FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH EMBANKMENTS AND SWAMPS
MUSKOKA CONNECTION TO HIGHWAY 124
HIGHWAY 11 FOUR LANING
BURK'S FALLS TO SOUTH RIVER, ONTARIO
G.W.P. 759-93-00
VOLUME 1

Geocres Number: 31E-220

Report to

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual information obtained from a foundation investigation at the proposed locations of high embankments and swamps along the proposed Highway 11 mainline alignment extending from Highway 124 to Muskoka Road (Strong Township, Mainline Sta. 19+875 to 21+150). The report also addresses high embankments and swamp crossings on the adjacent portions of Highway 124 and Muskoka Road as well as the ramps for the Highway 124 Interchange.

The purpose of the investigation was to explore the subsurface conditions at sites where embankments higher than 6 m or swamp crossings are proposed, and based on the data obtained, to provide a borehole location plan, borehole logs, stratigraphic profile and cross-sections and a written description of the subsurface conditions.

Thurber carried out the investigation as a sub-consultant to Marshall Macklin Monaghan (MMM), under the Ministry of Transportation Ontario (MTO) Agreement Number 5005-A-000188.

2 SITE DESCRIPTION

This report addresses the portion of the proposed Highway 11 Mainline extending approximately 1.3 km from Muskoka Road intersection with Hwy 11(at the south limit) to the north end at the proposed interchange with Highway 124. The proposed alignment is located in Strong Township and generally runs parallel to the existing Highway 11 in the southern portion and becomes new four-lane section in the northerly parts.

The site is located in the physiographic area known as the Laurentian Highlands of the Canadian Shield which generally consists of undulating terrain with uplands areas comprised of bedrock outcrop or overburden soils comprised of granular outwash or basal till of variable thickness. Swamps or lakes are commonly present in the low-lying areas. The southern portion of the

proposed alignment is located on the west side of a 30 m high upland area. The Highway 124 interchange at the north end of the project is located on relatively level swampy terrain east of a second 30 m high upland area.

Drainage in the surrounding areas is typically poor and is comprised of swamps and small streams. The majority of the study area drains generally north and then eastwards into Bernard Lake, located approximately 1 km east of Highway 11. The west edge of the study area (Highway 124) drains generally westwards into a tributary of Stirling Creek.

The majority of the land along this section of the proposed alignment is undeveloped forested land with occasional open swamps or pastures. The junctions of Muskoka Road and Highway 124 have light commercial and residential development which increases in density near the south boundary of the Town of Sunridge.

The proposed Highway 11 alignment and interchange crosses several wet, swampy areas where high fills are proposed. These areas are summarized below:

- Muskoka Road, Sta 9+275 to 9+550
- Highway 124, Sta 9+100 to 9+225
- West side of proposed Interchange, Hwy 11 Sta. 20+300 to 20+550 (E-S Ramp)

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this portion of the project were carried out between Sept 12, 2002 and May 27, 2004. The site investigation consisted of drilling and sampling a total of 162 boreholes and 22 Dynamic Cone Penetration Tests (DCPT) to depths ranging from 0 to 15 m. A summary of boreholes drilled at the various portions of the project are summarized below:

	Boreholes	DCPT
Highway 11 Mainline	58	3
Hwy 11/124 Interchange Ramps	61	11
Hwy 124	23	5
Muskoka Road	20	3

The median centreline location and stations were surveyed and staked in the field by Marshall Macklin Monaghan (MMM) prior to commencing drilling operations. The borehole and DCPT locations were established in the field by Thurber personnel based on the staked median centreline or approach ramp centreline as applicable. The boreholes are labelled based on the individual station and offset for each alignment. Property access, site preparation and utility clearances were carried out by Thurber prior to any drilling being carried out. The locations of the boreholes are

shown on the attached "Borehole Locations and Soil Strata Drawings" found in Appendices A through E. The site plans, topography and proposed height of embankments shown on the drawings were provided by MMM, dated May 2004.

The drilling, sampling and in-situ testing operations were carried out by All-Terrain Drilling of Waterloo, Ontario and George Downing Estate Drilling of Port Hawkesbury, Ontario. The boreholes were advanced by CME 75 drill rigs mounted on Nodwell tracked carriers using hollow stem and solid stem auger techniques. Disturbed samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in most overburden soils. Where cohesive layers exhibiting lower strength were encountered, in-situ vane shear tests and thin-walled tube samples were collected.

Dynamic Cone Penetration Tests (DCPT) were carried out at the toe of fill location (alternating intermediate stations) to obtain a continuous profile in the upper portion of the deposit. The DCPT tests were carried out by continuous penetration of a 50 mm diameter steel cone (60 degree) driven by a standard SPT hammer. The DCPT profiles are shown on the borehole logs in the Appendices A through E.

The drilling and sampling operations were supervised on a full time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and the recovered disturbed and undisturbed samples and processed the samples for transport back to Thurber's Oakville laboratory.

Upon completion of drilling and sampling, standpipe piezometers were installed in select boreholes. Piezometer construction generally utilized of 19 mm diameter Schedule 40 PVC pipe with 1.5 m long slotted tips installed near the bottom of the boreholes. The piezometers installations were backfilled with a sand filter pack extending from the bottom of the hole to at least 0.3 m above the top of the screen and bentonite clay seals (holeplug) placed above the filter sand and at just beneath the ground surface. The interval between the bentonite seals was backfilled with cuttings and bentonite. Boreholes without a piezometer were backfilled using bentonite and drill cuttings.

The Record of Borehole logs, "Borehole Locations and Soil Strata" drawings, and laboratory test result summaries are included in each of the separate appendices as shown below:

Appendix A	Hwy 11 Mainline, Strong Township, Sta. 19+875 to 20+525
Appendix B	Hwy 11 Mainline, Strong Township, Sta. 20+525 to 21+150
Appendix C	Highway 124/Highway 11 Interchange Ramps
Appendix D	Highway 124
Appendix E	Muskoka Road Connection

4 LABORATORY TESTING

All recovered soil samples were returned to Thurber's laboratory where they were subjected to visual identification and to natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in the Appendices as described in the preceding section.

Selected samples were subjected to gradation analysis (sieve test) and Atterberg Limit testing. A one-dimensional consolidation test was also carried out on one sample.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in the Appendices. Details of the soil stratigraphy encountered are presented in the Appendices A through E. A general description of the stratigraphy at each of the swamps and where high fills are proposed is given in the following sections.

5.1 Highway 11 Mainline Embankment, Sta. 19+875 to 20+525

The Highway11 Mainline between Sta. 19+875 and 20+525 will consist of a new four-lane section supported by an embankment which is generally 6 to 10 m in height. The anticipated footprint of the proposed fill is about 80 to 110 m in width.

The soils encountered in the boreholes drilled along this portion of the alignment generally consist of topsoil (organic silt) or peat layer overlying a mixture of silt and fine sand which in turn overlies a unit of silty clay to clayey silt. The above sequence is interrupted occasionally by a layer of discontinuous sand found either above or below the silt and sand unit. The preceding sequence, or the upper part of it, was found to overlay discontinuous sand a very hard layer, which resulted in auger refusal (inferred bedrock or cobbles and boulders).

Topsoil, Organic Silt and Peat

A layer of organic silt or topsoil was encountered in most borehole locations at the ground surface south of approximately Sta. 20+325. A surface peat layer was encountered at the ground surface between approximately Sta. 20+325 and Sta. 20+500.

The organic silt and topsoil layer is described as silt, organic, trace to some sand, with occasional rootlets and occasional wood fibres or as sandy topsoil. The deposit was typically dark brown in colour with occasional iron oxide staining. The thickness encountered in the borehole varied from 50 mm to 800 mm. The SPT N-values in this deposit varied from 1 to 7 indicating very loose to loose conditions. The moisture content of disturbed samples collected from the organic silt varied from 42 to102%.

The peat deposit is described as peat, fibrous, silty, trace sand, with occasional rootlets and wood fibres. The colour was dark brown. The thickness encountered at the borehole

locations varied from 0.2 to 1.5 m. The SPT N-values varied from 2 to 3 indicating very loose conditions. The moisture content of the disturbed samples recovered from the peat deposit varied from 106 to 856 % by weight.

Upper Sand

In localized areas, such as from Sta. 20+375 to 20+425 left of median centreline, an upper sand deposit was encountered underlying the topsoil or peat layers. The thickness of this unit encountered in the boreholes was 0.4 to 0.9 m.

This unit is generally described as fine grained sand, trace to some silt, trace gravel and occasional cobbles. Trace of organics and rootlets was noted in some samples. The deposit is brown in colour with occasional oxide staining. The SPT N-values ranged from 6 to more than 100 indicating loose to very dense conditions.

Silty Sand, Silt and fine Sand, Sandy Silt

At most locations the surficial topsoil and peat layers or upper sand layer were underlain by a deposit containing a variable mixture of silt and fine sand. The composition of this unit was variable ranging from silty sand; sand and silt mixtures; sandy silt; through to silt some clay. The minor constituents noted in the samples included, occasional rootlets, trace gravel and occasional cobbles. The sand fraction was typically fine grained. The thickness of this deposit varies from 1.0 to 4.6 m.

The deposit was typically brown in colour with occasional oxide staining.

SPT N-values in this deposit range from 7 to 46 indicating a loose to dense condition. Some higher SPT N-values (>100/0.1m) were noted near the lower boundary of this unit where refusal conditions were encountered.

The moisture content of disturbed samples collected from this unit varied from 16 to 24%.

The results of grain size analyses conducted on samples from this unit are summarized in Figures A1through A4 in Appendix A and on the Record of Borehole sheets.

Silty Clay to Clayey Silt

From Sta. 20+300 to 20+20+500, cohesive silty clay to clayey silt deposit was encountered underlying the silt and sand unit described above. This deposit is described as silty clay to clayey silt, trace sand. The thickness of silty clay and clayey silt encountered in the boreholes varied from 0.8 to 5.7 m. Auger refusal was generally encountered at the lower boundary of this unit indicating that it is underlain by boulders or bedrock.

The deposit is typically brown to grey in colour with occasional oxide staining.

The SPT N-values recorded in this unit range from 7 to 16, indicating a stiff to very stiff condition.

The moisture content of disturbed samples recovered from this unit varied from 23 to 37%. The Atterberg limit tests carried out in this deposit resulted in ranged liquid limits of 22 to 29% and plastic indices of 5 to 9%. The fraction of clay-sized particles (<2 μm) encountered in the samples ranged from 22 to 34% by weight. The portion of sand sizes was less than 10%.

The results of the laboratory testing are summarized in Figures A6 and A8 in Appendix A.

Groundwater

Observations of groundwater conditions during drilling and measurements of water levels in piezometers indicate that the groundwater table is generally near the ground surface (Elev 350 m to 352 m) in the low-lying swamp areas, and 1 to 2 m below the ground surface (Elev 353 m to 363 m) in the upland areas. The groundwater levels are expected to vary seasonally and with heavy precipitation events.

5.2 Highway 11 Mainline Embankment, Sta. 20+525 to 21+200

The Highway11 Mainline between Sta. 20+525 and Sta. 20+200 will consist of a new four-lane section supported by an embankment which is generally 5 to 11 m in height. South of approximately Sta 20+775 and north of approximately Sta. 20+950, the embankment height reduces to 6 m or less. The anticipated footprint of the proposed fill is about 80 to 90 m in width.

The soils encountered in the boreholes along this portion of the alignment generally consisted of a sandy topsoil or peat layer overlying a sand deposit. The sand layer in turn overlies bedrock or a deposit comprised of silt to sandy silt or a silt and sand mixture. Locally thin layers of clayey silt was encountered beneath the topsoil near BH20+550 L18.75, underlying the sandy silt deposit at Sta. 20+550 R21.75 and underlying the sand unit at BH20+925 L18.75.

Topsoil and Peat

A layer of topsoil or peat was encountered in most borehole locations. The thickness of this deposit varied from 0.2 to 0.6 m.

The topsoil layer is described as sandy topsoil, with occasional rootlets and occasional wood fragments. The deposit was typically dark brown in colour with occasional iron oxide staining. The SPT N-values in this deposit varied from 4 to 5 indicating very loose conditions. The moisture content of disturbed samples collected from the topsoil layer varied from 23 to 25%.

The peat deposit was encountered locally from 20+895 to 21+000 and is described as peat, fibrous. The colour was dark brown to black.

Sand

At most locations, a sand deposit was encountered underlying the topsoil or peat layers described above. The thickness of the sand unit as encountered in the boreholes was 0.4 to 3.8 m.

This unit is generally described as fine grained sand, trace silt to silty, trace gravel with occasional cobbles and gravelly zones. Trace to some organics were noted in some samples. The deposit is brown or reddish-brown in colour with occasional oxide staining. The SPT N-values ranged from 6 to more than 100 indicating loose to very dense conditions.

The moisture content of the disturbed samples varied from 10 to 24%.

The results of the gradation analyses in Figure B1 and B2 in Appendix B.

Clayey Silt

In localized areas between Sta. 20+550 and Sta. 20+625 and at 20+925, a cohesive clayey silt deposit was encountered underlying the sand unit described above. This deposit is described as clayey silt, trace to some sand with occasional sand, silt and clay lenses or laminations. The thickness of the clayey silt encountered in the boreholes varied from 0.8 to 1.8 m.

The deposit is typically grey in colour.

The SPT N-values recorded in this unit range from 4 to 30, indicating a soft to very stiff condition.

The moisture content of disturbed samples recovered from this unit varied from 22 to 36%. The Atterberg limit tests carried out in this deposit resulted in liquid limits ranging from 23 to 25% and plastic indices of 4 to 6% indicating low plasticity. The fraction of clay-sized particles (<2 μm) encountered in the samples ranged from 18 to 23% by weight. The portion of sand sizes in the samples was typically less than 5%.

The results of the laboratory testing are summarized in Figure B3 in Appendix B.

Silt to Sandy Silt

From Sta. 20+525 to 20+600 and locally at Sta. 2+800, 20+950 and 20+970, a layer of silt to sandy silt was encountered underlying the sand unit described above. This deposit is generally non-cohesive to slightly cohesive and is described in the borehole records as silt, some sand or as sandy silt, some clay. Occasional silty clay laminations were noted in some boreholes (20+598 R18). The thickness of silt and sandy silt encountered in the boreholes varied from 0.3 to 1.6 m.

The deposit is typically brown to grey in colour with occasional oxide staining.

The SPT N-values recorded in this unit range from 6 to 49, indicating loose to dense conditions. At locations where the deposit was considered to be cohesive, the SPT N-values ranged from 6 to 8 indicating firm consistency.

The moisture content of disturbed samples recovered from this unit varied from 18 to 28%. The Atterberg limit tests carried out in this deposit resulted in liquid limits ranging from 22 to 25% and plastic indices of 4 to 5% indicating low plasticity. The fraction of clay-sized particles (<2 μm) encountered in the samples ranged from 7 to 15% by weight. The portion of sand sizes was less than 4 to 38%.

The results of the laboratory testing are summarized in Figures B4 to B5 in Appendix B.

Silty Sand to Silt and Sand

From Sta. 20+950 to 21+200, the stratigraphic layers described above were underlain by a deposit containing a mixture of silt and sand grading to silty sand. The composition of this unit was variable ranging from sand and silt mixtures to silty sand trace clay. The deposit was stratified with thin silty sand layers. The sand fraction was typically fine grained. The thickness of this deposit varies from 0.9 to greater than 4.4 m. The lower boundary of this unit was not encountered in the boreholes.

The deposit was typically brown in colour with grey silty interbeds.

SPT N-values in this deposit range from 11 to 30 indicating a compact condition.

The moisture content of disturbed samples collected from this unit varied from 19 to 27%.

The results of grain size analyses conducted on samples from this unit are summarized in Figures B5, B6 and B7 in Appendix B and on the Record of Borehole sheets.

Groundwater

Observations of groundwater conditions during drilling and measurements of water levels in piezometer at 21+150 R18.75 (Elev 352.1 m) indicate that the groundwater table is generally near the ground surface (Elev 350 m to 352 m) in the low-lying swamp areas, and 1 to 2 m below the ground surface (Elev 350 m to 352 m) in the upland areas. The groundwater levels are expected to vary seasonally and with heavy precipitation events.

5.3 Highway 11/ Highway 124 Interchange Ramps

Seven new ramps are proposed for the interchange of Highway 11 and Highway 124 and will consist of several intersecting embankments with different heights. The proposed embankment section will consist of an approximately 8 m wide road allowance supported by fill with a footprint varying from about 32 m to 60 m in width, depending on the embankment height. Subsurface information was collected where proposed embankment

heights exceeded 6 m at the proposed embankment centreline and toe locations. A list of the interchange ramps investigated is provided below:

N-E Ramp
N-EW Ramp
E-S Ramp
S-S Ramp
W-S Ramp
W-N Ramp
E-N Ramp

The soils encountered in the boreholes along the various interchange ramps generally consisted of a discontinuous topsoil or peat layer overlying a silt and sand deposit. The silt and sand layer in turn overlies a deposit of cohesive clayey silt to silty clay. A lower sand unit was encountered underlying the cohesive deposit. Most of the boreholes and DCP tests encountered auger or cone refusal at the base of the lower sand unit indicating the presence of boulders or bedrock. The depth of the overburden soils was variable generally ranging from 2 m to 13 m below the ground surface.

Topsoil and Peat

A surficial layer of topsoil or peat was encountered at most borehole locations. The topsoil was typically encountered on the upland areas and the peat in the wet, low-lying areas. At the borehole locations, the thickness of the topsoil layer varied from 0.05 m to 0.6 m and the thickness of the peat varied from 0.3 to 1.7 m.

The topsoil layer is described as sandy or silty topsoil, with occasional rootlets and occasional wood fibres. The deposit was typically dark brown or brown in colour. The SPT N-values in this deposit varied from 2 to 15 indicating very loose to compact conditions. The moisture content of disturbed samples collected from the topsoil layer varied from 22 to 164%.

The peat deposit was encountered locally from 20+895 to 21+000 and is described as peat, fibrous with occasional layers of silty sand. The colour was dark brown to black. The moisture content of disturbed samples varied from 85% to 448%.

Sand, Silt and fine Sand, Sandy Silt

At most locations the surficial topsoil and peat layers were underlain by a deposit containing a variable mixture of non-cohesive silt and fine sand. The composition of this unit ranges sand trace to some silt; sand and silt mixtures; sandy silt; through to silt trace to some sand. The sand fraction was typically fine grained. The deposit generally becomes finer grained with increasing depth. The minor constituents noted in the samples included,

occasional rootlets, trace gravel and occasional cobbles. The thickness of this deposit varies from 0.8 to 5.3 m.

The deposit was typically brown in colour with occasional grey silt and clay laminations and oxide staining.

SPT N-values in this deposit range from 3 to 66 indicating a loose to very dense condition. Some higher SPT N-values (>100/0.1m) were noted where cobbles were encountered or near the lower boundary of this unit where refusal conditions were met.

The moisture content of disturbed samples collected from this unit varied from 8 to 32%.

The results of grain size analyses conducted on samples from this unit are summarized in Figures C1through C4 in Appendix C and on the Record of Borehole sheets.

Clayey Silt to Silty Clay

Beneath most of the proposed interchange ramps, except for the N-W Ramp and south of Sta. 20+600 on the N-E ramp, a cohesive clayey silt to silty clay deposit was encountered underlying the silt and sand unit described above. The cohesive deposit is generally described as clayey silt to silty clay, trace sand, but varies to silt, some clay trace sand to sandy. The deposit has frequent sand seams, and silt or clay lenses or laminations. The thickness of the clayey silt to silty clay encountered in the boreholes varied from 0.7 to 11 m.

The deposit is typically grey in colour, with occasional brown areas noted.

The SPT N-values recorded in this unit range from 1 to 24, indicating a soft to very stiff condition. Vane shear test resulted in measured shear strengths of 36 kPa to more than 100 kPa. The sensitivity of the cohesive deposits, based on remolded vane shear measurements, varied from 2 to 7, indicating low sensitivity.

The moisture content of disturbed samples recovered from this unit varied from 22 to 58%. The Atterberg limit tests carried out in this deposit resulted in ranged liquid limits of 22 to 32% and plastic indices of 4 to 13% indicating low plasticity. The fraction of clay-sized particles (<2 μm) encountered in the samples ranged from 9 to 36% by weight. The portion of sand sizes in the samples was typically less than 12%, with a maximum sand content of 23% in one sample.

The results of the laboratory testing are summarized in Figures C5 to C16, in Appendix C.

Lower Sand

In some areas near the western edge of the interchange (N-E and E-S ramps), a layer of sand was encountered underlying the cohesive clayey silt to silty clay unit described above. The sand deposit is described in the borehole records as sand trace to some silt, trace to some gravel and as gravelly or silty sand. Occasional cobbles or boulders were also noted

in the boreholes. The thickness of the lower sand layer encountered in the boreholes varied from 0.4 to 2.0 m.

The deposit is typically brown in colour.

The SPT N-values recorded in this unit generally range from 12 to more than 100, indicating compact to very dense conditions. The higher SPT N-values (>100/0.1m) were noted where cobbles, boulders or the underlying bedrock were encountered.

The moisture content of disturbed samples recovered from this unit varied from 18 to 22%.

The results of the laboratory testing for this unit are summarized in Figures C3 in Appendix C.

Groundwater

Observations of groundwater and soil moisture conditions during drilling indicate that the groundwater table is generally near the ground surface (Elev 350 m to 352 m) in the low-lying swamp areas, and 1 to 3 m below the ground surface (Elev 350 m to 353 m) in the upland areas. The groundwater levels are expected to vary seasonally and with heavy precipitation events.

5.4 Highway 124 Embankments

A realignment of the existing Highway 124 is proposed west and east of the new interchange with Highway 11. The new alignment of Highway 124 will have three separate areas where embankment fill higher than 6 m or swamp crossings are proposed. These areas are:

Hwy 124, Sta. 9+100 to 9+240:	3 - 4 m high embankment on swamp
Hwy 124, Sta. 9+760 to 9+940:	7 – 18 m high embankment on swamp
Hwy 124, Sta. 10+050 to 10+150:	6 – 10 m high embankment

The soils encountered in the boreholes advanced within the three areas identified above generally consisted of a discontinuous topsoil or peat layer overlying a sandy silt to sand deposit. From Sta. 9+100 to 9+240, where the bedrock was relatively shallow (<2 m), the sand directly overlies the bedrock. However, at the two more eastern locations, the depth of bedrock increases to 15 m maximum, and the silty sand to sand deposit was found to overlay a layer of sandy silt supported by an underlying layer of silty clay unit. A lower sand to sand and gravel unit was encountered underlying the cohesive silty clay deposit. Most of the boreholes and DCP tests encountered auger or cone refusal at the base of the lower sand unit indicating the presence of boulders or bedrock.

Standing water was encountered up to 300 mm above the ground surface during drilling at the lower elevations from Sta. 9+100 to 9+240.

Topsoil and Peat

A surficial layer of topsoil or peat was encountered at most borehole locations. The topsoil was typically encountered on the upland areas and the peat in the wet, low-lying areas. At the borehole locations, the thickness of the topsoil layer varied from 0.1 m to 0.5 m and the thickness of the peat varied from 0.1 to 0.9 m.

The topsoil layer is described as sandy topsoil, with occasional rootlets and occasional wood fibres. The deposit was typically dark brown in colour.

The peat deposit is described as peat, fibrous with occasional rootlets. The colour was dark brown to black. The moisture content of disturbed samples varied from 119% to 385%.

Sand to Silty Sand

At most locations along Highway 124, the surficial topsoil or peat layers (where present) were underlain by a variable deposit comprised of cohesionless sand to sandy silt. The composition of this unit generally ranges from sand trace to some silt; to silty sand. Less frequently areas of sand and silt mixtures or sandy silt were encountered. The minor constituents noted in the samples included: peat inclusions, occasional rootlets, wood-fibres, trace gravel. The thickness of this deposit varies from 0.1 to 2.8 m.

The deposit was typically brown in colour.

Most of the SPT N-values in this deposit range from 2 to 50 indicating a very loose to dense condition. Some higher SPT N-values (>100/0.1m) were noted near the lower boundary of this unit where refusal conditions on boulders or bedrock were encountered.

The moisture content of disturbed samples collected from this unit generally varied from 15 % to 22%. Extreme values up to 82% were encountered where peat inclusion or other organics were noted in the deposit.

The results of grain size analyses conducted on samples from this unit are summarized in Figures D1 and D2 in Appendix D and on the Record of Borehole sheets.

Silt and Sand to Sandy Silt

At Hwy 124, Sta. 9+760 to 9+940, where the depth to bedrock increases to more than 12 m a cohesionless silt and sand to sandy silt unit was encountered underlying the sand to silty sand deposit described in the preceding section. The deposit is generally described as sand and silt varying to sandy silt or to silt some clay, trace to some sand. Occasional clay or sand seams and layers were noted in this unit. The thickness of the Silt and Sand unit encountered in the boreholes varied from 0.7 to 4.3 m.

The deposit is typically brown in colour, with occasional grey areas noted.

The SPT N-values recorded in this unit range from 4 to 37, indicating very loose to dense condition.

The moisture content of disturbed samples recovered from this unit varied from 20 to 28%.

The results of the laboratory testing are summarized in Figure D3 in Appendix D.

Silty Clay

A silty clay deposit was encountered underlying the silt and sand to sandy silt unit described above. The silty clay deposit is varies from clayey silt to silty clay, or a mixture of silt and clay. The deposit contains trace to some sand. The deposit has frequent sand and silt seams, lenses or laminations. The thickness of the clayey silt to silty clay encountered in the boreholes varied from 2.7 to 10.0 m.

The deposit is typically grey in colour, with rare brown zones noted in the upper part of the deposit.

The SPT N-values recorded in this unit range from 1 to 6, but occasionally up to 16.. Vane shear test resulted in measured shear strengths of 8 kPa to more than 100 kPa indicating very soft to very stiff conditions. The sensitivity of the cohesive deposits, based on remolded vane shear measurements, varied from 2 to 7, indicating low sensitivity.

The moisture content of disturbed samples recovered from this unit varied from 18 to 48%. The Atterberg limit tests carried out in this deposit resulted in ranged liquid limits of 22 to 30% and plastic indices of 4 to 10% indicating low plasticity. The fraction of clay-sized particles (<2 μm) encountered in the samples ranged from 13 to 40% by weight. The portion of sand sizes in the samples was typically less than 10%.

A one-dimensional consolidation test was carried out on an undisturbed sample from Borehole 9+899 L1.5 at 8.8 m depth. The results of the test are summarized in Table 5.1. Detailed test results are included in Appendix D.

TABLE 5.1: CONSOLIDATION TEST SUMMARY

Borehole	Sample depth (m)	Insitu s' (kPa)	w (%)	e_o	Pc' (kPa)	OCR	Cc	Cr
9+899 L1.5	8.85	88	36	1.01	50	0.6	0.20	0.05

Where

s'	insitu overburden pressure
w	moisture content
eo	initial void ratio
Pc'	Preconsolidation pressure
OCR	Overconsolidation ratio
Cc	Compression Index
Cr	Recompression Index

The results of the laboratory testing are summarized in Figures D4 to D9, in Appendix D.

Lower Sand or Sand and Gravel

In most areas along Highway 124, a layer of sand or sand and gravel was encountered beneath the units described above and directly overlying auger refusal conditions indicating bedrock or boulders. The sand deposit is described in the borehole records as sand trace to some silt, trace to some gravel or as sand and gravel. Occasional cobbles were also noted in the boreholes. The thickness of the lower sand layer encountered in the boreholes varied from 0.1 to 1.2 m.

The deposit is typically brown in colour.

The SPT N-values recorded in this unit generally range from 39 to greater than 100, indicating dense to very dense conditions. The higher SPT N-values (>70/0.2m) were generally noted where cobbles or the underlying bedrock were encountered.

The moisture content of disturbed samples recovered from this unit varied from 8 to 22%.

