ranged from 10 to 19%.

Six samples of sandy silt/silty sand till were subjected to gradation analysis. The results of these tests are summarized in the table below as well as on the Record of Borehole sheets included in Appendix A. Figures B25 presents the grain size distribution curves for these samples.

Soil Particles	Percentage
Gravel	0 to 5
Sand	21 to 31
Silt	56 to 70
Clay	6 to 15

Two samples of the sandy silt/silty sand till exhibited sufficient plasticity for Atterberg Limits testing, the results of which are summarized below. Figure B36 illustrates the results of the Atterberg Limits tests on a plasticity chart.

Soil Particles	Percentage
Liquid Limit	22
Plasticity Index	8 to 9

The results of the Atterberg Limits tests indicate that the sandy silt/silty sand till has zones of low plasticity (CL).

It should be noted that glacial tills inherently contain cobbles and boulders.

5.10 Shale Bedrock

The soils described above are underlain by shale bedrock of the Queenston Formation, which was proven by coring in Boreholes GD-NB-03, GD-NB-05, GD-NB-09, GD-SB-06 and GD-SB-10. The remaining boreholes were terminated upon auger refusal on probable bedrock or boulder, and/or split spoon refusal on bedrock. The following table summarizes the depths and elevations of bedrock, split spoon, or auger refusal encountered at the borehole locations.

Proposed Foundation Element	Borehole Number	Depth to Bedrock or Auger Refusal (m)	Elevation of Top of Bedrock or Auger Refusal (m)
North Abutment (Hwy. 406 NB Structure)	GD-NB-03	32.6*	98.2*
North Pier (HWY 406 NB Structure)	GD-NB-05	27.4*	96.6*
	GD-NB-06	25.9	98.1
	GD-NB-07	25.9	98.0
South Pier (HWY 406 NB Structure)	GD-NB-08	24.6**	99.4**
	GD-NB-09	27.0*	97.0*
	GD-NB-10	24.4**	99.6**
South Abutment (HWY 406 NB Structure)	GD-NB-11	32.9**	98.3**
	GD-NB-12	32.0	99.6
	GD-NB-13	25.9	98.3
North Abutment (HWY 406 SB Structure)	GD-SB-02	25.0	98.7
	GD-SB-04	30.8**	99.3**
North Pier (HWY 406 SB Structure)	GD-SB-05	26.4	97.8
	GD-SB-06	27.0*	97.2*
	GD-SB-07	25.5	98.7
South Pier (HWY 406 SB Structure)	GD-SB-08	24.6**	99.5**
	GD-SB-10	26.5*	97.6*
South Abutment (HWY 406 SB Structure)	GD-SB-11	25.9	98.8
	GD-SB-12	30.7	100.7

* Bedrock proven by coring
** Split spoon shale samples recovered

Borehole 1 (Reference 1) indicated that bedrock near the north abutment of the NB bridge was at Elevation 98.0 m.

Based on the rock cores from the current investigation, the bedrock was described as thinly bedded, reddish brown, shale with frequent hard grey limestone and siltstone interbeds. The bedrock was generally in a moderately to slightly weathered state. Occasional fractures and rubble zones were observed in the bedrock cores.

Total Core Recovery (TCR) of the bedrock ranged from 78 to 100%. The Rock Quality Designation (RQD) values generally ranged from 39% to 100%, indicating a poor to excellent rock quality. The Fracture Index (FI) of the rock, expressed as fractures or joints per 0.3 m of core, was generally less than 5, except for highly fractured zone encountered near the bedrock surface at each of the borehole locations.

Point load tests were carried out at regular intervals on selected rock cores. The estimated Unconfined Compressive Strength (UCS) of the bedrock as inferred from the point load tests ranged from 7 MPa to 49 MPa, indicating a weak intact rock strength for the shale cores and medium strong for the limestone interbeds.

5.11 Groundwater Levels

Standpipe piezometers were installed in selected boreholes to facilitate monitoring of groundwater levels. The water levels observed in the open boreholes on completion of drilling are summarized below along with the groundwater levels measured in the standpipe piezometers.

Borehole	Date	Water Levels		Comment
		Depth (m)	Elevation (m)	
GD-NB-01	Nov 15, 2012	DRY		Open Borehole
GD-NB-02	Dec 10, 2012	8.3	121.9	Piezometer
GD-NB-03	Nov 14, 2012	N/A		Borehole filled with water from coring.
GD-NB-04	Sep 13, 2012	N/A		Methane gas encountered. Water level affected by bubbling gas.
GD-NB-05	Dec 10, 2012	11.8	112.3	Piezometer
GD-NB-06	Nov 20, 2012	4.7	119.3	Piezometer
GD-NB-07	Sep 11, 2012	-	-	Borehole caved to 7.8 m.
GD-NB-08	Nov 20, 2012	14.5	109.6	Piezometer
GD-NB-09	Sep 20, 2012	N/A		Borehole filled with water from coring.
GD-NB-10	Oct 09, 2012	10.9	113.0	Open Borehole
GD-NB-11	Dec 10, 2012	8.4	122.8	Piezometer
GD-NB-12	Nov 14, 2012	DRY		Open Borehole
GD-NB-13	Oct 09, 2012	11.8	112.4	Piezometer
GD-NB-14	Nov 11, 2012	DRY		Open Borehole
GD-SB-01	Nov 16, 2012	DRY		Open Borehole
GD-SB-02	Sep 25, 2012	10.7	113.1	Piezometer
GD-SB-03	Nov 19, 2012	20.4	110.0	Open Borehole
GD-SB-04	Dec 10, 2012	8.3	121.9	Piezometer
GD-SB-05	Nov 20, 2012	6.9	117.3	Piezometer
GD-SB-06		-	-	Borehole caved to 13.4 m.
GD-SB-07	Sep 5, 2012	6.1	118.0	Open Borehole
GD-SB-08	Nov 20, 2012	12.0	112.2	Piezometer
GD-SB-09	Nov 19, 2012	1.2	123.0	Open Borehole
GD-SB-10	Oct 10, 2012	N/A		Borehole filled with water from coring.
GD-SB-11	Nov 20, 2012	12.5	112.2	Piezometer
GD-SB-12	Nov 27, 2012	14.3	117.1	Open Borehole
GD-SB-14	Nov 22, 2012	DRY		Open Borehole

All groundwater observations at this site are short term and the levels are expected to fluctuate seasonally and after severe climatic events.

Once groundwater monitoring is completed, all piezometer installations will be decommissioned in accordance with Ministry of the Environment Regulation 903 and its Amendments (the water well regulation under the OWRA).

6 MISCELLANEOUS

Borehole locations were established in the field relative to the location of the existing structure. The ground surface elevations and coordinates at all borehole locations were established by surveyors arranged by MRC upon completion of drilling. Underground utility clearances were obtained for the borehole locations prior to drilling.

Elite Drilling Services of St. Catharines, Ontario and Walker Drilling Inc. supplied truck-mounted and track-mounted drill rigs and conducted the drilling, sampling and in-situ testing operations.

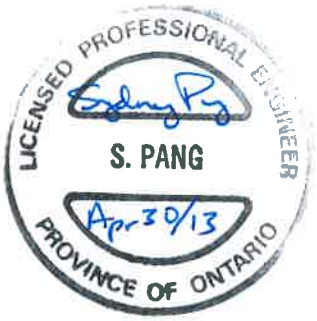
The field investigation was supervised by Mr. Ryan Kromer, E.I.T. Ms. Katrina Young, E.I.T. and Ms. Eckie Siu, C.E.T. of Thurber. Geotechnical laboratory testing was carried out in Thurber's Toronto Area laboratory.

Overall planning and supervision of the field program was conducted by Mr. Lukasz Gilarski, E.I.T. and Mr. Sydney Pang, P.Eng. Interpretation of the data and preparation of this report was carried out by Mr. Lukasz Gilarski, E.I.T.

The report was reviewed by Messrs. Sydney Pang, P.Eng. and P.K. Chatterji, P.Eng., who is a Designated Principal Contact for MTO Foundations Projects.

THURBER ENGINEERING LTD.

Lukasz Gilarski, E.I.T.
Project Manager



Sydney Pang, P.Eng.
Associate, Senior Foundations Engineer

P. K. Chatterji, P.Eng.
Review Principal, Designated MTO Contact

Appendix A

Record of Borehole Sheets

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-01 1 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 272.8 E 327 520.9 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.15 - 2012.11.15 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.5											
0.0	**ASPHALT:**(150mm)										
0.2 / 130.1	**CONCRETE**										
0.4	**SAND**, some gravel, occasional cobbles Compact Brown Moist (FILL)		1	SS	29		130		○		
	Trace silt, trace clay		2	SS	22		129		○		
127.4			3	SS	15		128		○		
3.0	Sandy **SILT**, some clay, trace gravel Compact Brown Moist (FILL)		4	SS	10		127		○		
			5	SS	11		126		○		
			6	SS	11		125		○		
			7	SS	9		124		○		2 19 65 14
122.7							123				
7.8	Silty **CLAY**, trace sand Very Stiff to Hard Brown Moist		8	SS	25		122		○		
			9	SS	48		121		○		0 4 38 58
120.7											
9.8	END OF BOREHOLE AT 9.8m.										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-01 2 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 272.8 E 327 520.9 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.15 - 2012.11.15 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT w_P w w_L	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60	γ kN/m^3	GR SA SI CL
	Continued From Previous Page										
	BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 7.3m, CUTTINGS AND HOLEPLUG TO 0.2m, CONCRETE TO 0.15m THEN ASPHALT TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-02 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.7 E 327 510.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.06 - 2012.12.06 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.2											
0.0 / 0.1	**TOPSOIL:** (75mm)										
129.6 / 0.6	**SAND**, some gravel, trace silt, mixed with organics, occasional cobble Dense Dark Brown Moist (FILL)		1	SS	31		130				
			2	SS	24		129				
128.7 / 1.5	Clayey **SILT**, some sand, trace gravel, trace organics Very Stiff Brown (FILL)		3	SS	11		128				
	Clayey **SILT**, some sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)		4	SS	9						
			5	SS	13		127				
			6	SS	15		126				
			7	SS	15		125				
123.0 / 7.2	Silty **CLAY**, trace sand Hard Brown Moist		8	SS	24		124				
			9	SS	38	▼	123				
			10	SS	43		122				0 3 41 56
							121				

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

$\frac{20}{15 \quad 5}$ (%) STRAIN AT FAILURE
10

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-02 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.7 E 327 510.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.06 - 2012.12.06 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand Very Stiff to Hard Brown Moist						120				
			11	SS	25		119		○		
			12	SS	52		118		○		
			13	SS	29		117		○		
115.4							116				
14.8	Silty **CLAY**, some sand, trace gravel Hard Brown Moist (TILL)		14	SS	48		115		○		7 18 51 24
			15	SS	65		114		○		
			16	SS	82		113				
							112				
							111				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-02 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.7 E 327 510.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.06 - 2012.12.06 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Hard Reddish Brown Moist (TILL)						110				
							109				
			17	SS	88				○		3 21 56 20
							108				
							107				
105.8							106				
104.4	**SAND** and **GRAVEL** Very Dense Reddish Brown Wet		18	SS	105/ 0.250				○ ○		
103.6 24.6	Sandy **SILT**, some clay Very Dense Reddish Brown Moist (TILL)						105				
							104				
			19	SS	125/ 0.200		103		○		0 31 56 13
							102				
101.0			20	SS	110/ 0.225				○		
29.2	END OF BOREHOLE AT 29.2m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.										

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-02 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.7 E 327 510.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.06 - 2012.12.06 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Dec.10/12 8.3 121.9										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-03 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.0 E 327 521.1 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.8											
0.0	**ASPHALT:**(175mm)										
0.2 / 130.3	**CONCRETE**, with rebar										
0.5	**SAND**, some gravel Compact Brown Moist (FILL)		1	SS	19		130		○		
	Some to trace gravel		2	SS	12		129		○		
			3	SS	11				○		
	Occasional cobbles, reddish brown		4	SS	14		128		○		
			5	SS	25		127		○		
126.2											
4.6 / 125.6	Silty **CLAY**, trace sand (FILL)		6	SS	42		126		○		0 3 37 60
5.2			7	SS	36		125		○		
							124				
122.8			8	SS	21		123		○		
8.0	Silty **CLAY**, trace sand Hard to Very Stiff Brown Moist						122				
			9	SS	33		121		○		

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-03 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.0 E 327 521.1 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand Very Stiff Brown Moist										
			10	SS	22		120		o		0 5 31 64
							119				
			11	SS	17				o		
							118				
			12	SS	23		117		o		0 4 38 58
116.0											
14.8	Trace sand Stiff		13	SS	9		116		o		
114.5							115				
16.3	Very Stiff Mottled Brown and Grey		14	SS	27		114		o		
112.5							113				
18.3	Silty **CLAY**, some sand, trace gravel Hard Brown to Reddish Brown Moist (TILL)		15	SS	33		112		o		4 22 55 19
							111				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-03 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.0 E 327 521.1 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Hard Reddish Brown Moist (TILL)						110				
			16	SS	75		109		○		
							108				
							107				
106.4 24.4 106.1 24.7	**SILT**, trace clay Very Dense Grey Moist		17	SS	83/ 0.275		106		○ ○		0 0 93 7
	SAND, trace gravel, occasional cobbles Very Dense Brown to Reddish Brown Moist						105				
							104				
			18	SS	106/ 0.250		103		○		
							102				
							101				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-03 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 259.0 E 327 521.1 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Coring COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
100.3											
30.5	Sandy **SILT**, trace gravel Very Dense Reddish Brown Moist (TILL)		19	SS	110/ 0.275		100		○		
98.2							99				
32.6	**SHALE**, weathered						98				
	Start coring at 33.2m		20	SS	100/ 0.0					FI	
	SHALE, moderately weathered, fine grained, thinly bedded, reddish brown, occasional grey limestone and siltstone interbeds (QUEENSTON FORMATION) Limestone interbed at 33.5m, 33.6m, 33.9m, 34.1m Siltstone interbed (25mm to 50mm) at 34.4m, 34.8m, 34.9m		1	RUN			97			6 5 1 >5 3	RUN #1 TCR=100% SCR=92% RQD=87% UCS=49MPa (Average)
	Sub-vertical fracture (25mm to 50mm) at 33.6m, 34.6m, 34.7m									1	
	Limestone interbed (25mm to 75mm) at 35.1m, 35.2m, 36.3m, Siltstone interbed at 35.2m, 35.6m, 36.1m		2	RUN			96			1 3 1	RUN #2 TCR=100% SCR=100% RQD=100% UCS=44MPa (Average)
	Sub-horizontal fractures at 35.8m, 36.4m						95			3	
94.2											
36.6	END OF BOREHOLE AT 36.6m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 2.1m, CUTTINGS AND HOLEPLUG TO 0.9m, HOLEPLUG TO 0.4m THEN CONCRETE TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-04 1 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 269.0 E 327 543.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.13 - 2012.09.13 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
123.3												
0.0	**TOPSOIL:**(175mm)											
0.2	Silty **CLAY**, trace sand, trace gravel, occasional sand and rootlets Stiff to Hard Brown Moist		1	SS	10		123			○		
			2	SS	19		122			○		
			3	SS	32					○		2 6 39 53
	Greyish Brown		4	SS	25		121			○		
			5	SS	18		120			○		
			6	SS	16		119			○		0 2 45 53
			7	SS	11		117			○		
			8	SS	13		115			○		
			9	SS	26		114			○		0 22 48 30

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-04 2 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 269.0 E 327 543.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.13 - 2012.09.13 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand, trace gravel Very Stiff Brown/Grey Moist						113				
			10	SS	18				○		
111.6							112				
11.7	Silty **CLAY**, some sand, trace gravel Very Stiff Brown/Grey Moist (TILL) Occasional cobbles and sand lenses		11	SS	16		111		○		
			12	SS	21		110		○		
			13	SS	25		109		○		2 19 59 20
107.3							108				
16.0	**SILT**, trace clay, trace sand Dense Grey to Reddish Brown Moist		14	SS	39		107		○		0 10 83 7
106.0							106				
17.4	END OF BOREHOLE AT 17.4m. BOREHOLE FILLED WITH WATER UPON COMPLETION OF DRILLING. BOREHOLE TERMINATED DUE TO ENCOUNTERING METHANE GAS WITHIN THE SILT DEPOSIT. BOREHOLE WAS LEFT OPEN OVERNIGHT TO ALLOW DISSIPATION OF THE METHANE. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

15 (20 / 10) 5 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 5/1/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-05 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 233.0 E 327 510.3 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/NXL Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.12 - 2012.09.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.1											
0.0	**ASPHALT:**(150mm)						124				
0.2	**SAND,** some gravel Compact Reddish Brown Moist to Wet (FILL)		1	AS							
123.0			1	SS	25		123				
1.1	Silty **CLAY,** trace to some sand, trace gravel Very Stiff to Hard Brown Moist		2	SS	31		122				
			3	SS	29						
			4	SS	21		121				0 4 38 58
			5	SS	17		120				
			6	SS	23		119				
			7	SS	21		118				4 14 43 39
			8	SS	20		117				
							116				
							115				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-05 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 233.0 E 327 510.3 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/NXL Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.12 - 2012.09.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
113.8							114				
10.2	Sandy **SILT**, some clay, trace gravel, occasional clay layers Compact to Dense Brown Moist (TILL)		9	SS	25		113		○		
			10	SS	31		112		⊣●		5 24 58 13
110.8							111				
13.3	Very Dense		11	SS	61		110		○		
			12	SS	58		109		○		
			13	SS	73		108		○		
			14	SS	70		107		○		
							106				
							105				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-05 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 233.0 E 327 510.3 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/NXL Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.12 - 2012.09.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Sandy **SILT**, trace clay, trace gravel Very Dense Brown Moist (TILL)		15	SS	76		104		○		
							103				
							102				
			16	SS	102		101		○		0 24 70 6
							100				
							99				
98.4	Tricone to 25.7 m depth										
25.7	**GRAVEL**, shale fragments, some clay: (silty fines washed out)		1	RUN			98		○		RUN #1 TCR=32%
							97				
96.6										FI	
27.4	**SHALE**, slightly weathered to fresh, fine grained, thinly bedded, reddish brown, occasional grey limestone interbeds		2	RUN			96			1 6 3 5 4	RUN #2 TCR=100% SCR=87% RQD=39% UCS=29MPa (Average)
	Limestone interbed (50mm) at 28.2m Limestone interbed (75mm) at 28.7m Limestone interbed (100mm) at 29.0m										
	Limestone interbed (25mm) at 29.4m		3	RUN			95			4 1 8	RUN #3 TCR=98% SCR=90% RQD=73% UCS=33MPa (Average)

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-05 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 233.0 E 327 510.3 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/NXL Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.12 - 2012.09.14 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page						94			2	
93.5										1	
30.5	END OF BOREHOLE AT 30.5m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.									0	

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Sep.17/12	11.8	112.3
Sep.18/12	12.0	112.1
Sep.25/12	11.9	112.2
Nov.16/12	12.1	112.0
Nov.20/12	12.3	111.8
Dec.10/12	11.8	112.3

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 ⊕ 5 (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-06 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 242.2 E 327 526.1 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.0							124		
0.0 / 123.7	**ASPHALT:**(275mm)								
0.3	**SAND**, occasional clay and gravel Compact Brown to Grey Wet (FILL)		1	SS	14		123		
			2	SS	24				
121.8							122		
2.2	Silty **CLAY**, trace sand Very Stiff to Hard Brownish Grey Moist		3	SS	25				
			4	SS	31		121		0 7 38 55
119.6							120		
4.4	Mottled Brown		5	SS	13		119		
	Occasional sand Moist		6	SS	12		118		
			7	SS	13		117		0 10 47 43
115.3							116		
8.7	Very Stiff Occasional sand and gravel		8	SS	20		115		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa 20 40 60 80 100
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-06 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 242.2 E 327 526.1 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page						114				
113.8											
10.2	Silty **CLAY**, some sand, trace gravel Very Stiff to Hard Grey to Brownish Grey Moist (TILL)										
			9	SS	18		113				6 22 49 23
							112				
			10	SS	21						
							111				
			11	SS	15		110				
							109				
			12	SS	42						2 20 57 21
							108				
			13	SS	52		107				
							106				
105.2			14	SS	62						
18.7	**SAND**, medium grained, occasional clay Very Dense Reddish Brown						105				
104.2											
19.8											

Continued Next Page

$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-06 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 242.2 E 327 526.1 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand, trace gravel Hard Grey to Reddish Brown Moist		15	SS	56		104		○		
							103				
							102				
	Sandy layer (approx. 300mm thick)						101		○		
100.8 23.2	Sandy **SILT**, trace clay, trace gravel Dense Reddish Brown Moist (TILL)		16	SS	42				○		2 28 64 6
							100				
							99				
98.1 25.9	END OF BOREHOLE AT 25.9m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.										

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Sep.25/12	11.7	112.3
Oct.09/12	11.9	112.1
Nov.16/12	4.8	119.2
Nov.20/12	4.7	119.3

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \oplus^{20}_{10} 5$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-07 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 246.8 E 327 535.5 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.11 - 2012.09.11 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.0									
0.0	**ASPHALT:**(175mm)								
0.2	**SAND** and **GRAVEL** Brown Moist		1	AS					
123.2	(FILL)								
0.8									
122.9	**SAND**, some gravel Compact Reddish Brown Wet		1	SS	17		123		
1.1	(FILL)								
	Silty **CLAY**, trace gravel Very Stiff Grey/Brown Moist		2	SS	23		122		
			3	SS	30				
	Trace shale fragments		4	SS	20		121		
			5	SS	20		120		0 0 28 72
			6	SS	16		119		
116.8							118		
7.2	Silty **CLAY**, some sand, trace to some gravel Very Stiff to Hard Dark Brown Moist (TILL)		7	SS	24		117		
			8	SS	36		116		
							115		
							114		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-07 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 246.8 E 327 535.5 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.11 - 2012.09.11 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
			9	SS	30		113		○		3 22 44 31
							112				
	Moist to Wet		10	SS	26				○		
							111				
			11	SS	25		110		○		
109.0											
14.9	Silty **CLAY**, trace sand Hard Brown to Grey Wet		12	SS	86		109		○		
							108				
			13	SS	82		107		○		0 6 61 33
							106				
105.4			14	SS	70				○		
18.6	Sandy **SILT**, trace gravel, trace clay Very Dense Brown Wet						105		○		
							104				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\overset{20}{15}\oplus\overset{5}{10}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-07 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 246.8 E 327 535.5 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.11 - 2012.09.11 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Sandy **SILT**, trace clay, trace gravel Very Dense Brown Wet		15	SS	91		103 102 101 100 99		○		0 20 73 7
			16	SS	82				○		
98.0											
25.9	END OF BOREHOLE AT 25.9m UPON AUGER REFUSAL. BOREHOLE CAVED TO 7.8m, BENTONITE HOLEPLUG TO 6.1m, CUTTINGS AND BENTONITE HOLEPLUG TO 0.3m, CONCRETE TO 0.1m, THEN ASPHALT COLDPATCH TO SURFACE.								○		

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\oplus}} 5$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-08 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 211.5 E 327 508.0 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.03 - 2012.10.04 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.1											
0.0	**ASPHALT:**(200mm)						124				
0.2	**SAND**, some to trace gravel Loose Reddish Brown Moist (FILL)		1	SS	7				○		
122.9							123				
1.2	Silty **CLAY**, trace sand, trace gravel Very Stiff Reddish Brown (FILL)		2	SS	28				○		0 8 42 50
121.8							122				
2.3	Silty **CLAY**, some sand, trace gravel Very Stiff Brown Moist		3	SS	24				○		
			4	SS	20		121		○		
			5	SS	17		120		○		
			6	SS	24		119		○		3 13 37 47
			7	SS	22		118		○		
115.4							117				
8.7	Hard		8	SS	45		116		○		
114.2							115				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-08 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 211.5 E 327 508.0 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.03 - 2012.10.04 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60	kN/m^3	GR SA SI CL
	Continued From Previous Page										
9.9	Silty **CLAY**, trace to some sand, trace gravel Hard Brown Moist (TILL)		9	SS	45		114 113		○		0 20 59 21
			10	SS	31		112 111		○		
	Occasional sand pockets Reddish Brown		11	SS	41	▼	110		○		3 24 63 10
			12	SS	74		109 108		○		
			13	SS	45		107		○		
			14	SS	49		106 105		○		

Continued Next Page

+^{3}, ×^{3}: Numbers refer to Sensitivity

15 (20 / 10) 5 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-08 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 211.5 E 327 508.0 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.03 - 2012.10.04 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
104.0	Continued From Previous Page						104				
20.1	**SILT**, some sand, trace clay Dense Reddish Brown Moist		15	SS	41		103		○		0 13 80 7
							102				
							101				
99.7							100				
24.4 99.4	**GRAVEL**, some sand Very Dense Reddish Brown Wet		16	SS	101/ 0.225				○ ○		
24.6 98.6	**SHALE**, weathered Reddish Brown Moist						99				
25.5	END OF BOREHOLE AT 25.5m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.										

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Oct.04/12	6.0	118.1
Oct.09/12	10.7	113.4
Nov.16/12	14.4	109.7
Nov.20/12	14.5	109.6

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-09 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.5 E 327 525.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.19 - 2012.09.20 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.0							124				
0.0	**ASPHALT:**(150mm)										
0.2	**SAND** and **GRAVEL** Brown Moist (FILL)		1	AS							
123.3							123				
0.8	**SAND** Compact Brown Wet (FILL)		1	SS	11						
122.8											
1.2	Silty **CLAY**, trace to some sand Hard to Very Stiff Grey to Brown Moist		2	SS	38		122				
			3	SS	35						
			4	SS	25		121				
			5	SS	28		120				0 8 34 58
			6	SS	20		119				
			7	SS	17		118				
			8	SS	36		117				0 17 50 33
							116				
							115				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-09 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.5 E 327 525.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.19 - 2012.09.20 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page						114				
			9	SS	32		113		○		
111.9							112				
12.2	Sandy **SILT**, trace gravel, some clay Dense to Very Dense Brown to Grey Moist		10	SS	35		111		○		
			11	SS	55		110		○		2 21 63 14
109.3											
14.8	Silty **CLAY**, trace gravel Hard Brown to Grey Moist		12	SS	40		109		○		
			13	SS	81		108				
							107		○		
			14	SS	95		106		⊢●		0 0 70 30
							105				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-09 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.5 E 327 525.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.19 - 2012.09.20 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace gravel Hard Grey Moist		15	SS	54		104		○		
							103				
							102				
			16	SS	135		101		○		
							100				
							99				
							98				
97.0	Auger refusal at 27.0m										
27.0	**SHALE**, fresh, lfine grained, thinly bedded, reddish brown, occasional limestone interbeds Rubble zone (25mm thick) at 27.0m Limestone interbed (25mm) at 27.2 and 27.5m		1	RUN			97			FI 2 3 7	RUN #1 TCR=97% SCR=90% RQD=50% UCS=22MPa (Average)
	Limestone interbed (50mm) at 28.1m Limestone interbed (25mm) at 28.3m						96			2 5	
	Limestone interbed (50mm) at 28.7m		2	RUN			95			1 7 0 2 1	RUN #2 TCR=95% SCR=92% RQD=63% UCS=21MPa (Average)
	Rubble zone (25mm thick) at 29.9m										

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-09 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.5 E 327 525.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.19 - 2012.09.20 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
94.0	Continued From Previous Page						94				
30.1	END OF BOREHOLE AT 30.1m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.6m, SAND TO 0.3m, CONCRETE TO 0.1m AND ASPHALT COLD PATCH TO SURFACE.										