Groundwater

Observations of groundwater and soil moisture conditions during drilling indicate that the groundwater table is generally near or 0.3 m above the ground surface (Elev 370 m to 370.5 m) in the swamp areas between Stations 9+100 and 9+250 along Highway1214.

West of the proposed Highway 124/ 11 underpass the groundwater table was encountered 1 to 2 m below the ground surface (Elev 350 m to 363 m) in the upland areas and near or 1 m above the ground surface (Elev 350 m to 351 m) in the low-lying areas.

East of the proposed underpass, the groundwater table was encountered approximately 0.9 m below the ground surface (Elev 354 m).

The groundwater levels are expected to vary seasonally and with heavy precipitation events.

5.5 Muskoka Road Embankments

A new Muskoka Road Connection is proposed west of the proposed Highway 11 four-lane alignment and south of the interchange with Highway 124. The new alignment of Muskoka Road Connection will have two separate areas where embankment fill higher than 6 m or swamp crossings are proposed. These areas are:

Muskoka Rd, Sta. 9+250 to 9+500:	6 – 10.5 m high embankment on swamp
Muskoka Rd, Sta. 9+625 to 9+825:	6 – 15 m high embankment

The soils encountered in the boreholes advanced within the southern swamp area identified above (Sta. 9+250 to 9+500) generally consisted of a surficial topsoil or peat layer overlying an upper sand layer which in turn was underlain by a slightly cohesive deposit of

silt with some clay. North of approximately Sta. 9+400, refusal conditions were encountered beneath the cohesive silt at 3.5 to 6.5 m depth. However, south of this location a deposit of cohesionless sandy silt to silty sand was encountered underlying the cohesive silt layer. Occasional zones of cohesionless sandy silt to silty sand materials were also encountered within the cohesive silt. An underlying layer of sand and gravel was encountered locally beneath the silt and sand layers near the south limits of the proposed embankment (Sta. 9+250).

The soils encountered beneath the proposed northern embankment (Sta. 9+625 to 9+825) generally consisted of the following sequence:

- Fill
- Peat or topsoil
- Silt and Sand mixtures (silty sand to sandy silt)
- Silt some clay to Clayey silt (cohesive)
- Lower sand, silty or gravelly

Not all the layers noted above were encountered in each borehole. The fill soils for example were only present near the existing access road, and some of the units were not continuous across the proposed embankment foundation area. A generalized description of the soil units is provided in the following sections.

Fill

Fill was encountered near the Access Road at Muskoka Rd Sta.9+722. The fill was comprised of sand and gravel over silty sand with organics. The thickness of the fill was 1.2 m. SPT N-values ranged from 4 to 5 indicating the materials were very loose to loose.

Topsoil and Peat

A surficial layer of topsoil or peat was encountered at most borehole locations. The topsoil was typically encountered on the upland areas and the peat in the wet, low-lying areas. At the borehole locations, the thickness of the topsoil layer varied from 0.1 m to 0.6 m and the thickness of the peat varied from 0.2 to 1.9 m.

The topsoil layer is described as sandy topsoil, with occasional rootlets and occasional wood fibres. The deposit was typically dark brown in colour.

The peat deposit is described as peat, fibrous with occasional rootlets. The colour was dark brown to black. The moisture content of disturbed samples varied from 58% to 552%.

Upper Sand Deposit

The upper sand layer was only encountered at the southern swamp area and is described as sand, trace silt, trace gravel. The sand was typically fine to medium grained. The thickness of this deposit varied from 0.8 m to 2.0 m. The colour was brown or grey. SPT N-values

ranged from 10 to 24 indicating compact conditions. The moisture content of disturbed samples varied from 15 to 22%.

Silt and Sand Mixture

In the northern embankment foundation area, a non-cohesive deposit of silt and sand in varying proportions was encountered. The composition of this unit generally ranges from sandy silt to silty sand and includes mixtures of fine grained sand and silt. Occasional silt and clay seams were noted at some locations. The minor constituents noted in the samples included: occasional rootlets, peat inclusions, trace to some gravel or trace clay. The thickness of this deposit varies from 0.3 to 2.8 m.

The deposit was typically brown, reddish brown or grey in colour with occasional oxide staining.

The SPT N-values in this deposit ranged from 7 to 49 indicating loose to compact conditions.

The moisture content of disturbed samples collected from this unit generally varied from 10 % to 22%. Extreme values up to 94% were encountered where peat inclusion or organics were noted in the deposit.

The results of grain size analyses conducted on samples from this unit are summarized in Figures E1 through E4 in Appendix E and on the Record of Borehole sheets.

Silt some clay to Clayey Silt

Beneath portions of both the south and northern embankment locations, a cohesive silt deposit was encountered underlying the Upper Sand or the Silt and Sand units described above. This cohesive deposit varies from silt some clay to clayey silt. The deposit contains trace to some sand and occasional cobbles. Sand, silt and clay seams, lenses or laminations were noted in the north of Sta. 9+700. The thickness of the silt some clay to clayey silt unit encountered in the boreholes varied from 0.3 to 3.1 m.

The deposit is typically brown or grey in colour, with occasional oxide staining.

The SPT N-values recorded in this unit generally range from 9 to 33, indicating generally stiff to hard conditions.

The moisture content of disturbed samples recovered from this unit varied from 13 to 29%. The Atterberg limit tests carried out in this deposit resulted in ranged liquid limits of 19 to 23% and plastic indices of 4 % indicating very low plasticity. The fraction of clay-sized particles (<2 μm) encountered in the samples ranged from 13 to 29% by weight. The portion of sand sizes in the samples was typically less than 15%.

The results of the laboratory testing are summarized in Figures E5 to E6 and E8, in Appendix E.

Lower Sand or Sand and Gravel

A layer of sand or sand and gravel was encountered beneath the units described above and directly overlying auger refusal conditions indicating bedrock or boulders. The sand deposit is described in the borehole records as silty sand, trace to some gravel, as gravely sand, or as sand and gravel trace to some silt. Occasional cobbles and boulders were also noted in some boreholes. The thickness of the lower sand layer encountered in the boreholes varied from 0.8 to 3.9 m.

The deposit is typically brown in colour.

The SPT N-values recorded in this unit generally range from 27 to more than 100, indicating compact to very dense conditions. The higher SPT N-values (>100/0.05m) were generally noted where cobbles, boulderd or the underlying bedrock were encountered.

The moisture content of disturbed samples recovered from this unit varied from 8 to 35%.

Groundwater

Observations of groundwater and soil moisture conditions during drilling and in the standpipe piezometers indicate that the groundwater table is generally near the ground surface. Depth to groundwater table measured in the piezometers varied from 0.3 to 0.64 m below the surface following completion of drilling. Some boreholes were drilled from frozen swamps where up to 500 mm of surface water was encountered above the ground surface.

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FOUNDATION INVESTIGATION AND DESIGN REPORT

HIGH EMBANKMENTS AND SWAMPS

MUSKOKA ROAD CONNECTION TO HIGHWAY 124

HIGHWAY 11 FOUR LANING

BURKES FALLS TO SOUTH RIVER, ONTARIO

G.W.P. 759-93-00

Geocres Number: 31E-220

PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

6 GENERAL

This report presents interpretation of the geotechnical data in the factual report and presents preliminary foundation design recommendations where embankment heights exceed 6 m or swamp crossings have been proposed.

The discussion and preliminary recommendations presented in this report are based on our understanding of the project and on the factual data obtained in the course of the investigation.

7 ENGINEERING ANALYSIS METHODOLOGY

7.1 General

The project information, including plan and profile of the proposed alignments dated May 2004, utilized in the engineering analysis was provided by MMM. For the purpose of analysis and reporting the proposed embankments and swamp crossings along the proposed Highway 11 alignment, interchange ramps and other highway alignments have been treated separately. A summary of the various segments is provided below:

- Hwy 11 Mainline, Strong Township, Sta. 19+875 to 20+525
- Hwy 11 Mainline, Strong Township, Sta. 20+525 to 21+150
- Highway 124/Highway 11 Interchange Ramps
- Highway 124
- Muskoka Road

The major factors governing foundation design of the proposed embankments include:

- Proposed embankment geometry (height, slope angle, footprint, etc)
- Embankment material type (earthfill, Select Subgrade Material -SSM or rockfill)

- Extent and thickness of surficial organic soils
- Thickness and engineering properties of underlying mineral soils
- Depth to competent layer (bedrock or dense gravel)
- Groundwater conditions

The geotechnical analysis summarized in this report includes assessment of the global stability of different embankment geometries and material types for both short and long term conditions. Assessment of immediate and long term settlement magnitudes and rates was also carried out. The analyses were based on the soil profiles and properties encountered at various locations. The location of the design sections and soil properties were selected for the more unfavourable locations.

The design of embankment stability and settlement are based on conventional factors of safety and selection of design parameters obtained from careful review of field and laboratory test results and engineering experience. The level of field and laboratory testing carried out for this project is expected to yield a reasonable level of reliability for the design. The design reliability could be improved by carrying out additional field investigation and laboratory testing (such as CPT). However, this additional work is not part of the current scope of work.

7.2 Design Options

Several design alternatives were considered in carrying out the embankment design, including:

- Subexcavation of peat and organics versus overland construction
- Provision for berms, geosynthetic reinforcement or flattening of slopes to improve global stability
- Staged construction to improve short term stability
- Preloading/surcharge to reduce long term settlements
- Wick drains to accelerate dissipation of excess pore pressure

A comparison of the advantages, disadvantages and relative cost is presented in the Table 7.1. The table presents design options for addressing stability, short term and long term settlements. For comparison purposes, the estimated relative unit costs presented in the table are based on generalized design parameters for a 60 m wide by 18.3 m high embankment section founded on a 12 m deep deposit of soft silty clay, similar to Hwy 124, near Sta.9+920.

The preferred design options are presented in Section 8. The recommended embankment design options are based on an anticipated construction schedule of 2 years. The final grading and pavement construction is expected to occur after this time.

7.3 Stability and Settlement Analyses

The stability analyses were carried out using limit equilibrium methods by the commercially available slope stability program "GSLOPE" developed by Mitre Software Inc. Bishop's modified method of slices was used in the analyses. Based on consideration of the risk involved and past experience with highway embankment design and monitoring of embankment performance, a Factor of Safety (FS) of 1.3 is considered appropriate to maintain embankment stability and control deformations during construction. A FS of 1.5 is recommended for assessment of global embankment stability for long term conditions.

Immediate foundation settlements due to compression of the non-cohesive soils have been estimated based on the methods described in the CHBDC, 2000 Commentary Section C6.6.3.6.

The estimated consolidation settlement magnitude and time to achieve the majority of this consolidation (90%) was calculated based on Terzaghi's one-dimensional vertical consolidation formulation combined with calculation of stresses in a two-dimensional elastic half-space as described in the CHBDC Commentary Section 6.6. The parameters used in the settlement analysis were determined by correlation of soil moisture and strength data to numerous laboratory tests from similar geologic units in the central Ontario region.

7.4 Seismic Considerations

The following seismic parameters have been used in design

- Velocity Related Seismic Zone 1
- Zonal Velocity Ratio 0.05
- Acceleration Related Seismic Zone 2
- Zonal Acceleration Ratio 0.1

In accordance with the CHBDC, the soil profile type at this site is classified as Type III (more than 9 m of soft to medium stiff clay), which according to Table 4.4.6.1 of the CHBDC is associated with a Site Coefficient of 1.5. A peak horizontal ground acceleration (PHA) of 0.17g, where g is the acceleration due to gravity, has therefore been used in this analysis. This PHA value corresponds to a probability of exceedance of 10% in 50 years.

7.4.1 Stability

Stability of the embankments under seismic loading was assessed by carrying out a pseudo-static analysis using the parameters noted above. The pseudo-static analysis considers the application of the PHA to the soil mass on a non-softening foundation to assess the embankment stability. This assumption is considered reasonable given the subsurface conditions encountered in the site investigation. The analysis was carried out for embankments constructed from rockfill or from Select Subgrade Material (SSM). A summary of the results of each analysis is included in Appendix F.

The embankment stability analyses indicate that the Factor of Safety under short term seismic loads will range from FS = 1.1 to 1.2. These results indicate an acceptable margin of stability under seismic loading conditions.

7.4.2 Liquefaction Potential

Several of the proposed embankments will be constructed on relatively thin (<2 m thick) loose to compact cohesionless layers overlying cohesive deposits. The water-table at the time of the field investigation was generally within or below the cohesionless soils. Based on the SPT N-values, partially saturated condition and the shallow depth of the cohesionless deposits, the likelihood of liquefaction of the foundation soils during the design seismic event is considered low. Some local liquefaction may occur during a seismic event resulting in local toe failure or minor settlement of the embankment, but this is expected to be readily repairable.

8 EMBANKMENT DESIGN

8.1 General

The generalized subsurface conditions and proposed embankment configurations for the various ramps, alignments and sections, are summarized in Table 8.1. Six representative areas were selected for detailed analysis based on the depth of compressible soils and areas exhibiting low shear strength. The areas selected for analysis are shown in Figure 1 following the text of this report.

Assessment of stability and settlement for embankments lower than 6 m height is beyond the scope of this report and is not included in this assessment.

The subsurface conditions vary from shallow cohesionless deposits providing relatively good stability and low foundation settlements, to deeper deposits of soft to firm cohesive clay where greater settlements and lower FS of global stability are expected. The groundwater table is typically at the ground surface where the deeper clay deposits are

encountered and 1 to 3 m below the surface in the upland areas A summary of the soil model and the engineering parameters used in the analysis is included in Table 8.2.

8.2 Comparison of Foundation Design Options

A comparison of advantages, disadvantages and relative costs for various design options is presented in Table 7.1. The foundation design and construction issues related to embankment settlement and stability are presented in Table 8.3 along with the recommendations for the preferred design options.

A brief summary of the results of the analysis and the embankment design recommendations are described below:

Hwy 124 (9+865 to 9+950)

A 20 m high embankment (including surcharge) is proposed and is to be founded on 10 m of firm, compressible cohesive soils. Design issues at this location include potential instability, short term settlement and long term foundation settlement. The preferred design measures recommended to address these issues consist of berms, staged construction, preloading/ surcharging, wick drains and monitoring of instrumentation.

The recommended berm sizes are based on the relative height of the proposed embankment and the depth of soil encountered. The berms are designed to provide a minimum Factor of Safety of 1.3 at each construction stage, for undrained loading conditions associated with expected construction rates. The assumption of undrained loading is considered reasonable given the limited plan area of the berms and embankments. Reduction of berm sizes may be possible if restrictions are placed on construction rates and partially drained conditions are allowed to develop during construction. This type of construction would require instrumentation and monitoring of excess pore pressure and displacements during construction. Development of these design options is outside of the current project scope.

Muskoka Road (9+885 to 9+960)

The subsurface conditions encountered at centerline of the Muskoka Connection 9+885 to 9+960 consist of an approximately 6.5 m thickness of silty sand with interbedded stiff silty clay. Settlement of the roadway is not expected to be a factor in design for this section. However, the thickness of soft cohesive soil increases significantly towards the east, and at the location of the east embankment toe, the borehole information indicates that soft, cohesive deposits extend to at least 10 m depth. Analysis indicates that for the proposed 14 m high embankment height, short term stability will require provision for berms and staged construction in the design. The recommendations are discussed further in the following sections.

Hwy 11 Mainline (20+400 to 20+500)

The subsurface conditions encountered in the foundation for the proposed Hwy 11 mainline embankment comprise a surficial peat layer overlying compact silt and stiff to very stiff silty clay to more than 7 m depth. Aside from removal of the peat layer detailed in the following section, the foundation conditions encountered do not require specialized design recommendations related to stability and settlement of the proposed 8 m high embankment.

8.3 Peat and Topsoil Removal

It is standard procedure in MTO projects to subexcavate peat deposits from within the embankment footprint if the underlying mineral soil will be encountered within 6 m of the ground surface. The foundation is then backfilled with rock or granular fill. For peat thickness of less than 6 m, this method is an economical and efficient method of improving stability during construction and minimizing the potential for large post-construction settlements. Where the peat thickness is greater than 6 m, construction becomes more costly and overland construction with surcharging may then be the preferred option.

Within the project limits addressed in this report, the depth of peat and organic soils is generally less than 2 m thick. It is therefore recommended that all peat and organic soils, where present be subexcavated from within the proposed fill footprint. The foundation area should be backfilled with rock or granular backfill as described in the following section. Placement of coarse rockfill material is recommended where standing water is encountered.

Table 8.4 provides a summary of the anticipated depth of subexcavation for peat and topsoil removal along the proposed alignments. The depth of stripping is based on the thickness of organics noted at the borehole locations. Stripping depth may vary from that noted in the table between the borehole locations.

In the stability and settlement analyses summarized below it has been assumed that the organic and peat layers have been removed and replaced with granular backfill as appropriate.

8.4 Stability Analysis

The input parameters and soil model used in the stability analyses, including soil stratigraphy, properties, piezometric pressures, and embankment geometry, are summarized in Figures F1 through F14 in Appendix F following the text of the report. The stability analyses were only carried out where embankment heights exceed 6 m from the original ground surface.

Separate analyses were carried out for both earth fill embankments and rockfill embankments for short term (undrained), long term (effective stress) and seismic conditions. The analyses used the following variables:

- Earth fill embankment slopes 2H:1V
- Rock fill embankment slopes 1.25H:1V
- Height of surcharge 2 m

The results of the stability analysis for all other swamp areas where embankment height exceeds 6 m resulted in FS greater than 1.3 for short term conditions and greater than 1.5 for long term conditions. Stability analysis under pseudo-static seismic loading indicates a Factor of Safety exceeding 1.1. A summary of results of the stability analyses is provided in Table F-1 in Appendix F.

The results of the analyses indicate that stability will be acceptable (FS greater than 1.5) under long term drained conditions and under seismic loads (FS greater than 1.1). However, short term stability will not be adequate at several sites where high fills are proposed on soft foundation soils. These sites will require stabilizing measures to improve stability to acceptable levels as described below.

Hwy 124, 9+865 to 9+950

This portion of Highway 124 will require a 20.3 m high embankment (including 2 m surcharge) founded on loose silt and clay extending to 14.8 m depth. The lower 9 m of the soil profile is comprised of cohesive, firm to stiff, clayey silt. The analysis indicates a FS<1 under undrained conditions for this configuration. Construction in two stages and addition of berms are therefore required to allow construction up to the required embankment height with FS=1.3. To reduce the required berm sizes, the stability analysis allows for strength gain within the foundation following the application of the first construction stage. Instrumentation and monitoring of the excess pore pressures will be required to confirm loading conditions and control start of placement of the second construction stage. Details of berm placement and size are summarized in Table 8.5 following the text of the report.

E-S Ramp, 20+630 to 20+720

A 13.2 m high embankment (including 2 m surcharge) is proposed for this portion of the E-S ramp. The embankment will be founded on soft clayey silt extending to 7 m depth. The analysis indicates that FS =1 for undrained loading under these conditions. The addition of berms is required to allow construction without interruption to the required height with acceptable stability (FS=1.3).

E-N Ramp, 20+720 to 20+800

A 10 m high embankment is proposed for this location with no allowance for surcharge. The embankment will be founded on soft to firm clayey silt extending to 7.2 m depth. The analysis indicates FS<1 for undrained loading under these conditions. A berm is recommended on the right (east) side of the embankment to allow uninterrupted construction of the embankment to the design grade with FS>1.3.

N-E Ramp, 20+700 to 20+790

An 11.4 m high embankment is proposed at this location, with no allowance for surcharge. The embankment will be founded on firm clayey silt extending to 7.1 m depth. The analysis indicates FS=1 for undrained loading under these conditions. A berm is recommended to allow uninterrupted construction of the embankment to the design grade.

Muskoka Road, 9+875 to 9+930

A 14 m high embankment is proposed at this location. Surcharge has not been include in the analysis as stiff soils near the road centreline are expected to result in foundation settlements of less than 50 mm. However, the thickness of soft cohesive soil increases significantly towards the east, at the location of the east embankment toe, where soft, cohesive deposits extend to at least 10 m depth. Analysis indicates that for the proposed embankment height, short term stability will not be adequate, FS<1. Provision for berms and staged construction in the design will be required for stability under undrained conditions (F=1.3). To keep the required berm sizes manageable, allowance for gain in foundation strength following the application of the first construction stage has been included in the analysis. Instrumentation and monitoring of the excess pore pressures will be required to confirm loading conditions and control the start of placement of the second construction stage. Details of berm placement and size are summarized in Table 8.5 following the text of the report.

8.4.1 Berm Design Configuration

Berm construction should be integrated with the overall construction of the embankments. The maximum slope of the berms should be as recommended for embankments of earthfill or rockfill materials as described above.

8.4.2 Staged Construction

Staged construction, instrumentation and monitoring will be required to complete the 18 m high embankments at:

- Highway 124, Sta. 9+950 to 9+865
- Muskoka Road, Sta. 9+885 to 9+960

Based on the stability calculations shown in Appendix F, the embankments at these locations can be raised to a maximum height of 12 m above the elevation of the embankment toe during the first stage of construction, provided that the berms are constructed first.

The second stage and the 2 m surcharge can be placed after monitoring of field instrumentation indicates that an acceptable level of the consolidation and strength has been achieved. The analysis requires that 90% of the consolidation be achieved for the first stage loading prior placement of the second stage. The estimated time for achieving 90% consolidation at each stage is provided in the following section.

The monitoring of settlements and pore pressures will require installation of instrumentation and monitoring of the instruments during construction. Design of the instrumentation and monitoring plans is outside of the scope of the current assignment. Target values for maximum excess pore pressure and values for confirming adequate dissipation will depend on the location and depth of the instruments and should be calculated in conjunction with the instrumentation design.

8.5 Settlement Analysis

8.5.1 Foundation Settlements

A settlement analysis was carried out using Terzaghi's one-dimensional consolidation theory with stresses calculated for two-dimensional embankment loading configurations. Input parameters were developed based on correlations between index and strength parameters measured at the site and correlated with oedometer tests carried out for this site and from adjacent areas of the Highway 11 project. The correlation of the compressibility and moisture content is included in Figure G-1.

The result of the settlement analyses are summarized in Table 8.6 following the text of the report. A detailed summary of the settlement analyses is included in Table G-1 in Appendix G.

A summary of the results of the settlement analysis is included below:

Hwy 124, 9+865 to 9+950

The settlement analysis for the proposed 18.3 m high embankment indicates a maximum primary settlement of 1060 mm. This settlement will apply near the centreline of the embankment. The estimated time for 90% of the primary settlement to occur considering that the embankment is constructed in two stages is 1.06 years. Long term settlement is estimated at 70 mm for a period of 30 years following construction. The settlement values are calculated for conditions where the greatest thickness of compressible soil was

encountered, near Sta. 9+913. A minimum 2 m surcharge is recommended for this embankment to reduce the post-construction settlement rate to less than 50 mm in 30 years.

To reduce the likelihood of disruption to the construction schedule, it is recommended that: vertical wick drains be installed at Hwy 124, Sta. 9+865 to 9+950. The design of wick drains is beyond the scope of this assignment.

E-S Ramp, 20+550 to 20+720

The foundation settlement analysis for the proposed 11.2 m high embankment indicates a maximum primary settlement of 300 mm, calculated at the embankment centreline. The estimate time for 90% of the primary settlement to occur is 2 to 3 months. Post construction settlement is estimated to be 60 mm over a 30 year period. A minimum 2 m surcharge is recommended to reduce the post construction settlement rate to less than 50 mm in 30 years.

Interchange Ramps

The estimated primary settlements calculated where compressible clay was encountered in the foundation for the E-N Ramp, Sta. 20+720 to 20+800 and the N-E Ramp, Sta. 20+700 to 20+760, are between 150 and 200 mm. The estimated time to achieve 90% consolidation is 2 to 3 months. Post construction settlement is estimated to be less than 50 mm in 30 years, and therefore surcharge is not required in these areas.

Muskoka Connection

Soils beneath the ceterline of the Muskoka Connection were stiff to very stiff and highly overconsolidated. No significant foundation settlement is expected within the roadway.

Highway 11 Mainline

Compressible soil is present within the foundation of the Highway 11 mainline embankment between Sta. 0+400 and 20+450. The estimated primary foundation settlement associated with construction of the proposed 8.3 m high embankment is approximately 40 mm. Post construction settlement for a 30 year life is estimated to be 40 mm. Surcharge is not required for this area.

Design Settlement Rates

The rate of settlement due to primary consolidation in the field may vary from the theoretical estimates because of natural variation in soil properties, complex boundary conditions, and changes resulting from loss of structure in the clay deposit during loading. It is therefore recommended that the theoretical times for consolidation be increased by at least 100% to account for these variations for the purpose of estimating construction schedules.

The estimated long term foundation settlement rate resulting from secondary consolidation are considered manageable with conventional pavement maintenance schedules. However, surcharging of the embankment is recommended in all areas where total settlement will exceed 300 mm.

A minimum height of surcharge of 2 m is recommended. Additional height of surcharge is not expected to affect the long term settlement because the geometry of the fill would result in relatively small stress change in the foundation.

8.5.2 Embankment Settlements

The estimated settlement of embankments constructed of rock fill or compacted earth fill will be 0.5% of the embankment height. This settlement is expected to occur within one to two years following completion of the embankments.

8.6 Embankment Construction

8.6.1 Embankment Construction Over Swamps

Construction of new embankments over swamp should be carried out in accordance with OPSS 209, "Construction Specification for Embankments Over Swamps", dated March 1998, and with specific reference to OPSD 203.010, "Embankments Over Swamps, New Construction".

For backfilling of subexcavation below the water-table or in swamps where surface water may be seasonally present above the ground surface, it is recommended that rock fill or coarse granular materials (OPSS Granular B Type II), be used as backfill. Placement of earthfill over rockfill should be avoided to prevent potential loss of material resulting from internal erosion.

8.6.2 Embankments

Embankment construction should be carried out in accordance with OPSS 206, as amended by Special Provision "Amendment to OPSS 206, December 1993", dated November 2002. Earth fill may consist of granular materials and Select Subgrade Material (SSM) in compliance with Special Provision 110F13, "Amendment to OPSS 1010, March 1993".

Earth fill used for construction of embankments should be placed in regular lifts and compacted in accordance with OPSS 501. Benches, 2 m minimum in width, are required along slopes at 8 m maximum vertical intervals in earth and 6 m maximum vertical intervals in rock. The benches should extend the length of the embankment where the height exceeds 6 m.

Earth fill embankments slopes must be provided with erosion protection in accordance with Special Provision SP572SO1.

9 CONSTRUCTION CONCERNS

During construction, a qualified Geotechnical staff should be retained to observe activities related to embankment construction and advise the Contract Administrator on construction concerns or issues related to embankment stability or settlement.

Potential construction concerns to be highlighted are shown below, but the concerns are not necessarily limited to this list:

- Inspection and confirmation that all organics and peat materials within the proposed embankment footprints are sub-excavated and replaced with approved backfill.
- Instrumentation and monitoring of stability and settlement by qualified geotechnical staff is recommended where staged embankment construction has been recommended (Highway 124, Sta. 9+985 to 9+950) and Muskoka Road Connection (Sta.+885 to 9+960).
- The use of wick drains is recommended at Highway 124, Sta. 9+885 to 9+950 to increase the rate of consolidation. Detailed design of the wick drains is beyond the scope of the current assignment.