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-10 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 226.7 E 327 537.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.05 - 2012.10.09 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
123.9											
0.0	**ASPHALT:**(210mm)										
0.2	Gravelly **SAND** Compact Brown Wet (FILL)		1	SS	15		123				
122.6											
1.3 / 122.4	Clayey **SILT**, some sand Stiff Brown (FILL)		2	SS	27		122				
1.5	Silty **CLAY**, trace sand, trace gravel Very Stiff Brown Moist		3	SS	23						2 8 39 51
			4	SS	21		121				
			5	SS	28		120				
			6	SS	22		119				
			7	SS	22		118				0 8 44 48
			8	SS	23		117				
114.0							116				
							115				
							114				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-10 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 226.7 E 327 537.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.05 - 2012.10.09 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
9.9	Sandy **SILT**, some clay, trace gravel Dense Brown Moist (TILL)										
			9	SS	48	▽	113		○		
	Sand and gravel seam (100mm) at 11.1m										
							112				
			10	SS	34				○		
	Reddish Brown						111				
			11	SS	41		110		○		
			12	SS	47		109		○⊢		2 21 62 15
							108				
			13	SS	49		107		○		
106.1											
17.8	Silty **CLAY**, trace gravel Hard Brown Moist						106				
			14	SS	66		105		⊢		0 0 61 39
							104				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 5/1/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-10 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 226.7 E 327 537.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.05 - 2012.10.09 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Continued From Previous Page										
102.6							103				
21.4	**SAND**, some silt, occasional shale fragments Very Dense Reddish Brown Moist		15	SS	110/ 0.250		102		o		
99.6							101				
24.4	**SHALE**, weathered, occasional limestone fragments Reddish Brown		16	SS	100/ 0.150		100		o		
99.1											
24.9	END OF BOREHOLE AT 24.9m UPON AUGER REFUSAL. WATER LEVEL AT 10.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 6.1m, CUTTINGS AND HOLEPLUG TO 1.2m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\oplus^{20}_{15\ 10\ 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-11 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 184.5 E 327 505.7 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.28 - 2012.11.30 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.2											
0.0 / 0.0	**TOPSOIL:** (50mm)										
	Sandy **SILT**, some clay, some gravel Brown Moist (FILL)		1	GS			131		○		
130.6 / 0.6	Silty **CLAY**, some sand, trace gravel Stiff to Firm Brown Moist (FILL)		1	SS	10		130		○		
			2	SS	7		129		○		
			3	SS	8		128		○		
			4	SS	8		127		○		
127.4 / 3.8	Very Stiff		5	SS	17		126		○		2 23 49 26
			6	SS	21		125		○		
125.5 / 5.6			7	SS	7		124		○		
124.0 / 7.2	Very Stiff Dark Grey to Brown		8	SS	19		123		○		
122.3 / 8.8	Silty **CLAY**, some sand, trace gravel Hard Brown Moist		9	SS	40		122		○		

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-11 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 184.5 E 327 505.7 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.28 - 2012.11.30 CHECKED BY LPG

SOIL PROFILE			SAMPLES									
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand Very Stiff Brown Moist						121				
			10	SS	23		120		○		0 0 38 62
			11	SS	23	▽	119		○		
			12	SS	18		118		○		
			13	SS	15		117		○		
			14	SS	11		116		○		0 5 40 55
113.3							115				
17.8	Silty **CLAY**, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		15	SS	18		114		○		3 21 52 24
							113				
							112				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-11 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 184.5 E 327 505.7 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.28 - 2012.11.30 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page						111				
							110				
			16	SS	45				○		
							109				
106.8							108				
24.4	**SILT**, trace sand, trace gravel Very Dense Grey Moist (TILL)		17	SS	79		107		○		
							106				
			18	SS	89		105		○		
104.2							104				
27.0	Gravelly **SAND** Very Dense Reddish Brown Wet		19	SS	64				○		
102.1							103				
29.0	Sandy **SILT**, trace gravel Very Dense Reddish Brown Moist (TILL)		20	SS	79		102		○		

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-11 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 184.5 E 327 505.7 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.28 - 2012.11.30 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Sandy **SILT**, trace gravel Very Dense Reddish Brown Moist (TILL)		21	SS	109/ 0.275		101		○		
			22	SS	105/ 0.175		100		○		
98.3							99				
32.9	**SHALE**, weathered Reddish Brown						98				
97.6			23	SS	100/ 0.075				○		
33.6	END OF BOREHOLE AT 33.6m. WATER LEVEL AT 12.5m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. Piezometer installed in adjacent shallow borehole. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Dec.10/12 8.4 122.8										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-12 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 198.4 E 327 517.7 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.6												
0.0	**ASPHALT:**(75mm)											
0.1 / 131.2	CONCRETE											
0.4	**SAND**, some gravel Compact Light Brown Moist (FILL)		1	SS	23		131		○			
			2	SS	18		130		○			
129.5												
2.1	**SAND**, medium grained, trace silt and clay, trace gravel Compact Light Brown Moist (FILL)		3	SS	13		129		○			3 82 15 (SI+CL)
			4	SS	12		128		○			
127.6												
4.0	**SAND**, with gravel, trace silt and clay Dense to Very Dense Light Brown Moist (FILL)		5	SS	43		127		○			
			6	SS	50/ 0.100				○			
			7	SS	50/ 0.100		126		○			
			8	SS	64		125		○			32 51 17 (SI+CL)
	Compact		9	SS	26				○			
124.0							124					
7.6	Silty **CLAY**, trace sand Very Stiff Mottled Light Brown to Grey Moist		10	SS	25					○		
122.9							123					
8.7	Hard		11	SS	35		122			○		

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-12 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 198.4 E 327 517.7 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand Very Stiff Grey Moist						121				
			12	SS	22						0 6 42 52
							120				
			13	SS	21		119				
			14	SS	20		118				0 2 41 57
							117				
			15	SS	29		116				
114.8							115				
16.8	Silty **CLAY**, some sand Hard Grey Moist (TILL)		16	SS	32						0 23 56 21
							114				
			17	SS	30		113				
							112				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-12 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 198.4 E 327 517.7 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand Hard Grey Moist (TILL)						111				
			18	SS	44		110		○		0 22 60 18
							109				
							108				
			19	SS	80		107		○		
							106				
							105				
			20	SS	52		104		○		
							103				
							102				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15-20-10-5 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-12 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 198.4 E 327 517.7 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.12 - 2012.11.14 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand Hard Grey Moist (TILL)		21	SS	50/ 0.100		101 100		o		
99.6											
32.0	END OF BOREHOLE AT 32.0m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 1.2m, THEN CONCRETE TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-13 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 212.8 E 327 535.7 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.24 - 2012.09.24 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.2											
0.0	**TOPSOIL:** (100mm)										
0.1	Silty **CLAY**, trace to some sand, trace gravel, occasional shale fragments Very Stiff Brown Moist		1	SS	8		124				
			2	SS	27						
							123				
			3	SS	27						
	Greyish Brown						122				
			4	SS	23						0 4 40 56
			5	SS	15		121				
120.1											
4.1	Stiff						120				
			6	SS	12						
							119				
	Grey		7	SS	12		118				
							117				
			8	SS	14						
115.6							116				
8.7	Silty **CLAY**, with sand, trace gravel Very Stiff Greyish Brown Moist (TILL)		9	SS	26		115				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-13 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 212.8 E 327 535.7 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.24 - 2012.09.24 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, with sand, trace gravel Very Stiff Greyish Brown Moist (TILL)						114				
			10	SS	25		113		○		3 24 47 26
			11	SS	22		112		○		
			12	SS	16		111		○		
109.5							110				
14.8	Silty **CLAY**, some sand Very Stiff to Hard Grey Moist		13	SS	28		109		○		
			14	SS	44		108		○		0 0 63 37
			15	SS	45		107		○		
							106				
							105				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-13 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 212.8 E 327 535.7 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.24 - 2012.09.24 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand Hard Grey Moist		16	SS	60		104		○		0 14 72 14
							103				
							102				
			17	SS	107		101		○		
							100				
98.3							99				
25.9	END OF BOREHOLE AT 25.9m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.		18	SS	50/ 0.025				○		

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Oct.02/12	11.8	112.4
Oct.04/12	11.8	112.4
Oct.09/12	11.8	112.4

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \oplus^{20}_{10} 5$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-14 1 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 191.5 E 327 517.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.11 - 2012.11.11 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.7											
0.0 / 0.1 / 131.3	**ASPHALT:**(75mm)										
0.4	**CONCRETE:**(250mm)										
	SAND, with gravel Dense to Loose Medium Brown Moist (FILL)		1	SS	37		131		○		
			2	SS	19		130		○		
			3	SS	6		129		○ ○		
128.6											
3.0	Silty **SAND**, trace clay Loose Reddish Brown Moist		4	SS	6		128		○		
127.9	(FILL)										
3.8	Silty **CLAY**, some to trace sand Very Stiff Light Brown Moist (FILL)		5	SS	18		127		○		0 20 51 29
			6	SS	23		126		○		
			7	SS	14		125		○		
	Firm		8	SS	5		124		○		
			9	SS	7		123		○		
124.2											
7.5	Silty **CLAY**, some to trace sand Stiff Light Brown Moist		10	SS	13		122		○		0 5 52 43
123.0											
8.7	Hard		11	SS	34				○		

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-NB-14 2 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 191.5 E 327 517.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.11 - 2012.11.11 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand Very Stiff Grey Moist						121				
120.4			12	SS	23				w_P w w_L		0 0 40 60
11.3	**END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.6m, CONCRETE TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.**										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-01 1 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 263.2 E 327 492.0 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.16 - 2012.11.16 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.0							130				
0.0	**ASPHALT:**(150mm)										
0.2 / 129.6	**CONCRETE:**(300mm)										
0.5 / 129.2	**SAND**, some gravel, trace silt Very Dense Brown		1	SS	100/ 0.075				○ ○		
0.9 / 128.8	Moist (FILL)						129				
1.2	Clayey **SILT**, some sand Hard Brown Moist (FILL) Concrete layer (225mm) at 1.0m		2	SS	43				○		13 48 39 (SI+CL)
127.8 / 2.3	**SAND**, some gravel, some silt, trace clay, occasional cobbles Dense Brown Moist (FILL)		3	SS	17		128		○		
	SAND, some gravel, trace silt Compact Brown Moist (FILL)		4	SS	20				○		
	Occasional cobbles		5	SS	13		127		○		
			6	SS	14				○		
							126				
			7	SS	19				○		
122.9 / 7.2	Silty **CLAY**, trace sand, trace gravel Very Stiff to Hard Brown Moist						125				
			8	SS	15						
							124				
			9	SS	63				○		
							123				
							122				
							121				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-01 2 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 263.2 E 327 492.0 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.16 - 2012.11.16 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Continued From Previous Page						120				
118.8			10	SS	32		119		○		0 5 41 54
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 7.6m, CUTTINGS AND HOLEPLUG TO 2.4m, CONCRETE TO 0.15m, THEN ASPHALT COLD PATCH TO SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-02 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 234.4 E 327 472.6 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.05 - 2012.09.05 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
123.8											
0.0 / 123.5	**TOPSOIL**		1	SS	9						
0.3	**SAND**, trace gravel Loose Brown to Reddish Brown Moist		2	SS	7		123				
122.5											
1.3	Silty **CLAY**, trace sand Very Stiff to Stiff Brown Moist		3	SS	19		122				
			4	SS	17		121				
			5	SS	13						0 2 52 46
							120				
	Grey		6	SS	11		119				
118.1											
5.6	Firm		7	SS	6		118				0 9 46 45
							117				
			8	SS	6		116				
							115				
			9	SS	8						
							114				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-02 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 234.4 E 327 472.6 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.05 - 2012.09.05 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
113.6											
10.2	Silty **CLAY**, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL) Continued From Previous Page										
			10	SS	25		113		○		
							112				
			11	SS	18				○		4 27 45 24
							111				
			12	SS	31		110		○		
							109				
			13	SS	36				○		2 22 53 23
							108				
			14	SS	64		107		○		
	Occasional cobbles						106				
104.9			15	SS	28		105		○ ○		
18.9	Sandy **SILT**, some clay, trace gravel Dense to Very Dense Grey Moist (TILL)		16	SS	38		104		○		

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-02 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 234.4 E 327 472.6 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.05 - 2012.09.05 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Sandy **SILT**, some clay, trace gravel Very Dense Grey Moist (TILL)		17	SS	50		103		○		
			18	SS	67		102		○		2 21 62 15
			19	SS	50/ 0.075		101		○		
98.7			20	SS	50/ 0.050		99		○		
25.0	END OF BOREHOLE AT 25.0m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Sep.17/12 10.5 113.3 Sep.18/12 10.5 113.3 Sep.25/12 10.7 113.1										

+ ³, × ³: Numbers refer to Sensitivity

15 (20/10) 5 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-03 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 248.5 E 327 492.0 ORIGINATED BY KMY/ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.15 - 2012.11.19 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.4											
0.0	**ASPHALT:**(150mm)										
0.2 / 130.0	**CONCRETE**										
0.5	**SAND**, some gravel Compact Brown Moist (FILL)		1	SS	10		130				
			2	SS	10		129				
128.1											
2.3	Clayey **SILT**, some sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)		3	SS	15		128				
			4	SS	8		127				
			5	SS	12						
			6	SS	21		126				
124.9											
5.5	Sand Seams		7	SS	16		125				0 86 14 (SI+CL)
124.5											
5.9			8	SS	19		124				
			9	SS	5		123				
121.3							122				
9.1	Silty **CLAY**, trace sand Very Stiff to Hard Brown Moist		10	SS	44		121				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-03 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 248.5 E 327 492.0 ORIGINATED BY KMY/ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.15 - 2012.11.19 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page											
	Silty **CLAY**, trace sand Very Stiff to Hard Brown Moist						120					
			11	SS	35					○		0 2 31 67
							119					
			12	SS	26		118			○		
							117					
			13	SS	19					⊢○⊣		0 0 41 59
115.2							116					
15.2	Silty **CLAY**, some sand, trace gravel Stiff to Hard Brown to Reddish Brown Moist (TILL)		14	SS	11		115			○		
							114					
			15	SS	38					⊣○⊢		3 17 51 29
							113					
	Sand layer (200 mm)		16	SS	39		112			○		4 23 50 23
							111					

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-03 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 248.5 E 327 492.0 ORIGINATED BY KMY/ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.15 - 2012.11.19 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page					▽	110				
							109				
			17	SS	43				o		
							108				
							107				
106.0											
24.4 / 105.7	Gravelly **SAND** Very Dense Reddish Brown Moist		18	SS	101/ 0.200		106		o o		
24.7	Clayey **SILT**, some sand, trace gravel, occasional cobbles Hard Reddish Brown						105				
104.8 / 25.6	Sandy **SILT**, trace gravel Very Dense Reddish Brown Moist		19	SS	106/ 0.225				o		
							104				
102.7			20	SS	105/ 0.275		103		o		
27.7	END OF BOREHOLE AT 27.7m. BOREHOLE OPEN AND WATER LEVEL AT 20.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 7.6m, BENTONITE HOLEPLUG TO 0.6m, CONCRETE TO 0.2m THEN ASPHALT TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \oplus {}^{20}_{10} 5$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-04 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 254.2 E 327 502.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.05 - 2012.12.07 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.2									
0.0 / 0.1	**TOPSOIL:** (75mm)								
	Clayey **SILT**, some sand, trace gravel, occasional cobbles, mixed with roots and rootlets Stiff Dark Brown (FILL)		1	SS	12		130		
128.6							129		
1.5	Clayey **SILT**, some sand, trace gravel Stiff Grey (FILL)		2	SS	12		128		
	Brown/Grey to Brown		3	SS	9		127		
			4	SS	15		126		
			5	SS	14		125		
122.5							124		
7.6	Silty **CLAY**, trace sand Stiff to Very Stiff Mottled Brown/Grey Moist		6	SS	14		123		0 3 43 54
			7	SS	30		122		
							121		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-04 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 254.2 E 327 502.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.05 - 2012.12.07 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace sand Stiff to Very Stiff Mottled Brown/Grey Moist						120				
			8	SS	24		119		○		
			9	SS	14		118		●		0 5 42 53
							117				
							116				
							115				
			10	SS	13				●		0 0 43 57
							114				
							113				
111.9							112				
18.3	Clayey **SILT**, some sand, trace gravel Very Stiff Mottled Brown/Grey Moist (TILL)		11	SS	28				○		
							111				
110.2											

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-04 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 254.2 E 327 502.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.05 - 2012.12.07 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
20.0	Silty **CLAY**, some sand, trace gravel Hard Mottled Brown/Grey Moist (TILL)						110				
							109				
			12	SS	44				○		5 22 55 18
							108				
							107				
105.8							106				
24.4	Sandy **GRAVEL** Very Dense Reddish Brown		13	SS	57				○		
105.3	Wet								○		
24.9	Silty **CLAY**, some sand, trace gravel Hard Reddish Brown (TILL)						105				
							104				
							103		○		
			14	SS	107/ 0.275						
101.5							102				
28.7	Sandy **SILT**, trace gravel Very Dense Reddish Brown Moist (TILL)										
			15	SS	106		101		○		

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-04 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 254.2 E 327 502.8 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.12.05 - 2012.12.07 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
99.3			16	SS	106/ 0.250		100		○ ○		
99.9 30.9	**SHALE**, weathered, occasional limestone fragments Moist										
	END OF BOREHOLE AT 30.9m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.										
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Dec.10/12 8.3 121.9										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15\text{-}\frac{20}{10}\text{-}5$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-05 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 215.3 E 327 475.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.11 - 2012.09.11 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.2												
0.0 / 123.9	**ASPHALT:**(250mm)						124					
0.3 / 123.2	**SAND**, some gravel Reddish Brown Moist (FILL)											
0.9	Silty **CLAY** Stiff to Very Stiff Mottled Brown/Grey Moist		1	SS	5		123					
			2	SS	17		122					
			3	SS	24							0 0 49 51
			4	SS	22		121					
			5	SS	18		120					
			6	SS	19		119					
			7	SS	16		118					
			8	SS	18		117					
							116					
							115					

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\oplus^{20}_{15\ 10\ 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-05 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 215.3 E 327 475.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.11 - 2012.09.11 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page						114				
			9	SS	26		113		o		
112.0											
12.2	Silty **CLAY**, some sand, trace gravel, occasional cobbles Very Stiff to Hard Grey (TILL)		10	SS	20		112		o		1 20 54 25
			11	SS	30		111		o		
			12	SS	33		110		o		
			13	SS	37		109		o		
			14	SS	48		108		o		
							107				
							106		d		0 11 62 27
							105				

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 (20/10) 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-05 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 215.3 E 327 475.4 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.11 - 2012.09.11 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page		15	SS	42		104	○	○		
102.8							103				
21.3	**SAND**, trace gravel, trace silt, trace clay Compact to Very Dense Grey						102				
			16	SS	14		101		○		4 80 16 (SI+CL)
							100				
							99				
			17	SS	50/ 0.100		98		○ ○		
97.8											
26.4	END OF BOREHOLE AT 26.4m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.										

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Sep.17/12	13.1	111.1
Sep.18/12	12.0	112.2
Sep.25/12	11.9	112.3
Oct.09/12	11.8	112.4
Nov.16/12	7.0	117.2
Nov.20/12	6.9	117.3

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-06 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.2 E 327 485.6 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Tricone/NX Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.1											
0.0	**ASPHALT:**(150mm)		1	AS			124		○		
0.2	**SAND** and **GRAVEL** Reddish Brown Moist (FILL)										
123.2											
0.9	Silty **CLAY**, trace sand Stiff to Hard Grey to Brown Moist		1	SS	11		123		○		
			2	SS	15				○		
			3	SS	34		122		○		
			4	SS	23		121		○		0 4 38 58
			5	SS	18		120		○		
			6	SS	20		119		○		
			7	SS	15		118		○		
			8	SS	22		117		○		
							116				
							115				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\oplus} 5$ $_{10}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-06 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.2 E 327 485.6 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Tricone/NX Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
113.9							114				
10.2	Silty **CLAY**, some sand, trace gravel Hard Brown Moist (TILL) Continued From Previous Page		9	SS	38		113		○		
			10	SS	22		112		○		
110.9							111				
13.3	Very Stiff		11	SS	41		110		○		4 23 52 21
109.3											
14.8			12	SS	74		109		○		
			13	SS	69		108				
							107		○		
			14	SS	80		106				
104.8							105		○		
19.4	Silty **CLAY**, trace gravel Hard Brown Moist										

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-06 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.2 E 327 485.6 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Tricone/NX Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page		15	SS	64		104		○		0 4 62 34
101.9							103				
22.3	**SAND**, trace silt, trace clay, pooly graded Very Dense Brown Moist to Wet		16	SS	140		102				
							101		○		0 86 14 (SI+CL)
							100				
							99				
			17	SS	100/ 0.075		98				
97.2											Fl
27.0	**SHALE**, fresh, fine grained, thinly bedded, horizontal joints, reddish brown, occasional grey limestone interbeds Limestone interbed (25mm) at 27.3m Rubble zone (125mm thick) at 27.0m Rubble zone (50mm thick) at 28.2m, 28.4m Limestone interbed (100mm) at 29.0m		1	RUN			97				1 RUN #1 TCR=100% SCR=82% RQD=52% UCS=7MPa (Average)
							96				3 4 3 2
			2	RUN			95				0 RUN #2 TCR=100% SCR=91% RQD=74% UCS=19MPa (Average) 3 0 2
94.3											2
29.9											

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-06 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 220.2 E 327 485.6 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Tricone/NX Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.17 - 2012.09.17 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	END OF BOREHOLE AT 29.9m. BOREHOLE CAVED TO 13.4m, THEN BACKFILLED WITH BENTONITE HOLEPLUG TO 1.5m, SAND TO 0.6m, CONCRETE TO 0.1m, THEN ASPHALT COLD PATCH TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\oplus^{20}_{15\ 10\ 5}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-07 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 228.3 E 327 501.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.05 - 2012.09.05 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.1											
0.0	**ASPHALT:**(125mm)						124				
0.1	**SAND** and **GRAVEL** Loose Reddish Brown Moist (FILL)		1	SS	6		123		○		
122.9											
1.2	Silty **CLAY,** trace sand, trace gravel Very Stiff Reddish Brown Moist		2	SS	19		122		○		
			3	SS	30				○		
			4	SS	23		121		○		
			5	SS	18		120		⊢○⊣		0 9 35 56
	Grey					▽	119				
			6	SS	15		118		○		
			7	SS	21		117		○		
							116				
	Brown		8	SS	27		115		○⊣		2 12 36 50

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-07 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 228.3 E 327 501.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.05 - 2012.09.05 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
113.9							114				
10.2	Hard										
	Occasional gravel layers		9	SS	72		113		○		
112.4											
11.7			10	SS	22		112		○		
110.8							111				
13.3	Silty **CLAY**, some sand, trace gravel Hard Brown Moist (TILL)		11	SS	33		110		○		5 27 48 20
			12	SS	72		109		○		
			13	SS	65		108		○		
			14	SS	51		107		○		
104.8							106				
19.4	Silty **CLAY**, trace sand Hard Grey Moist						105				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-07 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 228.3 E 327 501.1 ORIGINATED BY RK

HWY 406 BOREHOLE TYPE Hollow Stem Augers/Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.05 - 2012.09.05 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page		15	SS	53		104		○		0 3 53 44
102.5							103				
21.6	**SAND**, coarse, some gravel Very Dense Reddish Brown Wet						102				
100.9			16	SS	100/ 0.225		101		○ ○		
23.2	Sandy **SILT**, trace clay Very Dense Reddish Brown Moist to Wet						100				
			17	SS	73				○		0 24 72 4
98.7			18	SS	50/ 0.0		99				
25.5	END OF BOREHOLE AT 25.5m UPON AUGER REFUSAL. WATER LEVEL AT 6.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 13.7m, BENTONITE HOLEPLUG AND CUTTINGS TO 1.5m, BENTONITE HOLEPLUG TO 0.3m, CONCRETE TO 0.1m, THEN ASPHALT COLD PATCH TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-08 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 194.3 E 327 475.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.03 - 2012.10.03 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.2											
0.0	**ASPHALT:**(200mm)						124				
0.2	**SAND**, some gravel, trace silt Compact Reddish Brown Moist (FILL)		1	SS	11				○		
122.9							123				
1.3	Silty **CLAY**, some sand Hard Brown (FILL)		2	SS	31				○		
121.9							122				
2.3	Silty **CLAY**, trace to some sand, trace gravel Hard to Very Stiff Brown Moist		3	SS	40				○		
			4	SS	28		121		⊖		0 11 44 45
			5	SS	25		120		○		
			6	SS	20		119		⊖		0 5 35 60
			7	SS	24		118		○		
115.5							117				
8.7	Silty **CLAY**, some sand, trace gravel Hard Brown Moist (TILL)		8	SS	31		116		○		1 20 52 27
							115				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-08 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 194.3 E 327 475.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.03 - 2012.10.03 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Hard Brown Moist (TILL) Occasional sand pockets		9	SS	50		114 113 112 111 110 109 108 107 106 105		○		
			10	SS	34				○		
			11	SS	77				○		4 24 55 17
			12	SS	54				○		
			13	SS	57				○		
			14	SS	61				○		

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-08 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 194.3 E 327 475.3 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.10.03 - 2012.10.03 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page						104				
102.7							103				
21.4	**SILT**, some sand Compact Grey Moist		15	SS	29		102		○		
99.8							101				
24.4	**SAND** and **GRAVEL**, trace silt, trace clay Very Dense Reddish Brown Wet		16	SS	105/ 0.200		100		○ ○		38 43 19 (SI+CL)
99.5 / 24.6	**SHALE**, weathered Reddish Brown						99				
98.7 / 25.4	END OF BOREHOLE AT 25.4m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.04/12 8.6 115.6 Oct.09/12 12.0 112.2 Nov.16/12 11.9 112.3 Nov.20/12 12.0 112.2										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-09 1 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 198.2 E 327 483.5 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.19 - 2012.09.19 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
124.2									
0.0 / 123.9	**ASPHALT:** (250mm)						124		
0.3 / 123.1	**SAND** and **GRAVEL**, asphalt pieces, oxidized stains, Compact, Brown/Grey, (FILL)		1	SS	10	▽	123		
1.1	Silty **CLAY**, trace sand, Stiff to Very Stiff, Reddish Brown		2	SS	11		122		
	Brown/Grey		3	SS	21		121		
			4	SS	14				0 5 37 58
			5	SS	16		120		
	Brown/Grey, Occasional cobbles		6	SS	18		119		
			7	SS	12		118		
115.5							117		
8.7	Silty **CLAY**, some sand, trace gravel, Very Stiff to Hard, Brown/Grey, Moist, (TILL)		8	SS	24		116		
							115		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 5/1/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-09 2 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 198.2 E 327 483.5 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.19 - 2012.09.19 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60	γ kN/m^3	GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Very Stiff to Hard Brown/Grey Moist (TILL)						114				
			9	SS	30		113		⊣●⊢		3 21 54 22
			10	SS	23		112		○		
			11	SS	37		111		○		
			12	SS	38		110 109		○⊣		4 22 53 21
			13	SS	48		108 107		○		
106.6											
17.5	END OF BOREHOLE AT 17.5m UPON AUGER REFUSAL. WATER LEVEL AT 1.2m UPON COMPLETION BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.5 m, THEN SAND TO 0.1m, THEN ASPHALT COLD PATCH TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\oplus} 5$ (10) (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-10 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 207.7 E 327 500.8 ORIGINATED BY RK/ES

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.21 - 2012.10.01 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
124.1						
0.0	**ASPHALT:**(150mm)					
0.2	**SAND** and **GRAVEL** Compact Brown Moist (FILL)		1	SS	11	
122.7						
1.4	Silty **CLAY**, some sand, trace gravel Stiff to Very Stiff Brown Moist		2	SS	12	
			3	SS	28	
121.1						
3.0	Hard		4	SS	34	
120.0						
4.1			5	SS	29	
			6	SS	29	
116.9						
7.2	Silty **CLAY**, some sand, trace gravel Hard Brown to Reddish Brown Moist (TILL)		7	SS	34	
			8	SS	39	

ELEVATION SCALE: 124, 123, 122, 121, 120, 119, 118, 117, 116, 115

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

15 (20) 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-10 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 207.7 E 327 500.8 ORIGINATED BY RK/ES

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.21 - 2012.10.01 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Hard Brown to Reddish Brown Moist (TILL)						114				
			9	SS	40		113		○		
							112				
			10	SS	39				○		
							111				
			11	SS	60		110		○		
							109				
			12	SS	137				○		
							108				
			13	SS	121		107		○		
105.8											
18.3 105.5	Sandy **GRAVEL**, some clay Very Dense						106		○		
18.6	Reddish Brown Moist		14	SS	72				○		
	SILT, some clay, trace sand Very Dense Moist						105				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-10 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 207.7 E 327 500.8 ORIGINATED BY RK/ES