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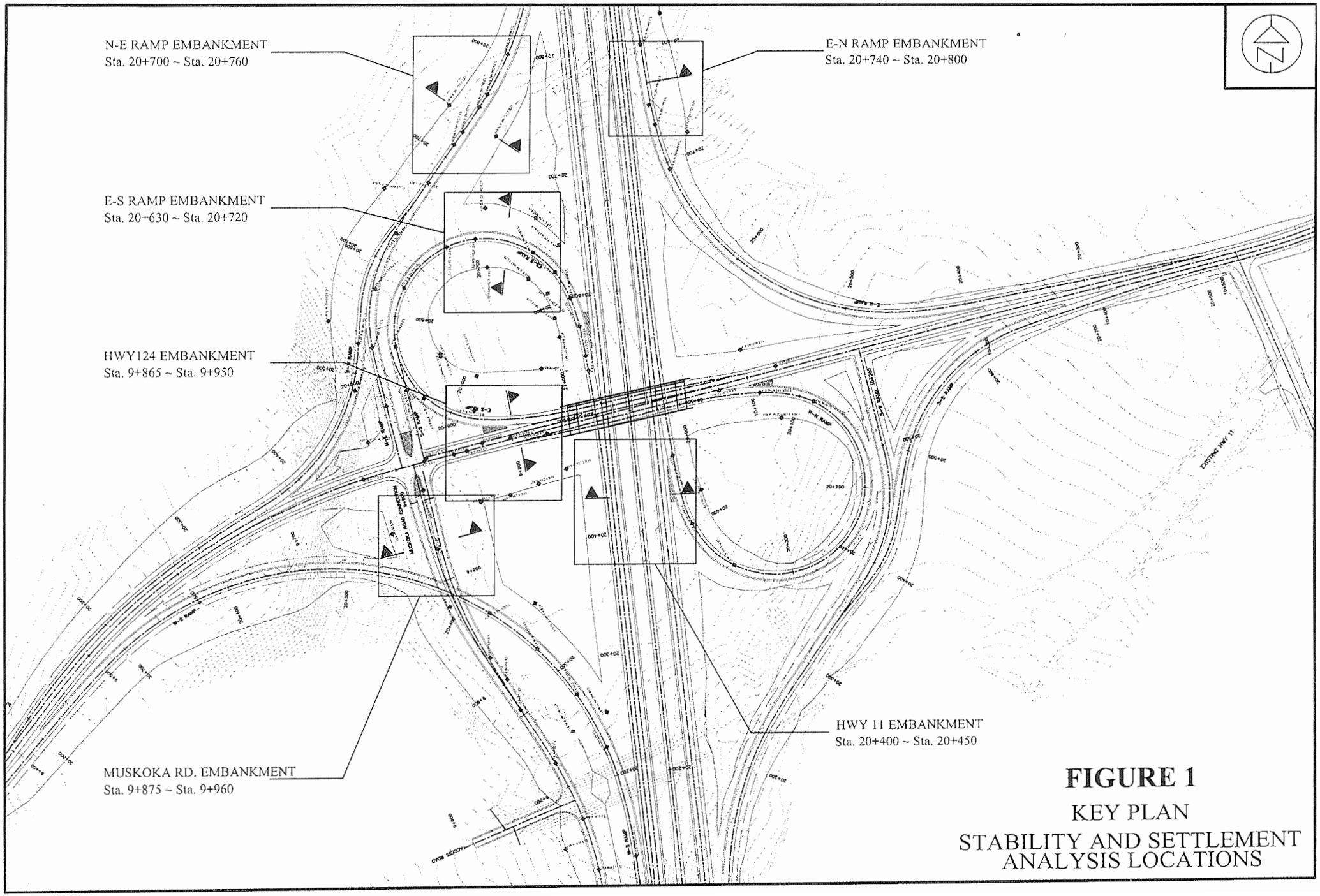


FIGURE 1

KEY PLAN

STABILITY AND SETTLEMENT ANALYSIS LOCATIONS

Stability Improvement

Design Options	Advantages	Disadvantages	Relative Cost ($/m)	Recommendation
berms	▪ common construction method	▪ increased fill volume and footprint	$ 3,300	recommended
Staged Construction with monitoring	▪ increases foundation strength, ▪ locally familiar construction method	▪ longer construction schedule, ▪ additional monitoring cost, ▪ requires time for dissipation of excess pore pressure	$ 1,500	recommended
Foundation Treatment	▪ can accommodate short construction schedules	▪ higher cost, ▪ complex construction method, ▪ requires specialized contractor	$ 80,000	not recommended
geosynthetic reinforcement	▪ readily available materials, ▪ can be incorporated into standard design sections	▪ increases construction complexity, ▪ not efficient when soft conditions extend to depth	$ 4,320	not considered practical at this site
rockfill or SSM embankment	▪ higher friction materials improve stability of embankment slope	▪ no significant influence on deep-seated instability	$ 2,800	design can accommodate either material with appropriate slope
lower vertical alignment	▪ reduced material volume and increased stability	▪ not feasible near grade separation structure, ▪ only marginal improvement in stability for 20 m high embankment	-	not considered practical with current design
flattening of slopes	▪ cost effective, ▪ common construction method	▪ less efficient use of material than berms	-	berms recommended in place of flatter slopes

TABLE 7.1: COMPARISON OF FOUNDATION DESIGN OPTIONS FOR STABILITY IMPROVEMENT

Short term settlement

Design Options	Advantages	Disadvantages	Estimated Cost ($/m)	Recommendation
lightweight fill	▪ reduced foundation stress and settlement	▪ high cost, ▪ complex construction method	$ 68,640	not recommended
Foundation Treatment	▪ increased foundation stiffness	▪ high cost, ▪ complex construction, ▪ requires specialized contractor	$ 80,000	not recommended
preload and monitoring	▪ reduced post-construction settlement	▪ may require extended construction schedule, ▪ monitoring costs	$ 1,500	recommended
surcharge	▪ increased settlement rate during construction ▪ reduced post-construction settlement	▪ large surcharge required to be effective for high embankments, ▪ reduces short term stability	$ 550	recommended
wick drains	▪ increased settlement rate, ▪ commonly applied construction method, ▪ reduced schedule uncertainty	▪ additional cost, complex construction, ▪ specialized equipment and materials	$ 3,120	recommended
peat subexcavation	▪ reduced post-construction settlement	▪ Increased material volumes and disposal requirements, ▪ requires excavation below water-table	$ 936	recommended

TABLE 7.1: COMPARISON OF FOUNDATION DESIGN OPTIONS FOR CONSTRUCTION SETTLEMENT

Long Term Settlement

Design Options	Advantages	Disadvantages	Estimated Cost ($/m)	Recommendation
surcharge with monitoring	▪ reduced long term settlement	▪ large surcharge required to be effective for high embankments, ▪ reduced stability	$ 1,500	Recommended
wick drains	▪ increased settlement rate, ▪ commonly applied construction method, ▪ reduced schedule uncertainty	▪ long term settlement may increase if construction schedule is shortened	$ 3,120	Recommended
peat subexcavation	▪ reduced long term settlement related to organic soils	▪ Increased material volumes and disposal requirements, ▪ requires excavation below water-table	$ 936	Recommended

Notes: Costs are per linear metre of embankment.
The costs are for comparison purposes only and are based on preliminary estimates and generalized design concepts and are therefore rough estimates.

TABLE 7.1: COMPARISON OF FOUNDATION DESIGN OPTIONS FOR POST-CONSTRUCTION SETTLEMENT

ALIGNMENT		Offset	Embankment Height (m)	Peat/ topsoil thickness (m)	Depth to Firm Bottom (m)
Hwy/Ramp	Station				
HWY 11	19+875 ~ 19+900	SBL	2.3 ~ 4.9	0.2	2
HWY 11	19+900 ~ 20+000	SBL	4.9 ~ 7	0 ~0.5	1 ~ 4.4
		CL	0 ~ 1.67		1.8
HWY 11	20+000 ~ 20+100	SBL	7 ~ 8.4	0.1	1.5 ~ 4.4
		CL	1.7 ~ 4.7	0	1.8
HWY 11	20+100 ~ 20+200	SBL	8.4 ~ 10.9	0 ~0.6	1.8
		CL	4.7 ~ 5.9	0	1.5
HWY 11	20+200 ~ 20+300	SBL	6.5 ~ 8.7	0.3	1.5 ~ 4.9
		CL	3.5 ~ 7.7	0	1.5
		NBL	4 ~ 5.9	0.3	1.7
HWY 11	20+300 ~ 20+400	SBL	7.8 ~ 8.8	0 ~ 1.5	2 ~ 8.2
		CL	6 ~ 7	0.6	1.25
		NBL	5.9 ~ 8.5	0 ~0.3	0.4 ~ 1.5
HWY 11	20+400 ~ 20+500	SBL	7.5 ~ 8	1.5	8.2
		CL	6	0.2 ~ 1.5	7 ~ 8.75
		NBL	6.5 ~ 7.5	0 ~ 1.3	0.75 ~ 7.75
HWY 11	20+500 ~ 20+600	SBL	5.5 ~ 7.5	0.2 ~ 0.6	2.75 ~ 3.75
		CL	3 ~ 4.5	0 ~ 0.2	1.2 ~ 2.2
		NBL	4 ~ 6	0.2	3
HWY 11	20+600 ~ 20+700	SBL	5.5 ~ 3.5	0.2	2.75 ~ 0.3
		CL	2.5 ~ 3	0 ~ 0.2	0.3 ~ 2.2
		NBL	3 ~ 5	0.2	0.5 ~ 3
HWY 11	20+700 ~ 20+800	SBL	3.5	0.2 ~0.3	0.5
		CL	2 ~ 2.5	0 ~0.2	0 ~ 0.3
		NBL	5 ~ 7.5	0 ~ 0.4	0.3 ~ 0.7
HWY 11	20+800 ~ 20+900	SBL	3 ~ 9	0.15 ~ 0.6	1.5
		CL	3 ~ 8.4	0 .2 ~ 0.5	0 ~ 0.5
		NBL	6 ~ 11	0 ~ 0.5	0.1 ~ 5.3
HWY 11	20+950 ~ 21+000	SBL	5 ~ 7.8	0.2	6.5
		NBL	6 ~ 9.5	0 ~0.2	2.5 ~ 6.5
HWY 11	21+000 ~ 21+200	CL	3 ~ 4	0	0
		NBL	5 ~ 6	0.1	7

SBL = South Bound Lane
NBL = North Bound Lane
RT = Right Embankment Toe
LT = Left Embankment Toe

TABLE 8.1
SUMMARY OF EMBANKMENT AND SITE CONDITIONS

ALIGNMENT		Offset	Embankment Height (m)	Peat/ topsoil thickness (m)	Depth to Firm Bottom (m)
Hwy/Ramp	Station				
HWY 124	9+100 ~ 9+240	RT CL LT	1 ~ 4	0 ~ 0.3 0 ~ 0.6 0.15 ~ 0.3	1 ~ 1.8 0 ~ 1.6 0.5 ~ 1.5
HWY 124	9+860 ~ 9+940	RT CL CL	8 ~ 18.3 7.5 ~ 12	0.6 ~ 0.9 0 .4 ~ 0.8 0.5	9 ~ 15 1.5 ~ 13.8 0.5 ~ 4.4
Muskoka Road	9+250 ~ 9+350	RT CL CL	8.2 ~ 10.4 10.5 ~ 9	0.15 0.5 0.5	1.5 4 ~ 5.3 5.3 ~ 6.7
Muskoka Road	9+400 ~ 9+500	RT CL LT	9 ~ 6	- 0.5 ~ 2.1 0.9	4.7 3.6 ~ 6.7 3.6
Muskoka Road	9+600 ~ 9+700	CL	3 ~ 8.5	0 ~ 1.1	1 ~ 2.5
Muskoka Road	9+700 ~ 9+800	CL	7 ~ 11.4	0 ~ 0.6	4 ~ 9
Muskoka Road	9+800 ~ 9+900	CL	11 ~ 14.8	0.1 ~ 0.3	3.4 ~ 6.2
Muskoka Road	9+900 ~ 10+000	CL	13 ~ 15	0.1 ~ 0.3	2.3 ~ 6
N-E Ramp	20+450 ~ 20+550	CL LT	12.3 ~ 13.5	0.1 0.2 ~ 0.5	1.2 ~ 1.8 1.6
N-E Ramp	20+550 ~ 20+650	CL	12.3 ~ 13.5	0.1 ~ 0.2	3.5 ~ 4.8
N-E Ramp	20+650 ~ 20+750	RT CL LT	10 ~ 13	- 0.3 ~0.9 0.5	3 6 ~ 6.6 1.1 ~ 5.3
N-E Ramp	20+750 ~ 20+850	CL	4.5 ~ 10	0.5 ~ 0.9	3.8 ~ 7
N-E Ramp	20+850 ~ 20+920	CL	4.5 ~ 6.2	0.3	6.9
W-S Ramp	20+050 ~ 20+130	CL	6.8 ~ 9	0	0 ~ 0.5
W-S Ramp	20+220 ~ 20+300	RT CL	6 ~ 7	0.1 0.3 ~ 0.5	4.1 6 ~ 6.5
W-S Ramp	20+300 ~ 20+380	RT CL	7	0.6	6.7 2.5 ~ 4.4

SBL = South Bound Lane
NBL = North Bound Lane
RT = Right Embankment Toe
LT = Left Embankment Toe

TABLE 8.1
SUMMARY OF EMBANKMENT AND SITE CONDITIONS

ALIGNMENT		Offset	Embankment Height (m)	Peat/ topsoil thickness (m)	Depth to Firm Bottom (m)
Hwy/Ramp	Station				
E-S Ramp	20+530 ~ 20+600	CL	6.2 ~ 7	0.1 ~ 0.3	3 ~ 5.5
		LT		0.1	5
E-S Ramp	20+600 ~ 20+700	RT	6.5 ~ 10.4	0.1	1.5 ~ 6
		CL		0.1	1.7 ~ 7.4
		LT		0.1 ~0.2	3.7 ~ 6.8
E-S Ramp	20+700 ~20+800	CL	9 ~ 11	0 .1 ~ 0.6	6.8 ~ 8
E-S Ramp	20+800 ~ 20+925	CL	9 ~ 17	0.1	4.5 ~ 12.6
		LT		0.1	7.3 ~ 11.5
W-N Ramp	20+060 ~ 20+120	CL	5.5 ~ 8.5	0.2 ~ 0.3	2.2 ~ 6.6
W-N Ramp	20+350 ~ 20+460	CL	6 ~ 7	0 ~ 0.2	0 ~ 4
E-N Ramp	20+694 ~ 20+800	CL	6.8 ~ 10.5	0 ~ 1.7	2.2 ~ 9.2
E-N Ramp	20+800 ~ 20+900	CL	6.5 ~ 9.5	0 ~ 0.6	3.1 ~ 9.2
E-N Ramp	20+900 ~ 20+950	RT		0.1	2.5
		CL	9.5 ~ 6.3	0.1 ~ 0.6	3 ~ 5.3

SBL = South Bound Lane
NBL = North Bound Lane
RT = Right Embankment Toe
LT = Left Embankment Toe

TABLE 8.1
SUMMARY OF EMBANKMENT AND SITE CONDITIONS

HIGH EMBANKMENTS AND SWAMPS - HWY 124 TO MUSKOKA ROAD

HWY 11 - FOUR LANING

Location		Soil Layers	Depth Interval		Unit	e_o	Undrained Shear Strength		Drained Shear Strength		Poisson's	Young's	Compression Ratio		Pre-Consolidation	Effective Stress	Coeff. Of Consolidation (m2/yr)				Secondary Compression
			From	To	Weight		Cohesion	Friction Angle	Cohesion	Friction Angle	Ratio	Modulus	Cc/(1+eo)	Cr/(1+eo)	Pressure (kPa)	At Mid-Layer (kPa)	Cv		Ch		Ratio: Ca/(1+eo)
Road	Chainage		(m)	(m)	(kN/m3)		(KPa)	(deg)	(KPa)	(deg)		(MPa)					O.C.	N.C.	O.C.	N.C.	
HWY 124	9+850 to 9+937	Sand/Silt	0	3	20	-	-	-	0	32	0.35	30	-	-	-	30	-	-	-	-	-
		Silty Clay	3	6	18.5	0.95	70	0	0	28	0.45	21	0.136	0.014	210	64	40	30	80	60	4.E-03
		Silty Clay	6	11	18	1.08	35	0	0	28	0.45	11	0.168	0.017	NC	98	40	30	80	60	5.E-03
		Silty Clay	11	13	18	1.08	60	0	0	28	0.45	18	0.168	0.017	NC	128	40	30	80	60	5.E-03
		Sand	13	14	21	-	-	-	0	33	0.30	40	-	-	-	141	-	-	-	-	-
E-S Ramp	20+550 to 20+725	Peat Replaced by Fill/Rock	0	0.5	22/20	-	-	-	0	30/42	0.3	150	-	-	-	2	-	-	-	-	-
		Sand/Silt	0.5	1.5	20	0.50	-	-	0	32	0.35	30	-	-	-	12	-	-	-	-	-
		Silty Clay	1.5	3.5	18.5	0.86	50	0	0	28	0.45	30	0.126	0.013	200	31	40	30	80	60	4.E-03
		Silty Clay	3.5	7	18	0.97	35	0	0	28	0.45	21	0.163	0.016	120	47	40	30	80	60	5.E-03
		Sand/Silt	7	7.5	21		-	-	0	33	0.30	40	-	-	-	59	-	-	-	-	-
N-E Ramp	20+700 to 20+760	Peat Replaced by Fill/Rock	0	0.5	22/20	0.65	-	-	0	30/42	0.30	150	-	-	-	3	-	-	-	-	-
		Sand/Silt	0.5	2.4	20	0.71	-	-	0	32	0.35	30	-	-	-	15	-	-	-	-	-
		Silty Clay	2.4	7.1	18.5	0.94	35	0	0	28	0.45	11	0.134	0.013	175	44	40	30	80	60	4.E-03
Mainline HWY 11	20+400 to 20+450	Peat Replaced by Fill/Rock	0	1.5	22/20	0.39	-	-	0	30/42	0.3	150	-	-	-	15	-	-	-	-	-
		Sand/Silt	1.5	4.5	20	0.53	-	-	0	32	0.35	30	-	-	-	40	-	-	-	-	-
		Silty Clay	4.5	6.5	20	0.73	69	0	0	28	0.45	21	0.100	0.010	345	65	40	30	80	60	3.E-03
		Silty Clay	6.5	8.5	19	0.81	72	0	0	28	0.45	22	0.115	0.012	360	84	40	30	80	60	3.E-03
		Silty Clay	8.5	10.5	19	0.81	75	0	0	28	0.45	23	0.115	0.012	375	102	40	30	80	60	3.E-03
E-N Ramp	20+740 to 20+800	Sand/Silt	0	1	20	0.68	-	-	0	32	0.3	150	-	-	-	5	-	-	-	-	-
		Silty Clay	1	2.5	19	0.81	30	0	0	28	0.35	30	0.115	0.012	150	17	-	-	-	-	-
		Silty Clay	2.5	5.5	20	0.65	24	0	0	28	0.45	14	0.086	0.009	120	39	40	30	80	60	3.E-03
		Silty Clay	5.5	7	20	0.30	42	0	0	28	0.45	13	0.031	0.003	210	61	40	30	80	60	9.E-04

TABLE 8.2
SUMMARY OF SOIL ENGINEEERING PROPERTIES

Hwy 11 Four Laning: Muskoka Connection to Hwy 124

Location	Design Issues	Recommended Design Measures				
		Berms	Staged Construction	Wick Drains	Preload/ surcharge	Monitoring
Hwy 124: 9+865 to 9+950	Potential Instability Short term settlement:1050 mm Duration of short term settlement: 2.2 yrs Long term settlement :70 mm	Yes	Yes	Yes	Yes	Yes
Muskoka Road: 9+885 to 9+930	Potential Instability	Yes	Yes	No	No	Yes
E-S Ramp 20+550 to 20+720	Potential Instability Short term settlement: 300 mm Duration of short term settlement: 0.4 yrs Long term settlement: 60 mm	Yes	No	No	Yes	Yes
E-N Ramp 20+720 to 20+800	Potential Instability Short term settlement: 160 mm Duration of short term settlement: 0.4 yrs Long term settlement: 30 mm	Yes	No	No	No	Yes
N-E Ramp 20+700 to 20+760	Potential Instability Short term settlement: 180 mm Duration of short term settlement: 0.3 yrs Long term settlement: 50 mm	Yes	No	No	No	Yes
Hwy 11 20+400 to 20+450	Short term settlement: 40 mm Long term settlement: 40 mm	No	No	No	No	No

TABLE 8.3 - RECOMMENDED FOUNDATION DESIGN OPTIONS

ALIGNMENT		Offset	Stripping Depth (mm)
Hwy/Ramp	Station		
HWY 11	19+875 ~ 19+900	SBL	200
HWY 11	19+900 ~ 20+000	SBL CL	200 500
HWY 11	20+000 ~ 20+100	SBL CL	100 100
HWY 11	20+100 ~ 20+200	SBL CL	300 50
HWY 11	20+200 ~ 20+300	SBL CL NBL	300 50 300
HWY 11	20+300 ~ 20+400	SBL CL NBL	1200 600 50
HWY 11	20+400 ~ 20+500	SBL CL NBL	1500 1200 1200
HWY 11	20+500 ~ 20+600	SBL CL NBL	300 200 200
HWY 11	20+600 ~ 20+700	SBL CL NBL	200 200 200
HWY 11	20+700 ~ 20+800	SBL CL NBL	250 200 400
HWY 11	20+800 ~ 20+870	SBL CL NBL	200 200 150
Hwy 11	20+870 ~ 20+950	SBL CL NBL	600 500 500
HWY 11	20+950 ~ 21+200	CL NBL	200 200
HWY 124	9+100 ~ 9+240	RT CL LT	150 500 200
HWY 124	9+770 ~ 9+860	RT CL LT	100 100 100
HWY 124	9+860 ~ 9+940	LT CL	800 600
HWY 124	10+050 ~ 10+1125	RT CL	500 200

TABLE 8.4
ESTIMATED STRIPPING DEPTH

ALIGNMENT		Offset	Stripping Depth (mm)
Hwy/Ramp	Station		
Muskoka Road	9+250 ~ 9+350	RT CL LT	150 500 500
Muskoka Road	9+350 ~ 9+550	RT CL LT	1500 1500 900
Muskoka Road	9+600 ~ 9+700	CL	1100
Muskoka Road	9+700 ~ 9+800	CL	500
Muskoka Road	9+800 ~ 9+900	CL	200
Muskoka Road	9+900 ~ 10+000	CL	200
N-E Ramp	20+450 ~ 20+550	CL LT	100 300
N-E Ramp	20+550 ~ 20+650	CL	150
N-E Ramp	20+650 ~ 20+750	RT CL LT	600 600 500
N-E Ramp	20+750 ~ 20+850	CL	750
N-E Ramp	20+850 ~ 20+920	CL	300
W-S Ramp	20+050 ~ 20+130	CL	50
W-S Ramp	20+220 ~ 20+300	RT CL	100 400
W-S Ramp	20+300 ~ 20+380	CL	600
E-S Ramp	20+530 ~ 20+600	CL LT	300 100
E-S Ramp	20+600 ~ 20+700	RT CL LT	100 100 150
E-S Ramp	20+700 ~20+800	CL	500
E-S Ramp	20+800 ~ 20+925	CL LT	100 100
W-N Ramp	20+060 ~ 20+120	CL	250
W-N Ramp	20+350 ~ 20+460	CL	100
E-N Ramp	20+694 ~ 20+730	CL	200
E-N Ramp	20+730 ~ 20+800	CL	1500
E-N Ramp	20+800 ~ 20+875	CL	100
E-N Ramp	20+875 ~ 20+925	CL	700
E-N Ramp	20+925 ~ 20+950	CL	150
N-W Ramp	20+500 ~ 20+600	CL	200

TABLE 8.4
ESTIMATED STRIPPING DEPTH

Alignment	Location		Offset	Fill Height (m)	Berm Configuration		Construction Staging Required
	From	To			Width (m)	Height (m)	
Hwy 124	9+865	9+960	both sides	18.3	25	6	2 stages
Muskoka Road	9+885	9+930	right	18	25	6	2 stages
E-S ramp	20+630	20+720	both sides	11.2	12	4	1 stage
E-N ramp	20+720	20+800	right	10	15	4	1 stage
N-E ramp	20+660	20+790	right	11.4	15	4	1 stage
N-E ramp	20+700	20+790	left	11.4	15	1	1 stage

TABLE 8.5
SUMMARY OF BERM LOCATIONS

EMBANKMENT FOUNDATION SETTLEMENT

Alignment	Location		Stage	Fill Height (m)	Settlement		Time U90% (yrs)	Secondary Consolidation (30 yrs)
	From	To			Elastic (mm)	Consolidation (mm)		
Hwy 124	9+865	9+960	1 of 2	12.3	140	700	0.53	-
			2 of 2	18.3	204	1050	1.06	70
E-S ramp	20+550	20+720	1 of 1	11.2	40	300	0.16	60
E-N ramp	20+720	20+800	1 of 1	10	33	160	0.19	30
N-E ramp	20+700	20+760	1 of 1	11.4	60	180	0.12	50
Hwy 11	20+400	20+450	1 of 1	8.3	30	40	0.19	40

Notes U90% Percent completionof primary consolidations

TABLE 8.6
SUMMARY OF SETTLEMENT ANALYSIS

Appendix A
Hwy 11 Mainline, Strong Township, Sta. 19+875 to 20+525

THURBER

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE

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

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

$\underline{\nabla}$ Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

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

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

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

SYMBOLS

- CLAYSTONE
- SILTSTONE
- SANDSTONE
- COAL
- Bedrock (general)

DISCONTINUITY SPACING

Bedding	**Bedding Plane Spacing**
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

STRENGTH CLASSIFICATION

Rock Strength	**Approximate Uniaxial Compressive Strength (MPa)**	**(psi)**	**Field Estimation of Hardness***
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 19+875 L18.75

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 19+875, O/S 18.75L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 03.03.04 - 03.03.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
0.0	**SILT**, organic, trace sand, trace rootlets Dark Brown (TOPSOIL)													
0.2	Sandy **SILT**, trace rootlets, occasional iron oxide staining Loose Brown Wet		1	SS	7				○					
1.2	**SAND and SILT**, fine grained, trace clay, occasional iron oxide staining Compact Brown Wet		2	SS	27				○		0	54	43	3
1.9	END OF BOREHOLE AT 1.9 m. AUGER REFUSAL AT 1.9 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.22 m AND NO FREE WATER UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ 3, × 3 : Numbers refer to Sensitivity

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

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 19+925 L18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 19+925, O/S 18.75L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.03.04 - 03.03.04 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**SILT**, organics, trace sand, trace rootlets Dark Brown (TOPSOIL)										
0.2	**SILT and SAND**, trace clay, trace rootlets, occasional iron oxide staining Compact Brown Moist		1	SS	5				102		
			2	SS	7						0 45 52 3
1.4	**SAND**, fine grained, some silt, occasional iron oxide staining Compact Brown Wet		3	SS	16	▽					
2.3	**SAND**, fine to medium grained, trace silt, trace to some gravel Compact Brown Wet		4	SS	19						
	occasional cobbles or boulders between 3.96 and 4.42 m		5	SS	28						10 88 1 (SI+CL)
4.4	END OF BOREHOLE AT 4.42 m. AUGER REFUSAL AT 4.42 m ON PROBABLE BEDROCK OR BOULDER. WATER LEVEL AT 2.13 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 19+975 L18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 19+975, O/S 18.75L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.03.04 - 03.03.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**SAND**, fine grained, trace silt, occasional rootlets, occasional iron oxide staining Compact Brown Wet		1	SS	18	▽			○		
1.0	END OF BOREHOLE AT 1.02 m. BOREHOLE OPEN TO 0.57 m AND WATER LEVEL AT m UPON COMPLETION. AUGER REFUSAL AT 1.02 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

÷ 3, × 3: Numbers refer to Sensitivity

20 15 ⊕ 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+000 CL

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+000, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 03.03.04 - 03.03.04 | CHECKED BY JL

SOIL PROFILE 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
0.0	**SILT**, some sand, occasional rootlets, organic, occasional iron oxide staining Loose Dark Brown (TOPSOIL)		1	SS	5				○		
0.8	**SAND and SILT**, trace clay, occasional iron oxide staining Compact Brown Moist		2	SS	19				○		0 50 46 3
1.5	Silty **SAND** Compact Brown Moist		3	SS	50/.150				○		
1.8	END OF BOREHOLE AT 1.83 m. BOREHOLE OPEN TO 1.83 m AND DRY UPON COMPLETION. AUGER REFUSAL AT 1.83 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3 . × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+000 L50

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+000, O/S 50L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM
DATUM Geodetic | DATE 03.03.04 - 03.03.04 | CHECKED BY JL

SOIL PROFILE: ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: 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
0.0	DCPT from surface.										
5.0	END OF DCPT AT 5.03 m. CONE REFUSAL AT 5.03 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+025 L14

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+025, O/S 14L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 03.03.04 - 03.03.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**SILT**, trace sand, occasional rootlets										
0.1	Dark Brown										
	Silty **SAND**, fine grained, trace clay, occasional iron oxide staining, occasional rootlets Compact to Dense Brown Wet		1	SS	16				○		0 59 36 5
			2	SS	46				○		
1.8	Sandy **SILT**, trace clay, occasional iron oxide staining Compact Brown Wet		3	SS	18				○		
			4	SS	26				○		
3.8	**SAND and GRAVEL**, trace silt Very Dense Brown Wet		5	SS	50/.150				○		
4.5	END OF BOREHOLE AT 4.53 m. AUGER REFUSAL AT 4.53 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.53 m AND WATER LEVEL AT 0.72 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.										