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.21 - 2012.10.01 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SILT, some clay, trace sand Dense Moist						104				
							103				
			15	SS	53				○		0 1 85 14
							102				
99.7							101				
24.4	**GRAVEL**, some sand, some clay Dense Reddish Brown Moist		16	SS	37		100		○		
							99				
97.6							98		○		
26.5	**SHALE**, slighly weathered, fine grained, thinly bedded, reddish brown, occasional grey limestone and siltstone interbeds						97			FI >15 >10	RUN #1 TCR=96% SCR=60% RQD=60% UCS=26MPa (Average)
	Limestone interbed (25mm thick) at 28.2m, 28.3m, 28.4m		1	RUN			96			3 3	
	Siltstone interbed (25mm to 50mm thick at 28.3m, 29.1m, 29.8m									4 0	RUN #2 TCR=78% SCR=78% RQD=73% UCS=29MPa (Average)
	Limestone interbed (25mm to 50mm thick) at 28.9m, 29.8m, 30.0m		2	RUN			95			4 2	

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-10 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 207.7 E 327 500.8 ORIGINATED BY RK/ES

HWY 406 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2012.09.21 - 2012.10.01 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI CL
	Continued From Previous Page										
93.7							94			1	
30.4	END OF BOREHOLE AT 30.4m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.5m, BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 0.6m, SAND TO 0.1m, THEN ASPHALT COLD PATCH TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-11 1 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 175.2 E 327 469.0 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.20 - 2012.09.21 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT w_P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w_L	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60				GR SA SI CL
124.7													
0.0 / 0.1	**TOPSOIL:** (75mm)												
	Silty **CLAY**, rootlets Stiff Mottled Brown and Grey		1	SS	12								
124.0													
0.8	Silty **CLAY**, trace sand Very Stiff to Stiff Brown/Grey Moist		2	SS	27		124						
			3	SS	25		123						
			4	SS	23		122						
			5	SS	20								0 5 42 53
							121						
			6	SS	12		120						
							119						
			7	SS	12		118						
117.0													
7.8	Silty **CLAY**, some sand, trace gravel Stiff to Very Stiff Brown/Grey Moist (TILL)		8	SS	15		117						2 23 43 32
							116						
			9	SS	20								
							115						

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-11 2 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 175.2 E 327 469.0 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.20 - 2012.09.21 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Stiff to Very Stiff Brown/Grey Moist (TILL)										
			10	SS	21		114		○		
							113				
			11	SS	22	▼	112		○		
							111				
			12	SS	23				⊣○⊢		5 23 48 24
109.9							110				
14.8	Hard										
			13	SS	55		109		○		
							108				
			14	SS	49				○		4 23 51 22
106.9							107				
17.8	Silty **CLAY**, occasional sand layers Hard Grey Moist										
			15	SS	63		106		○		
							105				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-11 3 OF 3 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 175.2 E 327 469.0 ORIGINATED BY KMY

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.09.20 - 2012.09.21 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page		16	SS	60				○		0 0 70 30
101.7							104				
23.0	Sandy **SILT**, trace gravel Very Dense Grey Moist		17	SS	63		103				
							102		○		
98.8							101		○		
25.9	END OF BOREHOLE AT 25.9m UPON AUGER REFUSAL ON BEDROCK. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.		18	SS	20/ 0.0		100				
							99				

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Oct.02/12	12.5	112.2
Oct.04/12	12.4	112.3
Oct.09/12	12.4	112.3
Nov.16/12	12.5	112.2
Nov.20/12	12.5	112.2

$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-12 1 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 176.4 E 327 487.2 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.23 - 2012.11.27 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.4									
0.0	**ASPHALT:**(150mm)								
0.2	**SAND**, some gravel Dense to Compact Brown Moist (FILL)		1	SS	42		131		
	Clayey silt layers (200mm thick)		2	SS	12		130		
129.1									
2.3	Silty **CLAY**, some sand, trace gravel Firm Brown (FILL)		3	SS	8		129		
			4	SS	7		128		
			5	SS	9		127		
			6	SS	12				
126.1									
5.3	Very Stiff		7	SS	17		126		
125.3									
6.0			8	SS	11		125		
123.5									
7.9	Silty **CLAY**, some sand, trace gravel Very Stiff Brown		9	SS	27		124		0 10 42 48
	Occasional clay pockets		10	SS	30		123		
							122		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-12 2 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 176.4 E 327 487.2 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.23 - 2012.11.27 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Very Stiff Grey						121				
			11	SS	19						0 0 41 59
119.6							120				
11.7	Silty **CLAY**, some sand, trace gravel Very Stiff to Hard Reddish Brown (TILL)										
			12	SS	16		119				
			13	SS	15	▽	118				
			14	SS	23		117				
			15	SS	34		116				3 19 50 28
			16	SS	39		115				
							114				
							113				
							112				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-12 3 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 176.4 E 327 487.2 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.23 - 2012.11.27 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Very Stiff to Hard Reddish Brown (TILL)						111				
							110				
			17	SS	61				○		2 21 58 19
							109				
107.0											
							108				
24.4	**SILT**, some sand, occasional sand layers Very Dense Grey Moist		18	SS	103		107		○		
							106				
			19	SS	72		105		○		
							104				
			20	SS	103/0.250				○		
							103				
			21	SS	105/0.20				○ ○		
							102				

Continued Next Page

+ ³ , × ³ : Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-12 4 OF 4 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass N 4 777 176.4 E 327 487.2 ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.23 - 2012.11.27 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
							101				
100.7			22	SS	107/				○		
30.7	END OF BOREHOLE AT 30.7m. WATER LEVEL AT 14.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 22.9m, BENTONITE HOLEPLUG TO 0.5m, CONCRETE TO 0.2m THEN ASPHALT TO SURFACE.				0.175						

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-14 1 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.22 - 2012.11.22 CHECKED BY LPG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.4									
0.0	**ASPHALT**								
0.1	**SAND**, trace gravel Compact Brown Moist (FILL)		1	SS	14		131		
130.0							130		
1.4	Silty **CLAY**, some sand, trace gravel Firm to Stiff Brown (FILL)		2	SS	8				
			3	SS	9		129		
			4	SS	9		128		
			5	SS	7				
126.9							127		
4.5	Very Stiff Brown/Grey		6	SS	18				1 21 47 31
			7	SS	25		126		
			8	SS	21		125		
124.2									
7.2	Silty **CLAY**, trace sand, trace gravel Hard Brown		9	SS	53		124		0 0 37 63
							123		
	Very Stiff		10	SS	26		122		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No GD-SB-14 2 OF 2 METRIC

W.P. 2365-09-01 LOCATION Glendale Avenue Overpass ORIGINATED BY ES

HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2012.11.22 - 2012.11.22 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
							121				
120.1			11	SS	22				⊢○⊣		0 0 38 62
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 6.4m, BENTONITE HOLEPLUG TO 0.5m, CONCRETE TO 0.2m THEN ASPHALT TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

ONTMT4S 1221.GPJ 2012TEMPLATE(MTO).GDT 3/8/13

Appendix B

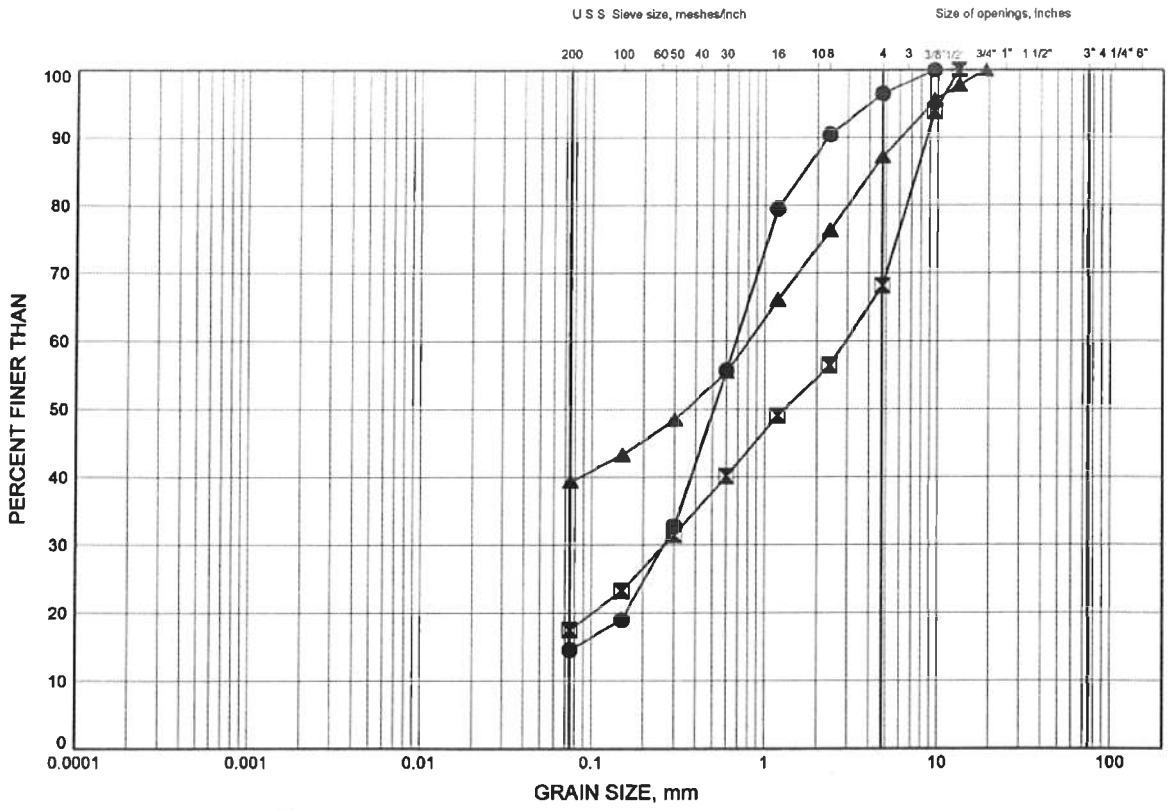
Laboratory Test Results

5 Bridges, Welland and St. Catharines

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)
●	GD-NB-12	2.44	129.16
⊠	GD-NB-12	6.40	125.20
▲	GD-SB-01	1.83	128.21

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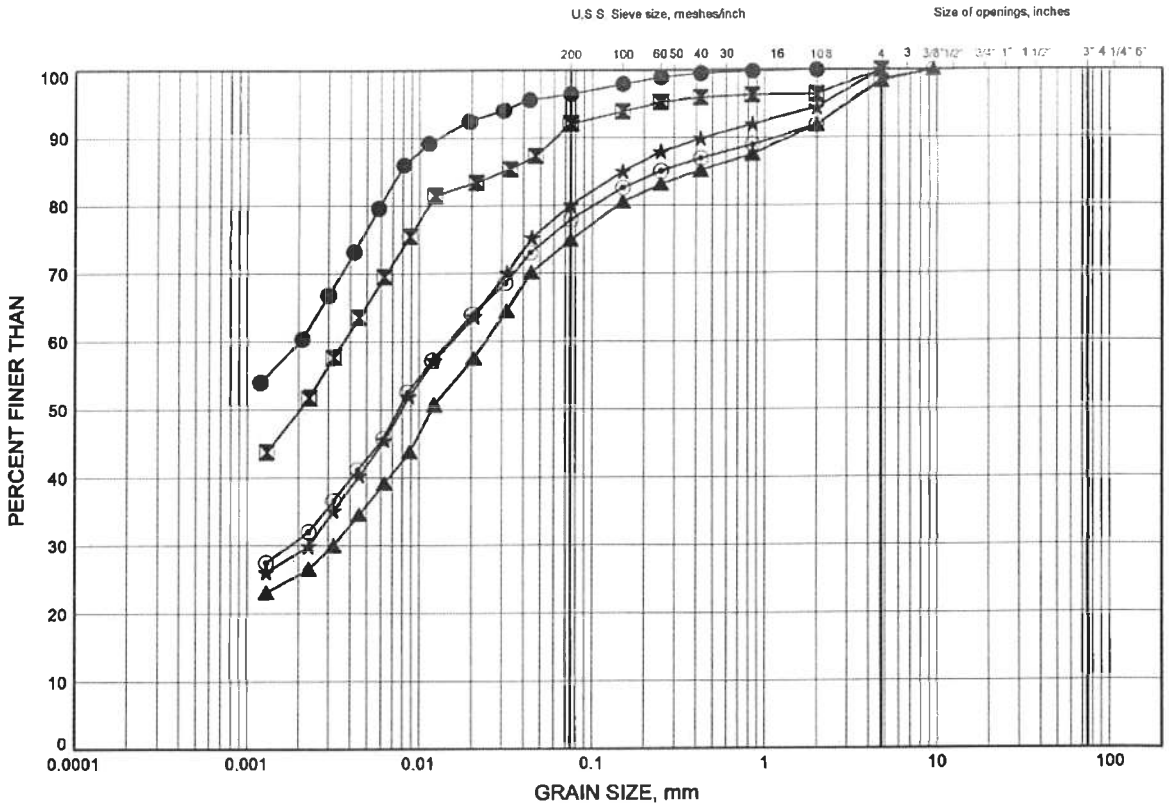
GRAIN SIZE DISTRIBUTION - THURBER 1221.GPJ 3/8/13

5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-03	4.88	125.89
⊠	GD-NB-08	1.83	122.26
▲	GD-NB-11	4.11	127.06
★	GD-NB-14	4.11	127.58
⊙	GD-SB-14	4.88	126.48

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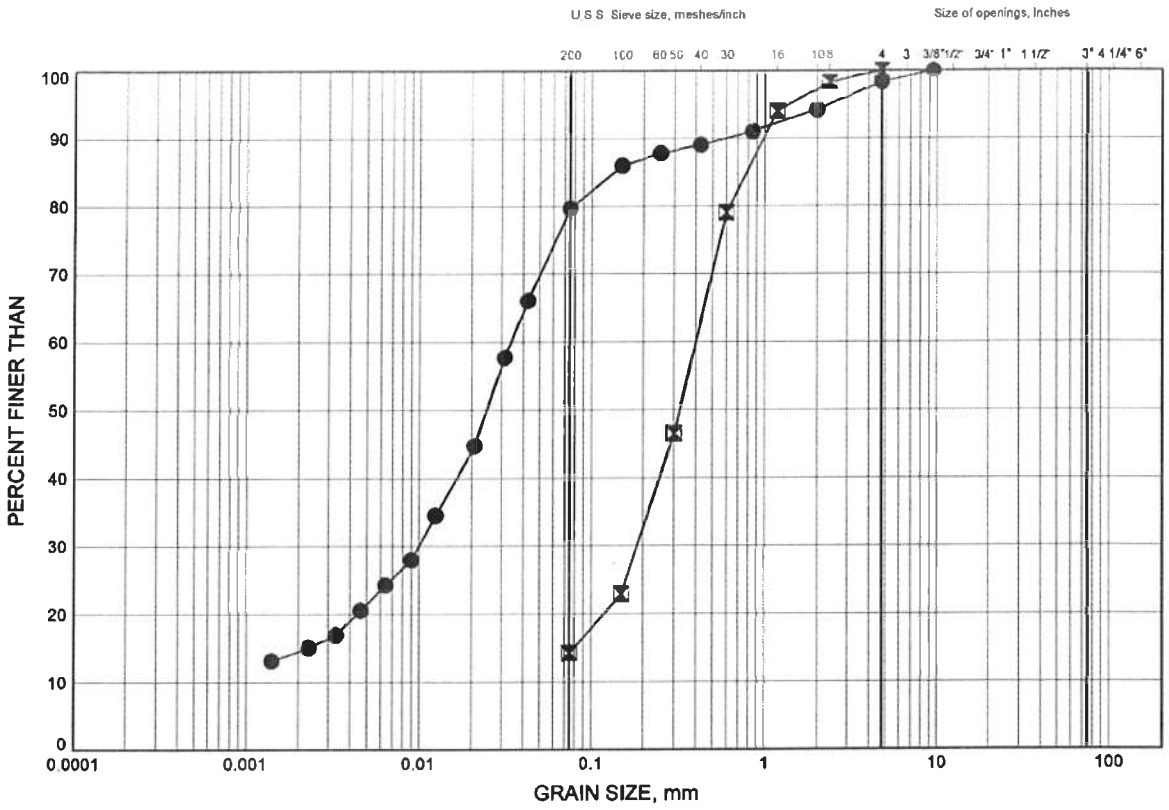
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B3

SANDY SILT TO SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-01	6.40	124.09
⊠	GD-SB-03	5.64	124.77

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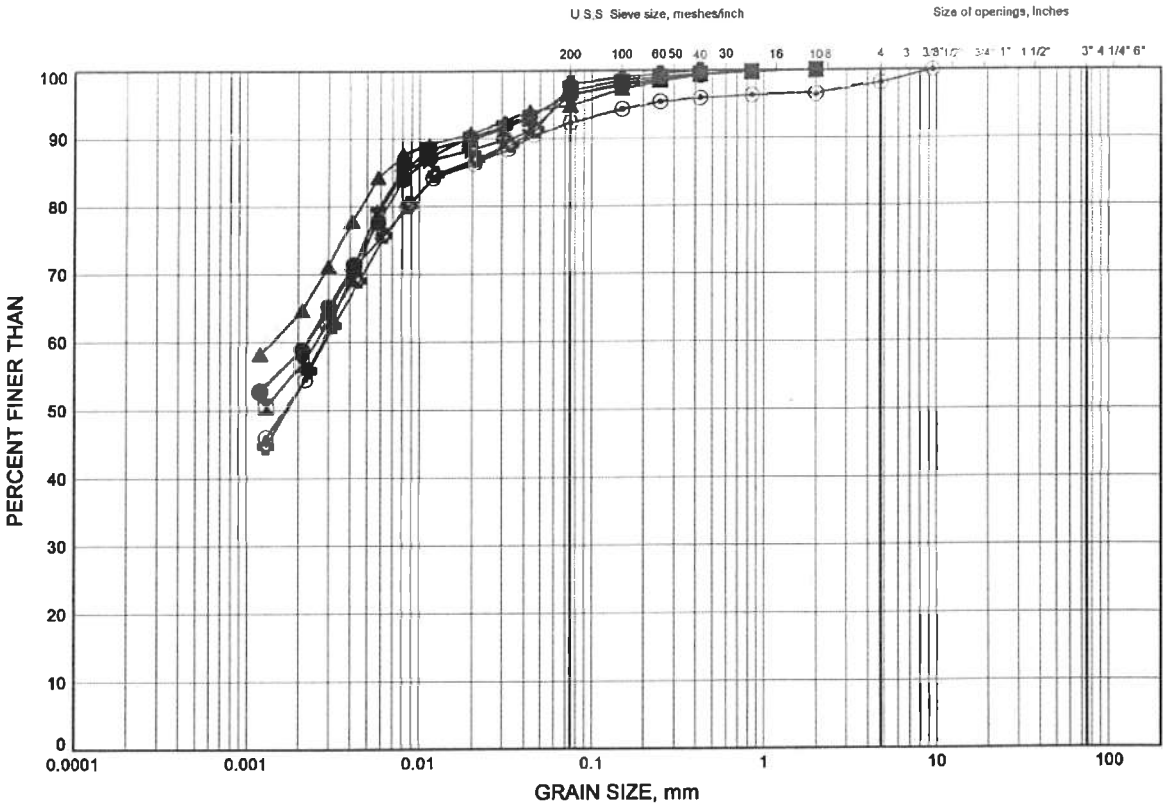
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B4

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-01	9.45	121.05
⊠	GD-NB-02	9.45	120.76
▲	GD-NB-03	10.97	119.80
★	GD-NB-03	14.02	116.75
⊙	GD-NB-04	1.83	121.50
✿	GD-NB-04	4.11	119.21

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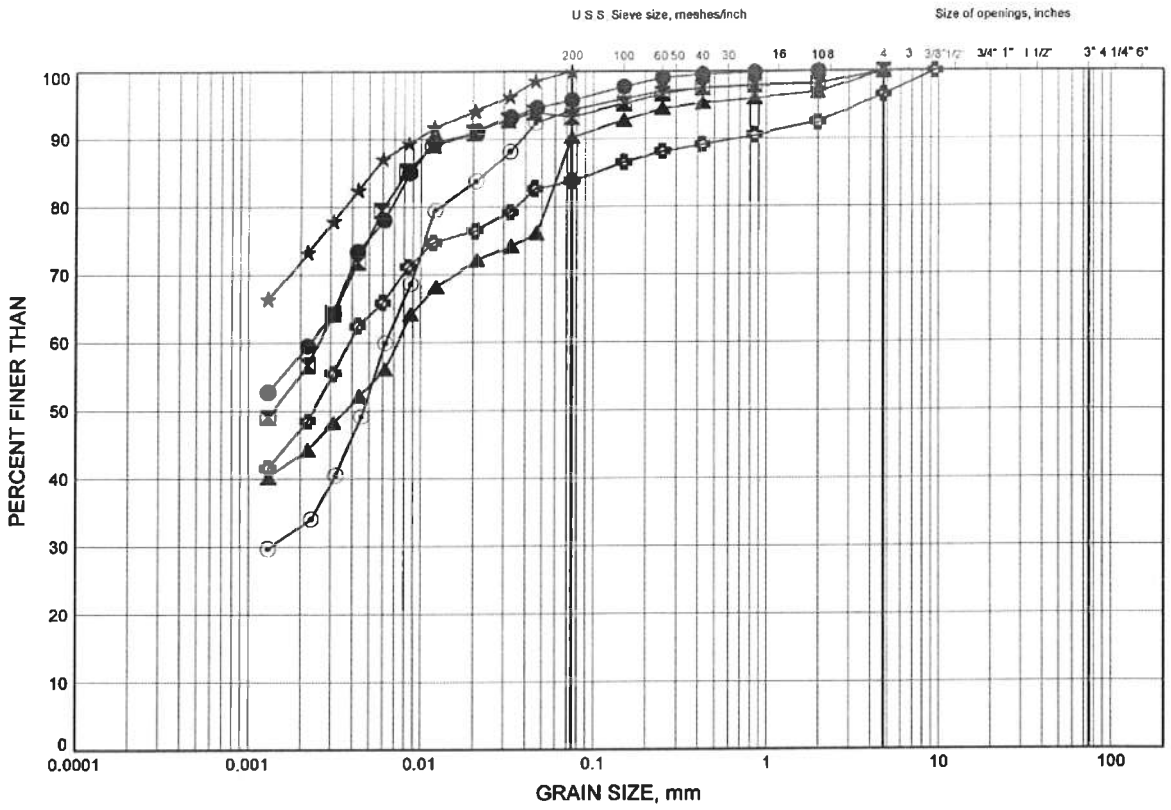
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B5

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-05	3.35	120.71
⊠	GD-NB-06	3.35	120.62
▲	GD-NB-06	7.92	116.05
★	GD-NB-07	4.88	119.08
⊙	GD-NB-07	17.07	106.88
✿	GD-NB-08	6.40	117.69

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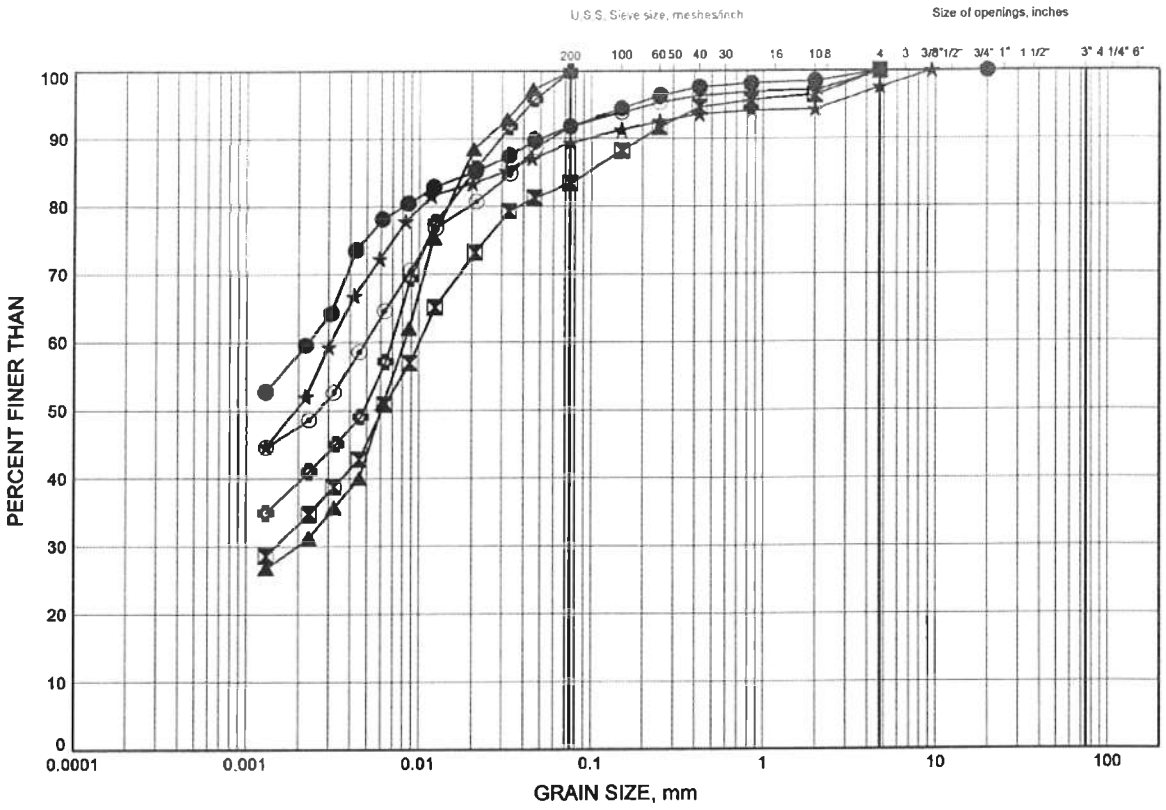
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B6

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-09	4.88	119.17
⊠	GD-NB-09	9.45	114.60
▲	GD-NB-09	18.59	105.45
★	GD-NB-10	2.59	121.35
⊙	GD-NB-10	7.92	116.02
✿	GD-NB-10	18.59	105.35

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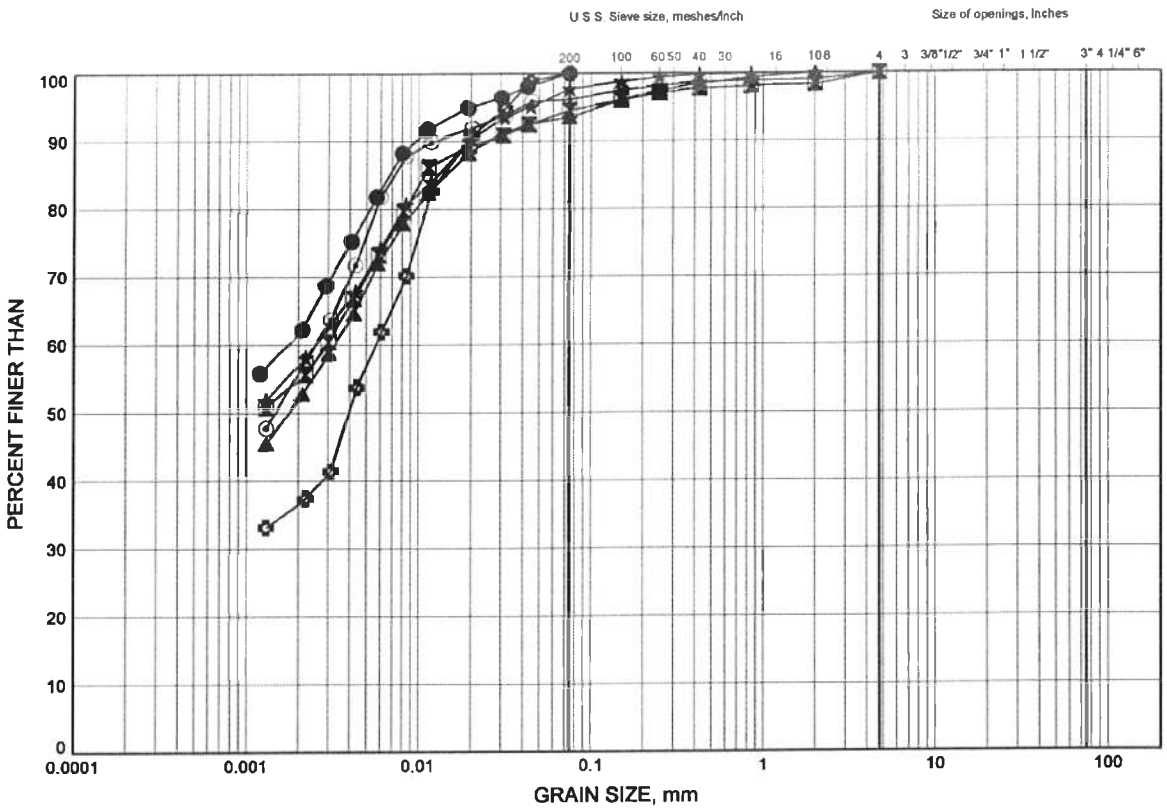
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B7