WATER LEVEL READINGS:

DATE	DEPTH (m)
03/03/04	-

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+075 L18.75

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+075, O/S 18.75L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 03.03.04 - 03.03.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
0.0	**SAND**, fine grained, trace silt, occasional iron oxide staining Compact Brown Wet		1	SS	10				○					
0.8	**SILT and SAND**, trace clay, trace gravel Compact Brown Wet		2	SS	16				○		1	45	51	3
1.5	END OF BOREHOLE AT 1.52 m. BOREHOLE OPEN TO 1.52 m AND DRY UPON COMPLETION. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ ³, × ³ : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+100 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+100, CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
1.4	END OF DCPT AT 1.42 m. CONE REFUSAL AT 1.42 m ON PROBABLE BEDROCK OR BOULDER.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+100 L46

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+100, CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY JL

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
0.0	Bedrock at surface.										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 14/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+125 L18.75

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+125, O/S 18.75L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**SAND and SILT**, fine grained, occasional iron oxide staining, occasional rootlets Compact Brown Wet		1	SS	14				○		
			2	SS	23				○		10 48 41 (SI+CL)
				3	50/.100	▽					
1.8	END OF BOREHOLE AT 1.83 m. AUGER REFUSAL AT 1.83 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.83 m AND WATER LEVEL AT 1.83 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+175 L18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+175, O/S 18.75L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.03.04 - 03.03.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**SILT**, trace sand, occasional rootlets, occasional wood fibers Loose Brown Wet		1	SS	6				○		
0.5	**SAND and GRAVEL**, trace silt, occasional iron oxide staining Dense Brown Wet		2	SS	43	▽			○		
1.2	END OF BOREHOLE AT 1.22 m. AUGER REFUSAL AT 1.22 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.22 m AND WATER LEVEL AT 1.22 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+190 L2

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+190, O/S 2L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY JL

SOIL PROFILE 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
0.0	**SAND**, fine grained, trace to some silt, occasional rootlets, occasional iron oxide staining Compact Brown to Grey Wet		1	SS	9				○		
			2	SS	11				○		
1.5	END OF BOREHOLE AT 1.52 m. BOREHOLE OPEN TO 1.22 m AND BOREHOLE DRY UPON COMPLETION. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+232 L14

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+232, O/S 14L | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 18.11.03 - 18.11.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL** Dark Brown Wet		1	SS	1	▽			○		
0.3	**SAND and SILT** Very Loose Reddish Brown Wet		2	SS	48				○		
0.9	Silty **SAND**, fine grained, some gravel, occasional cobbles Dense Brown Wet										
1.5	END OF BOREHOLE AT 1.52m. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.52 m AND WATER LEVEL AT 0.3 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+275 L18.75

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+275, O/S 18.75L | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 14.11.03 - 14.11.03 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
0.0	**TOPSOIL** Loose Dark Brown Moist	1	SS	5				
0.3	Silty **SAND**, fine grained Compact Brown Wet	2	SS	27				
	trace coarse grained sand	3	SS	30				
2.2	Sandy **SILT**, some clay, occasional brown sand lenses Compact Grey Wet	4	SS	28	0	21	59	19
		5	SS	12				
4.7	Silty **SAND**, fine grained, some gravel, occasional cobbles Very Dense Brown Wet	6	SS	80/ .150				
4.9	END OF BOREHOLE AT 4.88 m. AUGER REFUSAL AT 4.88 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.30 m AND WATER LEVEL AT 0.30 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.							

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 (%)

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+296 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+296, O/S 18.75R ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 14.11.03 - 14.11.03 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL** Dark Brown Moist										
0.3	**SILT**, some clay, some sand, occasional cobbles Hard Grey Moist		1	SS	2				96 ○		
			2	SS	67				○		
1.5	Silty **SAND**		~~3~~	~~SS~~	~~50/.025~~				○		
1.7	END OF BOREHOLE AT 1.68m. AUGER REFUSAL AT 1.68 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+300 L18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 20+300, O/S 18.75L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 19.05.04 - 19.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**SILT** mixed with **TOPSOIL**, trace rootlets, occasional iron oxide staining Loose Dark Brown Wet		1	SS	7				100					
0.8	**SILT**, some clay, trace sand Stiff Brown Moist to Wet		2	SS	13				○		0	4	83	13
			3	SS	10	▽			○					
2.1	END OF BOREHOLE AT 2.13 m. AUGER REFUSAL AT 2.13 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.13 m AND WATER LEVEL AT 1.83 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ 3, × 3 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+325 CL

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+325, CL | ORIGINATED BY SL
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 17.12.03 - 17.12.03 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous										
0.6	**SAND**, some silt, trace gravel, occasional cobbles Very Dense Brown Moist		1	SS	50/ .125				○		
1.1	END OF BOREHOLE AT 1.14 m. AUGER REFUSAL AT 1.14 m ON PROBABLE BEDROCK OF BOULDER. BOREHOLE CAVED TO SURFACE. WATER LEVEL AT SURFACE.										

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

20 15 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+325 L45

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+325, O/S 45L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM

DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface										
2.2	END OF DCPT AT 2.24 m. CONE REFUSAL AT 2.24 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+325 R41.5

METRIC

W.P.	759-93-00	LOCATION	Strong Township, ST. 20+325, O/S 41.5R	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	20.05.04 - 20.05.04	CHECKED BY	JL

SOIL PROFILE: ELEV / DEPTH	SOIL PROFILE: 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
0.0	**TOPSOIL** (50 mm)										
0.1	Silty **SAND**, fine grained, trace iron oxide staining Loose Brown Moist		1	SS	9				○		
0.8	END OF BOREHOLE AT 0.76 m. BOREHOLE OPEN TO 0.76 m AND DRY UPON COMPLETION.. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+350 L18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+350, O/S 18.75L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 19.05.04 - 19.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**PEAT**, fibrous, silty, trace sand, trace rootlets Dark Brown		1	SS	2				175					
0.6	**SILT**, some sand, trace clay, occasional gravel, occasional iron oxide staining Compact Brown to Grey Wet		2	SS	29	▽		○						
1.5	Silty **CLAY**, trace sand, occasional iron oxide staining Stiff Brown Wet		3	SS	11				⊢○		0	7	71	22
2.3	**SAND**, trace gravel, occasional iron oxide staining Compact Brown Wet		4	SS	25			○						
2.9	END OF BOREHOLE AT 2.90 m. AUGER REFUSAL AT 2.90 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.90 m AND WATER LEVEL AT 1.52 m UPON COMPLETION.													

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+350 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+350, O/S 18.75R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 19.05.04 - 19.05.04 CHECKED BY JL

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						
0.0	Silty **SAND**, trace gravel, occasional iron oxide staining Compact Brown Moist		1	SS	22				○		
0.5	END OF BOREHOLE AT 0.46 m. AUGER REFUSAL AT 0.46 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.46 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+375 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+375, CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

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
0.0	**PEAT**, fibrous, silty, trace sand, trace rootlets, occasional wood fibers Dark Brown		1	SS	3				133		
0.6	**SAND**, fine grained, trace silt, trace gravel, occasional iron oxide staining Compact Brown Wet		2	SS	21	▽			○		
1.3	END OF BOREHOLE AT 1.27 m. AUGER REFUSAL AT 1.27 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.27 m AND WATER LEVEL AT 1.22 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+375 L48

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+375, O/S 48L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

ELEV / DEPTH	SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, silty, trace rootlets Very Loose Dark Brown Wet		1	SS	2				80		
0.6	**SAND**, fine grained, trace organics, occasional rootlets Very Loose Dark Brown Wet		2	SS	2						
1.5	**SILT and SAND**, fine grained, trace clay Loose Grey Wet		3	SS	8						
2.3	**SAND**, fine grained, trace silt Compact Grey Wet		4	SS	10						
2.9	Sandy **SILT**, some clay Compact Grey Wet		5	SS	17						0 25 65 11
4.6	**SILT**, some sand to sandy, trace clay Compact Grey Wet		6	SS	14	▽					
6.4	Silty **CLAY**, trace sand Stiff Grey Wet		7	SS	9						0 5 61 34
			8	SS	14						
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE OPEN TO 8.23 m AND WATER LEVEL AT 6.1 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 14/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+400 L 18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+400, O/S 18.75L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 19.05.04 - 19.05.04 CHECKED BY JL

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
0.0	**PEAT**, fibrous, trace sand, trace rootlets Very Loose Dark Brown Wet		1	SS	2				614		
			2	SS	2				582		
1.5	**SAND and SILT**, fine grained, trace clay Compact Grey Wet Becoming brown at 2.3 m		3	SS	21						
			4	SS	10						0 54 42 4
3.1	Sandy **SILT**, trace clay seams Loose Brown Wet		5	SS	6						
4.6	Clayey **SILT** to Silty **CLAY**, trace to some sand, occasional iron oxide staining Stiff to Very Stiff Brown Wet		6	SS	7						
			7	SS	8	▽					0 6 70 24
			8	SS	15						
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE OPEN TO 8.23 m AND WATER LEVEL AT 6.71 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+400 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+400, O/S 18.75R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 19.05.04 - 19.05.04 CHECKED BY JL

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						
0.0	Silty **SAND**, trace gravel, occasional iron oxide staining Compact Brown Damp		1	SS	11				○		
0.8	END OF BOREHOLE AT 0.76 m. AUGER REFUSAL AT 0.76 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.76 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+425 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+425, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

ELEV / DEPTH	SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, silty, trace sand, trace rootlets, occasional wood fibers Very Loose Dark Brown Wet		1	SS	2				66		
			2	SS	2				106		
1.5	**SILT and SAND**, fine grained, trace clay, trace rootlets, trace wood fibers Loose to Compact Grey to Brown Wet		3	SS	8				20		
			4	SS	9				20		0 44 52 5
			5	SS	17				20		
4.6	Silty **CLAY**, trace sand, occasional iron oxide staining Stiff Brown Wet		6	SS	10	▽			20		0 5 72 23
			7	SS	14				20		
7.0	END OF BOREHOLE AT 7.01 m. AUGER REFUSAL AT 7.01 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 7.01 m AND WATER LEVEL AT 5.18 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³ : Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+425 L47

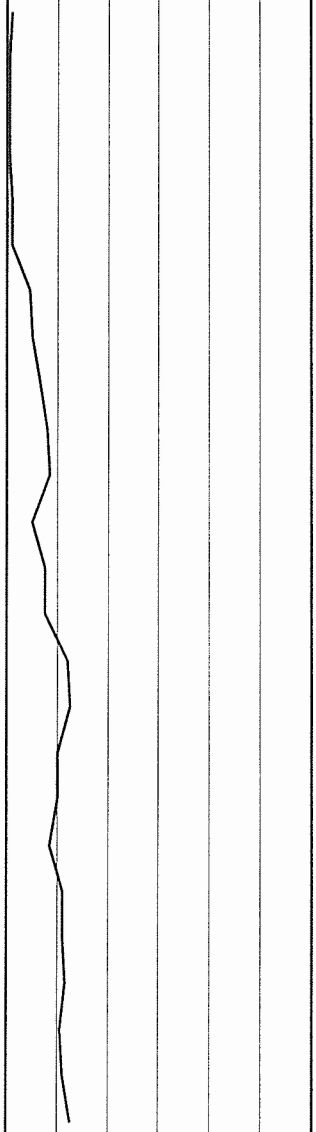
METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+425, O/S 47L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM

DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

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						
0.0	DCPT from surface.										
7.6	END OF DCPT AT 7.62 m.										



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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 10/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+450 L18.75

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+450, O/S 18.75L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, silty, trace sand, trace rootlets, occasional wood fibers Very Loose Brown Wet		1	SS	2				486		
			2	SS	2				461		
1.5	**SAND**, fine grained, trace silt Loose Grey Wet		3	SS	6						
2.3	**SILT**, some sand, some clay, some clayey silt seams Compact Grey Wet		4	SS	15						
			5	SS	19						0 13 74 13
4.6	Silty **CLAY**, trace sand Stiff to Very Stiff Brown Wet		6	SS	13						
			7	SS	10						0 6 66 28
			8	SS	15	▽					
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE OPEN TO 8.23 m AND WATER LEVEL AT 7.62 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

÷ 3, × 3 : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+450 R17

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+450, O/S 17R | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 19.05.04 - 19.05.04 | CHECKED BY JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, trace rootlets, occasional wood fibers, Very Loose, Dark Brown, Wet		1	SS	2				656		
			2	SS	2				726		
1.4	**SAND**, fine grained, trace silt, occasional iron oxide staining, Compact, Grey to Brown, Wet		3	SS	21						
2.3	Sandy **SILT**, some clay, occasional iron oxide staining, Compact, Brown, Wet		4	SS	21						0 21 65 14
			5	SS	14						
4.6	Silty **CLAY**, trace sand, Very Stiff, Brown, Wet		6	SS	16	▽					
			7	SS	16						
7.6	END OF BOREHOLE AT 7.62 m. AUGER REFUSAL AT 7.62 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 7.01 m AND WATER LEVEL AT 5.18 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+478 CL

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+478, CL | ORIGINATED BY MF
HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 13.11.03 - 13.11.03 | CHECKED BY JL

ELEV / DEPTH	SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous										
0.2	Dark Brown Wet		1	SS	24				○		
	SAND and SILT, fine grained, Compact to Dense Grey Wet becoming brown		2	SS	28				○		
	occasional silt pockets		3	SS	31				○		0 51 49 (SI+CL)
2.2	Sandy **SILT** Compact Brown and Grey Wet		4	SS	12				○		
3.1	Silty **CLAY**, trace sand, occasional sand lenses Grey Very Stiff to Stiff Wet		5	SS	19				○		
			6	SS	10				○		0 6 62 32
			7	SS	8				○		
8.8	END OF BOREHOLE AT 8.84 m. AUGER REFUSAL T 8.84 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 8.84 m AND WATER LEVEL AT SURFACE UPON COMPLETION.										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+478 CL

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+478, CL | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 13.11.03 - 13.11.03 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

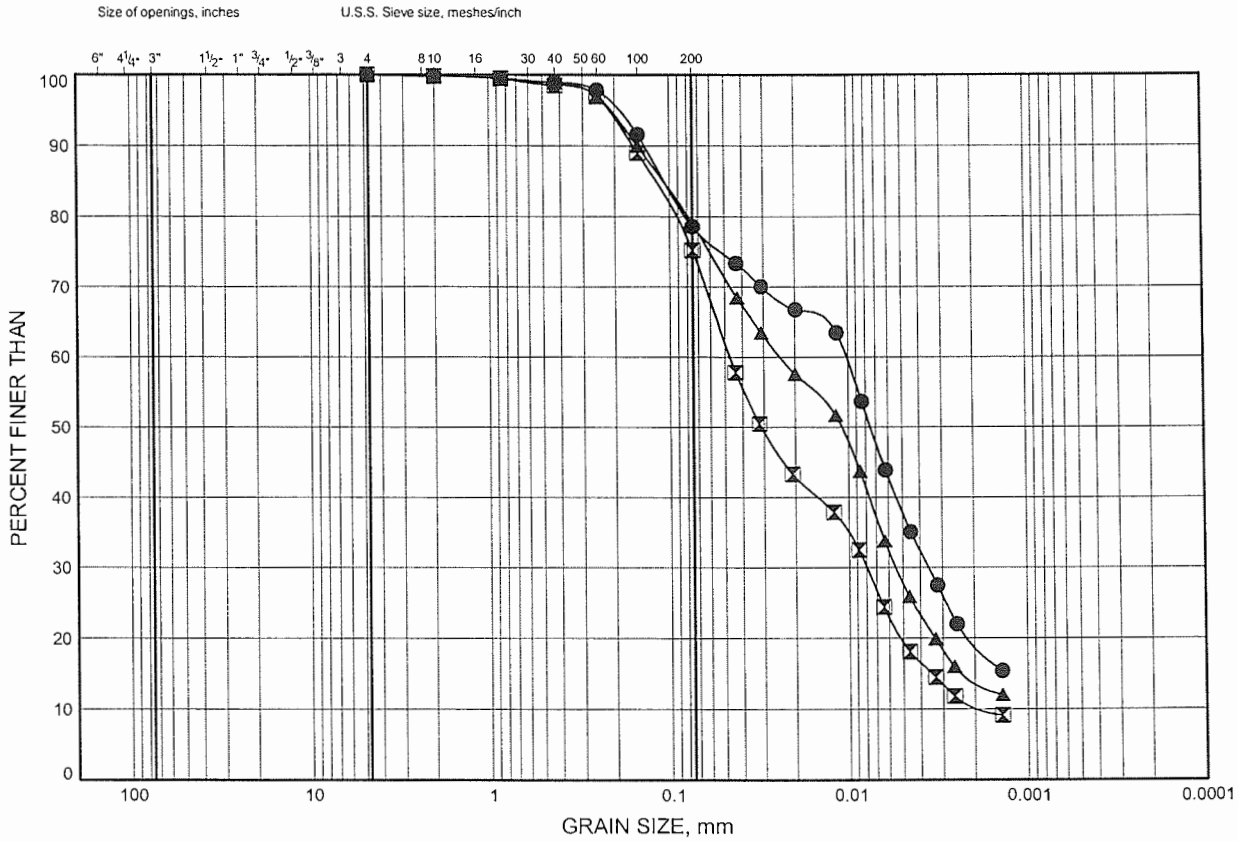
15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A1

Sandy Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+275 L18.75	2.59	
⊠	S 20+375 L48	3.35	
▲	S 20+450 R17	2.59	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

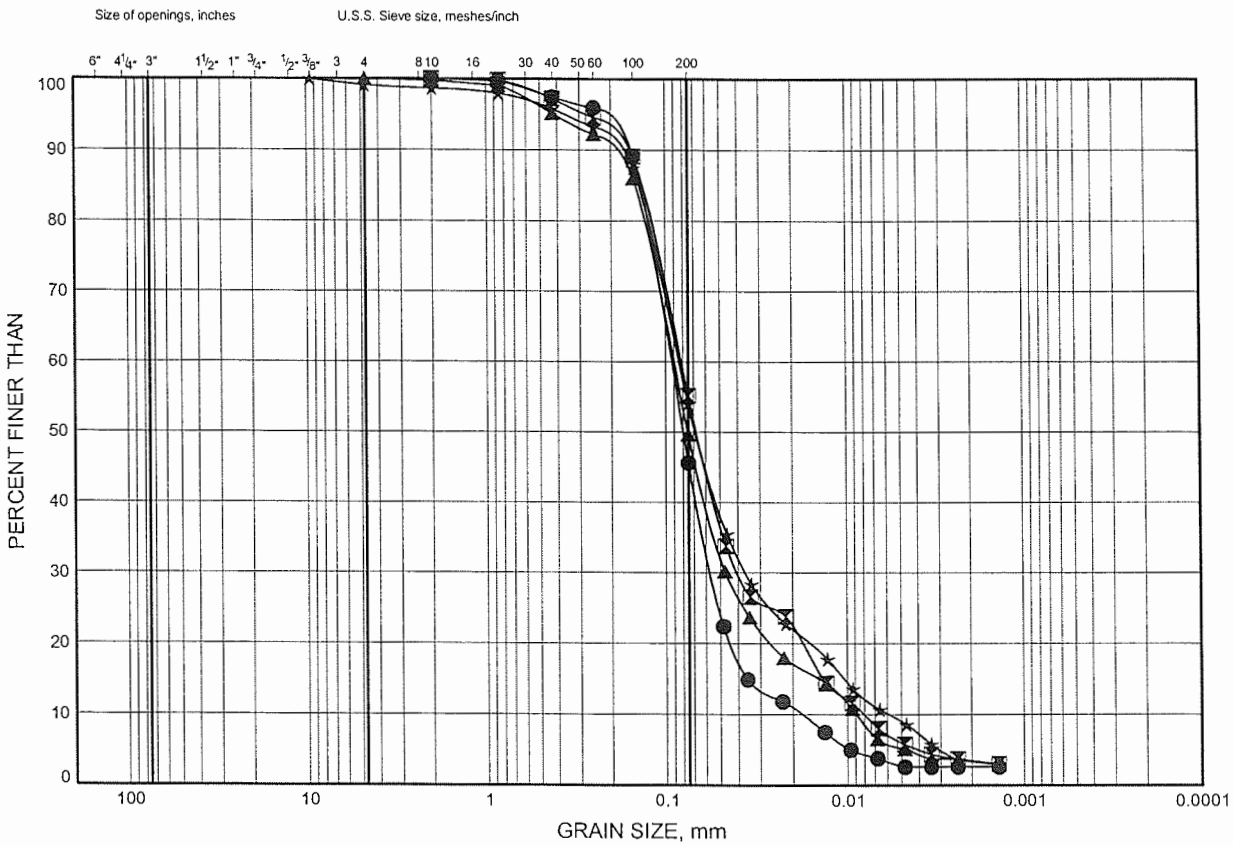
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A2

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 19+875 L18.75	1.53	
⊠	S 19+925 L18.75	1.07	
▲	S 20+000 CL	1.07	
★	S 20+075 L18.75	1.07	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

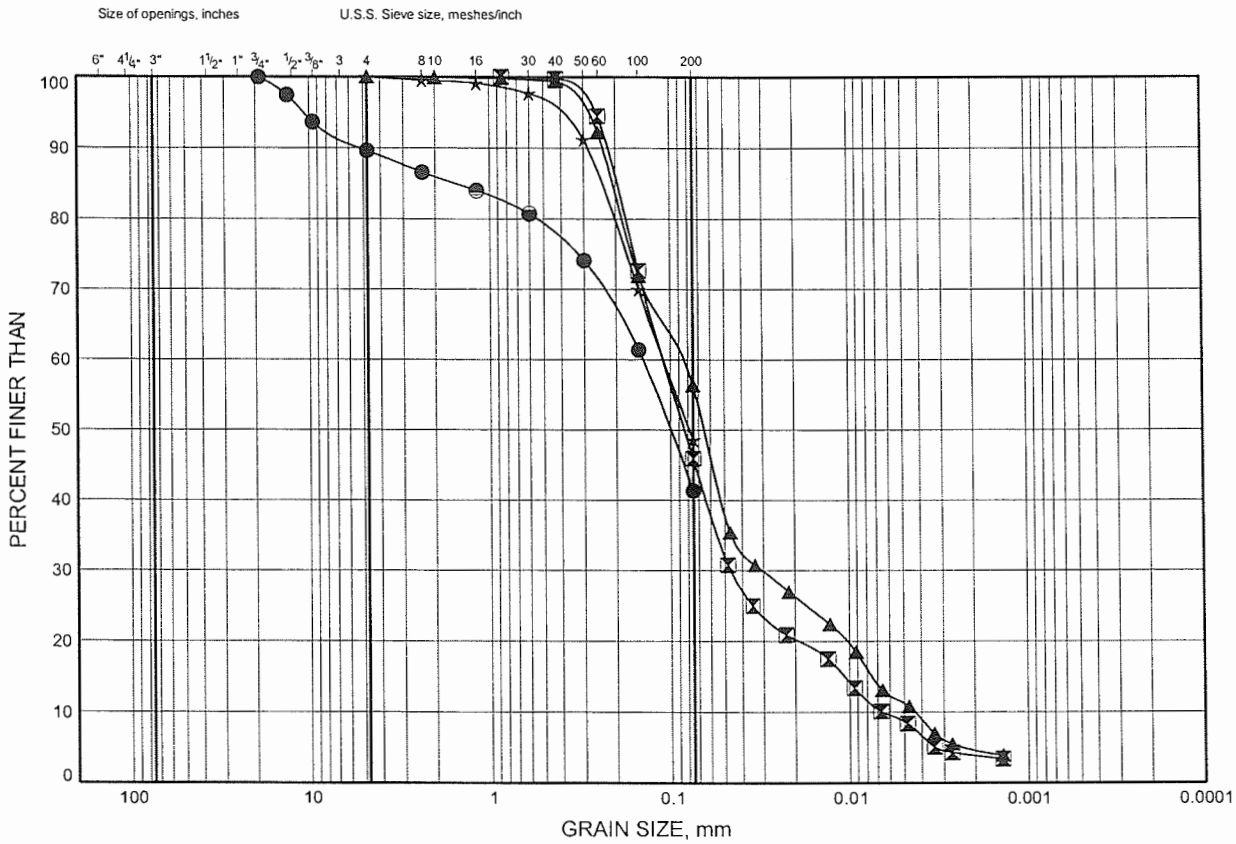
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A3

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+125 L18.75	1.07	
⊠	S 20+400 L 18.75	2.59	
▲	S 20+425 CL	2.59	
★	S 20+478 CL	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

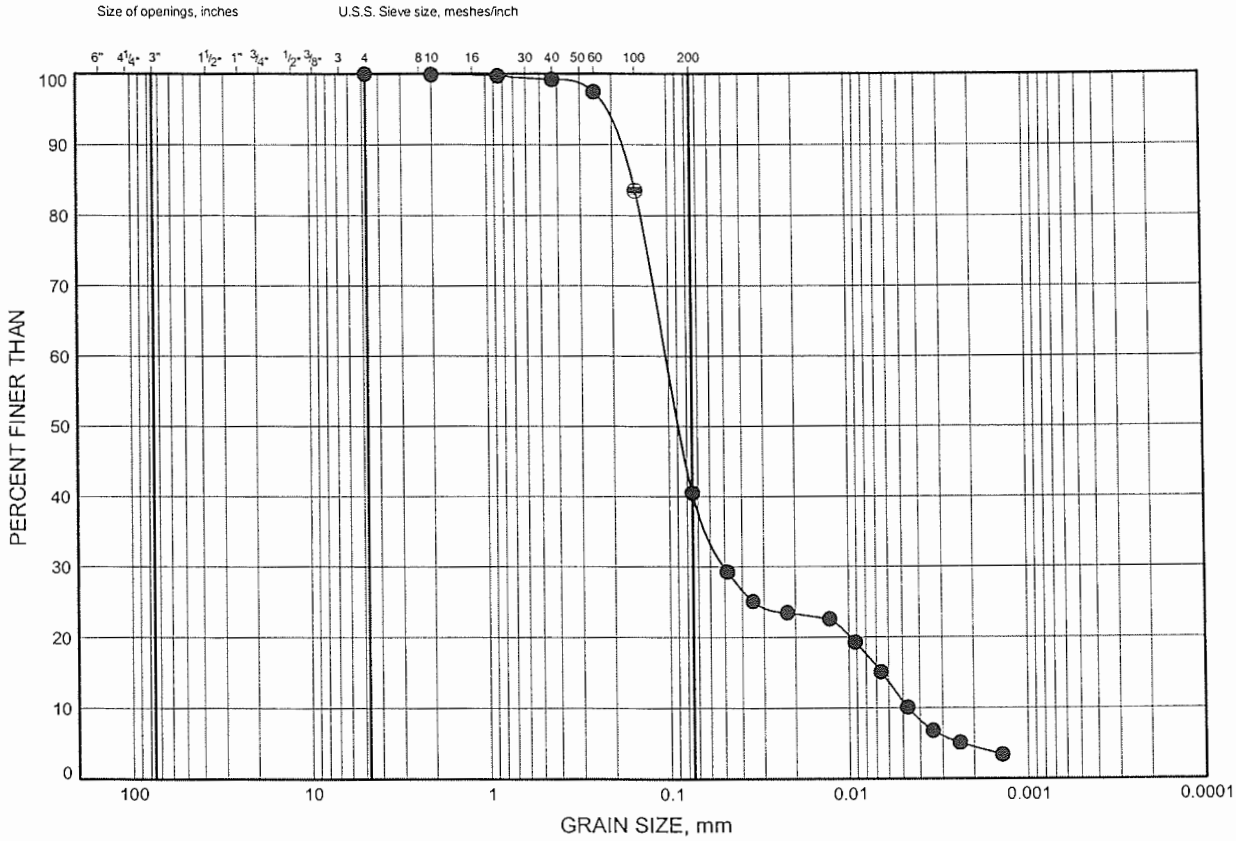
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A4