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-11	10.97	120.20
⊠	GD-NB-11	17.07	114.10
▲	GD-NB-12	10.97	120.63
★	GD-NB-12	14.02	117.58
⊙	GD-NB-13	2.59	121.65
✿	GD-NB-13	17.07	107.17

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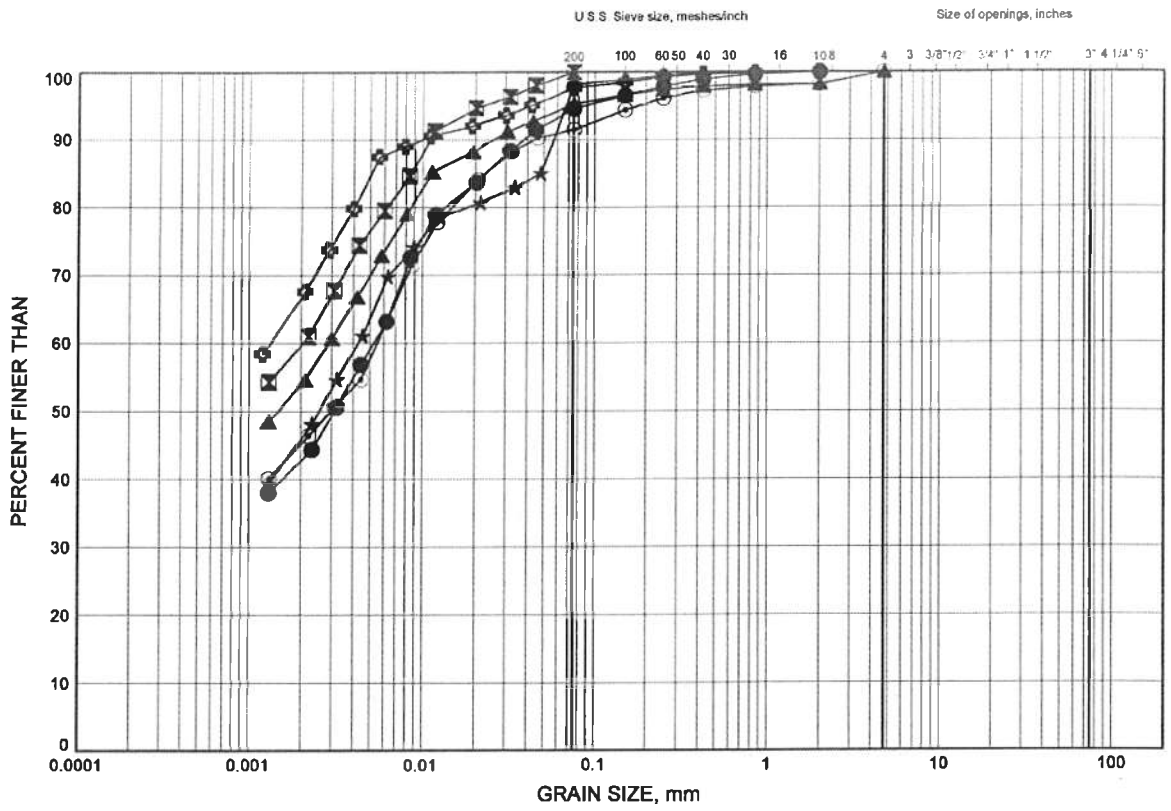
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B8

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-14	7.92	123.77
⊠	GD-NB-14	10.97	120.72
▲	GD-SB-01	10.97	119.06
★	GD-SB-02	3.35	120.41
⊙	GD-SB-02	6.40	117.36
✿	GD-SB-03	10.97	119.44

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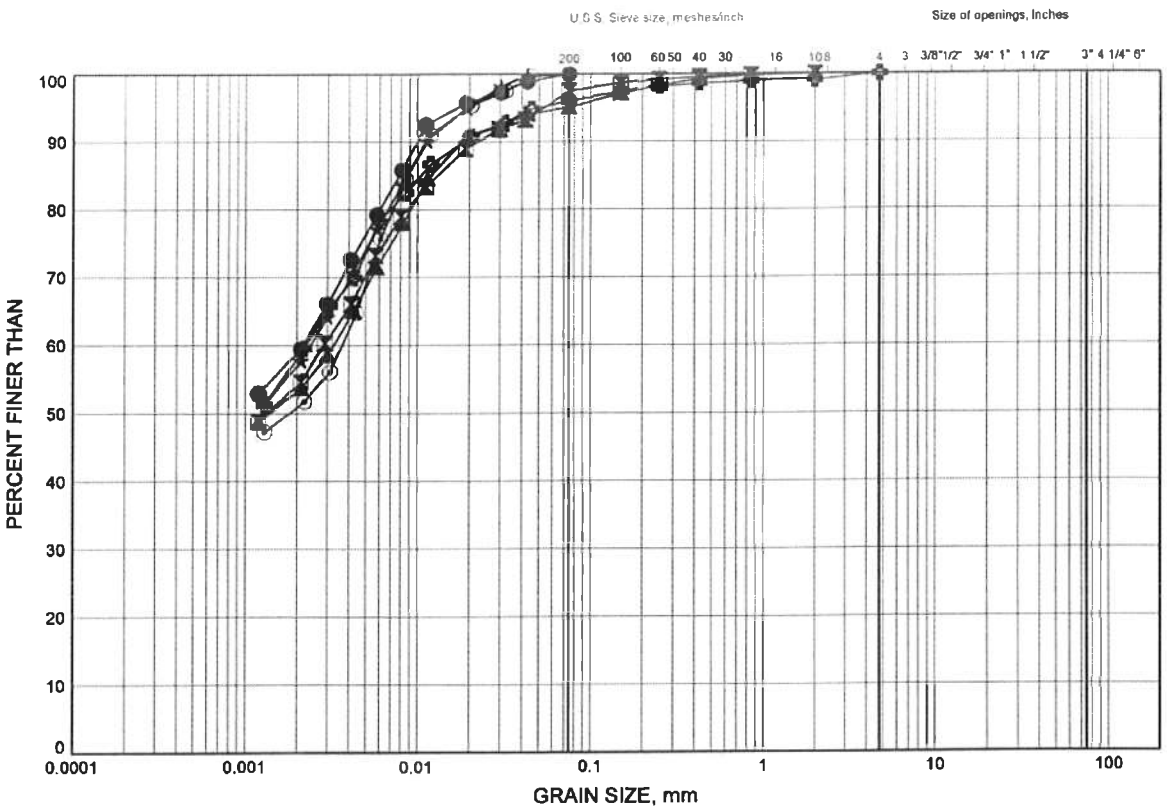
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B9

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-03	14.02	116.39
⊠	GD-SB-04	7.92	122.23
▲	GD-SB-04	12.50	117.66
★	GD-SB-04	15.54	114.61
⊙	GD-SB-05	2.59	121.57
✿	GD-SB-06	3.35	120.77

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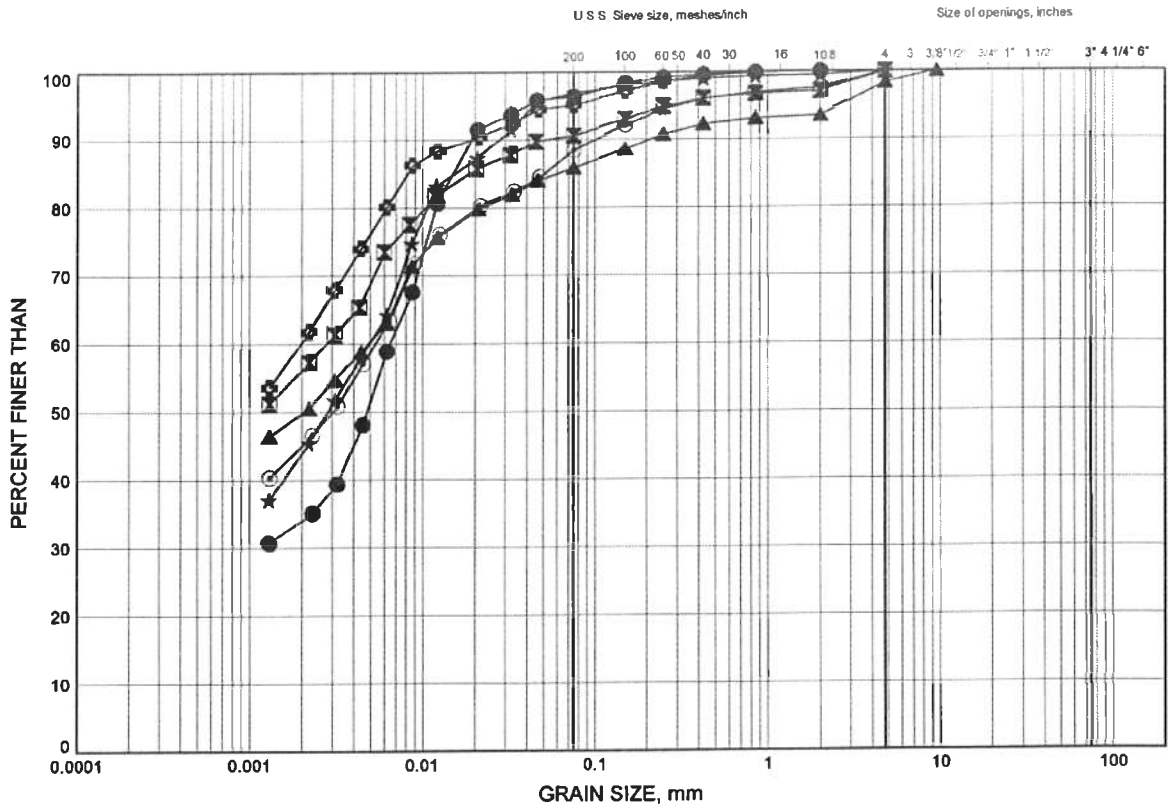
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B10

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-06	20.12	104.01
⊠	GD-SB-07	4.88	119.23
▲	GD-SB-07	9.45	114.66
★	GD-SB-07	20.12	103.99
⊙	GD-SB-08	3.35	120.82
✿	GD-SB-08	6.40	117.77

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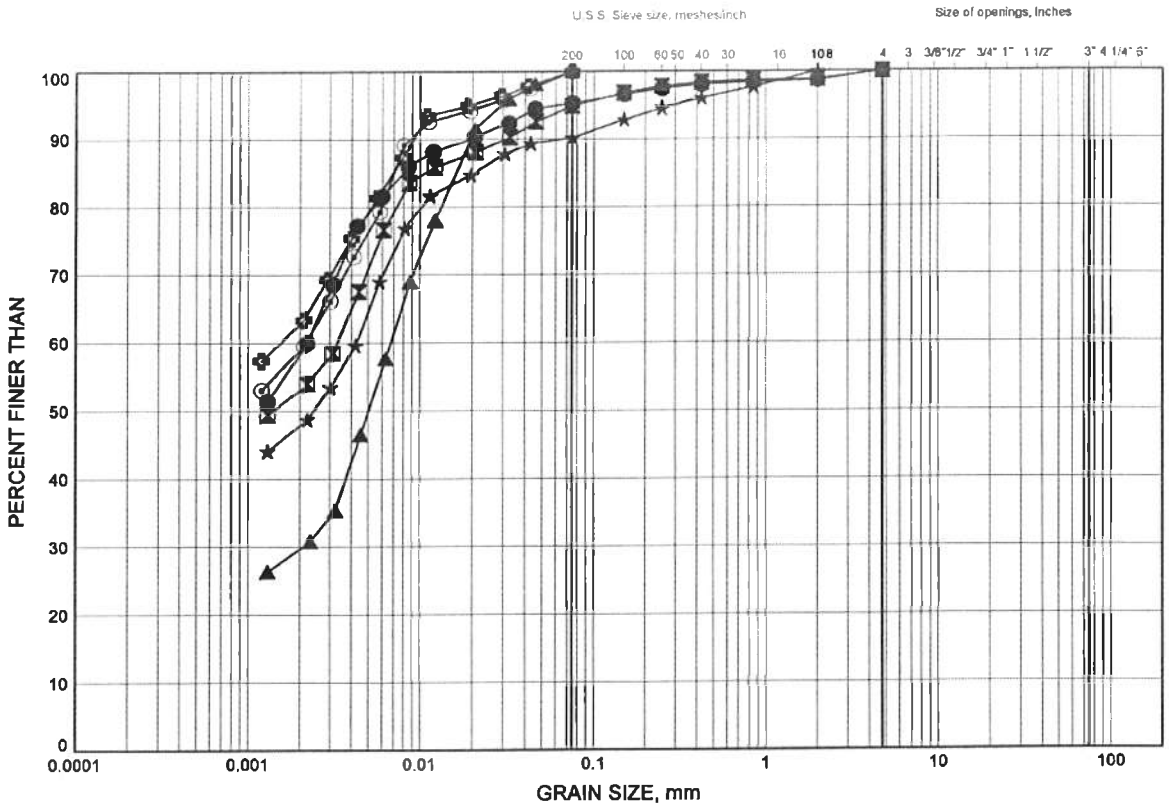
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B11

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-09	3.35	120.80
⊠	GD-SB-11	3.35	121.37
▲	GD-SB-11	20.12	104.61
★	GD-SB-12	7.92	123.43
⊙	GD-SB-12	10.97	120.38
✿	GD-SB-14	7.92	123.43

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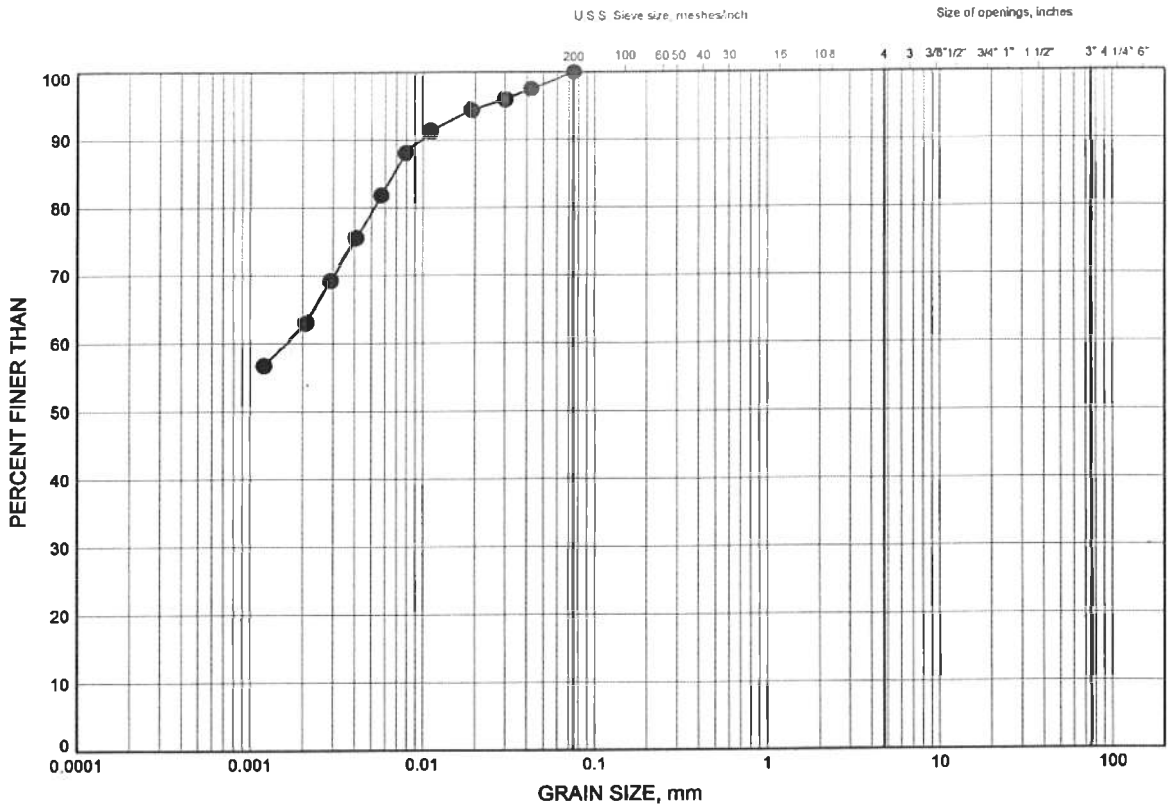
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B12

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-14	10.97	120.38

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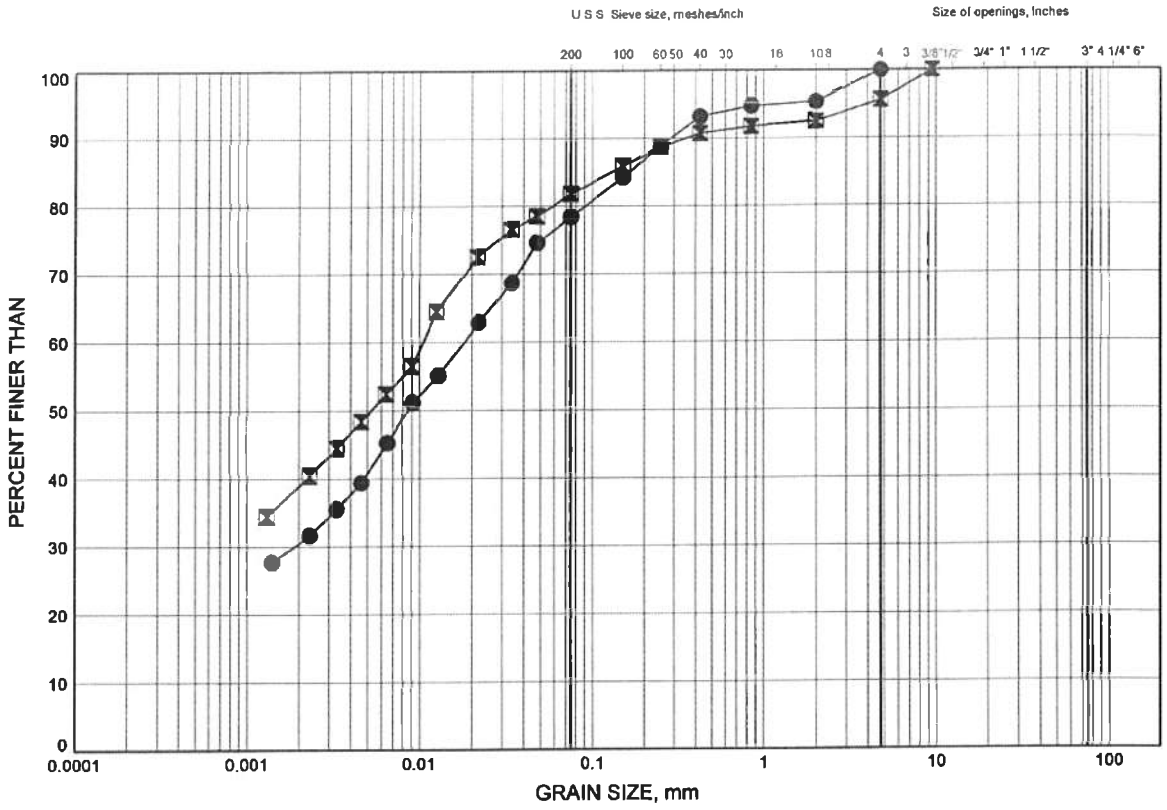
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B13

SILTY CLAY, Some Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-04	9.45	113.88
⧓	GD-NB-05	7.92	116.13

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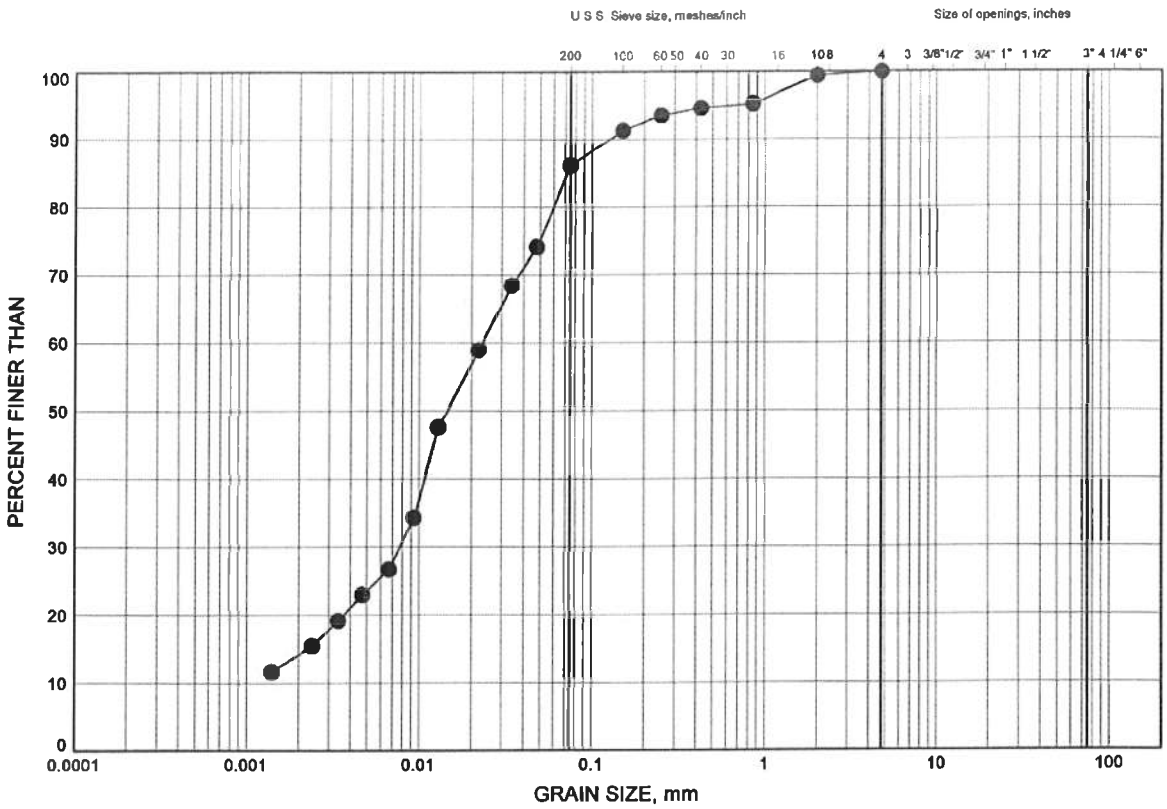
GRAIN SIZE DISTRIBUTION - THURBER 1221.GPJ 3/6/13

5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B14

SILTY CLAY, Trace Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-13	20.12	104.12

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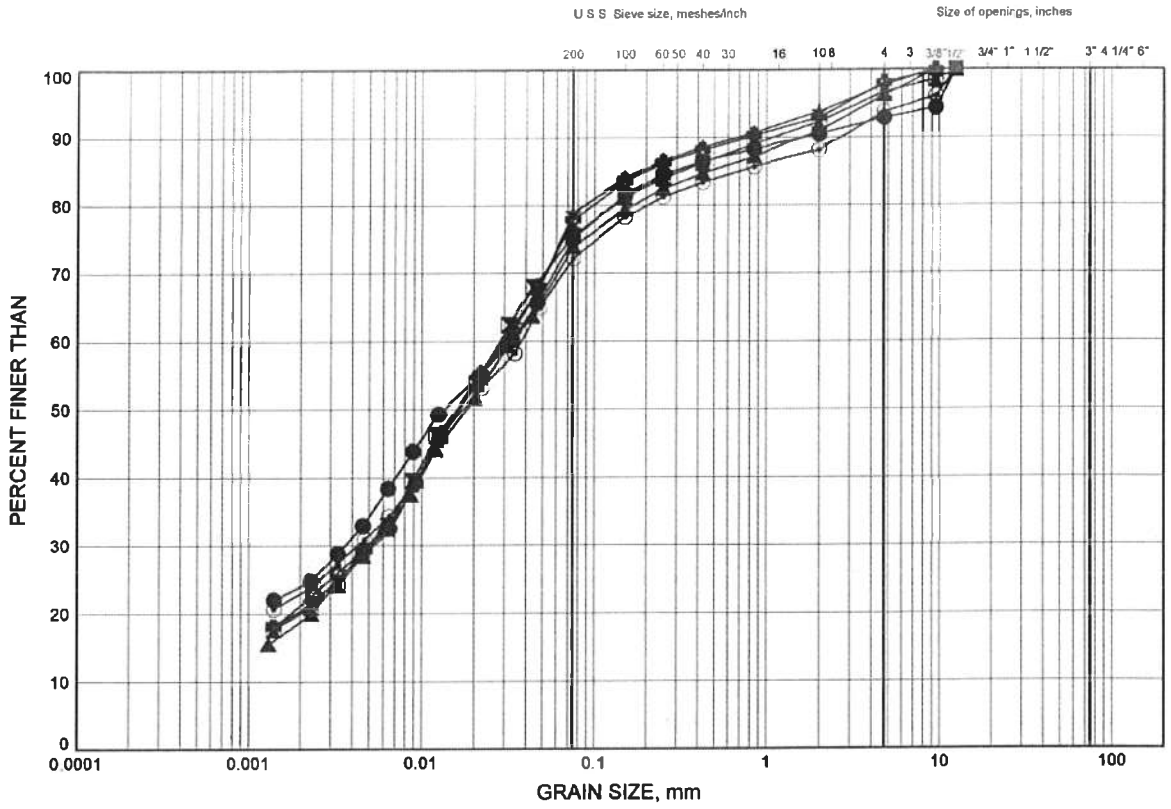
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B15

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-02	15.54	114.66
⊠	GD-NB-02	21.64	108.56
▲	GD-NB-03	18.59	112.18
★	GD-NB-04	15.54	107.78
⊙	GD-NB-06	10.97	113.00
✿	GD-NB-06	15.54	108.43

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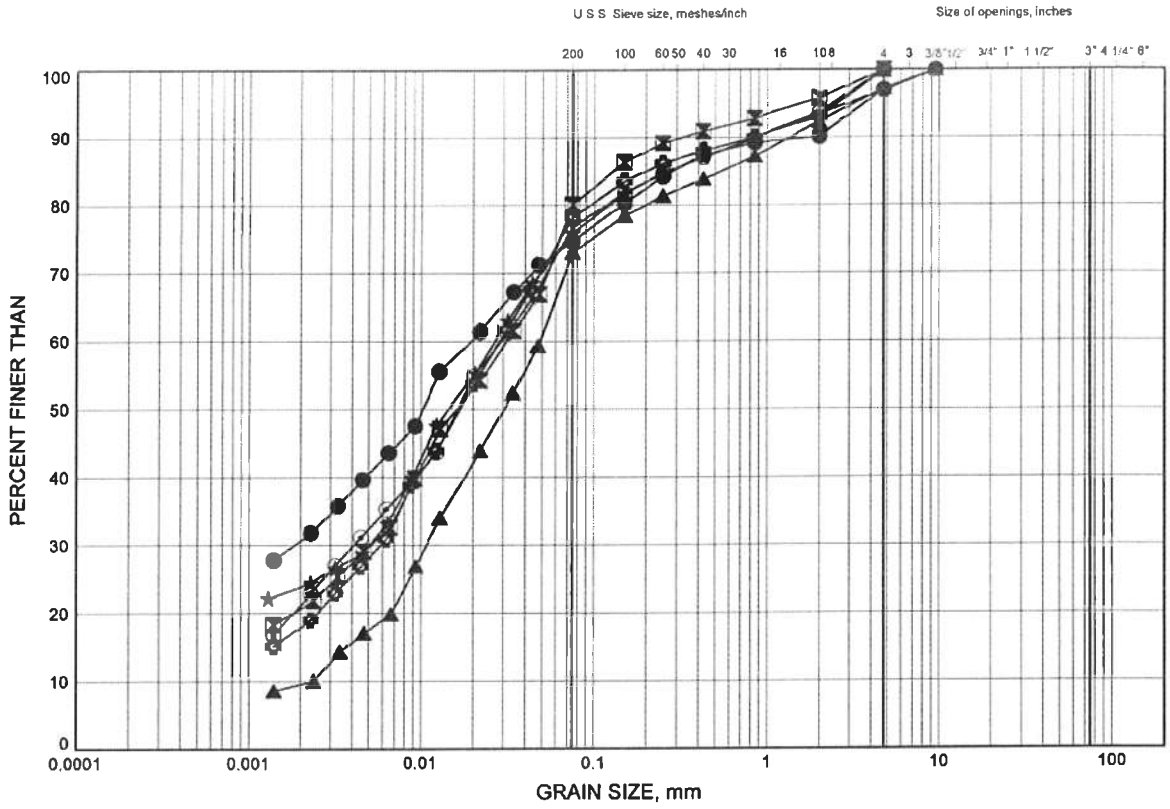
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B16

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-07	10.97	112.98
⊠	GD-NB-08	10.97	113.11
▲	GD-NB-08	14.02	110.07
★	GD-NB-11	18.59	112.58
⊙	GD-NB-12	17.07	114.53
✿	GD-NB-12	21.64	109.96

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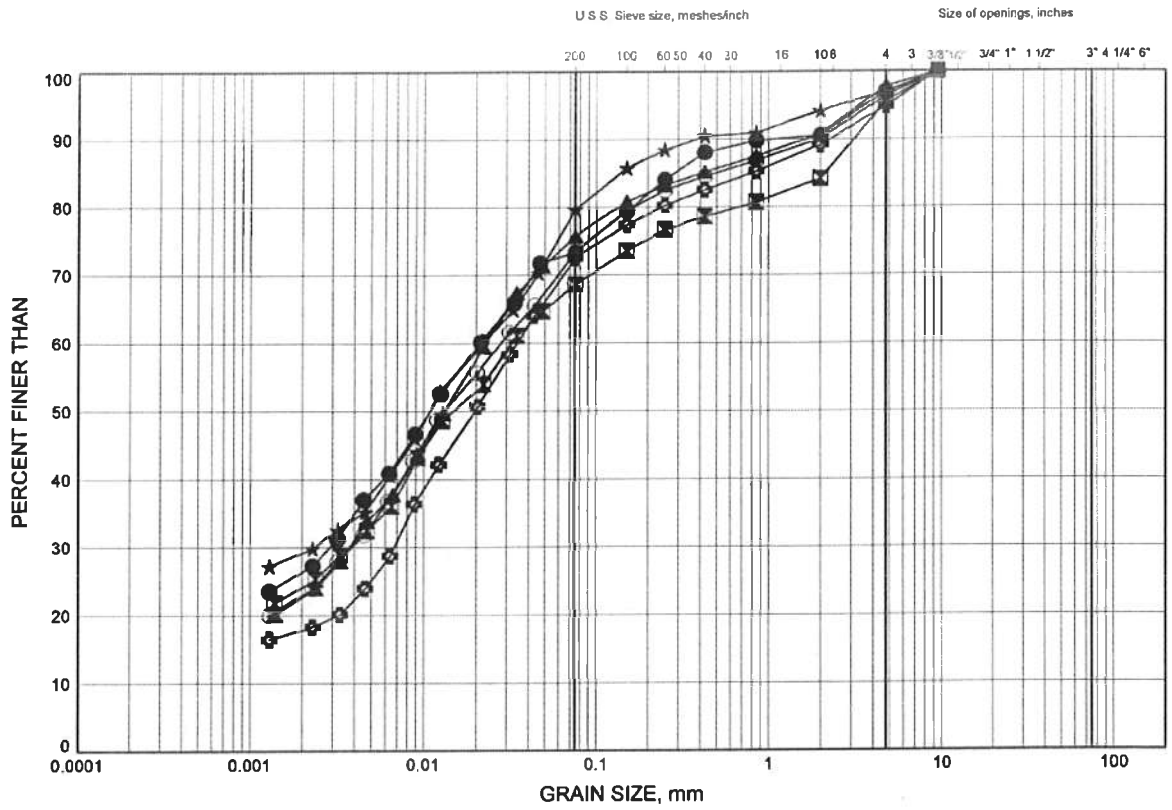
GRAIN SIZE DISTRIBUTION

FIGURE B17

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-13	10.97	113.27
⊠	GD-SB-02	12.50	111.27
▲	GD-SB-02	15.54	108.22
★	GD-SB-03	17.07	113.34
⊙	GD-SB-03	18.78	111.63
✿	GD-SB-04	21.64	108.51

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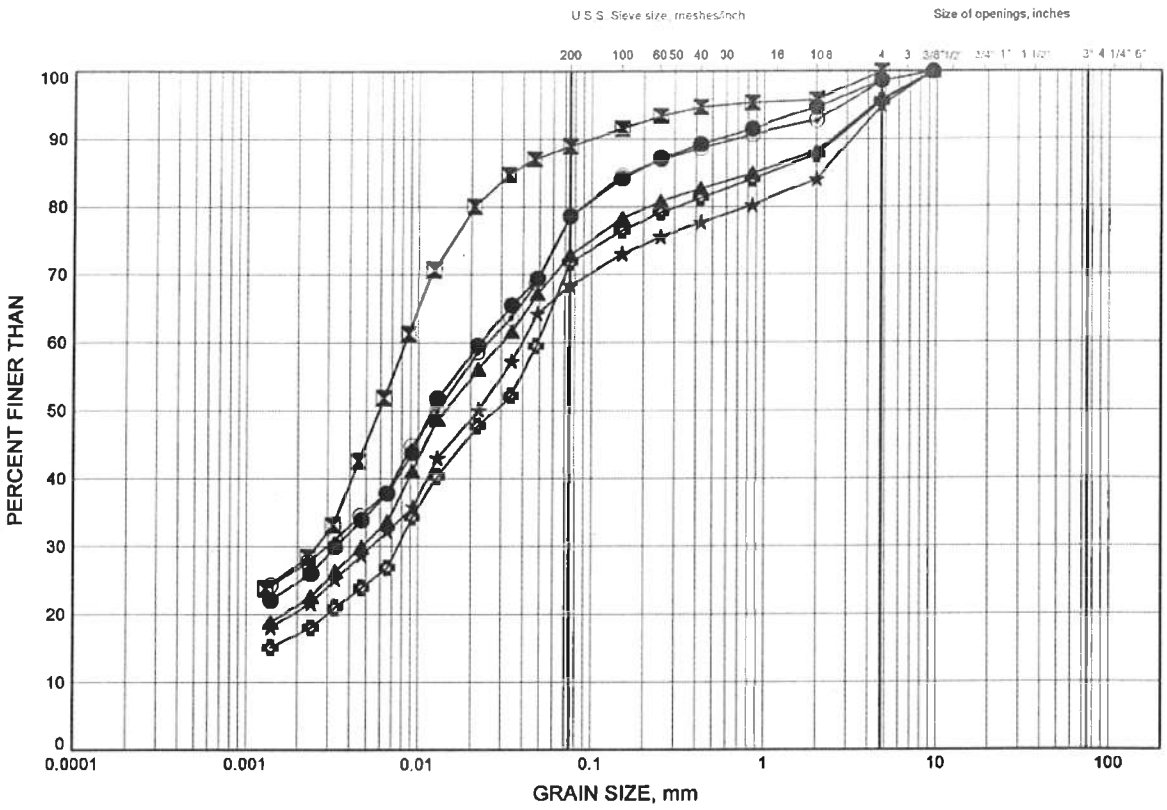
GRAIN SIZE DISTRIBUTION

FIGURE B18

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-05	12.50	111.66
⊠	GD-SB-05	18.59	105.57
▲	GD-SB-06	14.02	110.11
★	GD-SB-07	14.02	110.08
⊙	GD-SB-08	9.45	114.73
✿	GD-SB-08	14.02	110.15

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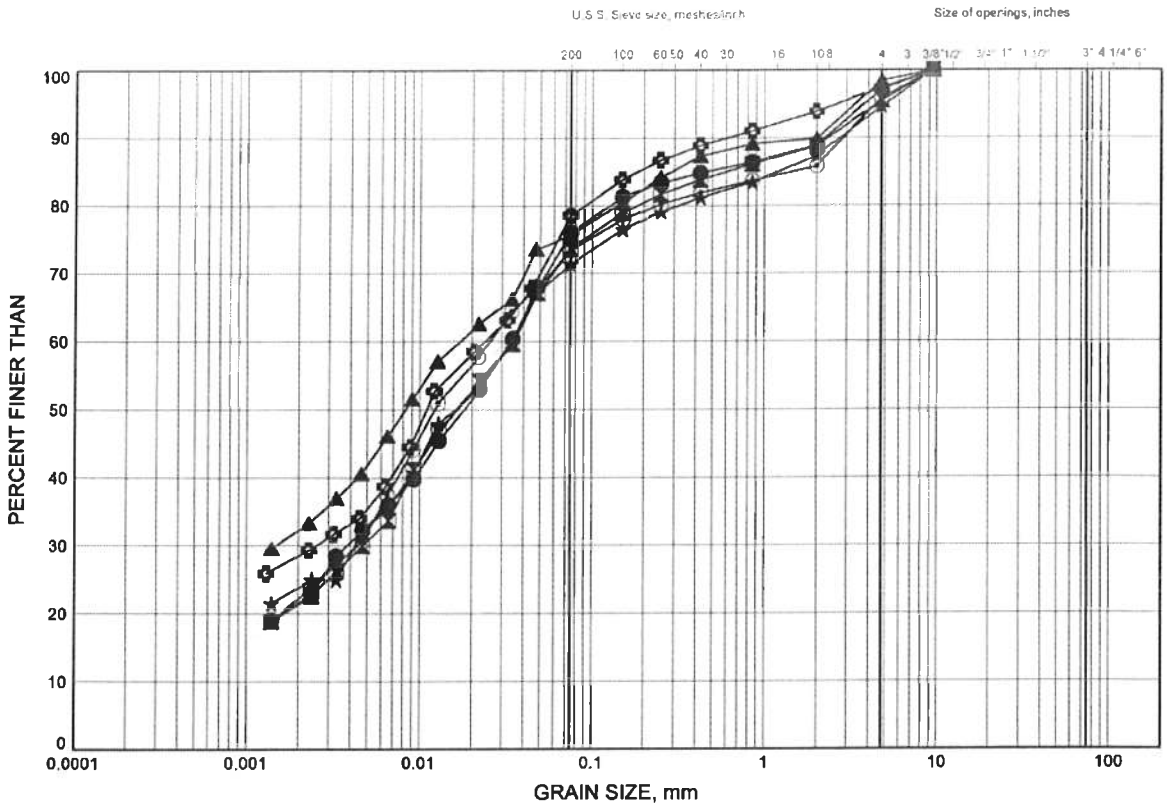
GRAIN SIZE DISTRIBUTION

FIGURE B19

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-09	10.97	113.18
⊠	GD-SB-09	15.54	108.61
▲	GD-SB-11	7.92	116.80
★	GD-SB-11	14.02	110.71
⊙	GD-SB-11	17.07	107.66
✿	GD-SB-12	17.07	114.29

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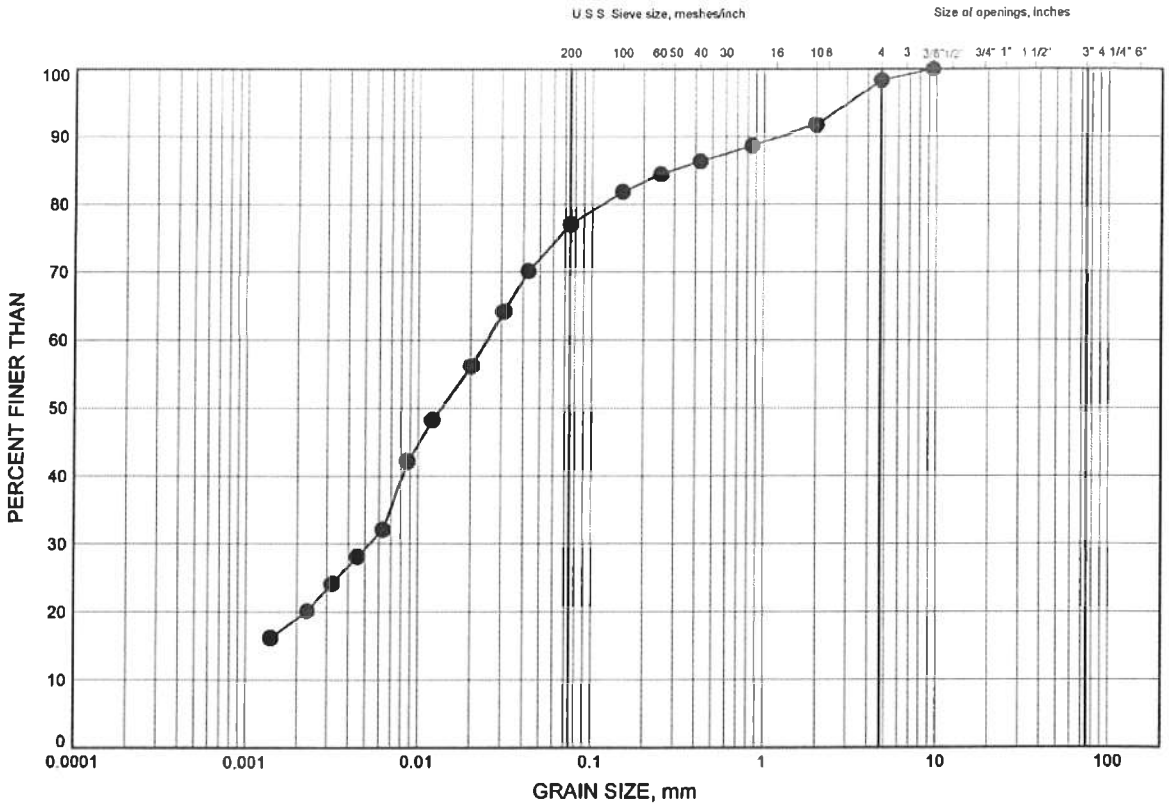
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B20

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-12	21.64	109.71

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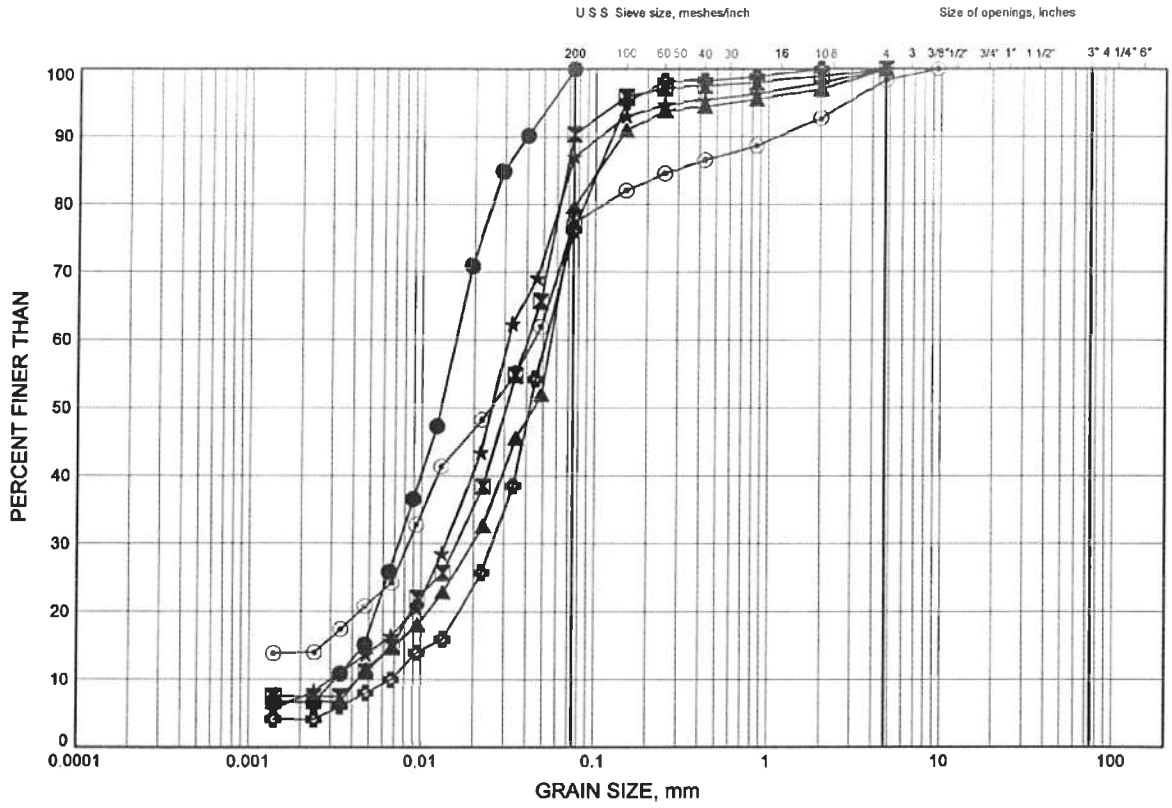
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B21

SILT TO SANDY SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-03	24.54	106.23
⊠	GD-NB-04	17.07	106.26
▲	GD-NB-07	20.12	103.84
★	GD-NB-08	21.64	102.45
⊙	GD-NB-09	14.02	110.02
✿	GD-SB-07	24.60	99.51

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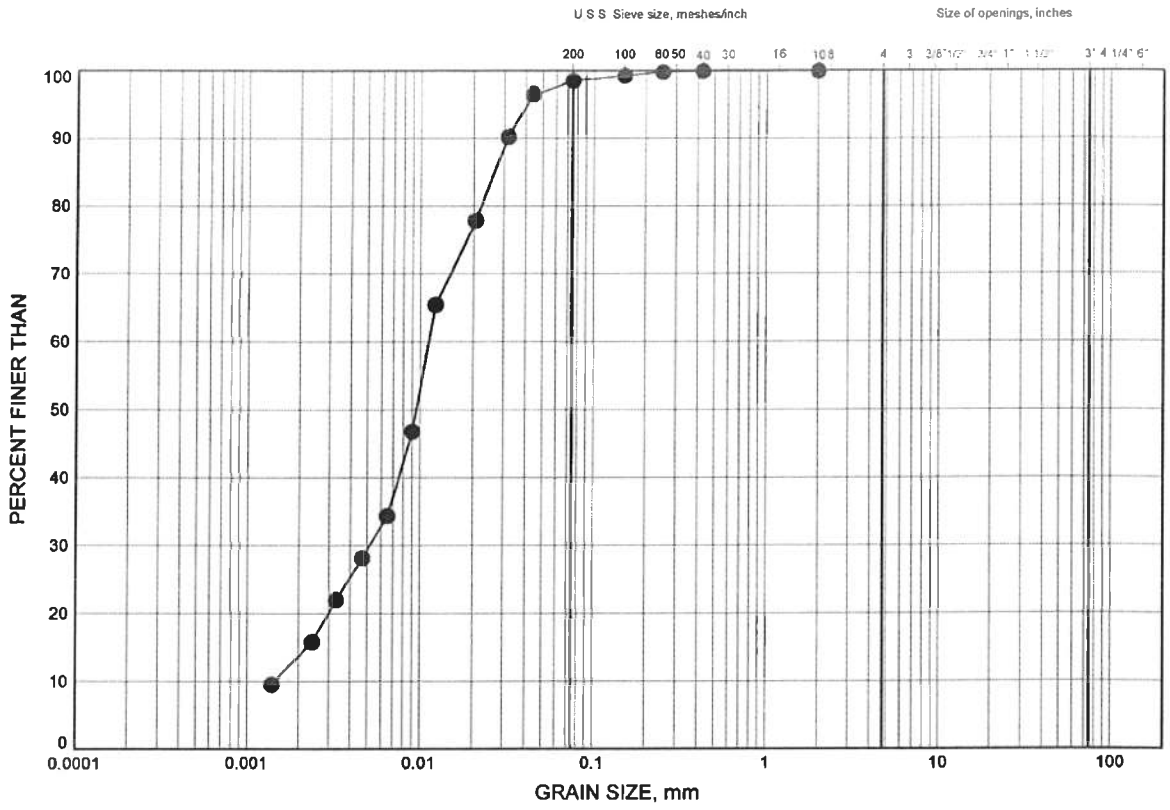
GRAIN SIZE DISTRIBUTION

FIGURE B22

SILT TO SANDY SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-10	21.64	102.47

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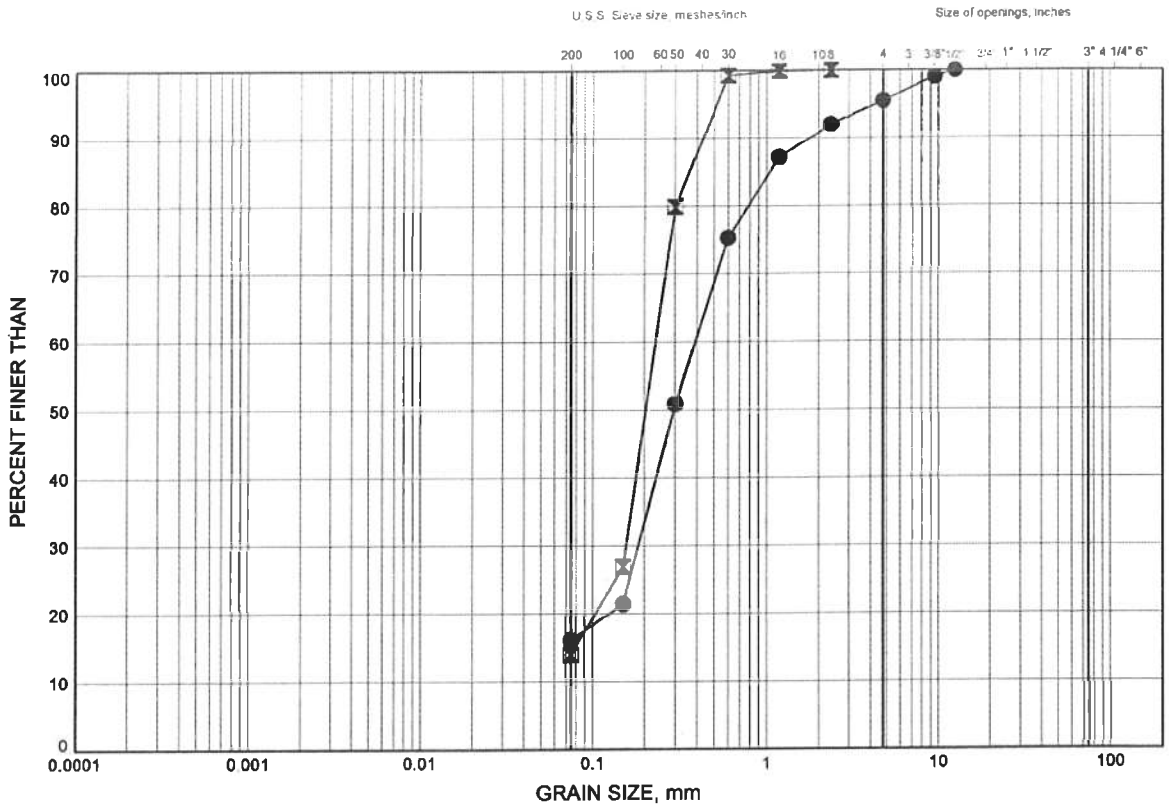
5 Bridges, Welland and St. Catharines

GRAIN SIZE DISTRIBUTION

FIGURE B23

SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-05	23.16	100.99
⧓	GD-SB-06	23.16	100.96

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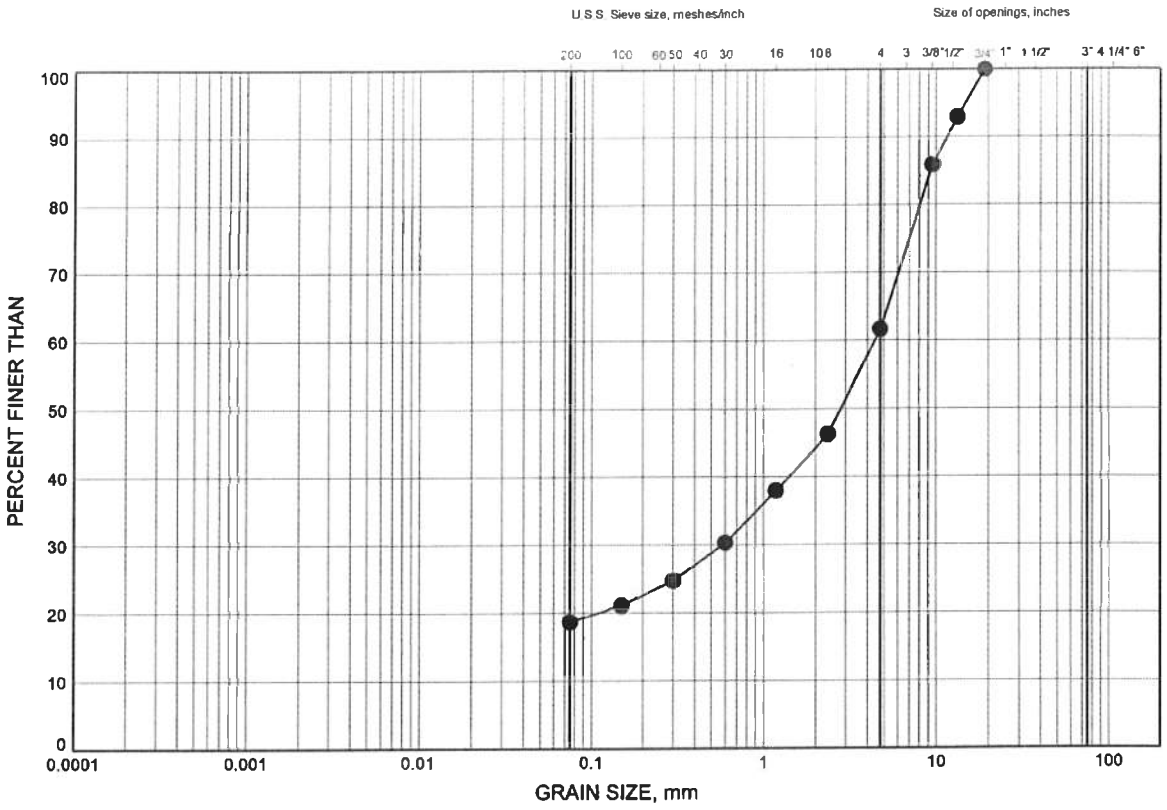
GRAIN SIZE DISTRIBUTION

FIGURE B24

SAND & GRAVEL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-08	24.51	99.67