Silty Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+025 L14	0.57	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

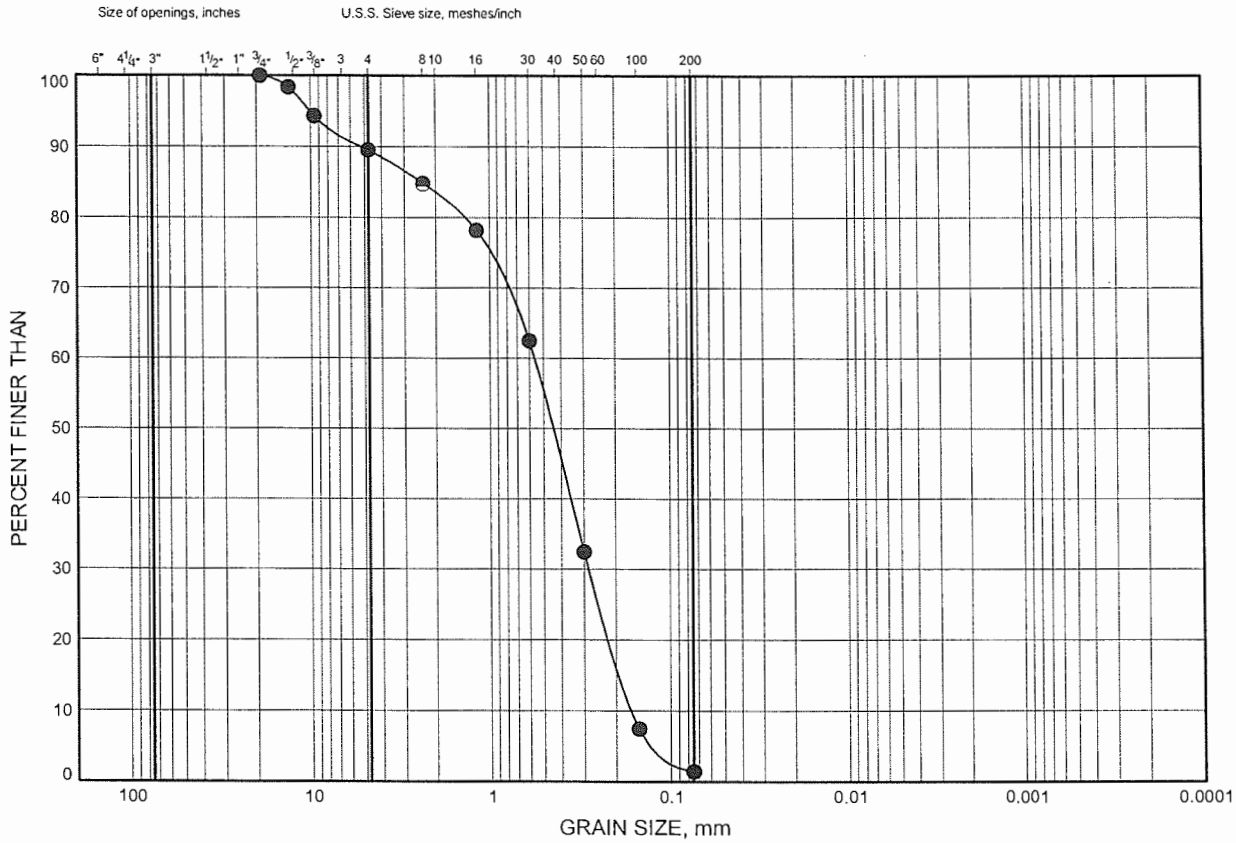
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A5

Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 19+925 L18.75	3.35	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

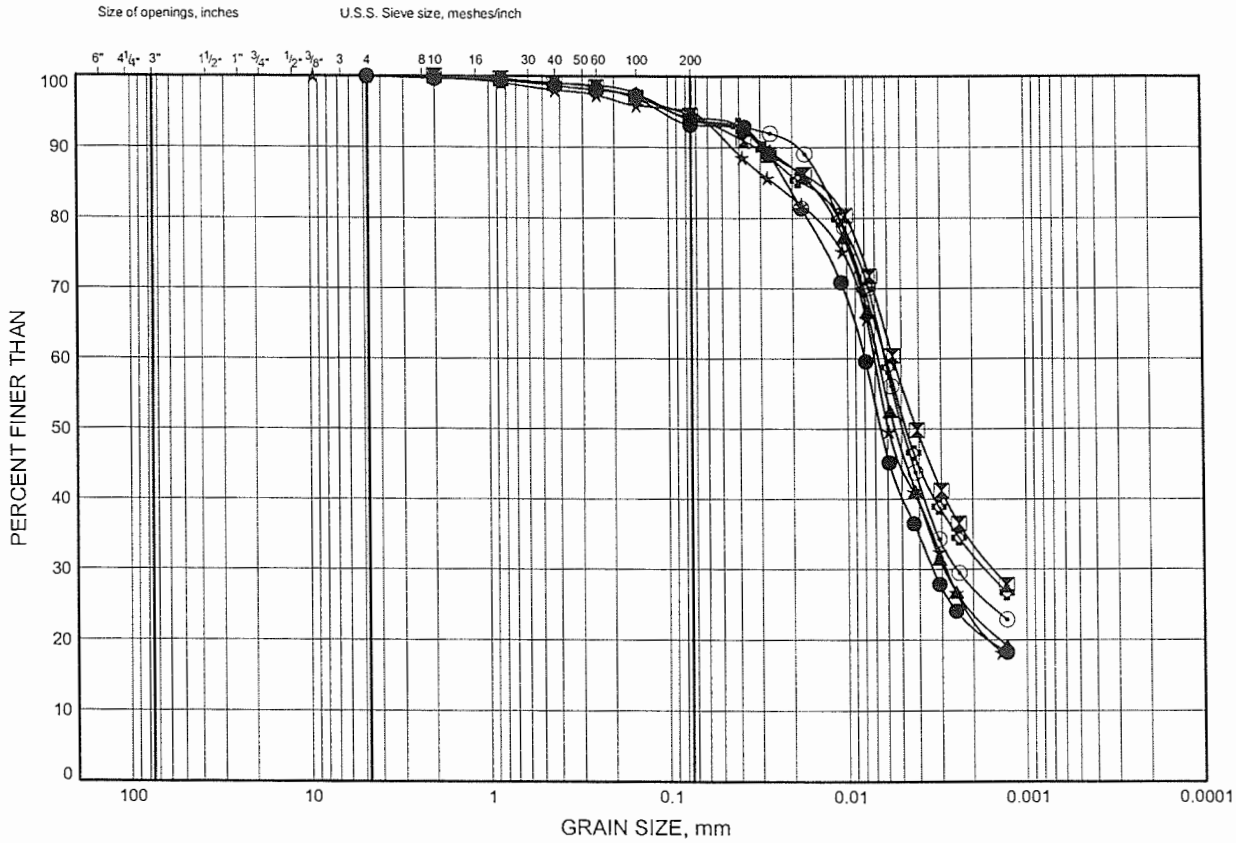
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A6

Silty Clay to Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+350 L18.75	1.83	
⊠	S 20+375 L48	6.71	
▲	S 20+400 L 18.75	6.40	
★	S 20+425 CL	4.88	
⊙	S 20+450 L18.75	6.40	
◇	S 20+478 CL	4.88	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

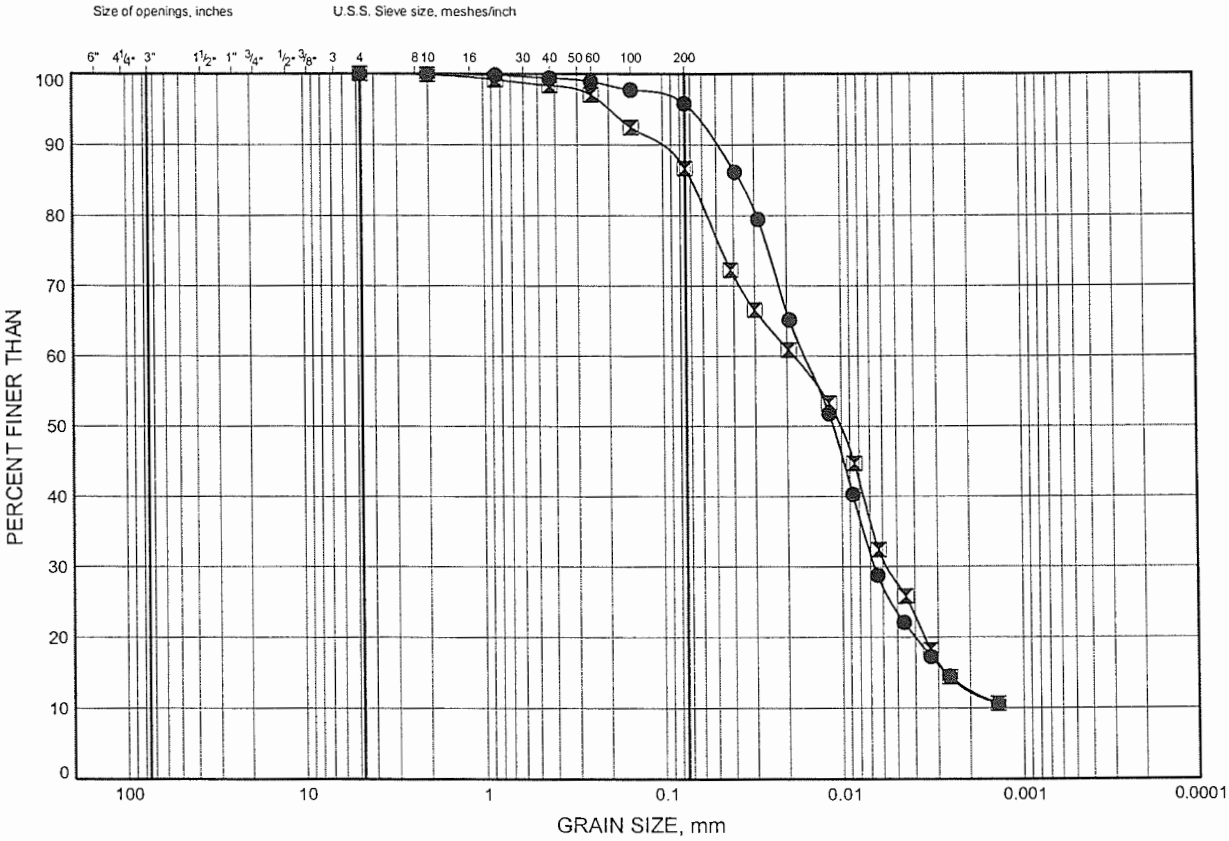
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE A7

Silt to Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+300 L18.75	1.07	
⊠	S 20+450 L18.75	3.35	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

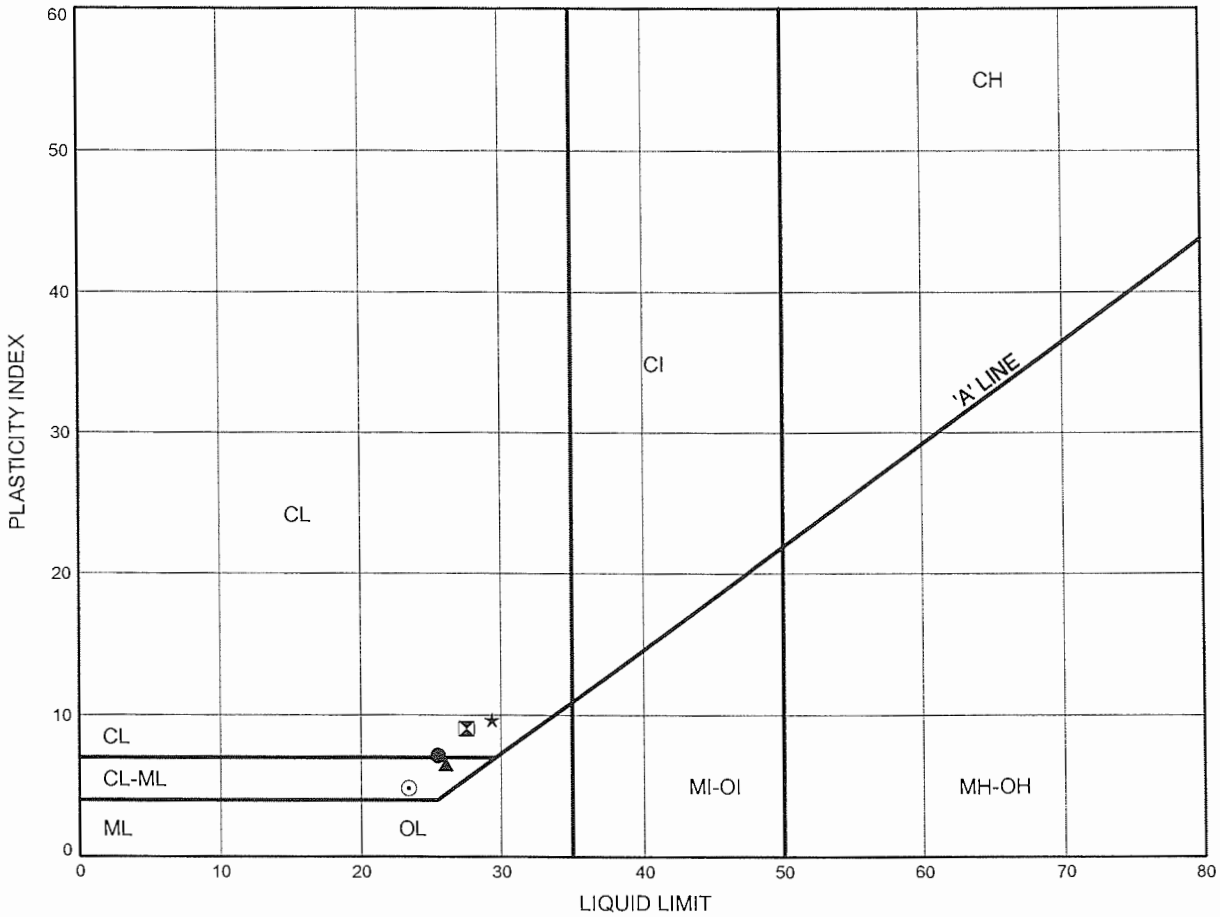
Chkd. JL

THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE A8



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+350 L18.75	1.83	
⊠	S 20+375 L48	6.71	
▲	S 20+400 L 18.75	6.40	
★	S 20+450 L18.75	6.40	
⊙	S 20+478 CL	4.88	

Date December 2004

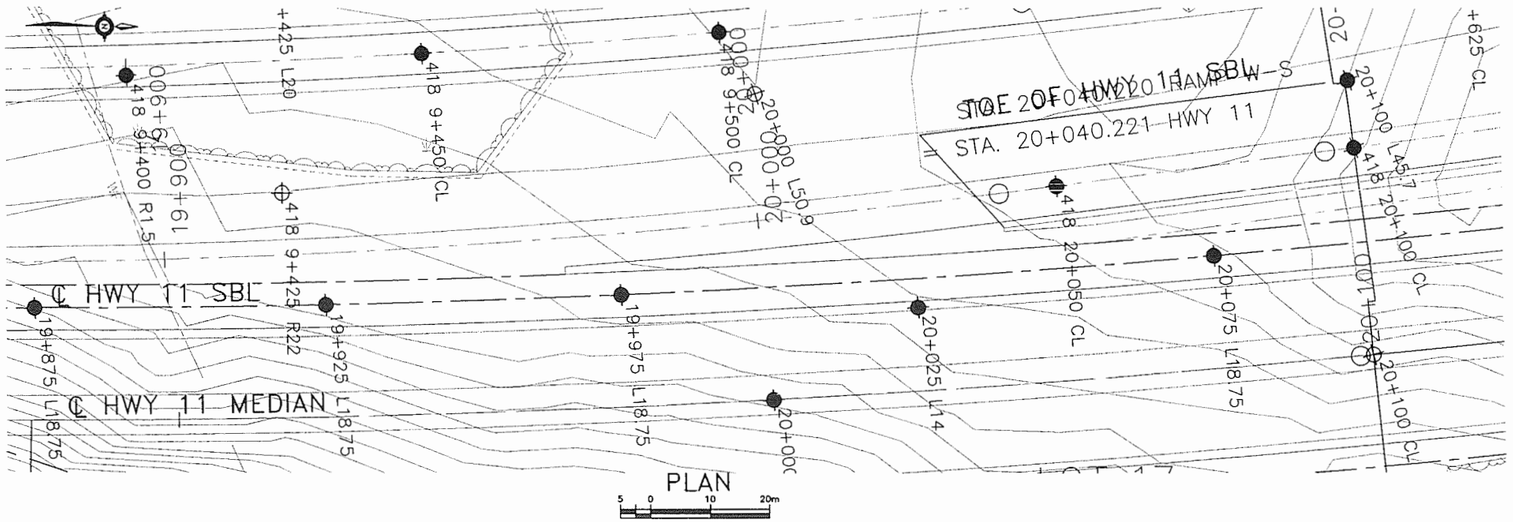
Project 759-93-00

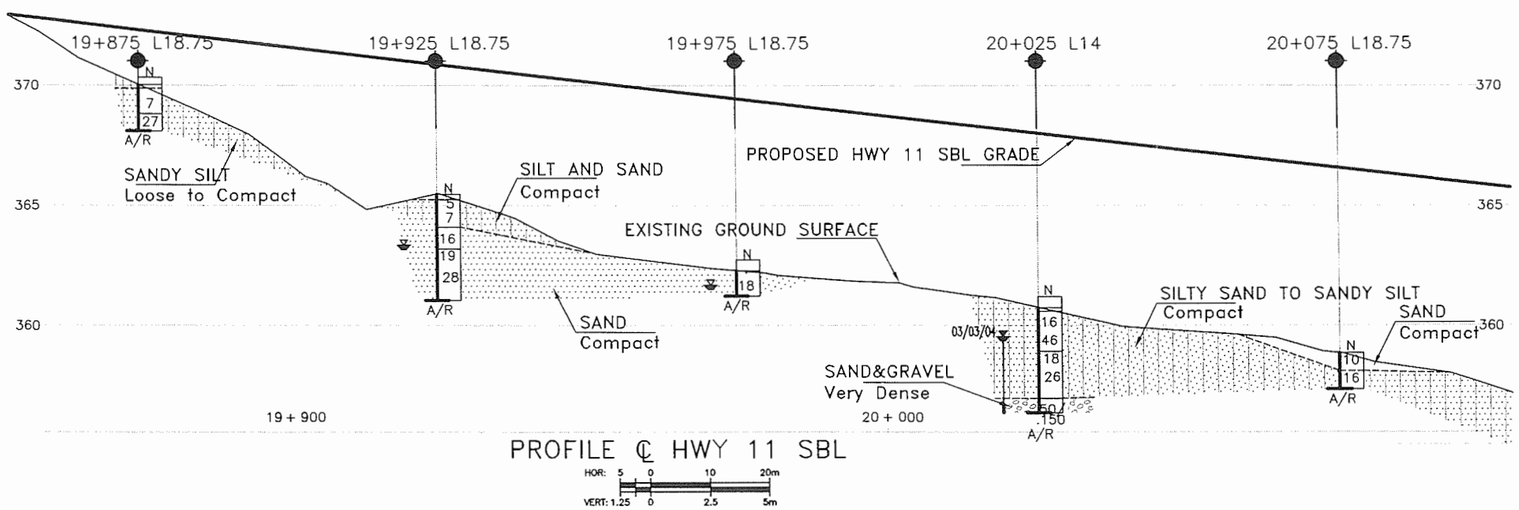
THURBER

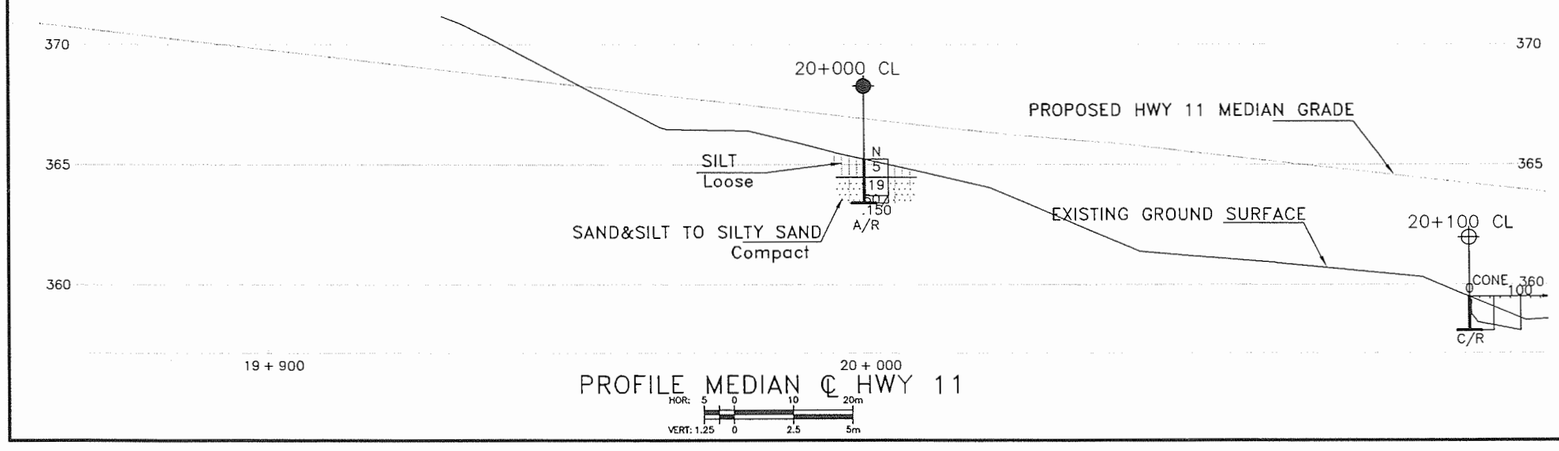
Prep'd WM

Chkd. JL

THURBALT STRONGTOWNSHIP.GPJ 19/12/04







METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

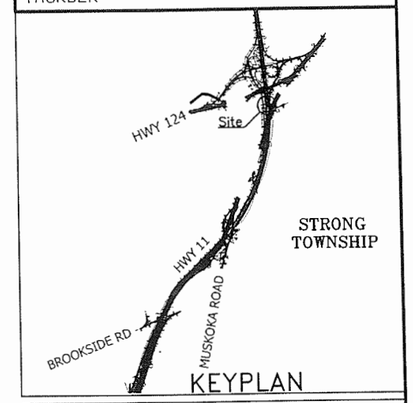
HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATIONS 19+875 TO 20+100
SBL CENTRELINE AND MEDIAN
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
⊻	WL in Piezometer at Time of Investigation (Date)
⊻	Head Artesian Water
⊻	Piezometer
⊻	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
19+875 L18.75	19 + 875	L18.75
19+925 L18.75	19 + 925	L18.75
19+975 L18.75	19 + 975	L18.75
20+000 CL	20 + 000	0
20+025 L14	20 + 025	L14
20+075 L18.75	20 + 075	L18.75
20+100 CL	20 + 100	0
20+125 L18.75	20 + 125	L18.75

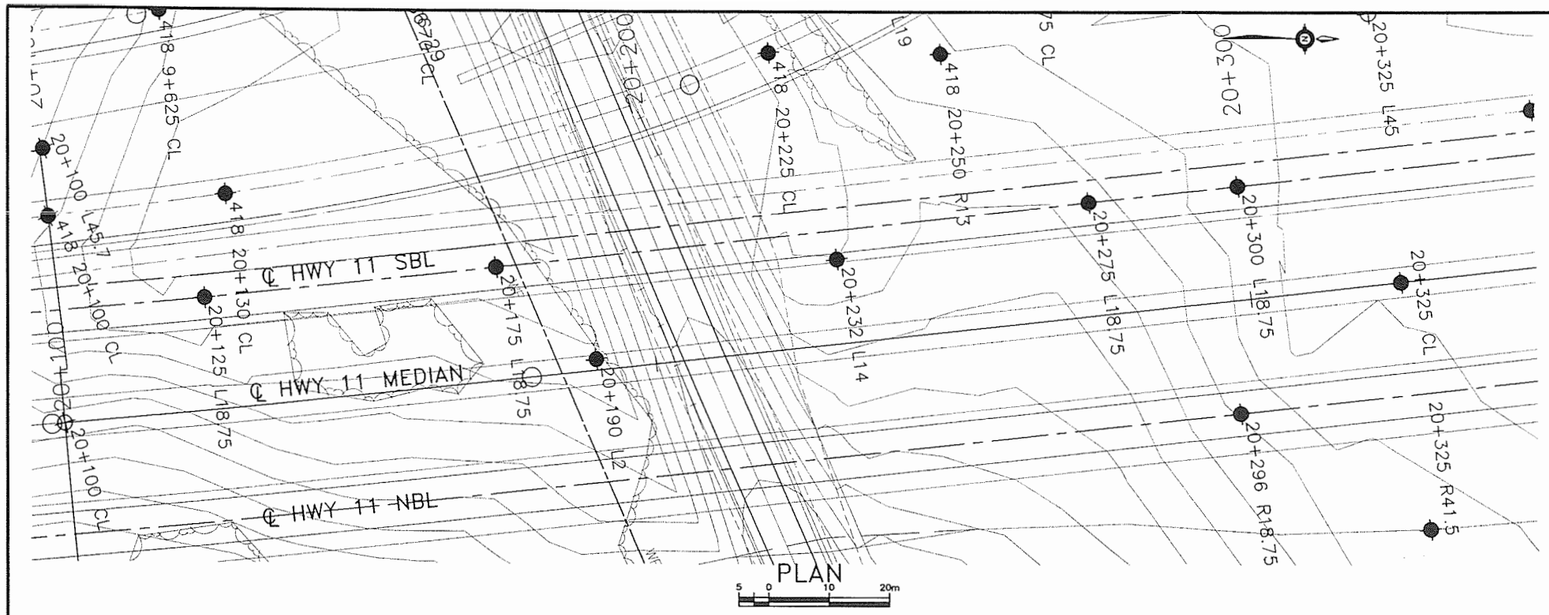
— NOTE —

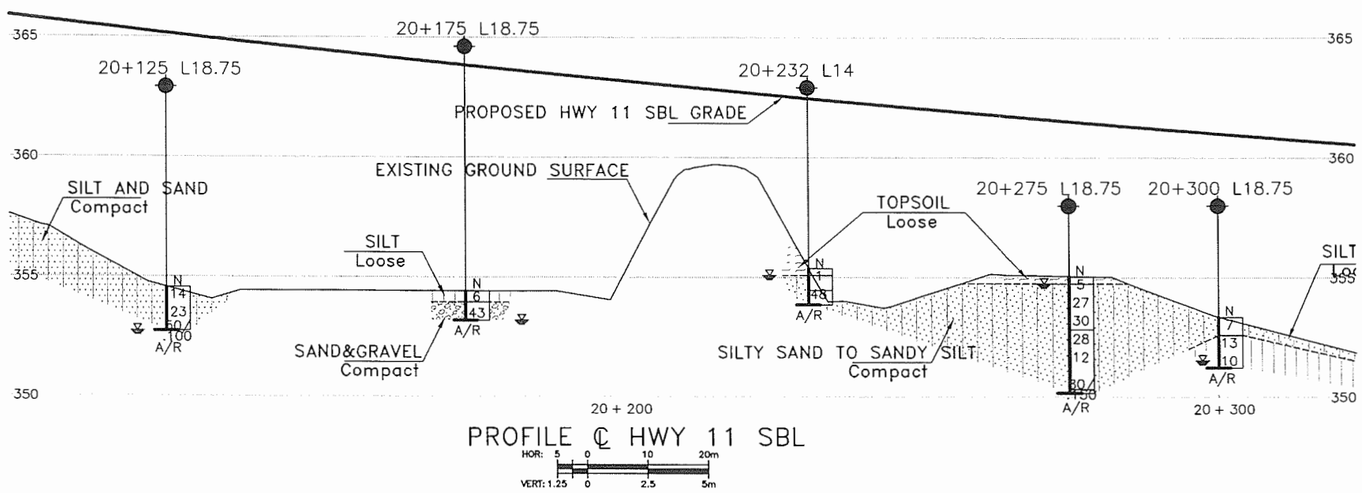
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