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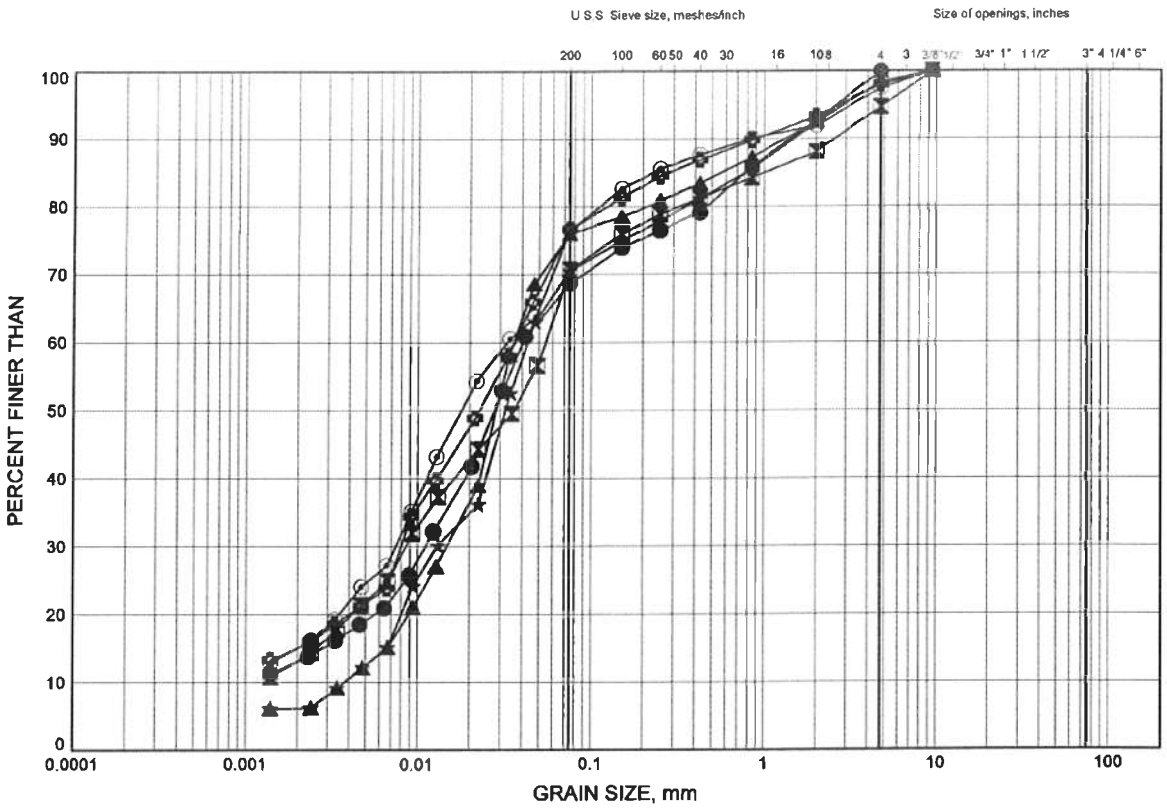
GRAIN SIZE DISTRIBUTION

FIGURE B25

SANDY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-02	27.74	102.47
⊠	GD-NB-05	12.50	111.56
▲	GD-NB-05	23.16	100.89
★	GD-NB-06	23.37	100.61
⊙	GD-NB-10	15.54	108.40
✿	GD-SB-02	21.64	102.12

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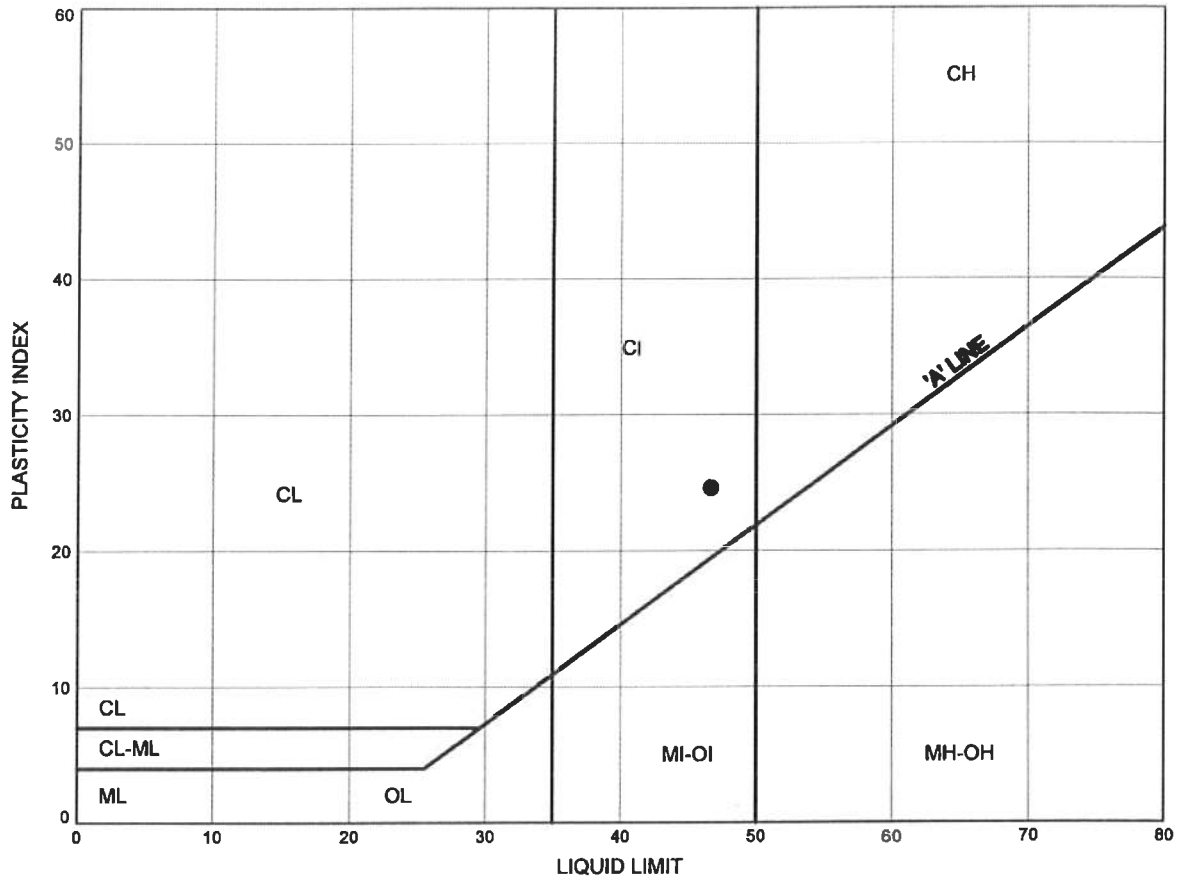
5 Bridges, Welland and St. Catharines

ATTERBERG LIMITS TEST RESULTS

FIGURE B26

SILTY CLAY FILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-08	1.83	122.26

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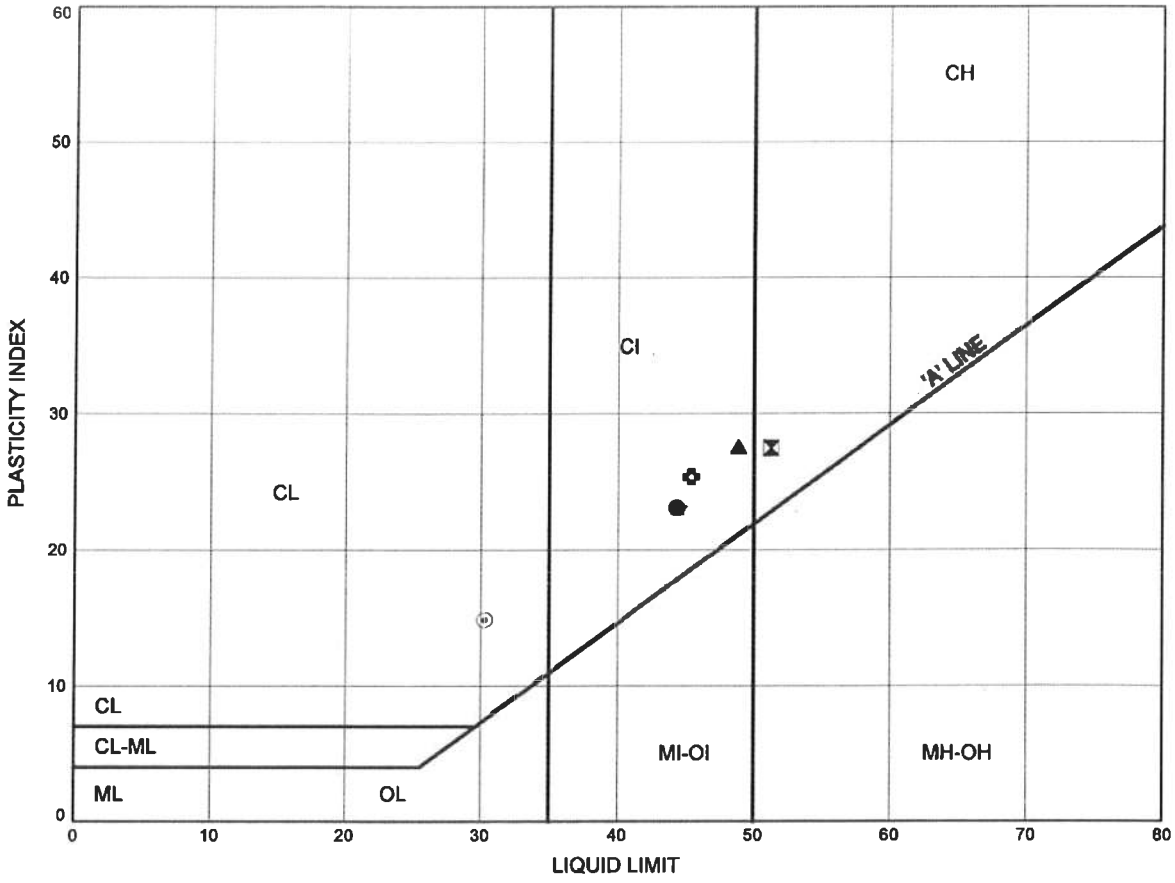
5 Bridges, Welland and St. Catharines

ATTERBERG LIMITS TEST RESULTS

FIGURE B27

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-02	9.45	120.76
⊠	GD-NB-03	10.97	119.80
▲	GD-NB-04	4.11	119.21
★	GD-NB-05	3.35	120.71
⊙	GD-NB-05	7.92	116.13
✿	GD-NB-06	3.35	120.62

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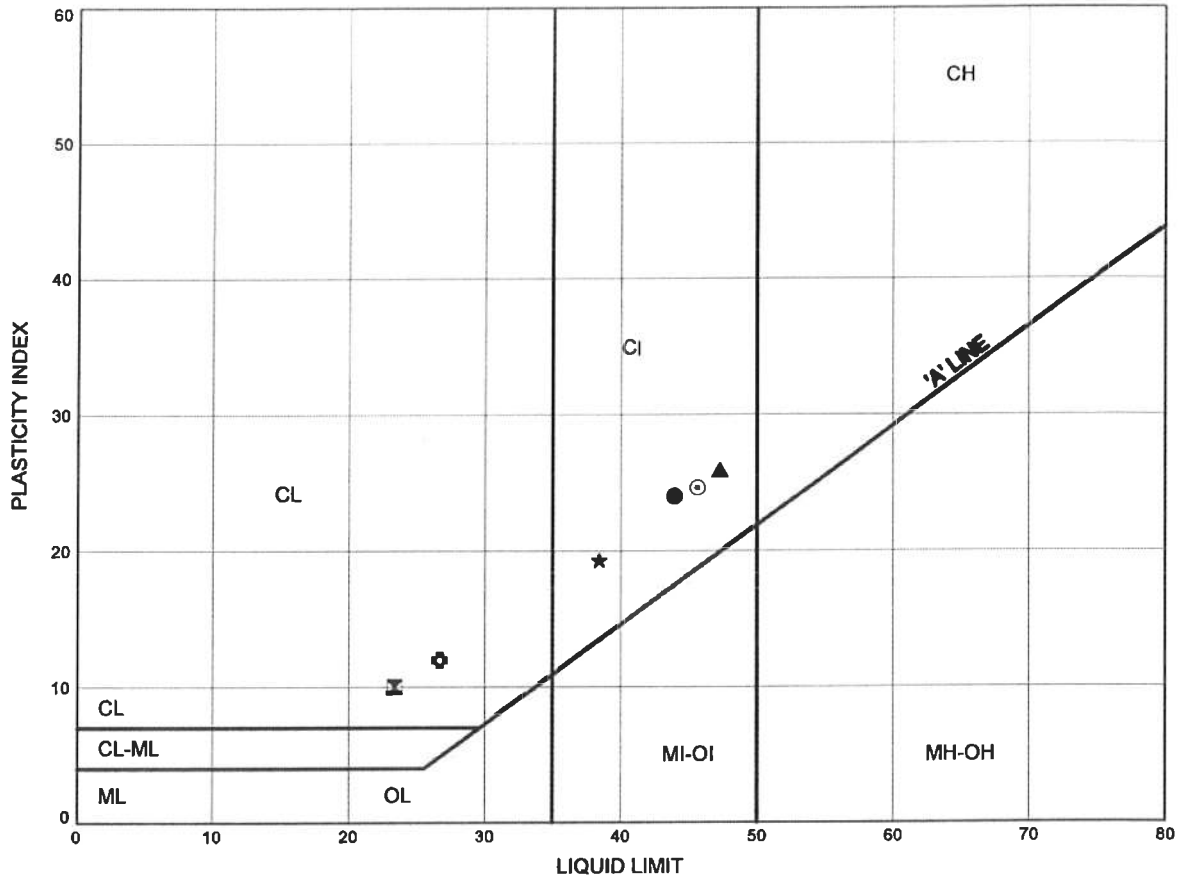
ATTERBERG LIMITS TEST RESULTS

FIGURE B28

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-06	7.92	116.05
⊠	GD-NB-06	10.97	113.00
▲	GD-NB-07	4.88	119.08
★	GD-NB-08	6.40	117.69
⊙	GD-NB-09	4.88	119.17
✿	GD-NB-09	9.45	114.60

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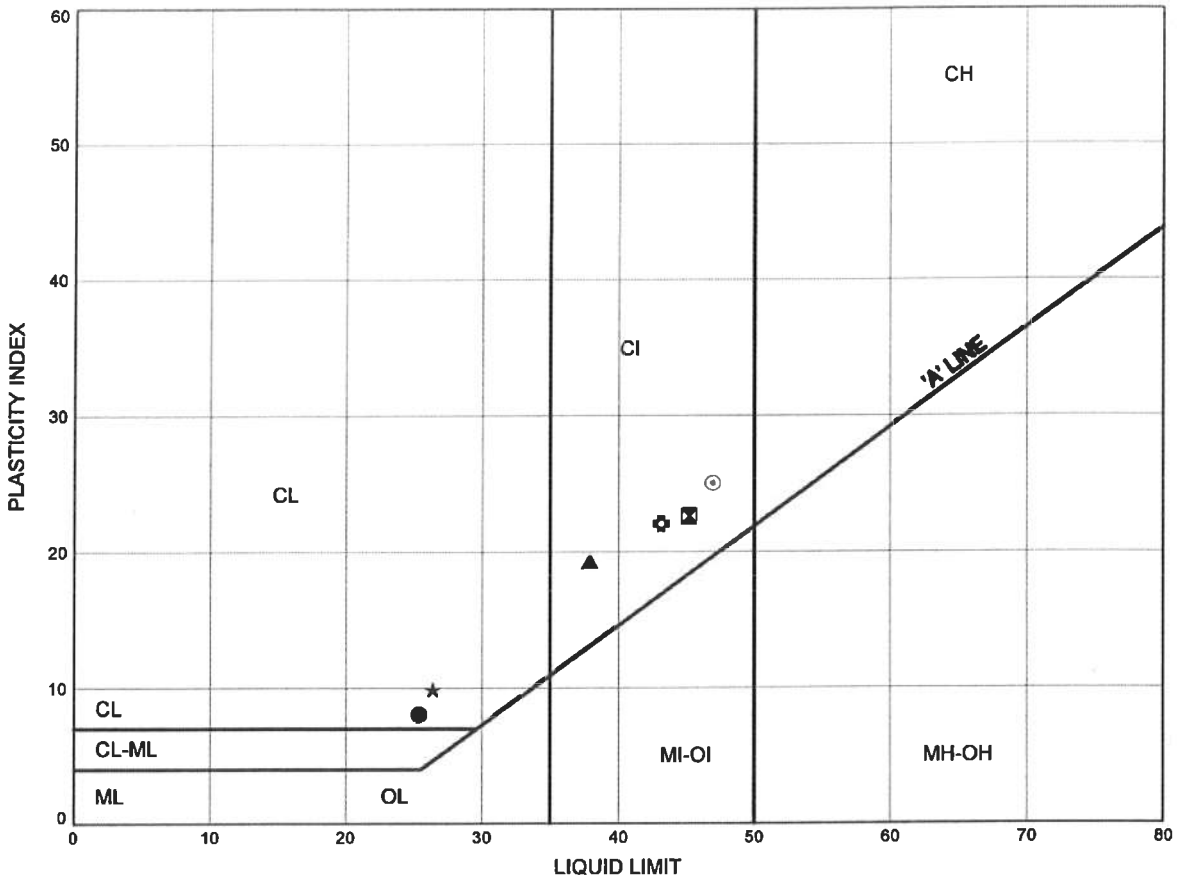
ATTERBERG LIMITS TEST RESULTS

FIGURE B29

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-09	18.59	105.45
⊠	GD-NB-10	2.59	121.35
▲	GD-NB-10	7.92	116.02
★	GD-NB-10	18.59	105.35
⊙	GD-NB-11	10.97	120.20
✿	GD-NB-11	17.07	114.10

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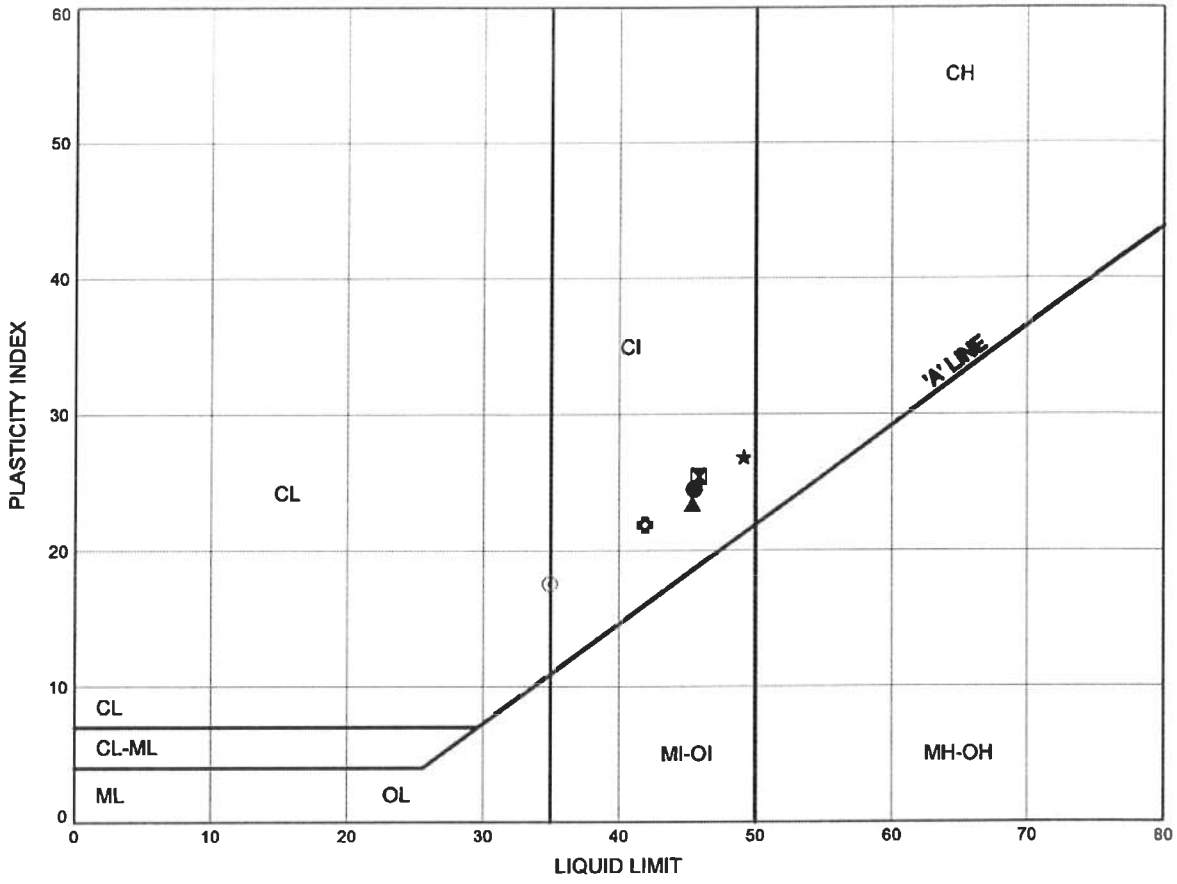
ATTERBERG LIMITS TEST RESULTS

FIGURE B30

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-12	14.02	117.58
⊠	GD-NB-13	2.59	121.65
▲	GD-NB-14	10.97	120.72
★	GD-SB-02	3.35	120.41
⊙	GD-SB-02	6.40	117.36
✿	GD-SB-03	14.02	116.39

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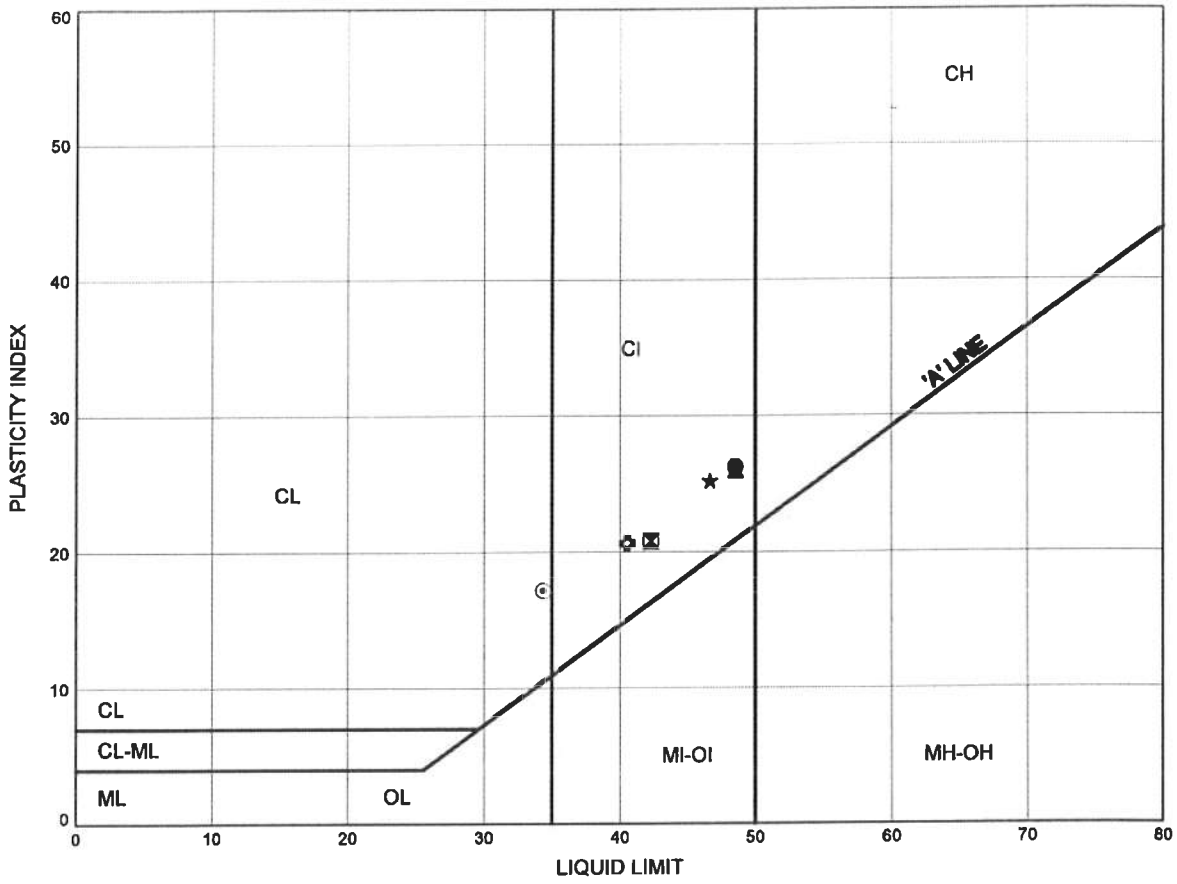
ATTERBERG LIMITS TEST RESULTS

FIGURE B31

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-04	12.50	117.66
⊠	GD-SB-04	15.54	114.61
▲	GD-SB-05	2.59	121.57
★	GD-SB-07	4.88	119.23
⊙	GD-SB-07	9.45	114.66
✿	GD-SB-08	3.35	120.82

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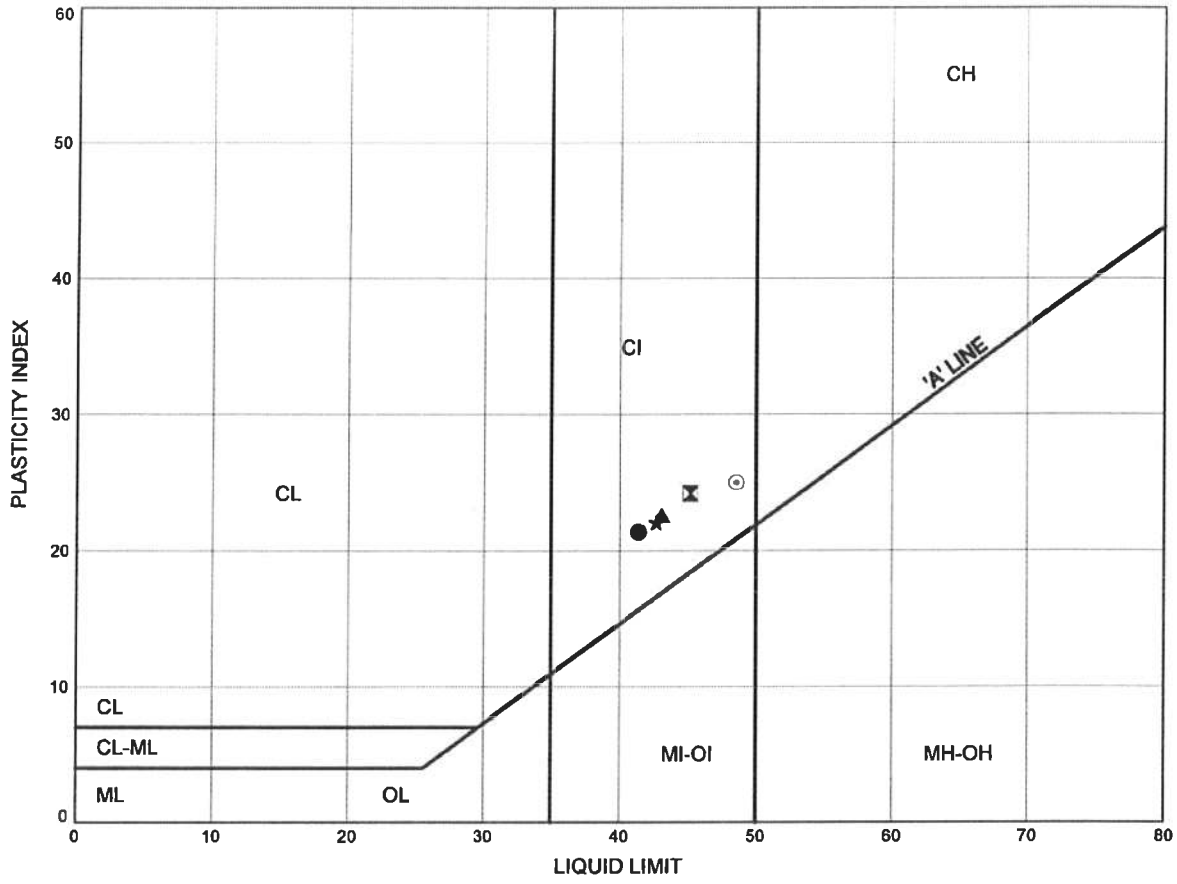
FIGURE B32

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-08	6.40	117.77
⊠	GD-SB-09	3.35	120.80
▲	GD-SB-11	3.35	121.37
★	GD-SB-12	10.97	120.38
⊙	GD-SB-14	10.97	120.38