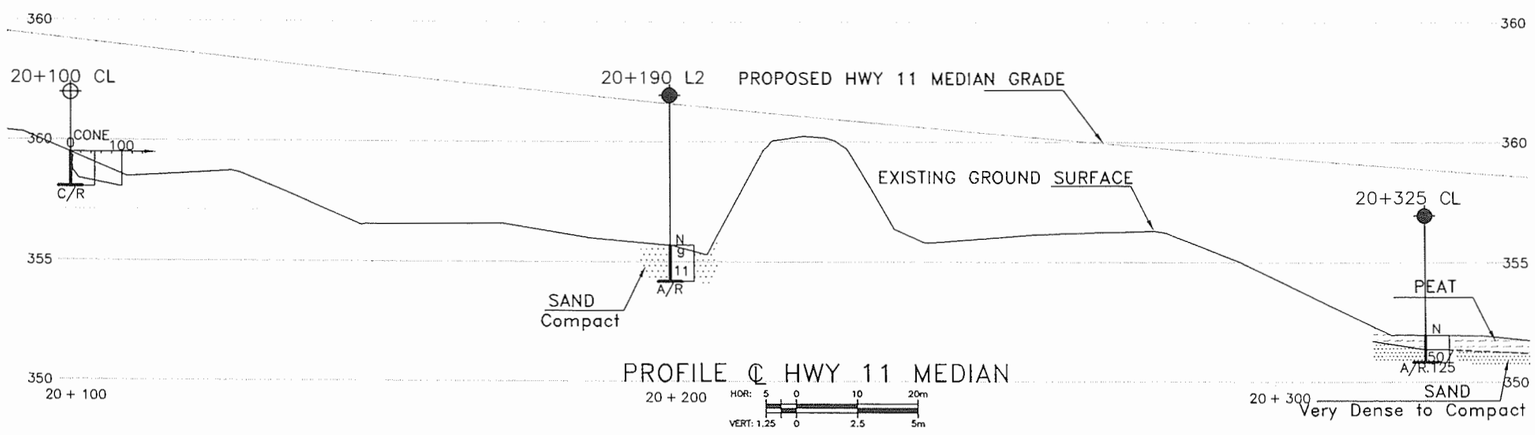
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07	SS	FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE CHBDL	LOAD	DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG A1







METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATIONS 20+100 TO 20+325
SBL CENTRELINE AND MEDIAN
BOREHOLE LOCATIONS AND SOIL STRATA

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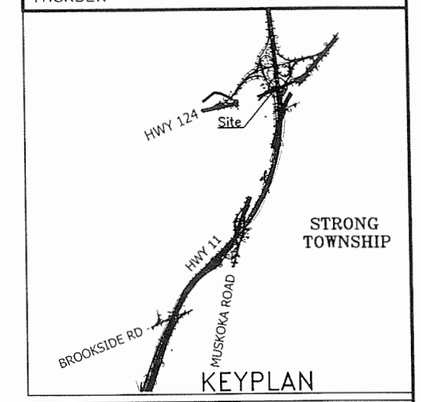

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water
▼	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
20+125 L18.75	20 + 125	L18.75
20+175 L18.75	20 + 175	L18.75
20+200 CL	20 + 200	0
20+232 L14	20 + 232	L14
20+275 L18.75	20 + 275	L18.75
20+300 L18.75	20 + 300	L18.75
20+325 CL	20 + 325	0

— NOTE —

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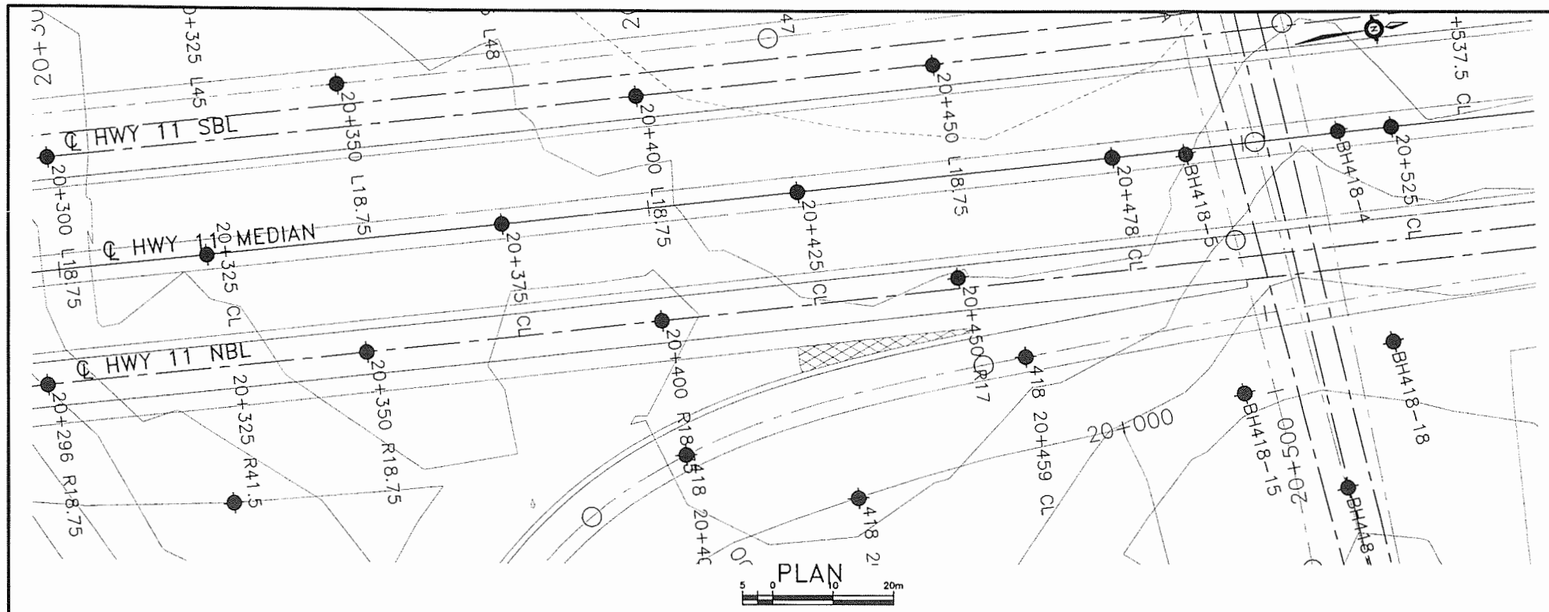
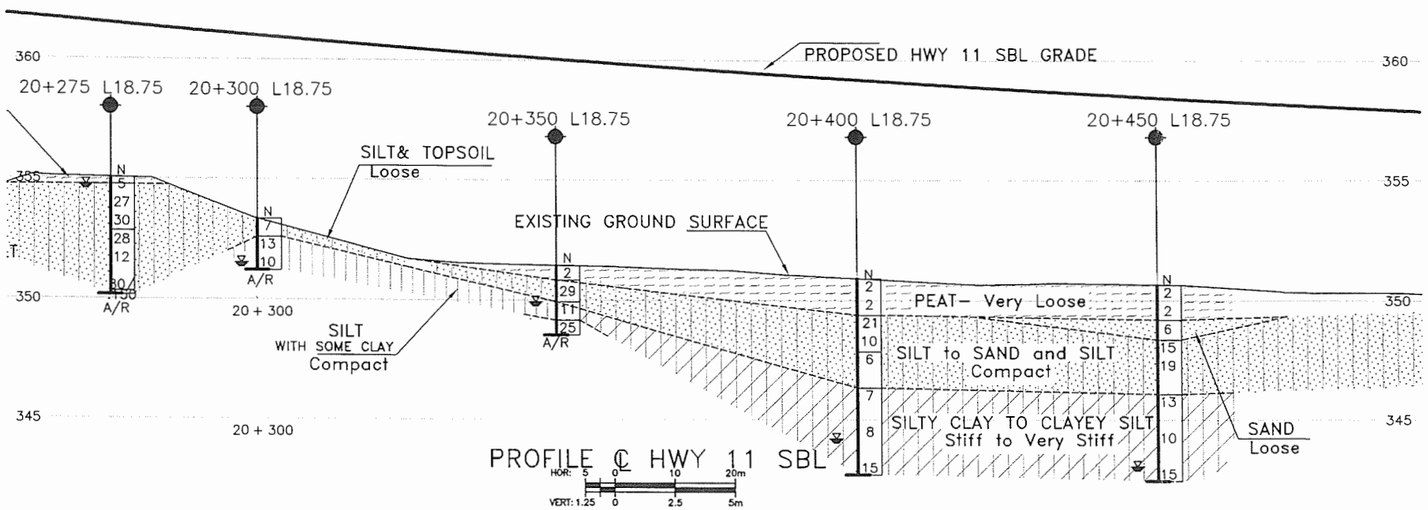
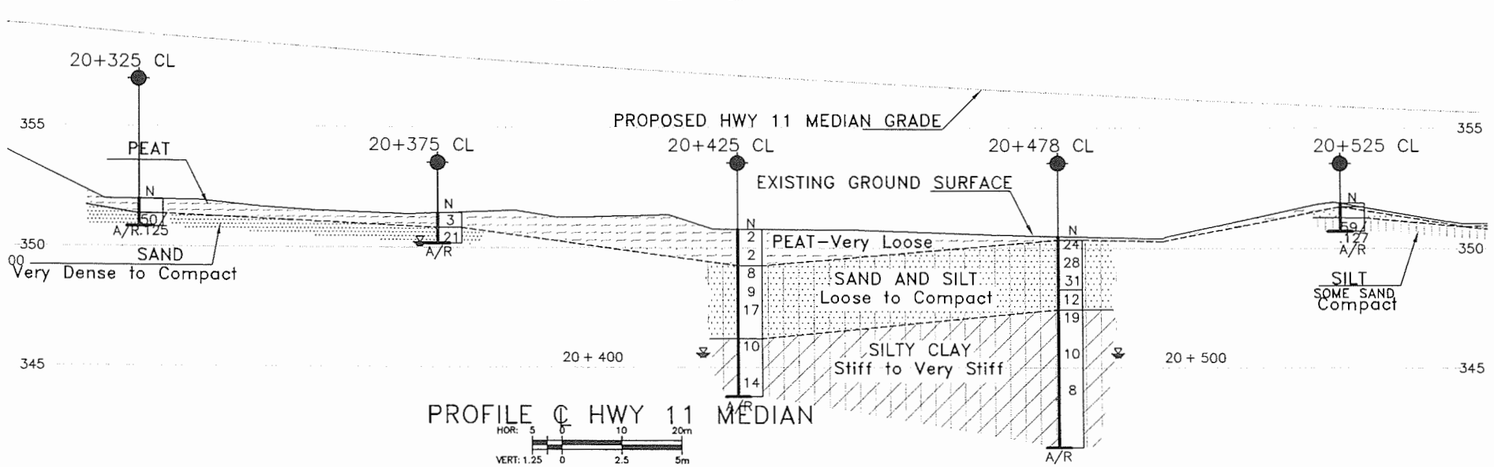
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07	SS	FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE CHBDL	LOAD	DATE FEB 2007	
DRAWN TF	CHK PJB	SITE	STRUCT	SCHEME	DWG A2







METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATIONS 20+325 TO 20+525
SBL CENTRELINE AND MEDIAN
BOREHOLE LOCATIONS AND SOIL STRATA

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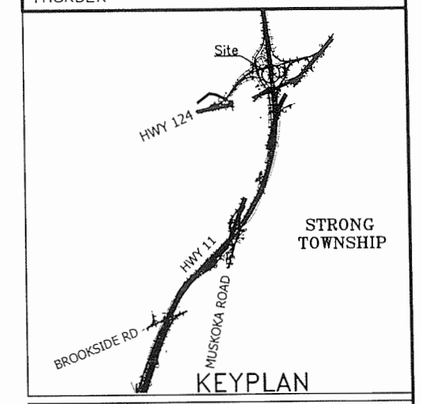


KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water
▼	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
20+350 L18.75	20 + 350	L18.75
20+375 CL	20 + 375	0
20+400 L18.75	20 + 400	L18.75
20+425 CL	20 + 425	0
20+450 L18.75	20 + 440	L18.75
20+478 CL	20 + 478	0
20+525 CL	20 + 525	0

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

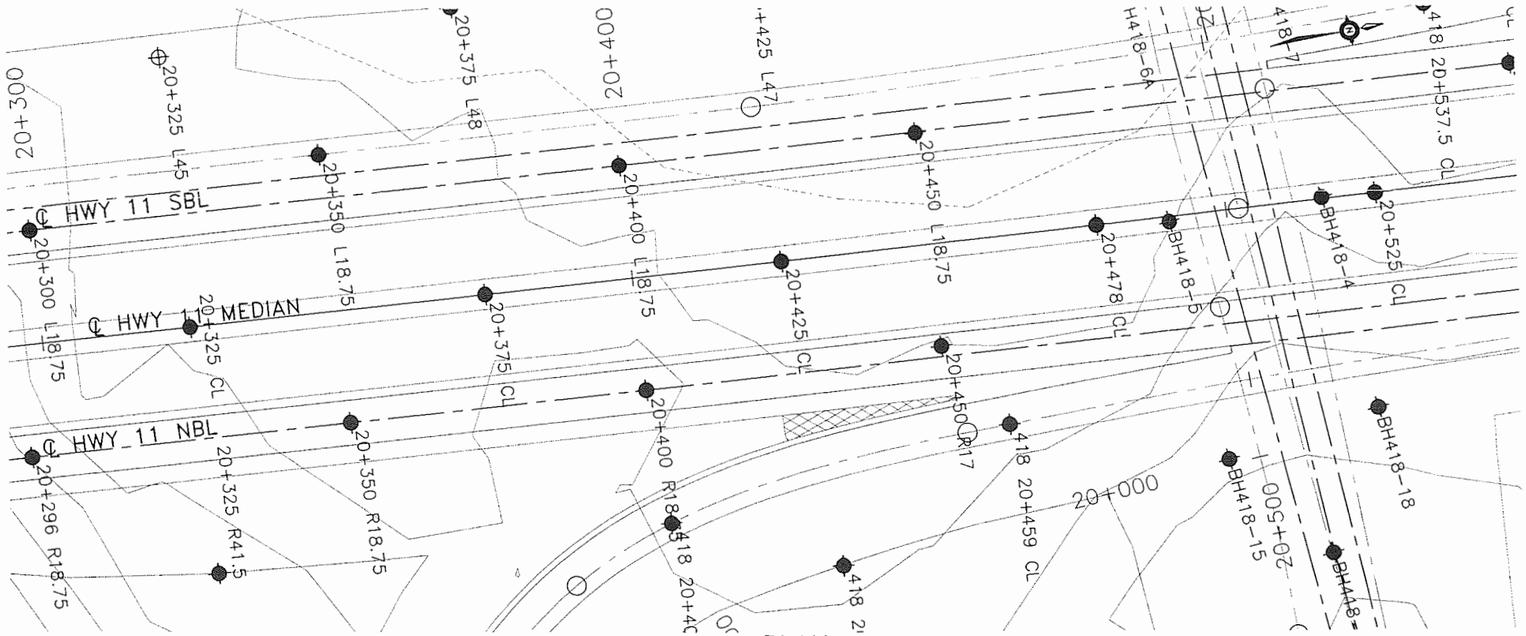
LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

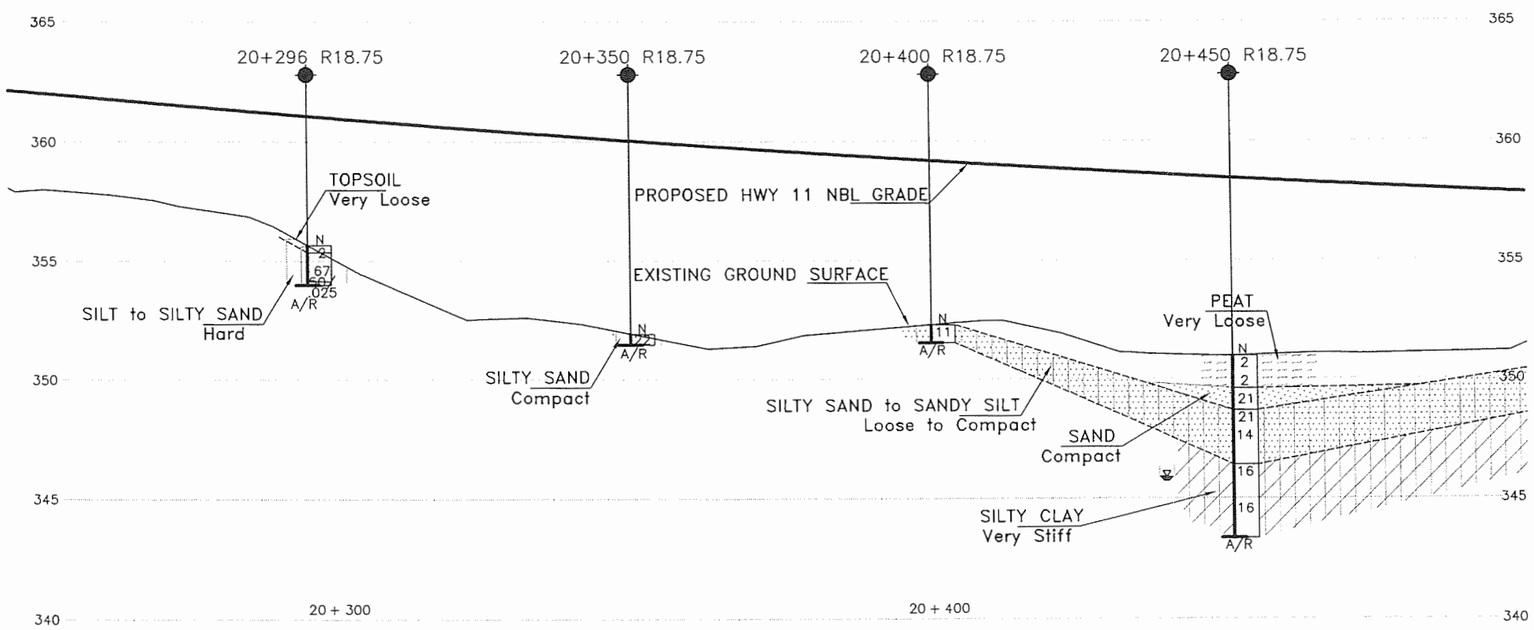
REVISIONS		
FEB 07	SS	FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE CHBDL	LOAD	DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG A3



PLAN

5 0 10 20m



PROFILE ℄ HWY 11 NBL

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+325 TO 20+525
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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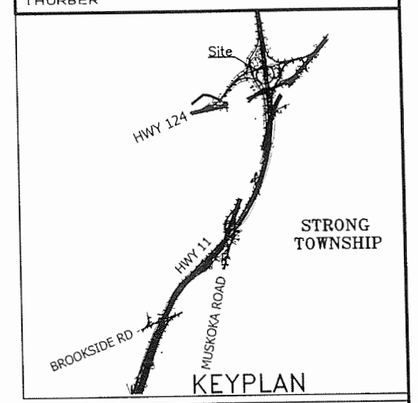


KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊤	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
20+296 R18.75	20 + 296	R18.75
20+350 R18.75	20 + 350	R18.75
20+400 R18.75	20 + 400	R18.75
20+450 R18.75	20 + 450	R18.75

— NOTE —

The boundories between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P.J. BRAUN
Feb 7/07
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07	SS	FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE CHBDL	LOAD	DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG A4

Appendix B
Hwy 11 Mainline, Strong Township, Sta. 20+525 to 21+150

THURBER

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+525 CL

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+525, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 24.10.03 - 24.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sandy **TOPSOIL**										
0.2	**SAND**, very fine to fine grained Brown										
0.6	**SILT**, some sand Compact Grey Moist		1	SS	59/127				○		
1.2	END OF BOREHOLE AT 1.17m. AUGER REFUSAL AT 1.17m. PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+550 L18.75

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+550, O/S 18.75L | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 13.11.03 - 13.11.03 | CHECKED BY JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sandy **TOPSOIL**, trace rootlets, occasional wood fragments, Dark Brown, Wet		1	SS	4	▽					
0.6	Clayey **SILT**, trace to some sand, occasional sand and silt lenses, Stiff, Grey		2	SS	9						
1.4	Sandy **SILT**, some clay, Compact to Dense, Grey		3	SS	10						0 37 48 14
			4	SS	49						
3.1	Silty **SAND**, medium grained, trace gravel, Very Dense, Brown, Wet		5	SS	75/.127						
3.7	END OF BOREHOLE AT 3.66m. AUGER REFUSAL AT 3.66 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.66m AND WATER LEVEL AT 0.30 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+550 R21.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+550, O/S 21.75R ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 12.11.03 - 12.11.03 CHECKED BY JL

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
0.0	**TOPSOIL**										
0.2	Dark Brown Moist Silty **SAND**, fine grained Loose to Compact Reddish Brown to Brown Moist to Wet some topsoil inclusion above 0.69m		1	SS	5				○		
			2	SS	24				○		
1.5	Clayey **SILT**, trace sand Very Stiff to Stiff Grey Moist		3	SS	15				○		
			4	SS	11				H ○		0 2 72 26
			5	SS	80				○		
3.2	**SAND**, trace gravel										
3.4	END OF BOREHOLE AT 3.35m. AUGER REFUSAL AT 3.35 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.35m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

÷ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 13/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+574 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+574, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 24.10.03 - 24.10.03 | CHECKED BY JL

ELEV / DEPTH	SOIL PROFILE: 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
0.0	Sandy **TOPSOIL**													
0.2	**SAND**, very fine to fine grained, trace silt Compact Brown Moist		1	SS	23				○ ○					
1.1	**SILT**, some sand Compact Brown and Grey Moist													
1.5	Clayey **SILT**, some sand Stiff Grey Wet		2	SS	8				H ○			0	3	74	23
2.3	END OF BOREHOLE AT 2.29 m. AUGER REFUSAL AT 2.29 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN IPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+598 R18

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+598, O/S 18R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 24.10.03 - 24.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sandy **TOPSOIL**										
0.2	**SAND**, fine grained Compact Brown Moist to Wet iron staining from 1.07m to 1.37m		1	SS	26				○		
1.5	Sandy **SILT**, some clay Compact Grey Wet		2	SS	18				○		0 27 62 11
2.2	**SILT**, with silty clay laminated, some clay Firm Grey/ Brown Wet		3	SS	6				○		
3.1	END OF BOREHOLE AT 3.05 m. AUGER REFUSAL AT 3.05 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+599 L19

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+599, O/S 19L | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 24.10.03 - 24.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sandy **TOPSOIL** 1										
0.2	**SAND**, fine grained Compact Brown Wet		1	SS	17	▽			○		
1.3	Clayey **SILT**, with silty clay laminated, trace sand Firm Grey Wet		2	SS	6			>>9.1	H○		0 3 74 23
2.7	END OF BOREHOLE AT 2.67 m. AUGER REFUSAL AT 2.67m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE WET AT 0.61 m AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³ Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+625 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+625, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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
0.0	Sandy **TOPSOIL**										
0.2	**SAND**, fine grained, trace gravel, trace silt Compact Brown Moist		1	SS	50/ .025						
1.5	**SILT**, some clay, trace sand Compact Grey Moist		2	SS	30						0 4 77 19
2.2	END OF BOREHOLE AT 2.21m. AUGER REFUSAL AT 2.21 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+625 R37.5

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+625, O/S 37.5R | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

SOIL PROFILE: ELEV / DEPTH	SOIL PROFILE: 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
0.0	**TOPSOIL**										
0.2	**SAND**, fine grained, trace silt Compact to Very Dense Brown Dry to Moist										
			1	SS	30				○		
			2	SS	55				○		
	trace gravel		3	SS	47				○		
2.7	END OF BOREHOLE AT 2.74m. AUGER REFUSAL AT 2.74 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+629 R43

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+629, O/S 43R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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
0.0	DCPT from surface										
1.2	END OF DCPT AT 1.17m. CONE REFUSAL AT 1.17 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+648 R19.5

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+648, O/S 19.5R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**TOPSOIL**										
0.2	**SAND**, fine grained, with organics Brown Wet		1	GS					○		
0.6	END OF BOREHOLE AT 0.56 m. AUGER REFUSAL AT 0.56 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+650.5 L19 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+650.5, O/S 19L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 27.10.03 - 27.10.03 CHECKED BY JL

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
0.0	TOPSOIL										
0.2	**SAND**, fine grained, trace silt, with organics Brown with gravel		1	SS	50/.050				○		
1.0	END OF BOREHOLE AT 0.97 m. AUGER REFUSAL AT 0.97 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+670 L42

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+670, O/S 42L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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						
0.0	**TOPSOIL**										
0.2	**SAND**, fine grained Dense Brown Moist										
0.9	Sandy **SILT**, fine grained Dense Grey Moist		1	SS	39						
1.5	END OF BOREHOLE AT 1.5 m. AUGER REFUSAL AT 1.5 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

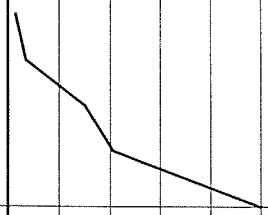
Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+674 R32

METRIC

W.P.	759-93-00	LOCATION	Strong Township, ST. 20+674, O/S 32R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	SS
DATUM	Geodetic	DATE	27.10.03 - 27.10.03	CHECKED BY	JL

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
0.0	DCPT from surface										
1.4	END OF DCPT AT 1.42 m. CONE REFUSAL AT 1.42 m ON HARD / VERY DENSE MATERIAL.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+676 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+676, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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
0.0	SAND, fine grained, with organics Reddish or Brown		1	GS					○		
0.5	END OF BOREHOLE AT 0.46m. AUGER REFUSAL AT 0.46 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+695 R18

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+695, O/S 18R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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
0.0	TOPSOIL										
0.2	SAND, fine grained, trace organics Brown		1	GS					○		
0.7	END OF BOREHOLE AT 0.71 m. AUGER REFUSAL AT 0.71 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+700 L18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 20+700, O/S 18.75L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 27.10.03 - 27.10.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Sandy **TOPSOIL** Reddish Brown										
0.2	**SAND**, fine grained Brown										
0.4	END OF BOREHOLE AT 0.38 m. AUGER REFUSAL AT 0.38 m ON PROBABLE BEDROCK OR BOULDER.. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE. AT S20+700 L20, AUGER REFUSAL AT 0.46 m. AT S20+700 L16, AUGER REFUSAL AT 0.30 m.										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+719 L36

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+719, O/S 36L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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
0.0	DCPT from surface										
0.5	END OF DCPT AT 0.46 m. CONE REFUSAL AT 0.46 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+725 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+725, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	Sandy **TOPSOIL**										
0.2	**SAND**, fine grained Brown										
0.3	END OF BOREHOLE AT 0.30 m. AUGER REFUSAL AT 0.30 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE. AT S20+727 CL AUGER REFUSAL AT 0.46 m.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+745 L18