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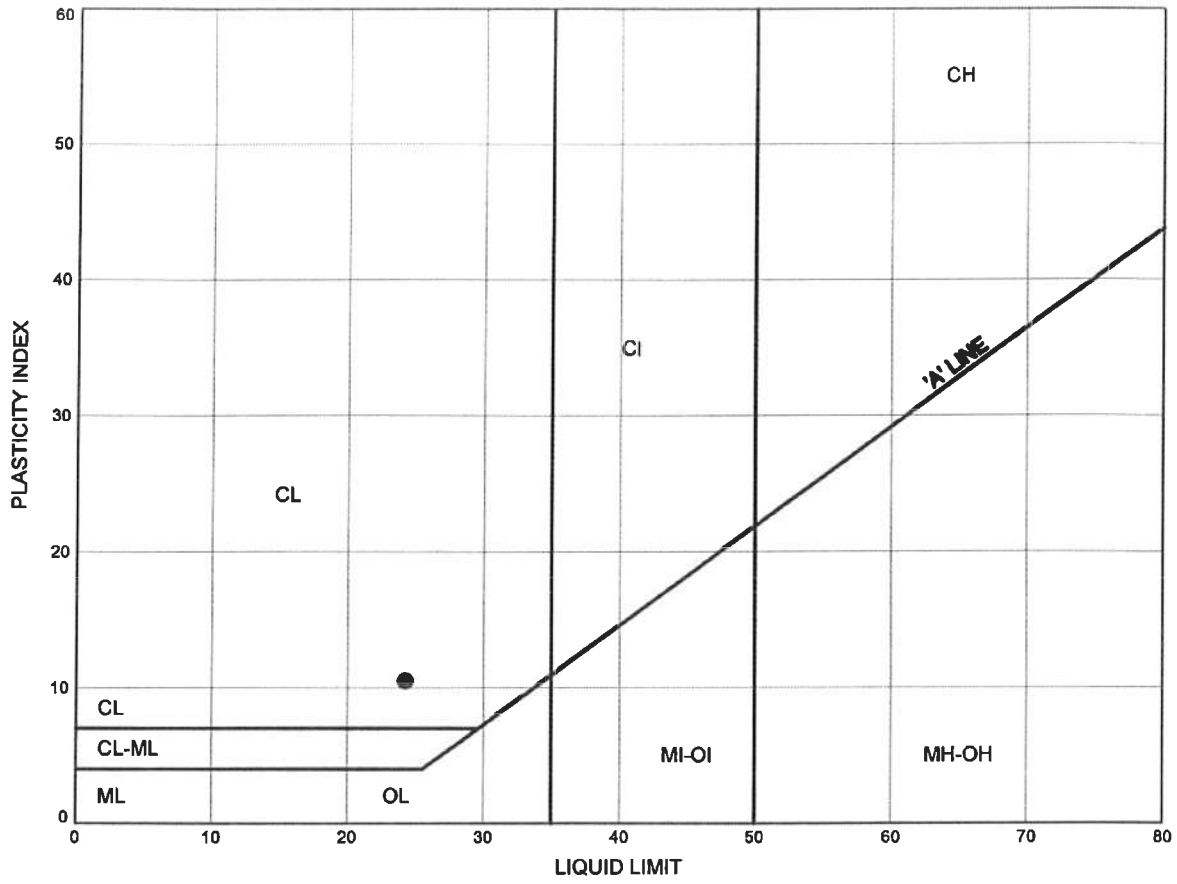
ATTERBERG LIMITS TEST RESULTS

FIGURE B33

SILTY CLAY, Some Sand



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-04	9.45	113.88

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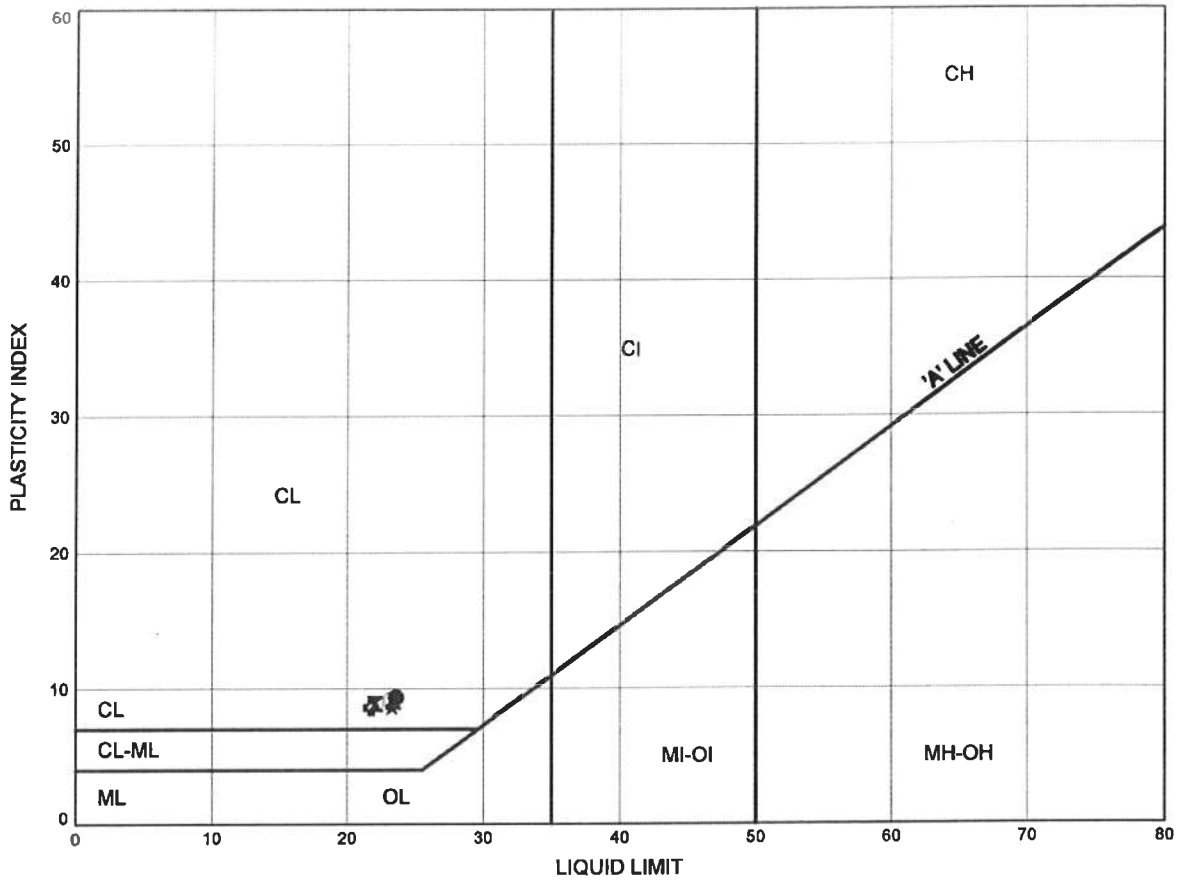
ATTERBERG LIMITS TEST RESULTS

FIGURE B34

SILTY CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-08	10.97	113.11
⊠	GD-NB-11	18.59	112.58
▲	GD-SB-03	17.07	113.34
★	GD-SB-05	18.59	105.57
⊙	GD-SB-09	10.97	113.18
✿	GD-SB-09	15.54	108.61

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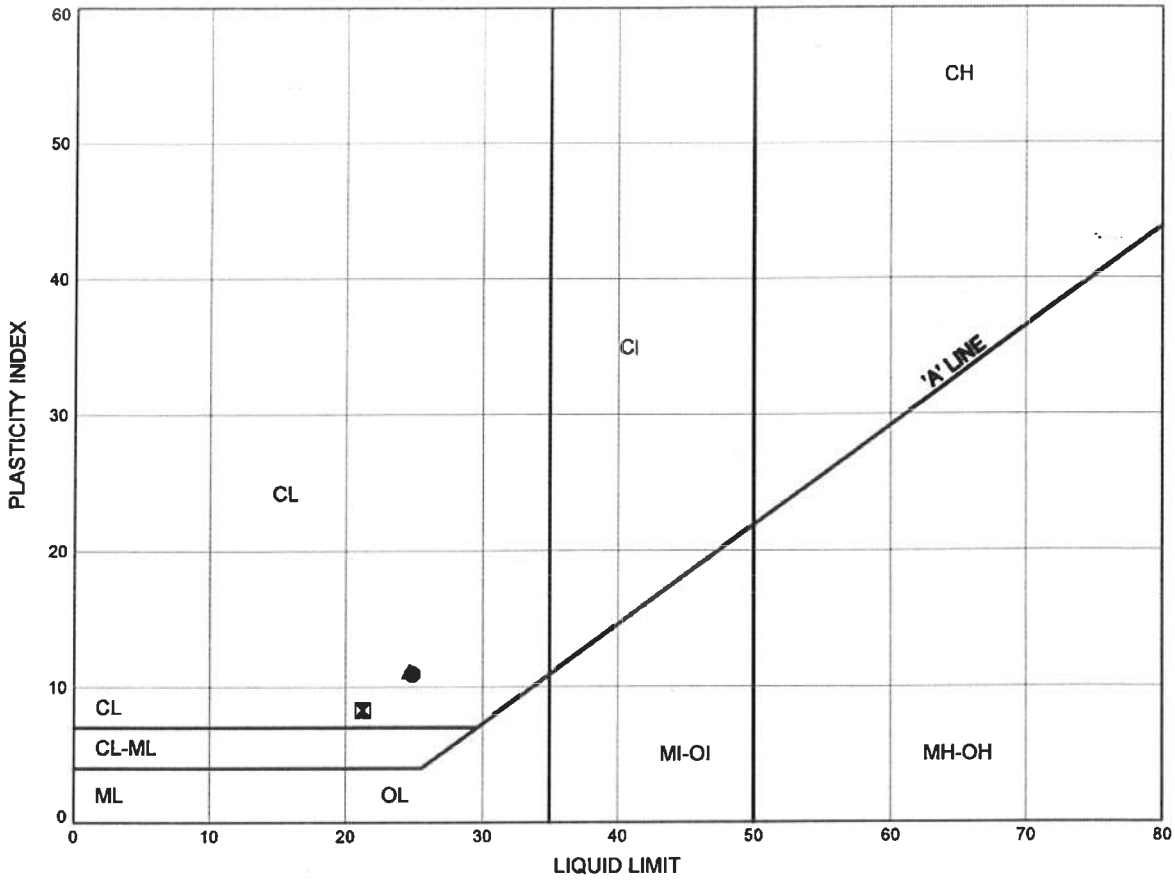
ATTERBERG LIMITS TEST RESULTS

FIGURE B35

SILTY CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-SB-11	7.92	116.80
⊠	GD-SB-11	14.02	110.71
▲	GD-SB-12	17.07	114.29

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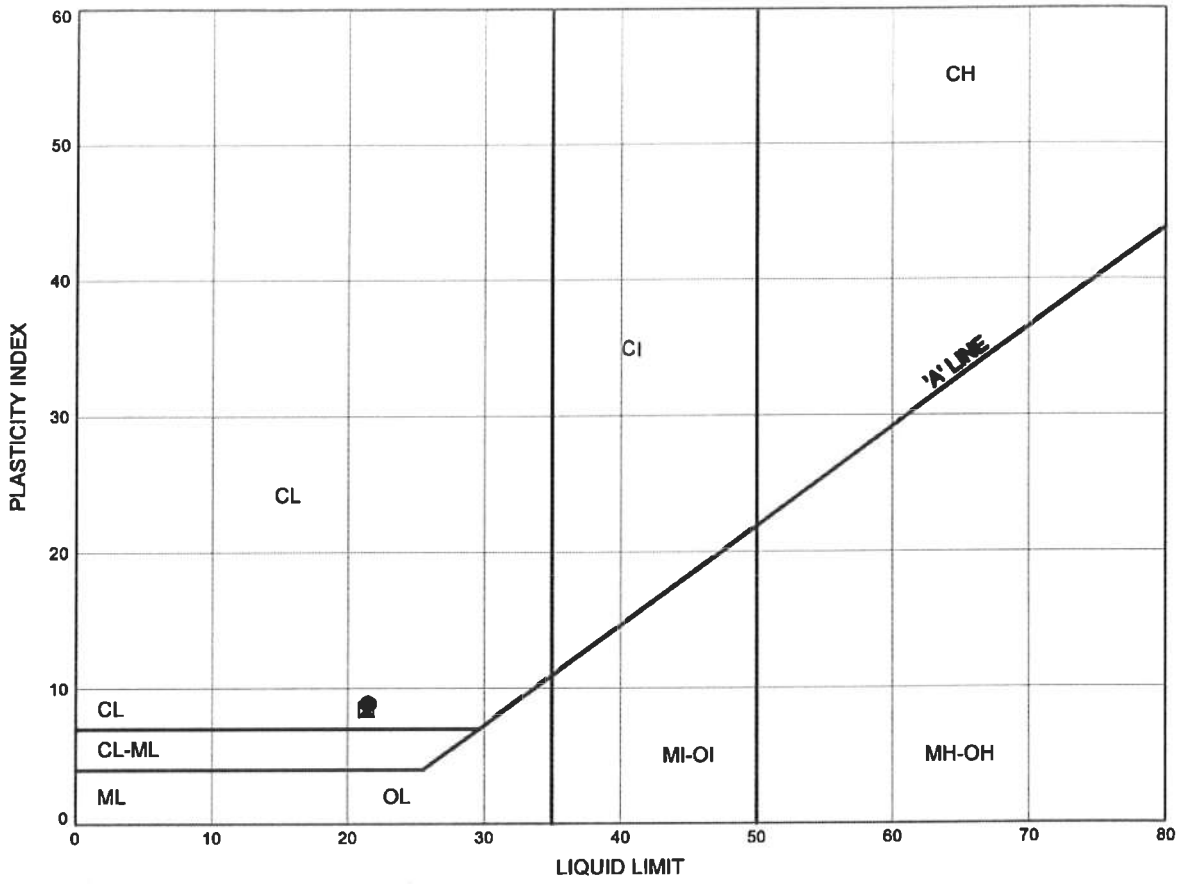
ATTERBERG LIMITS TEST RESULTS

FIGURE B36

SANDY SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GD-NB-05	12.50	111.56
⊠	GD-NB-10	15.54	108.40

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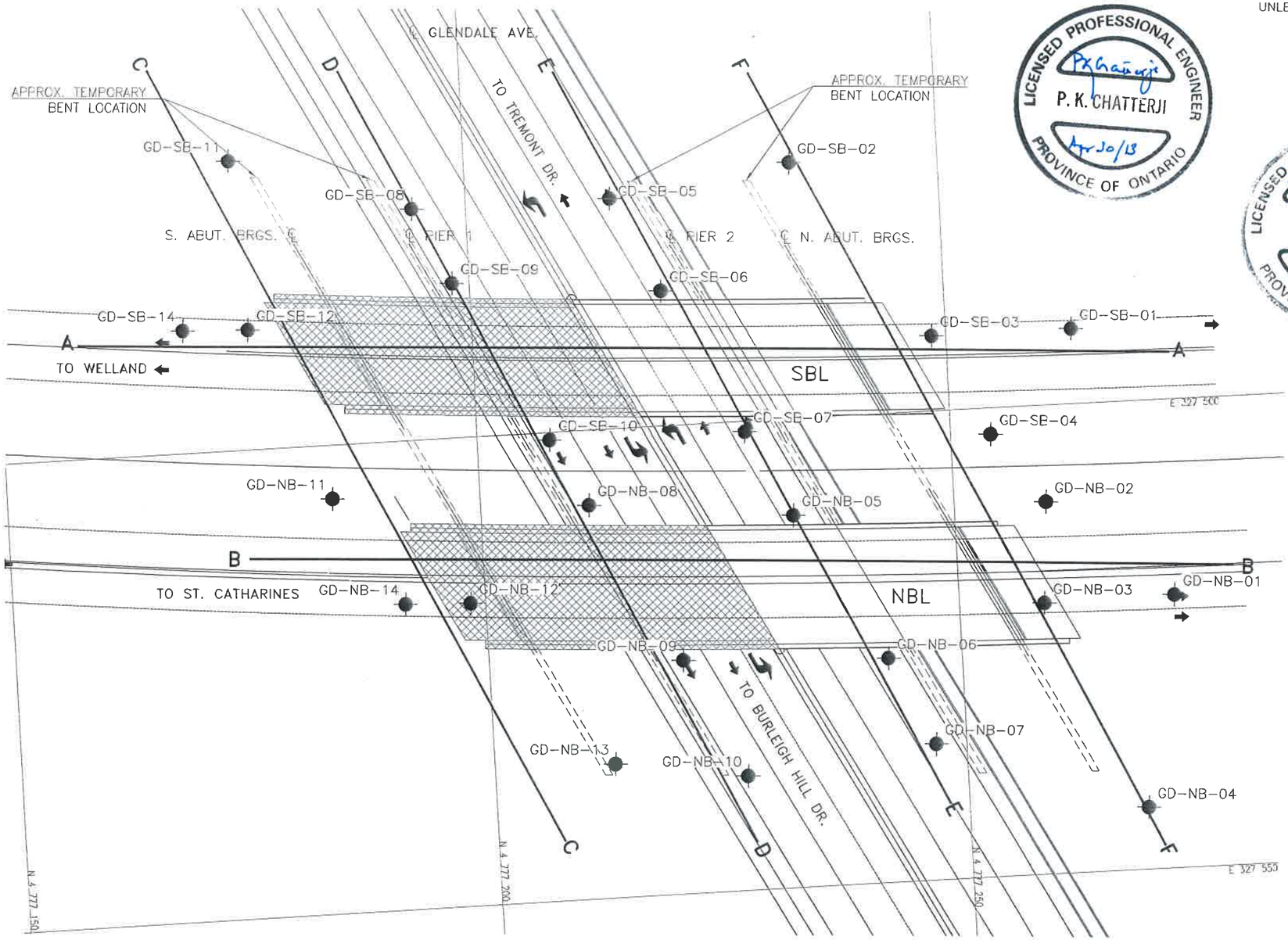
THURBALT 1221.GPJ 3/8/13

Appendix C

Drawings titled "Borehole Locations and Soil Strata"

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



PLAN

10 0 10 20m

SCALE 1:500

GD-SB-01	130.0	4 777 263.2	327 492.0
GD-SB-02	123.8	4 777 234.4	327 472.6
GD-SB-03	130.4	4 777 248.5	327 492.0
GD-SB-04	130.2	4 777 254.2	327 502.8
GD-SB-05	124.2	4 777 215.3	327 475.4
GD-SB-06	124.1	4 777 220.2	327 485.6
GD-SB-07	124.1	4 777 228.3	327 501.1
GD-SB-08	124.2	4 777 194.3	327 475.3
GD-SB-09	124.2	4 777 198.2	327 483.5
GD-SB-10	124.1	4 777 207.7	327 500.8
GD-SB-11	124.7	4 777 175.2	327 469.0
GD-SB-12	131.4	4 777 176.4	327 487.2
GD-SB-14	131.4	4 777 169.5	327 486.9

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Apr 30/13
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
Apr 30/13
PROVINCE OF ONTARIO

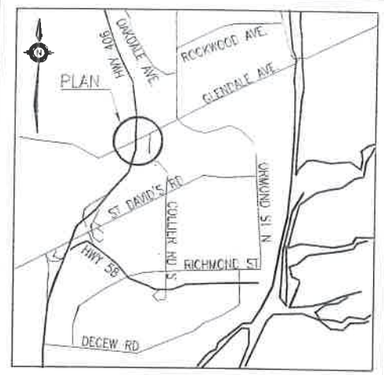
CONT No
GWP No 2348-09-00
WP No 2365-09-01

SHEET

HIGHWAY 406
GLENDALE AVE. OVERPASS
TWIN BRIDGE REHABILITATION
BOREHOLE LOCATIONS PLAN

McCORMICK RANKIN
A member of MMM GROUP

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
GD-NB-01	130.5	4 777 272.8	327 520.9
GD-NB-02	130.2	4 777 259.7	327 510.3
GD-NB-03	130.8	4 777 259.0	327 521.1
GD-NB-04	123.3	4 777 269.0	327 543.4
GD-NB-05	124.1	4 777 233.0	327 510.3
GD-NB-06	124.0	4 777 242.2	327 526.1
GD-NB-07	124.0	4 777 246.8	327 535.5
GD-NB-08	124.1	4 777 211.5	327 508.0
GD-NB-09	124.0	4 777 220.5	327 525.1
GD-NB-10	123.9	4 777 226.7	327 537.8
GD-NB-11	131.2	4 777 184.5	327 505.7
GD-NB-12	131.6	4 777 198.4	327 517.7
GD-NB-13	124.2	4 777 212.8	327 535.7
GD-NB-14	131.7	4 777 191.5	327 517.4

-NOTES-

1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

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

GEOCRES No. 30M3-277

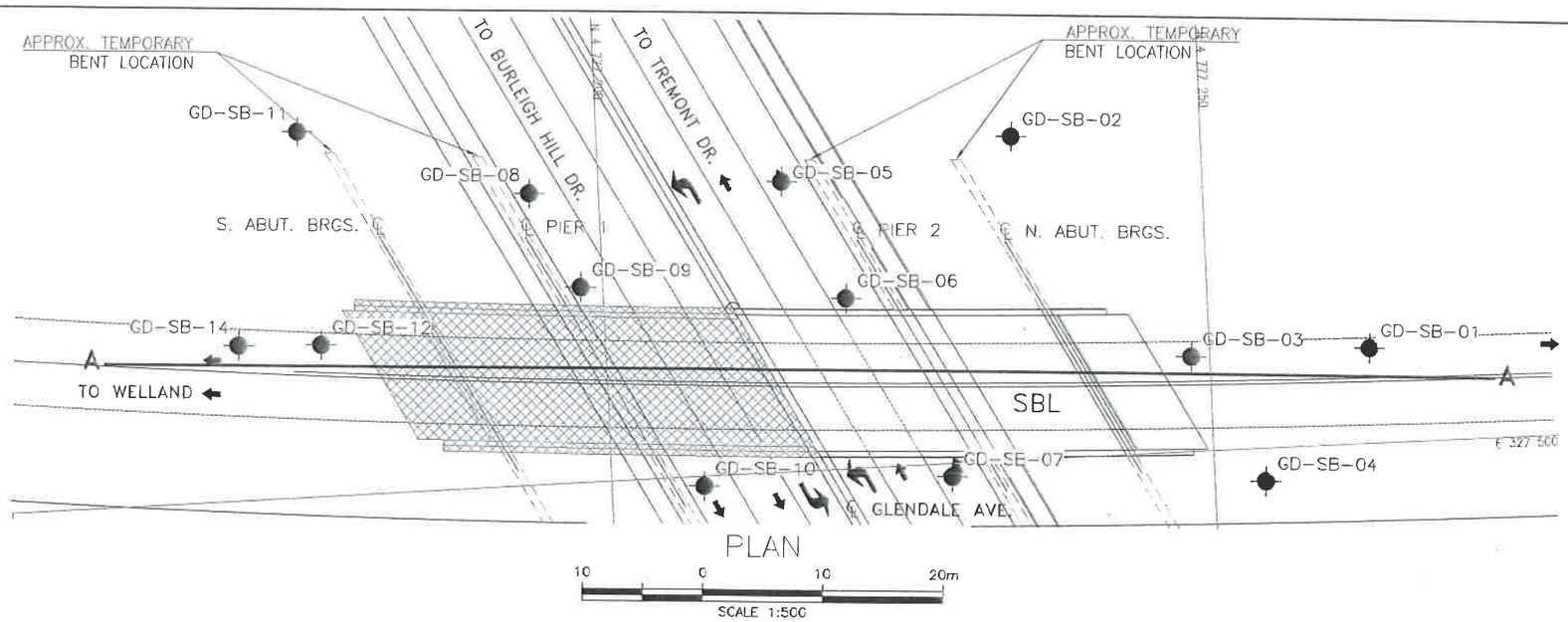
REVISIONS	DATE	BY	DESCRIPTION

DESIGN	LPG	CHK	LPG	CODE		LOAD	
DRAWN	AN	CHK	SKP	SITE		STRUCT	DWG 2

DATE MAY 2013

FILENAME: H:\Drafting\19\1351\221\ted1221-GlendaleAvenueOverpass.dwg
PLOTDATE: 5/1/2013 10:56 AM

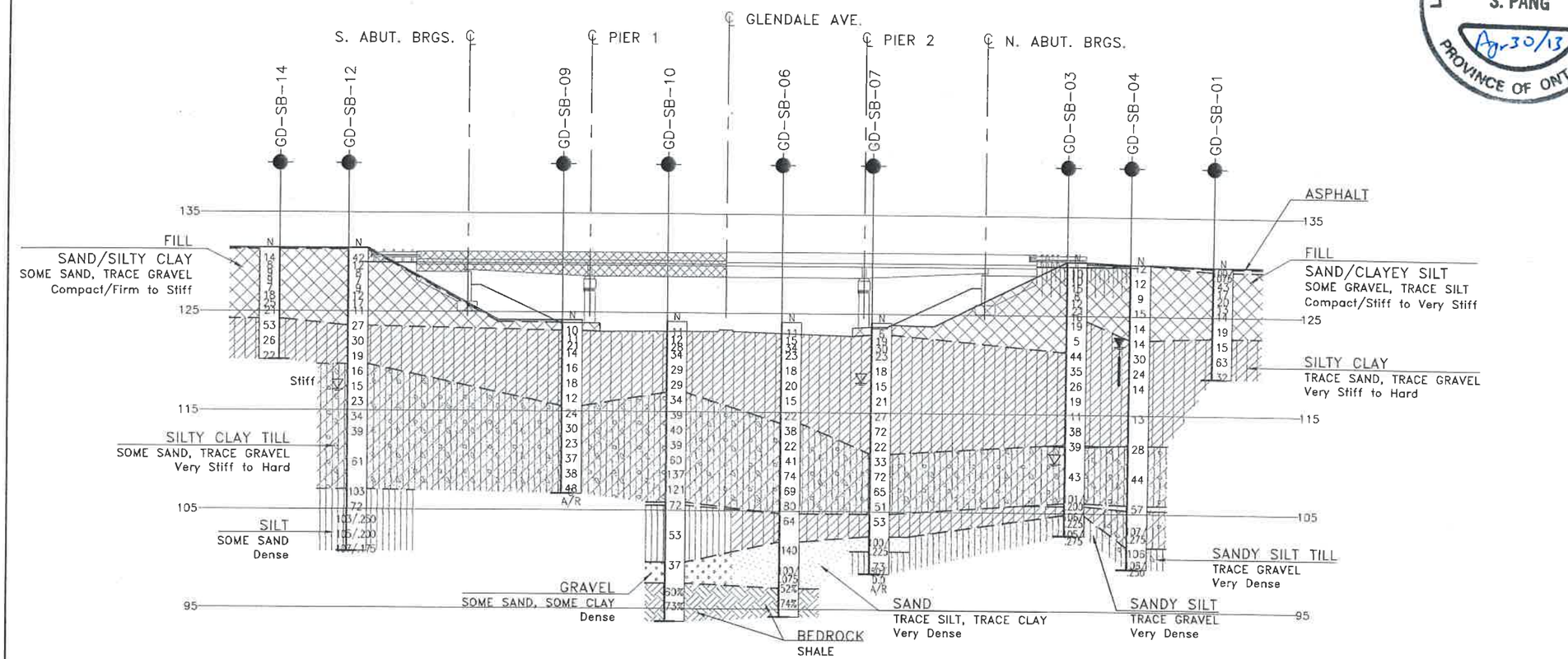
MINISTRY OF TRANSPORTATION, ONTARIO



PLAN

10 0 10 20m

SCALE 1:500



PROFILE ALONG A–A

10 0 10 20m

SCALE 1:500

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
April 30/13
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
Ap-30/13
PROVINCE OF ONTARIO

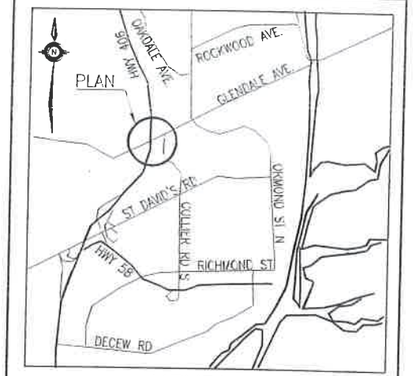
CONT No
GWP No 2348-09-00
WP No 2365-09-01

SHEET

HIGHWAY 406
GLENDALE AVE. OVERPASS
TWIN BRIDGE REHABILITATION
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN
A member of MMM GROUP

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
GD-SB-01	130.0	4 777 263.2	327 492.0
GD-SB-02	123.8	4 777 234.4	327 472.6
GD-SB-03	130.4	4 777 248.5	327 492.0
GD-SB-04	130.2	4 777 254.2	327 502.8
GD-SB-05	124.2	4 777 215.3	327 475.4
GD-SB-06	124.1	4 777 220.2	327 485.6
GD-SB-07	124.1	4 777 228.3	327 501.1
GD-SB-08	124.2	4 777 194.3	327 475.3
GD-SB-09	124.2	4 777 198.2	327 483.5
GD-SB-10	124.1	4 777 207.7	327 500.8
GD-SB-11	124.7	4 777 175.2	327 459.0
GD-SB-12	131.4	4 777 176.4	327 487.2
GD-SB-14	131.4	4 777 159.5	327 486.9

-NOTES-

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

GEOCRES No. 30M3-277

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN LPG	CHK LPG	CODE	LOAD
DRAWN AN	CHK SKP	SITE	STRUCT
			DATE MAY 2013
			DWG 3

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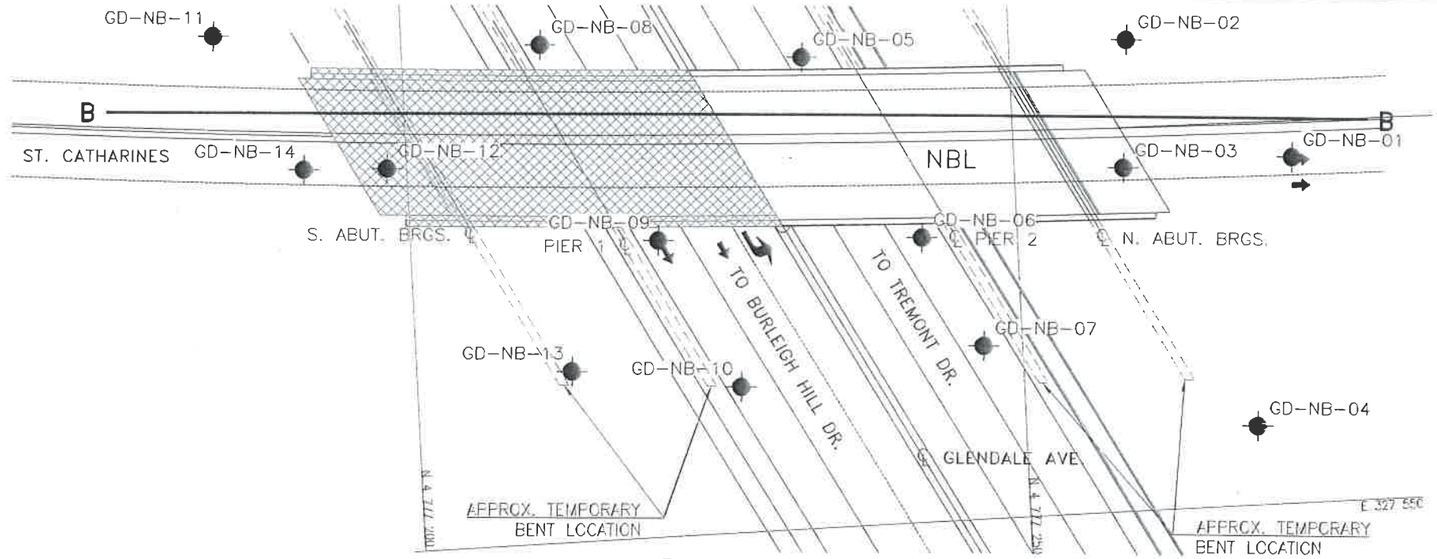
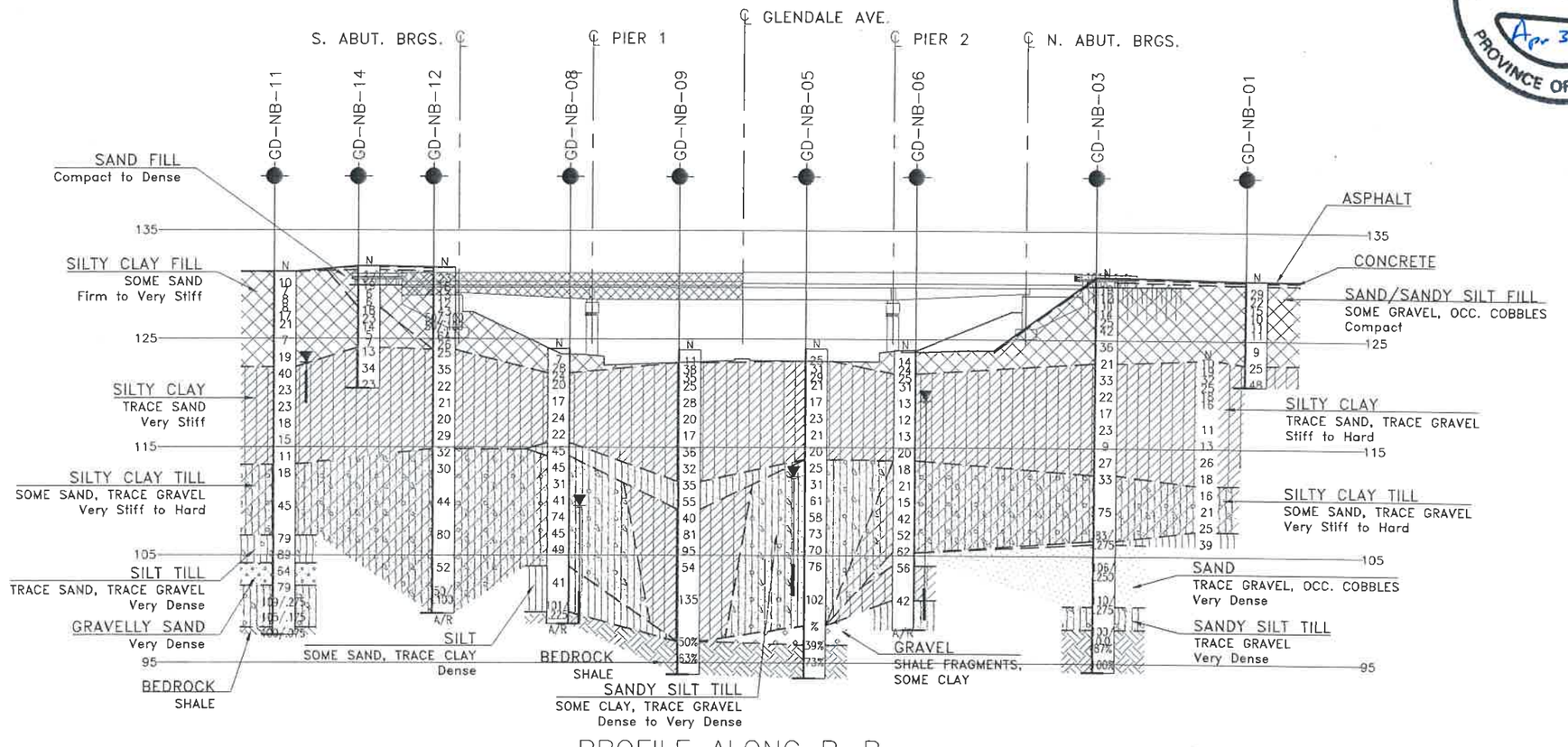


PLAN

10 0 10 20m

SCALE 1:500



PROFILE ALONG B–B

10 0 10 20m

SCALE 1:500

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Apr 30/13
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
Apr 30/13
PROVINCE OF ONTARIO

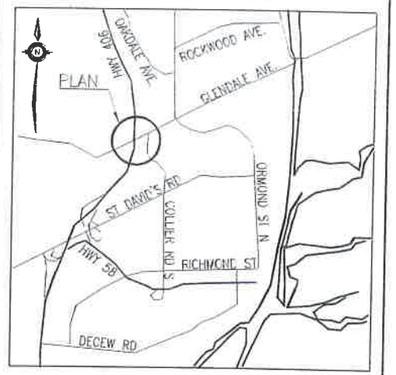
CONT No
GWP No 2348-09-00
WP No 2365-09-01

SHEET

HIGHWAY 406
GLENDALE AVE. OVERPASS
TWIN BRIDGE REHABILITATION
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN
A member of MMM GROUP

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
GD-NB-01	130.5	4 777 272.8	327 520.9
GD-NB-02	130.2	4 777 259.7	327 510.3
GD-NB-03	130.8	4 777 259.0	327 521.1
GD-NB-04	123.3	4 777 269.0	327 543.4
GD-NB-05	124.1	4 777 233.0	327 510.3
GD-NB-06	124.0	4 777 242.2	327 526.1
GD-NB-07	124.0	4 777 246.8	327 535.5
GD-NB-08	124.1	4 777 211.5	327 508.0
GD-NB-09	124.0	4 777 220.5	327 525.1
GD-NB-10	123.9	4 777 226.7	327 537.8
GD-NB-11	131.2	4 777 184.5	327 505.7
GD-NB-12	131.6	4 777 198.4	327 517.7
GD-NB-13	124.2	4 777 212.8	327 535.7
GD-NB-14	131.7	4 777 191.5	327 517.4

-NOTES-

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GEOCRES No. 30M3-277

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	LPG	CHK	LPG	CODE	LOAD
DRAWN	AN	CHK	SKP	SITE	STRUCT

DATE MAY 2013
DWG 4

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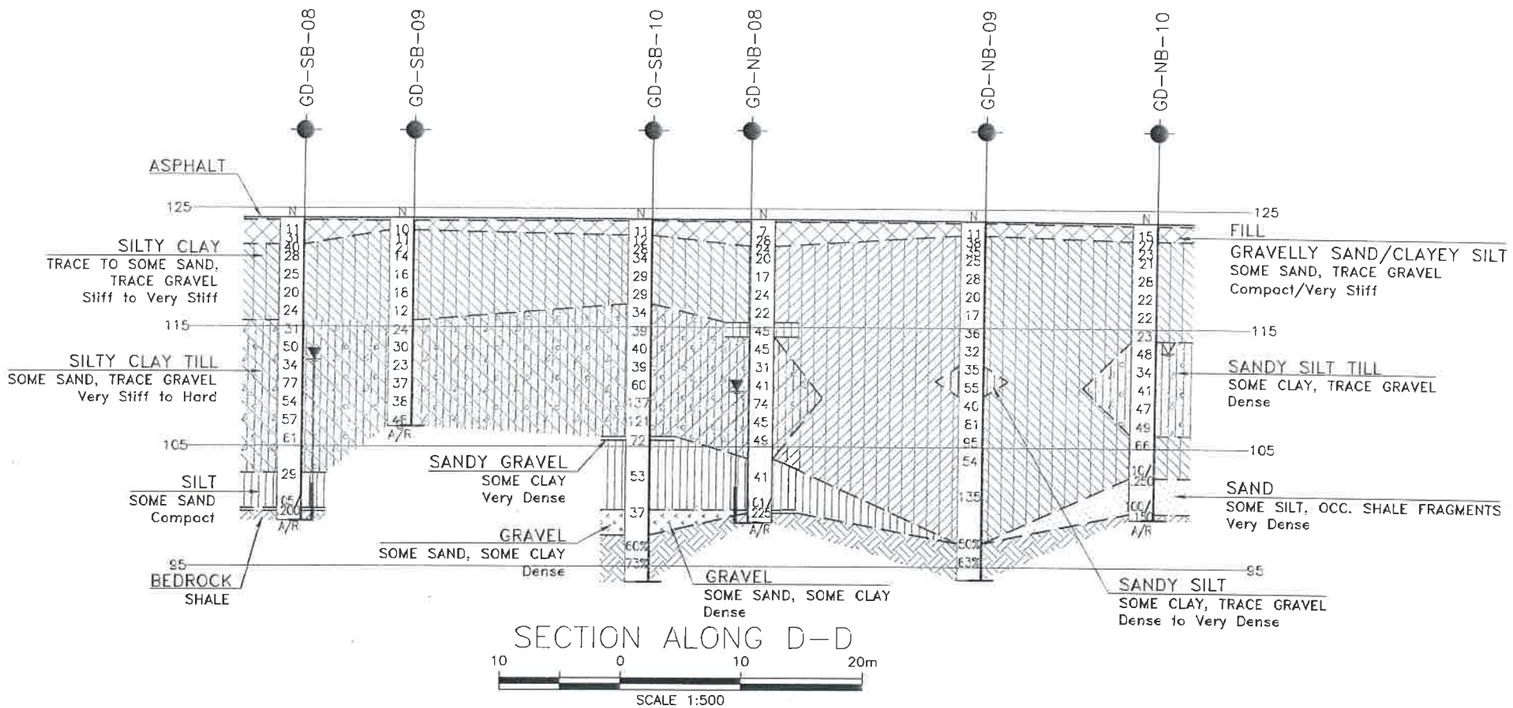
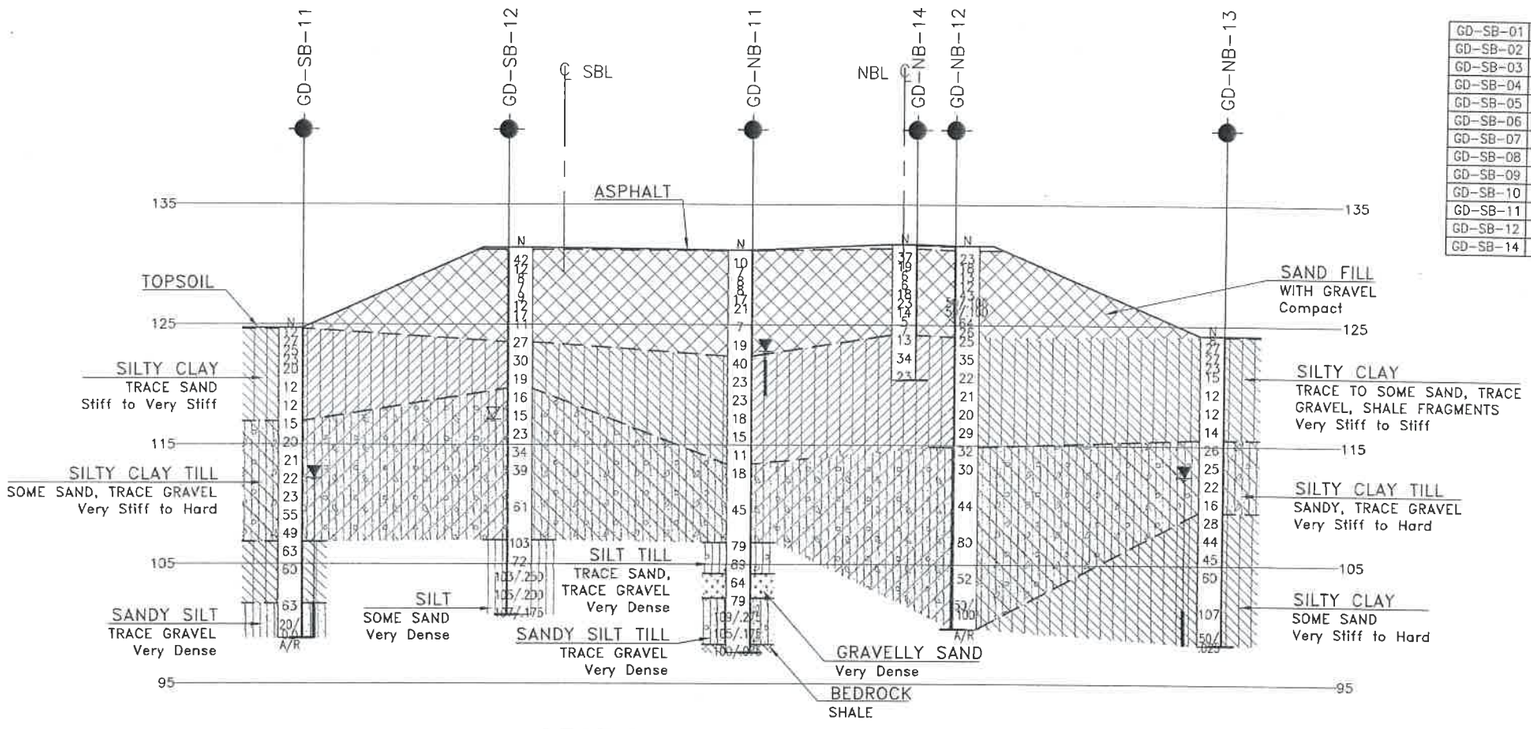


SECTION ALONG D–D

10 0 10 20m

SCALE 1:500



SECTION ALONG C–C

10 0 10 20m

SCALE 1:500

GD-SB-01	130.0	4 777 263.2	327 492.0
GD-SB-02	123.8	4 777 234.4	327 472.6
GD-SB-03	130.4	4 777 248.5	327 492.0
GD-SB-04	130.2	4 777 254.2	327 502.8
GD-SB-05	124.2	4 777 215.3	327 475.4
GD-SB-06	124.1	4 777 220.2	327 485.6
GD-SB-07	124.1	4 777 228.3	327 501.1
GD-SB-08	124.2	4 777 194.3	327 475.3
GD-SB-09	124.2	4 777 198.2	327 483.5
GD-SB-10	124.1	4 777 207.7	327 500.8
GD-SB-11	124.7	4 777 175.2	327 469.0
GD-SB-12	131.4	4 777 176.4	327 487.2
GD-SB-14	131.4	4 777 169.5	327 486.9

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
April 30/13
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
Apr. 30/13
PROVINCE OF ONTARIO

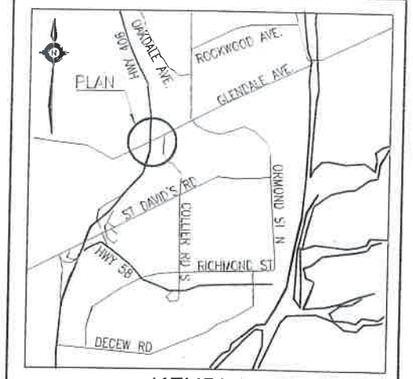
CONT No
GWP No 2348-09-00
WP No 2365-09-01

SHEET

HIGHWAY 406
GLENDALE AVE. OVERPASS
TWIN BRIDGE REHABILITATION
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN
A member of MMM GROUP

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
GD-NB-01	130.5	4 777 272.8	327 520.9
GD-NB-02	130.2	4 777 259.7	327 510.3
GD-NB-03	130.8	4 777 259.0	327 521.1
GD-NB-04	123.3	4 777 269.0	327 543.4
GD-NB-05	124.1	4 777 233.0	327 510.3
GD-NB-06	124.0	4 777 242.2	327 526.1
GD-NB-07	124.0	4 777 246.8	327 535.5
GD-NB-08	124.1	4 777 211.5	327 508.0
GD-NB-09	124.0	4 777 220.5	327 525.1
GD-NB-10	123.9	4 777 226.7	327 537.8
GD-NB-11	131.2	4 777 184.5	327 505.7
GD-NB-12	131.5	4 777 198.4	327 517.7
GD-NB-13	124.2	4 777 212.8	327 535.7
GD-NB-14	131.7	4 777 191.5	327 517.4

-NOTES-

1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

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

GEOCRES No. 30M3-277

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN LPG	CHK LPG	CODE	LOAD	DATE MAY 2013
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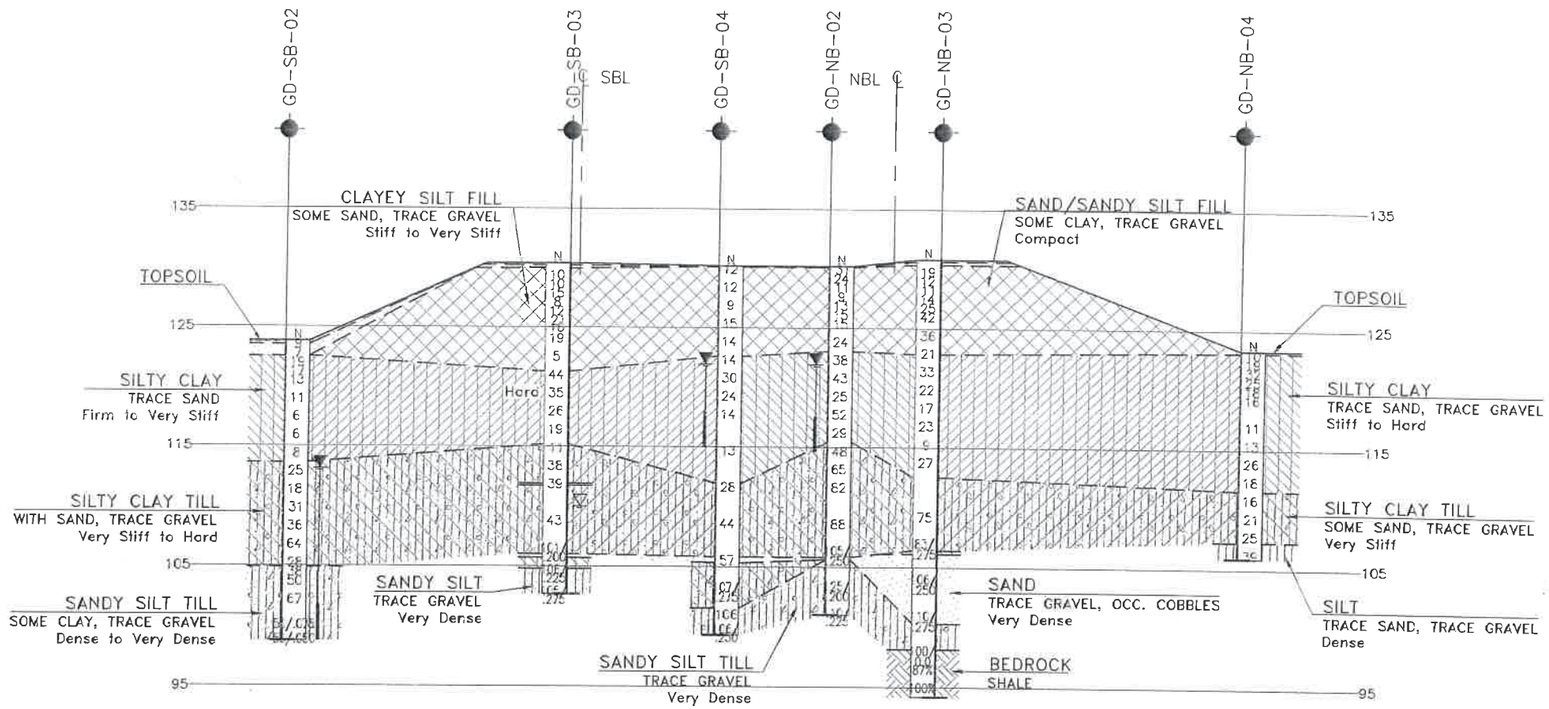
PLOTDATE: 5/1/2013 10:57 AM

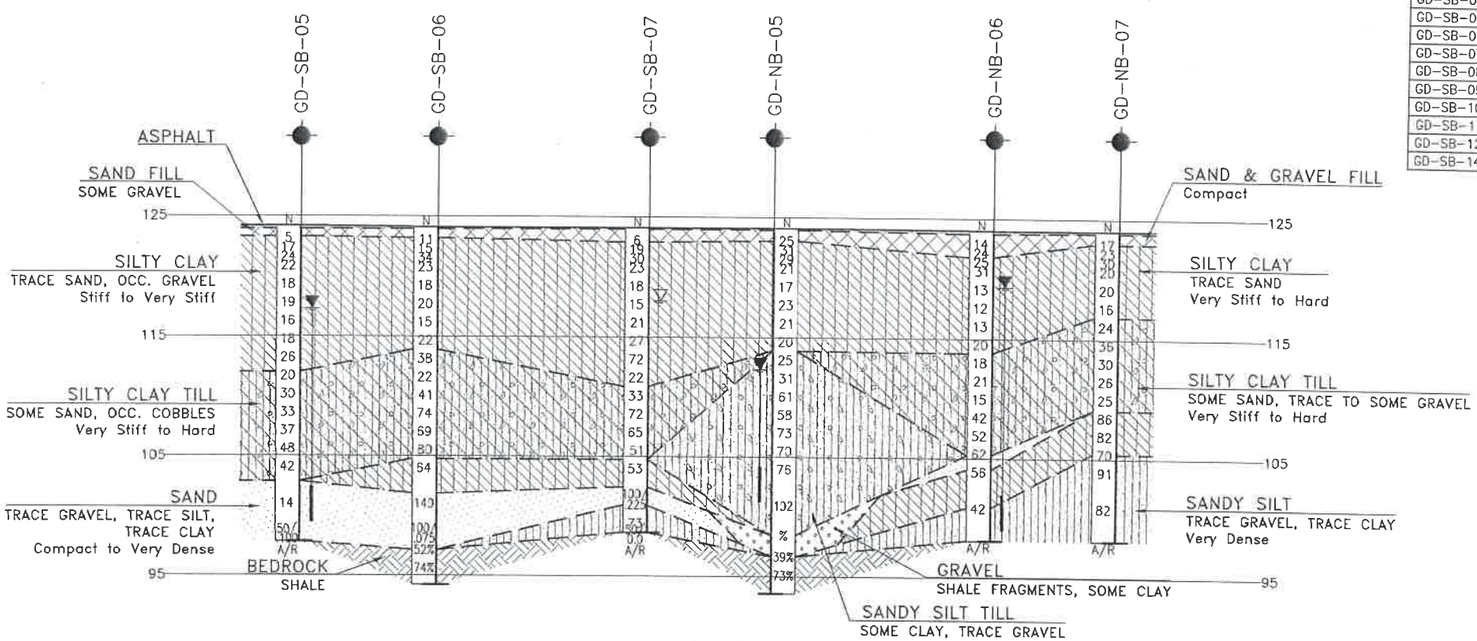
MINISTRY OF TRANSPORTATION, ONTARIO



SECTION ALONG F–F

10 0 10 20m

SCALE 1:500



SECTION ALONG E–E

10 0 10 20m

SCALE 1:500

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Apr 30/13
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
Apr 30/13
PROVINCE OF ONTARIO

GD-SB-01	130.0	4 777 263.2	327 492.0
GD-SB-02	123.8	4 777 234.4	327 472.6
GD-SB-03	130.4	4 777 248.5	327 492.0
GD-SB-04	130.2	4 777 254.2	327 502.8
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GD-SB-06	124.1	4 777 220.2	327 485.6
GD-SB-07	124.1	4 777 228.3	327 501.1
GD-SB-08	124.2	4 777 194.3	327 475.3
GD-SB-09	124.2	4 777 198.2	327 483.5
GD-SB-10	124.1	4 777 207.7	327 500.8
GD-SB-11	124.7	4 777 175.2	327 469.0
GD-SB-12	131.4	4 777 176.4	327 487.2
GD-SB-14	131.4	4 777 169.5	327 486.9

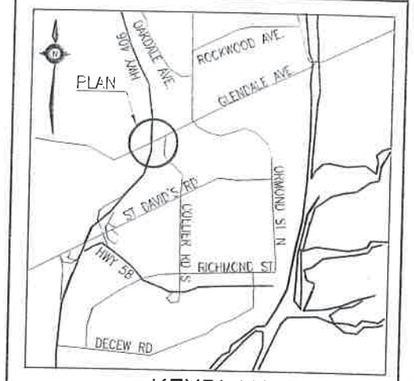
CONT No
GWP No 2348-09-00
WP No 2365-09-01

SHEET

HIGHWAY 406
GLENDALE AVE. OVERPASS
TWIN BRIDGE REHABILITATION
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN
A member of MMM GROUP

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
GD-NB-01	130.5	4 777 272.8	327 520.9
GD-NB-02	130.2	4 777 259.7	327 510.3
GD-NB-03	130.8	4 777 259.0	327 521.1
GD-NB-04	123.3	4 777 269.0	327 543.4
GD-NB-05	124.1	4 777 233.0	327 510.3
GD-NB-06	124.0	4 777 242.2	327 526.1
GD-NB-07	124.0	4 777 246.8	327 535.5
GD-NB-08	124.1	4 777 211.5	327 508.0
GD-NB-09	124.0	4 777 220.5	327 525.1
GD-NB-10	123.9	4 777 226.7	327 537.8
GD-NB-11	131.2	4 777 184.5	327 505.7
GD-NB-12	131.6	4 777 198.4	327 517.7
GD-NB-13	124.2	4 777 212.8	327 535.7
GD-NB-14	131.7	4 777 191.5	327 517.4

-NOTES-

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

GEOCRES No. 30M3-277

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN LPG	CHK LPG	CODE	LOAD	DATE	MAY 2013
DRAWN AN	CHK SKP	SITE	STRUCT	DWG	6

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PLOTDATE: 5/1/2013 10:57 AM