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+745, O/S 18L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 27.10.03 - 27.10.03 | CHECKED BY JL

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
0.0	**TOPSOIL**										
0.2	**SAND**, fine grained Dense Brown										
0.5	END OF BOREHOLE AT 0.46 m. AUGER REFUSAL AT 0.46 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+750 R23

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+750, O/S 23R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 28.10.03 - 28.10.03 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	TOPSOIL										
0.4	END OF BOREHOLE AT 0.36 m. AUGER REFUSAL AT 0.36 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+775 CL

METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+775, CL ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 27.10.03 - 27.10.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**BEDROCK** at surface (in creek)										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+775 L42

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+775, O/S 42L | ORIGINATED BY SL
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 16.12.03 - 16.12.03 | CHECKED BY JL

SOIL PROFILE: 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
0.0	**PEAT**, fibrous Dark Brown to Black										
0.3	**SAND**, trace silt Very Dense Brown Moist		1	SS	50/						
0.9	END OF BOREHOLE AT 0.89 m. AUGER REFUSAL AT 0.89 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE DRY AND OPEN UPON COMPLETION OF DRILLING.				.075						

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+798 L18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+798, O/S 18.75L ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Silty **SAND**, fine grained										
0.2	Reddish Brown		1	SS	14				○		
	SAND, fine grained, some silt										
	Compact										
	Brown										
0.8	Wet		2	SS	60	▽			○		
	Silty **SAND**, fine to medium grained, some gravel, occasional cobbles										
	Very Dense										
	Brown										
1.5	Wet										
	END OF BOREHOLE AT 1.52 m. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 0.91 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+800 R18.75

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 20+800, O/S 18.75R | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 18.11.03 - 18.11.03 | CHECKED BY JL

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
0.0	**SAND**, fine to medium grained, some silt, occasional organics Loose to Compact Reddish Brown to Brown Wet		1	SS	6				○					
			2	SS	28				○					
1.5	Sandy **SILT**, some clay Compact Brown Wet		3	SS	14	▽			○		0	20	66	14
2.2	**SILT**, some clay, trace sand, some sand layers Firm Grey Wet		4	SS	8				○					
			5	SS	6				○		0	8	75	16
4.1	**SAND**, fine to medium grained, some gravel, some cobbles Very Dense Brown Wet		6	SS	80/ .102				○					
5.3	END OF BOREHOLE AT 5.33 m. AUGER REFUSAL AT 5.33 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.96 m AND WATER LEVEL AT 1.52 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+825 L36

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+825, O/S 36L | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY SS

DATUM Geodetic | DATE 18.11.03 - 18.11.03 | CHECKED BY JL

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
0.0	DCPT from surface										
0.7	END OF DCPT AT 0.69 m. CONE REFUSAL AT 0.69 m ON PROBABLE BEDROCK OR BOULDER. (BEDROCK OUTCROPS IN VICINITY)										

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

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+827 CL

METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+827, CL ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

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						
0.0	TOPSOIL										
0.5	END OF BOREHOLE AT 0.46 m. AUGER REFUSAL AT 0.46 m ON PROBABLE BEDROCK OR BOULDER.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+850 L18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+850, O/S 18.75L ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	TOPSOIL										
0.2	Silty **SAND**, fine grained Brown										
1.5	END OF BOREHOLE AT 1.52 m. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+850 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 20+850, O/S 18.75R ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	TOPSOIL										
0.1	END OF BOREHOLE AT 0.05 m. AUGER REFUSAL AT 0.05 m ON PROBABLE BEDROCK OR BOULDER. (BEDROCK OUTCROPS IN VICINITY)										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+878 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+878, CL | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 18.11.03 - 18.11.03 | CHECKED BY JL

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
0.0	**TOPSOIL**										
0.2	Dark Brown Silty **SAND**, fine grained Reddish Brown Moist										
0.8	END OF BOREHOLE AT 0.76 m. AUGER REFUSAL AT 0.76 m ON PROBABLE BEDROCK OR BOULDER. (BEDROCK OUTCROPS IN VICINITY)										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+895 L15.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 20+895, O/S 15.75L ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 15.12.03 - 15.12.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous										
0.6	Gravelly **SAND**, some silt, trace rootlets Loose Brown Wet		1	SS	6	▽			○		28 49 23 (SI+CL)
			2	SS	50/ .075				○		
1.8	END OF BOREHOLE AT 1.80 m. AUGER REFUSAL AT 1.80 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.12 m AND WATER LEVEL AT 0.99 m UPON COMPLETION.										

+ 3, × 3 : Numbers refer to Sensitivity

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

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+900 R18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 20+900, O/S 18.75R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 15.12.03 - 15.12.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**PEAT**, fibrous Dark Brown to Black										
0.5	Silty **SAND**, trace rootlets, trace gravel Loose to Compact Brown Wet		1	SS	7				○		
			2	SS	16	▽			○		11 55 35 (SI+CL)
	Becoming Very Dense		3	SS	50/.125				○		
2.6	END OF BOREHOLE AT 2.59 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.39 m AND WATER LEVEL AT 2.06 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+925 L18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 20+925, O/S 18.75L ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 16.12.03 - 16.12.03 CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous Dark Brown to Black								
0.5	**SAND**, trace silt Compact Brown Wet		1	SS	17				
	trace to some silt		2	SS	16				
			3	SS	19				
	some silt to silty		4	SS	17				
4.6	**SILT**, some clay, some sand Stiff Grey Wet		5	SS	8				0 18 69 13
5.7	Silty **CLAY**, trace sand Soft to Firm grey		6	SS	4				
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 3.12 m AND WATER LEVEL AT 3.12 m UPON COMPLETION. AUGER REFUSAL AT 6.71 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.								

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

+ ³, × ³ : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+950 R18.75 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION Strong Township, ST. 20+950, O/S 18.75R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 16.12.03 - 01.12.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**PEAT**, fibrous Dark Brown to Black										
0.3	**SAND and SILT**, fine grained Compact Brown Moist		1	SS	20						
	Wet		2	SS	14						0 38 62 (SI+CL)
			3	SS	11						
			4	SS	14						
4.3	Clayey **SILT**, some sand, occasional silt and clay lamination Soft Grey		5	SS	4	▽					0 14 68 18
			6	SS	50/.075						
6.7	END OF BOREHOLE AT 6.65 m. AUGER REFUSAL AT 6.65 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 6.65 m AND WATER LEVEL AT 4.72 m UPON COMPLETION.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+970 R50

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+970, O/S 50R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY MF/SS

DATUM Geodetic | DATE 01.10.02 - 01.10.02 | CHECKED BY PJB

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous										
0.2	Dark Brown to Black					▽					
	SAND, fine to medium grained, trace to some silt Compact Brown Wet		1	SS	14				○		
	iron oxide staining								○		
1.5	thin silty layer at 1.22 m										
	SILT, trace to some sand, trace clay Compact Grey Wet		2	SS	22				○		0 10 81 9
			3	SS	50/.075				○ ○		
2.6	**SAND**, well graded, trace gravel Grey Wet										
2.8	END OF BOREHOLE AT 2.82 m. AUGER REFUSAL AT 2.82 m ON PROBABLE BEDROCK OR BOULDER. WATER LEVEL AT 0.30 m DURING INVESTIGATION.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 20+979 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 20+979, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY MF/SS

DATUM Geodetic | DATE 01.10.02 - 01.10.02 | CHECKED BY PJB

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
0.0	DCPT from surface.										
3.7	END OF DCPT AT 3.66 m.										

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

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+000 R17.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 21+000, O/S 17.75R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MF/SS

DATUM Geodetic DATE 01.10.02 - 01.10.02 CHECKED BY PJB

ELEV / DEPTH	SOIL PROFILE: 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)	WATER CONTENT (%) (PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous										
0.2	Black Wet										
	SAND, fine grained, trace silt, trace gravel Compact Brown Wet		1	SS	18						
1.5	**SAND**, well graded, trace gravel Compact Brown Wet		2	SS	20						1 88 10 (SI+CL)
2.2	**SILT and SAND**, trace clay Compact Brown Wet thin silty layers from 2.74m to 3.66m		3	SS	21						
			4	SS	18						0 47 53 (SI+CL)
3.7	END OF BOREHOLE AT 3.66 m.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+025 CL

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 21+025, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY MF/SS
DATUM Geodetic | DATE 01.10.02 - 01.10.02 | CHECKED BY PJB

ELEV / DEPTH	SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	SAND, fine grained, some organics										
0.2	Grey, Dry to Moist										
	SAND, fine grained, Compact, Brown, Dry to Moist		1	SS	25	▽			○		
1.5	SAND, well graded, trace gravel, trace to some silt, Dense, Brown, Wet		2	SS	40				○		6 84 10 (SI+CL)
2.2	SAND, fine grained, trace silt, Compact, Brown, Wet		3	SS	22				○		
			4	SS	17				○		
3.7	END OF BOREHOLE AT 3.66 m. BOREHOLE OPEN TO 3.66 m AND WATER LEVEL AT 1.45 m UPON COMPLETION.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+025 R37

METRIC

W.P.	759-93-00	LOCATION	Strong Township, ST. 21+025, O/S 37R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	MF/SS
DATUM	Geodetic	DATE	01.10.02 - 01.10.02	CHECKED BY	PJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	w_P — w — w_L	γ kN/m³	GR SA SI CL
0.0	DCPT from surface.										
3.7	END OF DCPT AT 3.66 m.										

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

WATER CONTENT (%)
20 40 60

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+050 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 21+050, O/S 18.75R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY MF/SS

DATUM Geodetic DATE 01.10.02 - 01.10.02 CHECKED BY PJB

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**SAND**, fine grained, trace organics										
0.2	Grey										
	SAND, fine grained Compact to Loose Brown Moist trace gravel from 0.15 m to 1.45 m Becoming Wet at 1.45 m		1	SS	29				○		
			2	SS	27				○		
			3	SS	8				○		0 91 9 (SI+CL)
			4	SS	24				○		
4.3	**SILT and SAND**, fine grained, trace clay Compact Brown Wet		5	SS	14				○		0 46 48 6
5.2	END OF BOREHOLE AT 5.18 m. SAND HEAVING IN AUGERS DCPT started at 5.18 m.										
6.4	END OF DCPT AT 6.40 m.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+100 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 21+100, O/S 18.75R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MF/SS

DATUM Geodetic DATE 01.10.02 - 01.10.02 CHECKED BY PJB

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**SAND**, fine grained, some organics										
0.2	Grey										
	SAND, fine grained Compact to Dense Brown Moist Becoming wet at 2.29 m		1	SS	11				○		
			2	SS	36				○		
2.2	**SAND**, well graded Compact Brown Wet		3	SS	20				○		
			4	SS	21				○		1 97 3 (SI+CL)
3.5	**SILT and SAND**, fine grained, trace clay Compact Brown Wet		5	SS	22				○		0 39 56 5
5.2	END OF BOREHOLE AT 5.18 m.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+125 CL

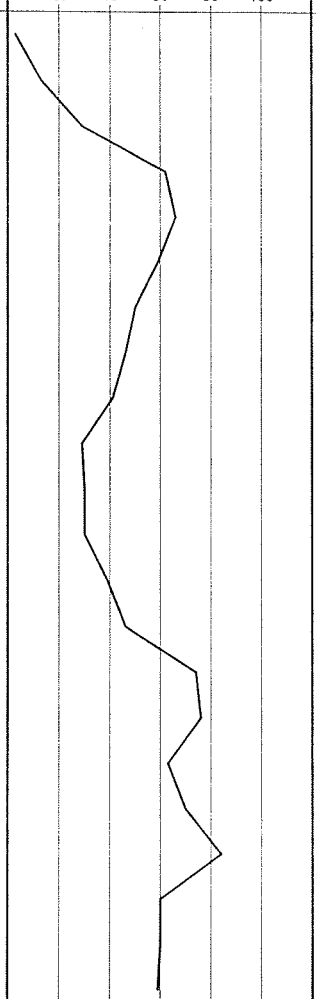
METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 21+125, CL | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY MF/SS

DATUM Geodetic | DATE 12.09.02 - 12.09.02 | CHECKED BY PJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
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
0.0	DCPT from surface.										
6.7	END OF DCPT AT 6.71 m.										



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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+128 R43.4

METRIC

W.P. 759-93-00 | LOCATION Strong Township, ST. 21+128, O/S 43.4R | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY MF/SS
DATUM Geodetic | DATE 30.09.02 - 30.09.02 | CHECKED BY PJB

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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
0.0	**SAND**, fine grained Compact Brown Dry to Moist										
			1	SS	18				○		
1.5	**SAND**, fine to medium grained Dense Brown Wet		2	SS	32				○		1 93 6 (SI+CL)
2.2	**SAND**, medium to coarse grained, trace gravel Compact Brown Wet		3	SS	12				○		
3.3	**SILT and SAND**, fine grained, trace clay Compact Brown Wet		4	SS	17				○		
			5	SS	30				○		0 37 57 6
			6	SS	18				○		
6.7	END OF BOREHOLE AT 6.71 m.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+150 R18.75 1 OF 1 METRIC

W.P. 759-93-00 LOCATION Strong Township, ST. 21+150, O/S 18.75R ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MF/SS

DATUM Geodetic DATE 12.09.02 - 12.09.02 CHECKED BY PJB

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
0.0	TOPSOIL								
0.2	Silty SAND, fine grained Reddish Brown Moist	1	GS						
0.8	SAND, medium grained, some gravel Very Dense Reddish Brown Dry to Moist	1	SS	50					
1.5	SAND, fine grained Compact Brown Wet	2	SS	27					
		3	SS	18					
		4	SS	16					
3.5	SILT and SAND, layers Compact Brown Sand and Grey Silt Wet	5	SS	27		0	36	58	6
		6	SS	21					
6.7	END OF BOREHOLE AT 6.71 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.								

WATER LEVEL READINGS:

DATE	DEPTH (m)
19/06/03	0.50
14/08/03	1.12

SOIL PROFILE: 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

+³, ×³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 STRONGTOWNSHIP.GPJ 09/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S 21+200 R18.75

METRIC

G.W.P. 759-93-00 | LOCATION Strong Township, ST. 21+200, O/S 18.75R | ORIGINATED BY MF
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY MF/SS
DATUM Geodetic | DATE 12.09.02 - 12.09.02 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
0.0	**TOPSOIL**										
0.2	Silty **SAND and GRAVEL** Reddish Brown Dry to Moist	1	GS								
0.8	**SAND**, fine grained Very Dense to Dense Brown Dry to Wet	1	SS	50							
		2	SS	46							
2.3	**SAND**, some silt to silty, trace clay Compact Brown Wet	3	SS	23							
		4	SS	20							
4.6	**SAND and SILT**, layered, trace clay Compact Brown Sand and Grey Silt Wet	5	SS	20				0	47	47	6
		6	SS	13							
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 3.96 m AND WATER LEVEL AT 3.96 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

+³, ×³: Numbers refer to Sensitivity

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

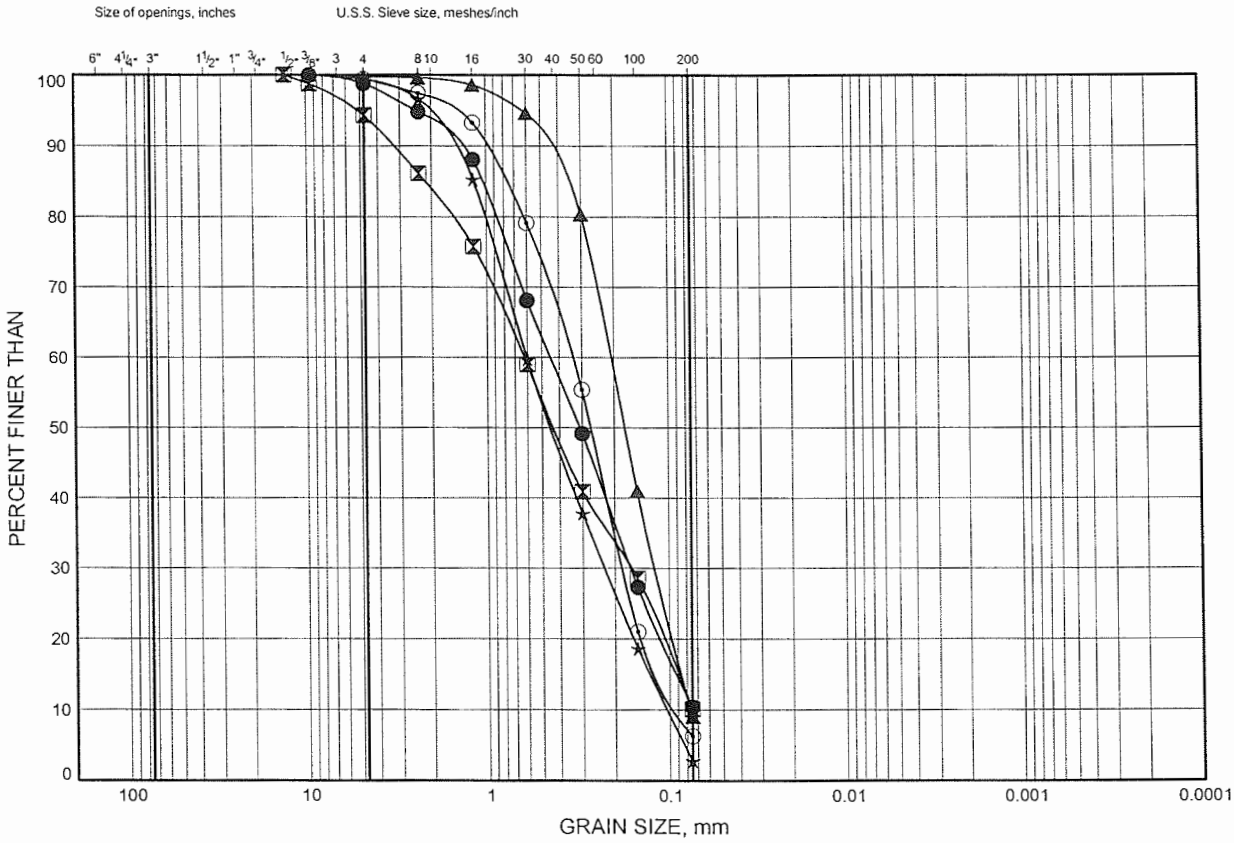
ONTMT4 STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B1

Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 21+000 R17.75	1.83	
⊠	S 21+025 CL	1.83	
▲	S 21+050 R18.75	2.59	
★	S 21+100 R18.75	3.35	
⊙	S 21+128 R43.4	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

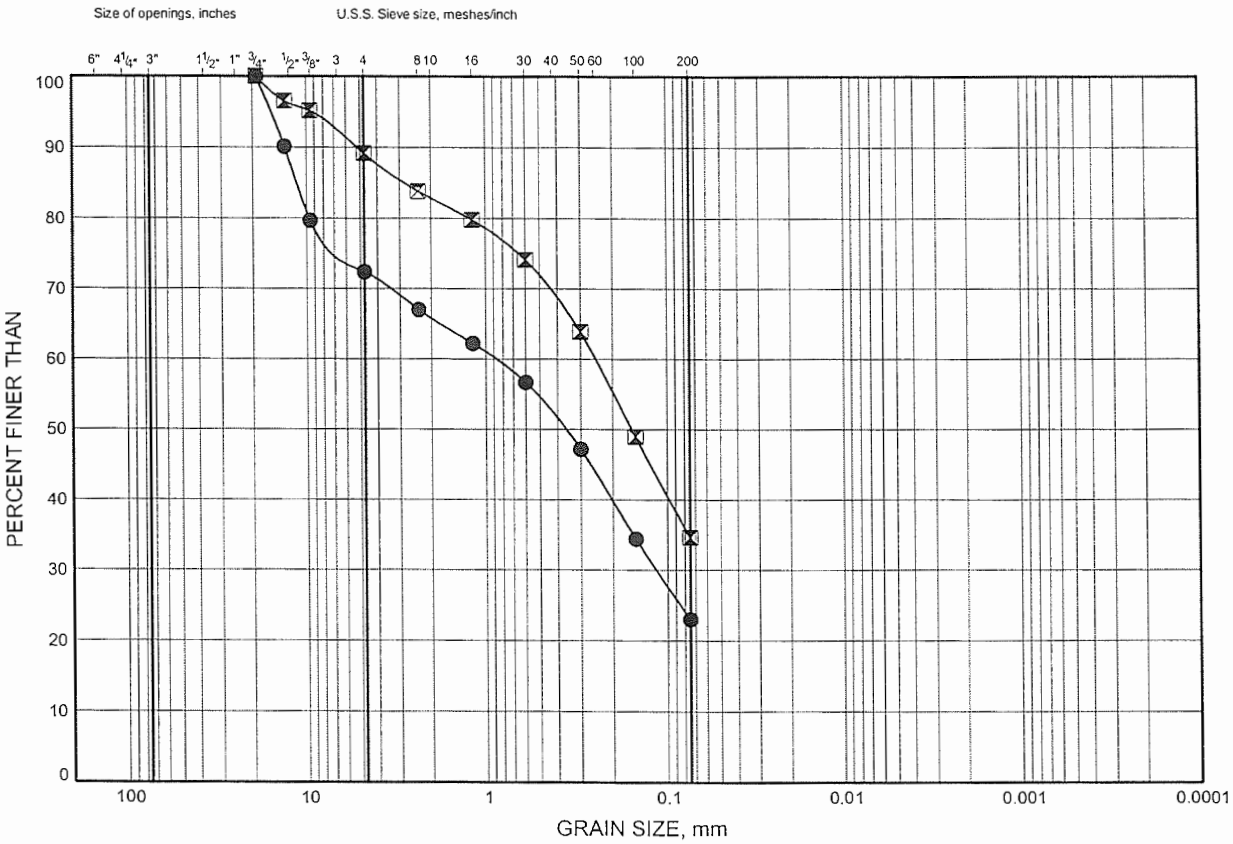
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B2

Silty Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+895 L15.75	1.07	
⊠	S 20+900 R18.75	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

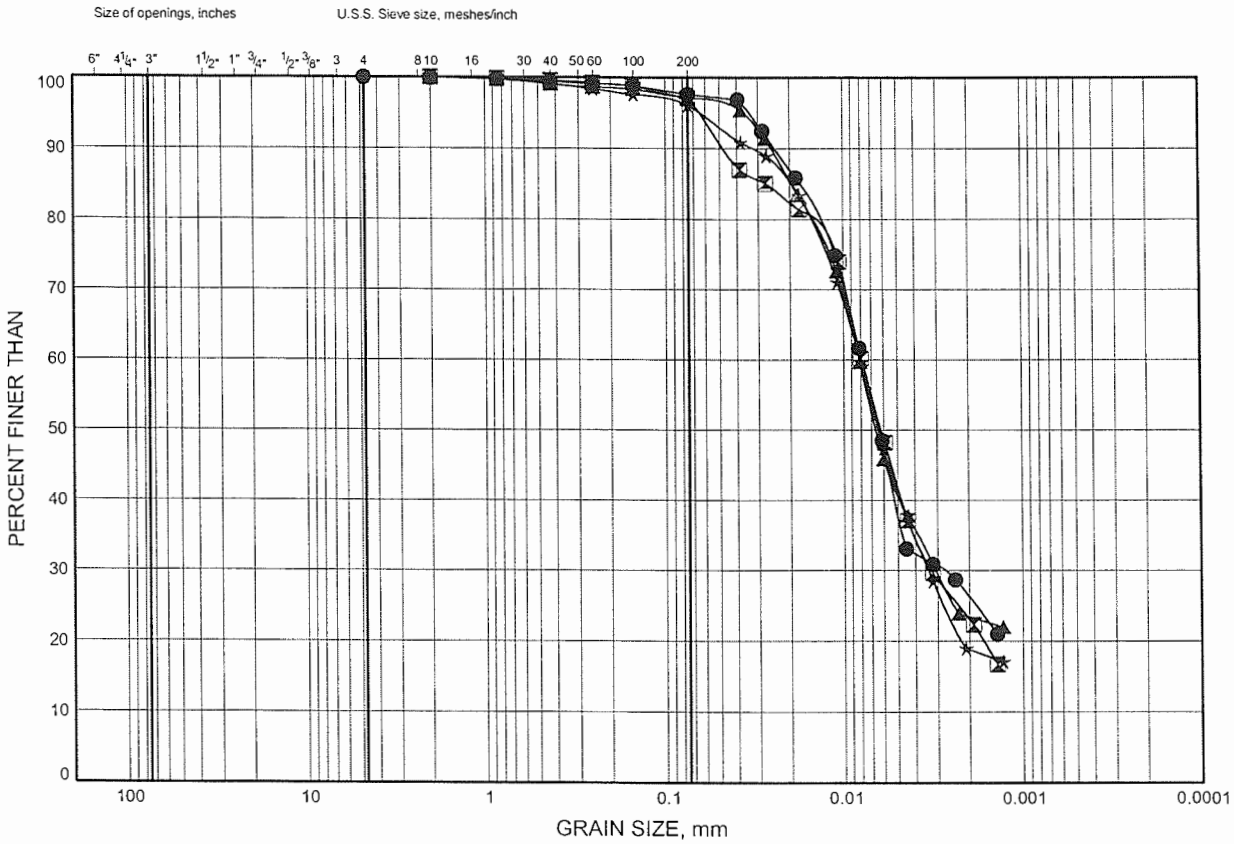
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B3

Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+550 R21.75	2.59	
⊠	S 20+574 CL	1.82	
▲	S 20+599 L19	1.83	
★	S 20+625 CL	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

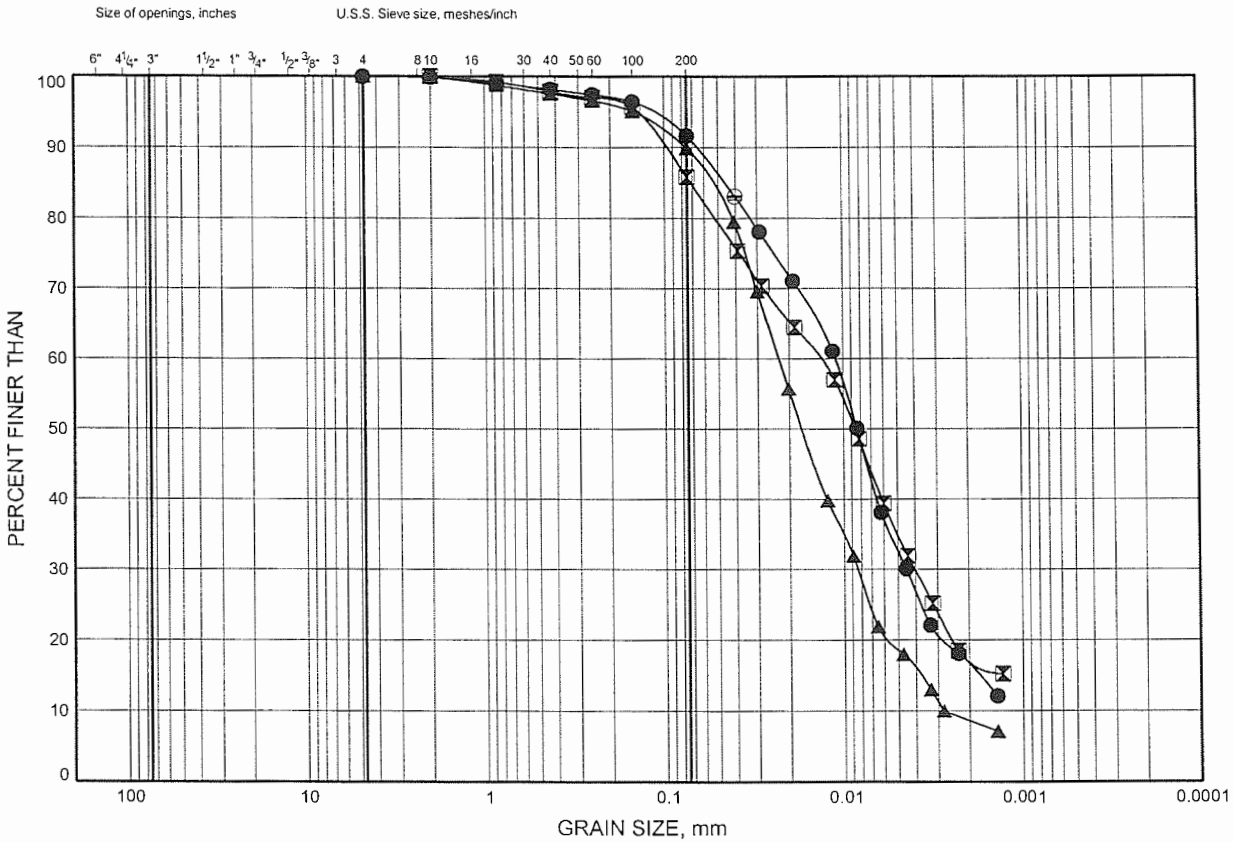
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B4

Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+800 R18.75	3.35	
⊠	S 20+950 R18.75	4.88	
▲	S 20+970 R50	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

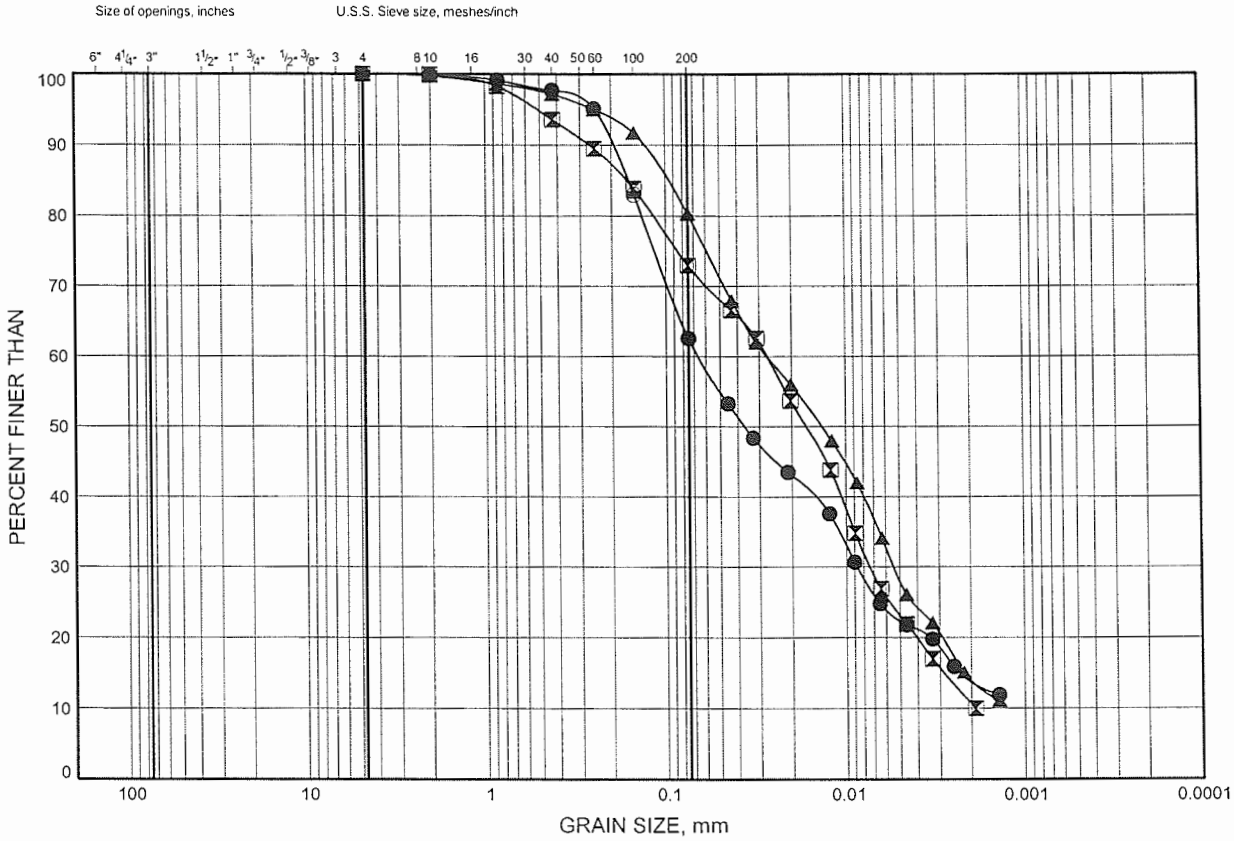
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B5

Sandy Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+550 L18.75	1.83	
⊠	S 20+598 R18	1.83	
▲	S 20+800 R18.75	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

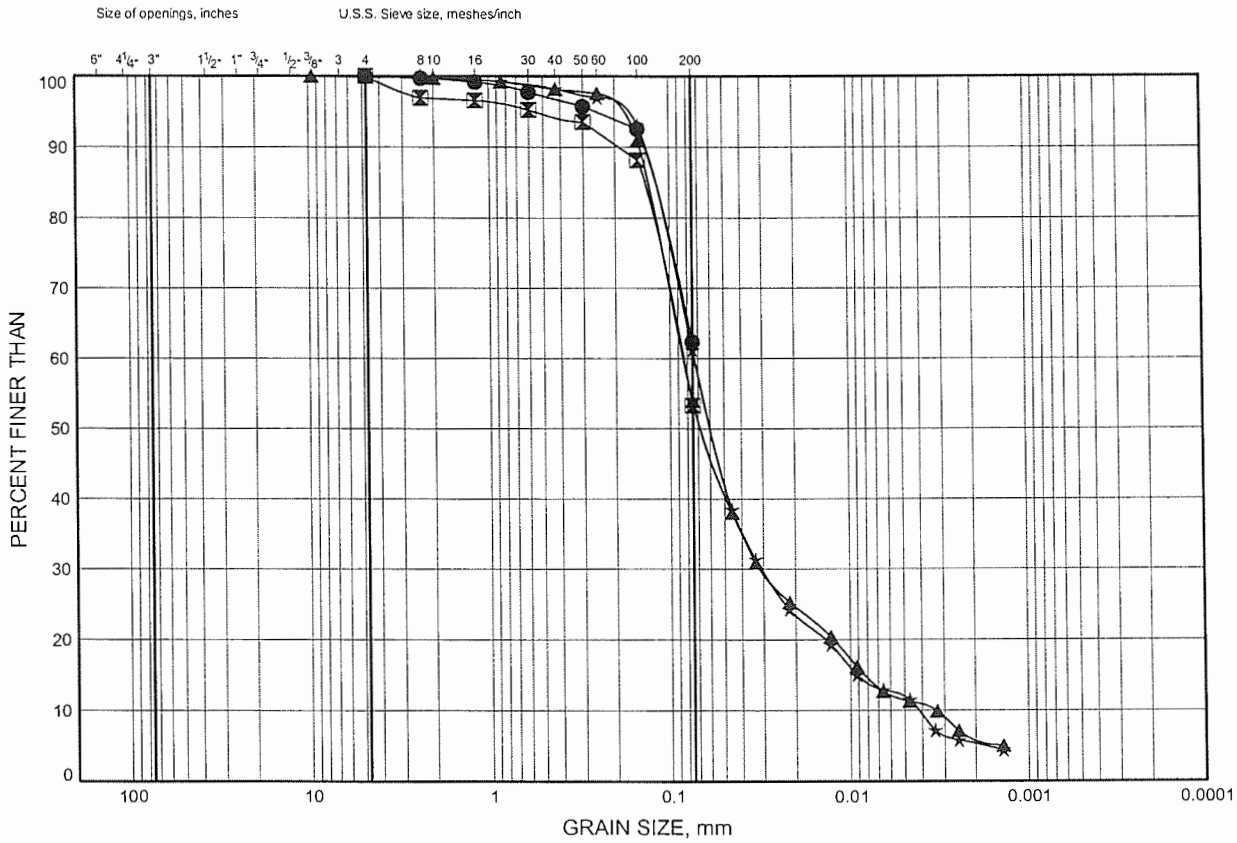
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B6

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+950 R18.75	1.83	
⊠	S 21+000 R17.75	3.35	
▲	S 21+050 R18.75	4.88	
★	S 21+100 R18.75	4.88	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

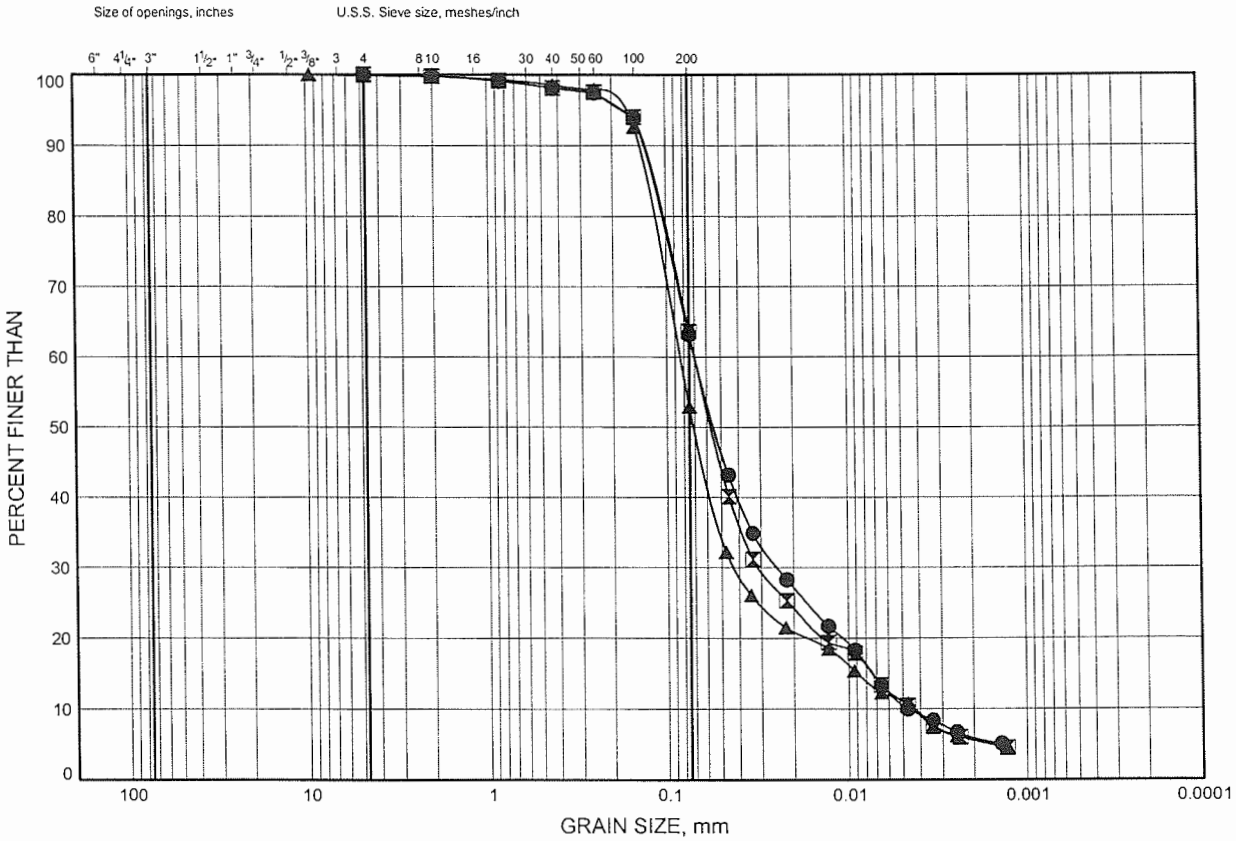
THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B7

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 21+128 R43.4	4.88	
⊠	S 21+150 R18.75	4.88	
▲	S 21+200 R18.75	4.88	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

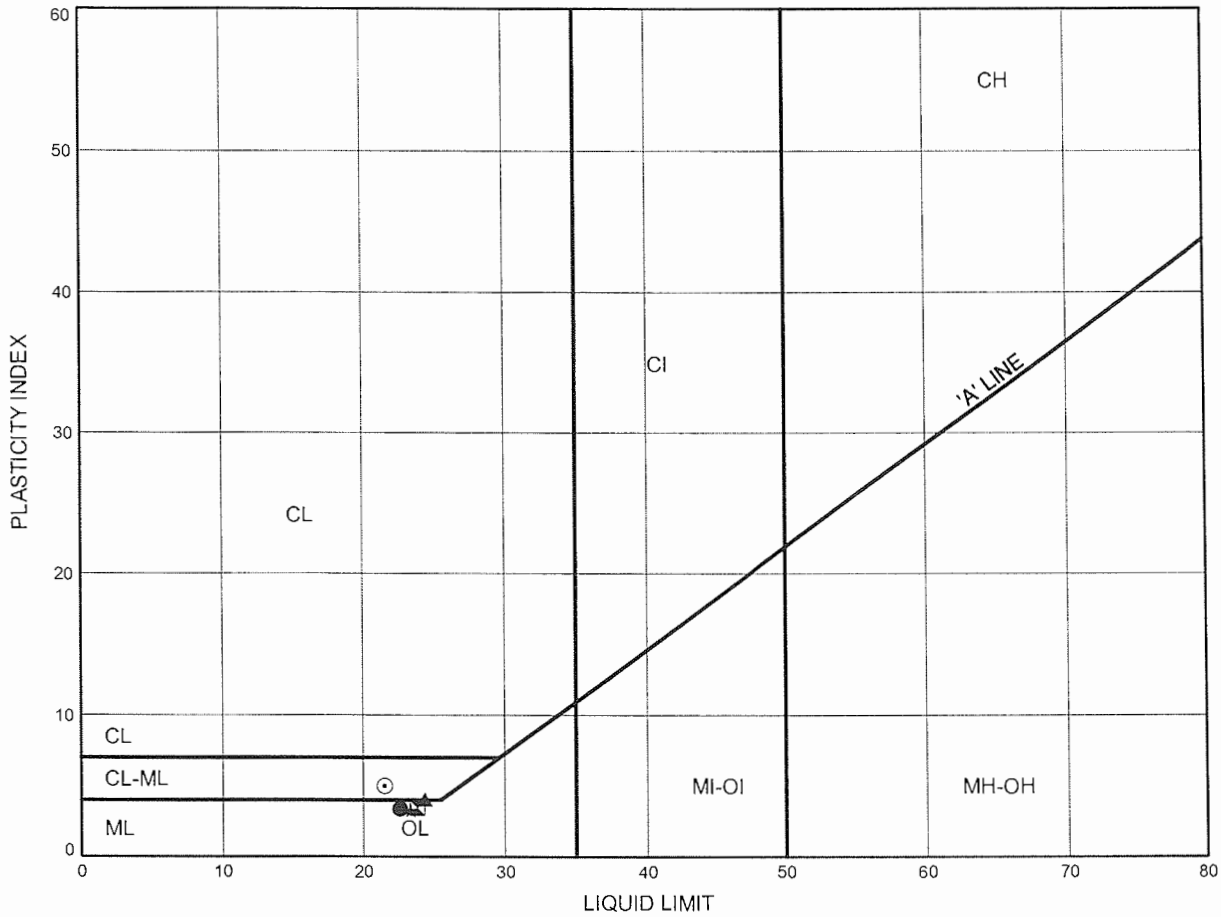
Chkd. JL

THURBGSD STRONGTOWNSHIP.GPJ 19/12/04

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE B8



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S 20+550 R21.75	2.59	
⊠	S 20+574 CL	1.82	
▲	S 20+599 L19	1.83	
★	S 20+625 CL	1.83	
⊙	S 20+950 R18.75	4.88	

Date December 2004

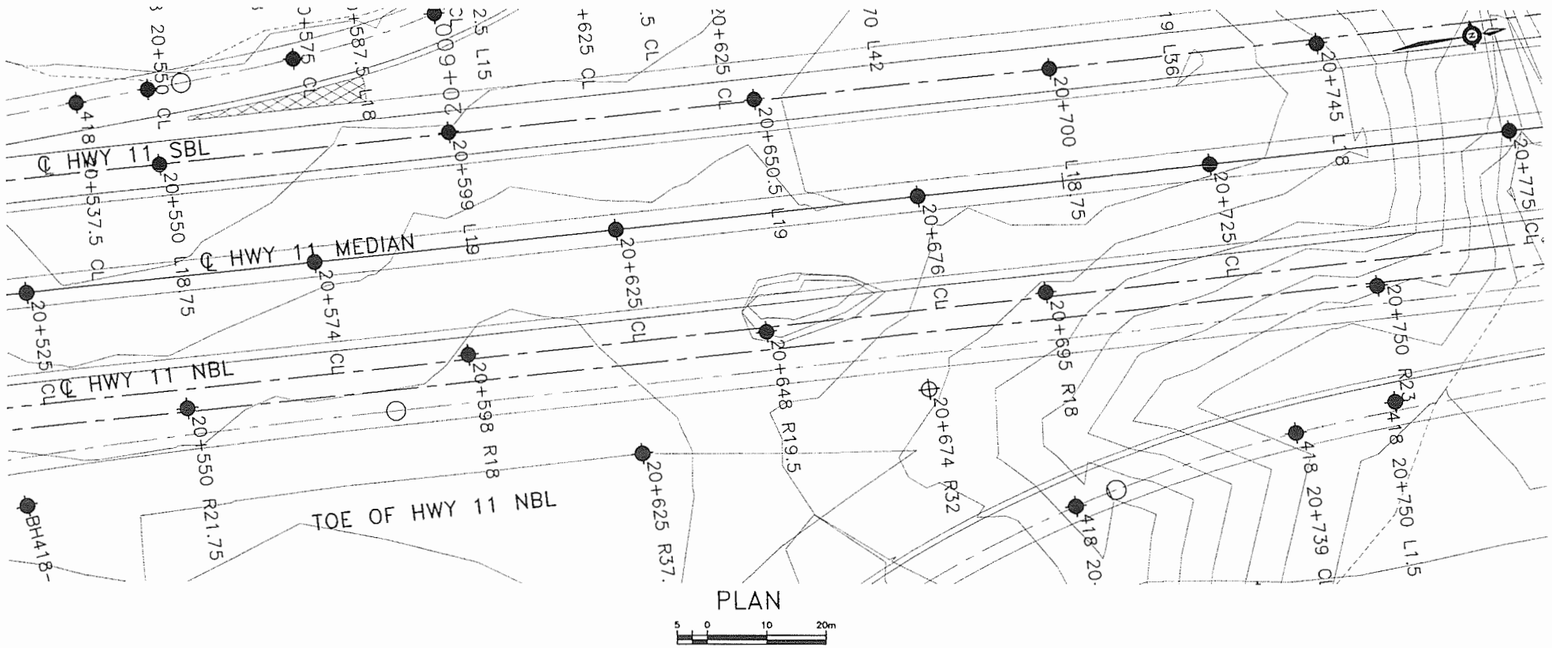
Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

THURBALT STRONGTOWNSHIP.GPJ 19/12/04



PROFILE ℄ HWY 11 NBL

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+525 TO 20+775
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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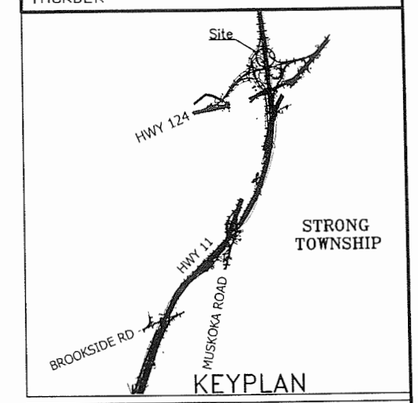


KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

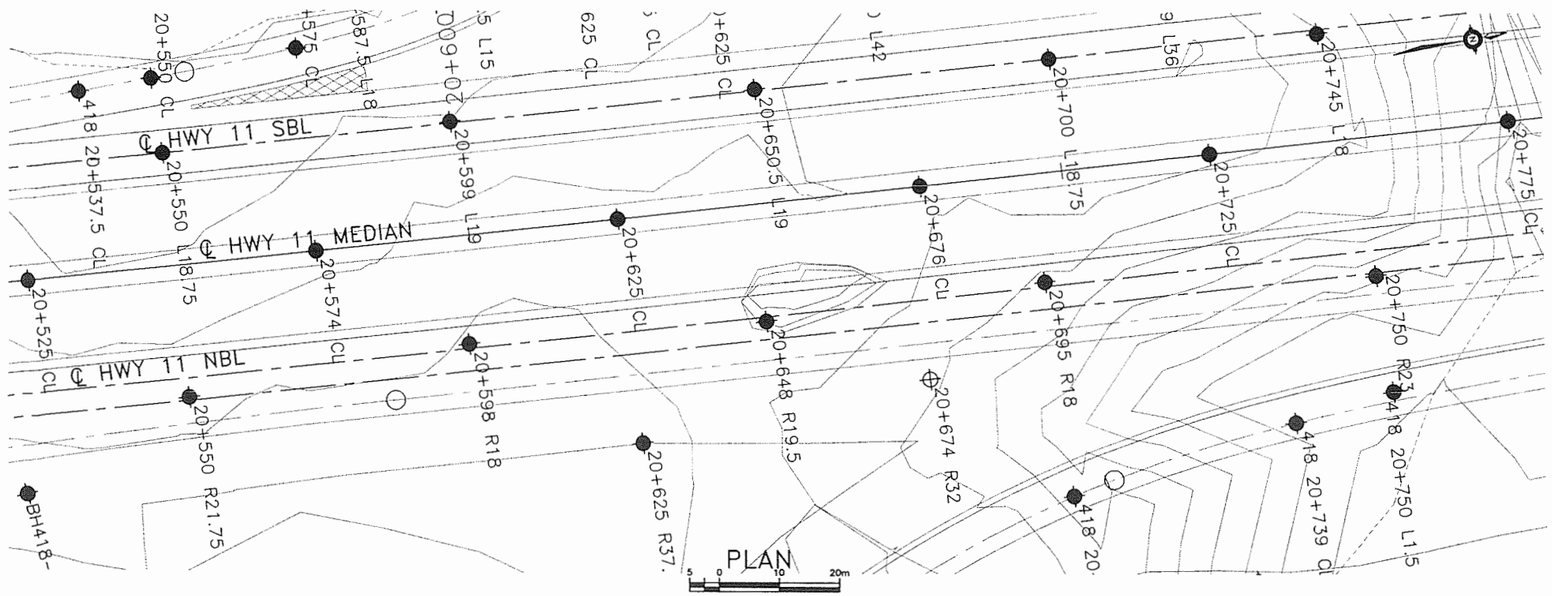
NO	STATION	OFFSET FROM MEDIAN CL
20+550 R21.75	20 + 550	R21.75
20+598 R18	20 + 598	R18
20+648 R19.5	20 + 648	R19.5
20+695 R18	20 + 695	R18
20+750 R23	20 + 750	R23

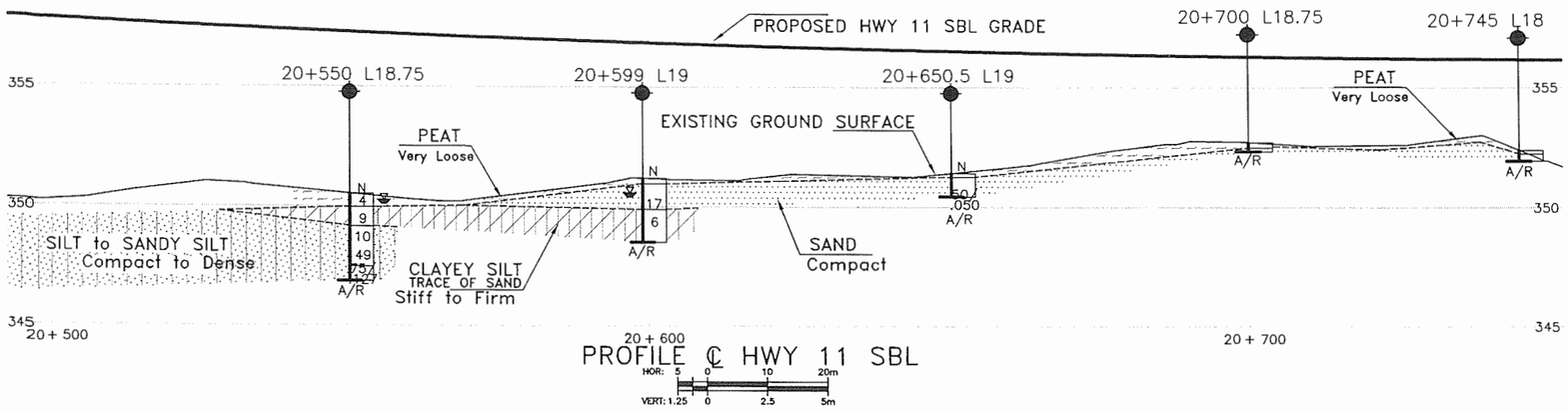
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

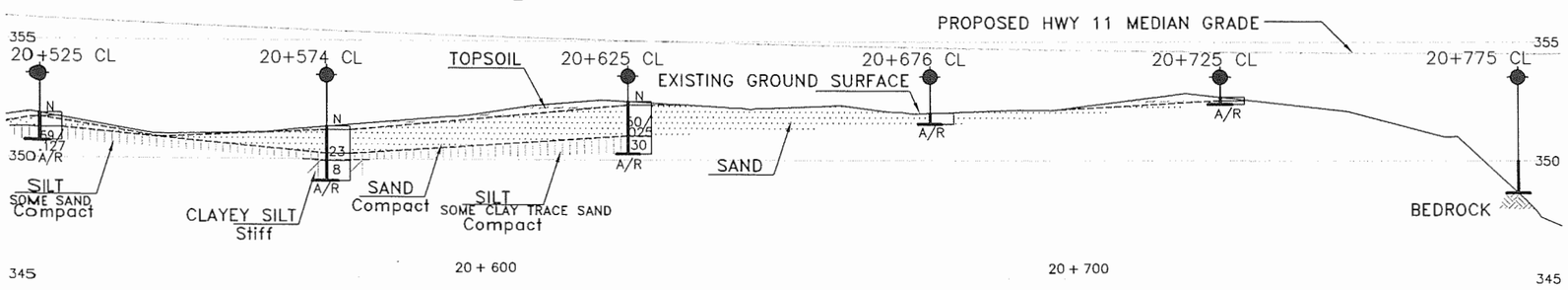
REVISIONS		
FEB 07	SS	FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE CHBDL	LOAD	DATE FEB 2007	
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG B1





PROFILE ℄ HWY 11 SBL



PROFILE ℄ HWY 11 MEDIAN

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

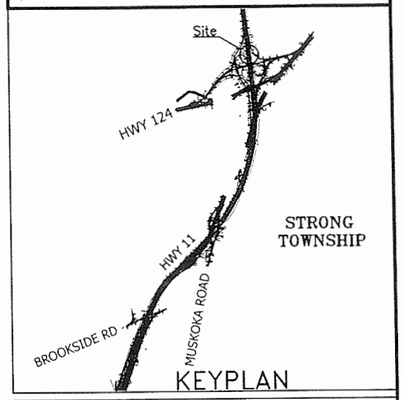
HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+525 TO 20+775
SBL CENTRELINE AND MEDIAN
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
⊻	WL in Piezometer at Time of Investigation (Date)
⊼	Head Artesian Water
┃	Piezometer
⊻	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
20+525 CL	20 + 525	0
20+550 L18.75	20 + 550	L18.75
20+574 CL	20 + 574	0
20+599 L19	20 + 599	L19
20+625 CL	20 + 625	0
20+650.5 L19	20 + 650.5	L19
20+676 CL	20 + 676	0
20+700 L18.75	20 + 700	L18.75
20+725 CL	20 + 725	0
20+745 L18	20 + 745	L18
20+775 CL	20 + 775	0

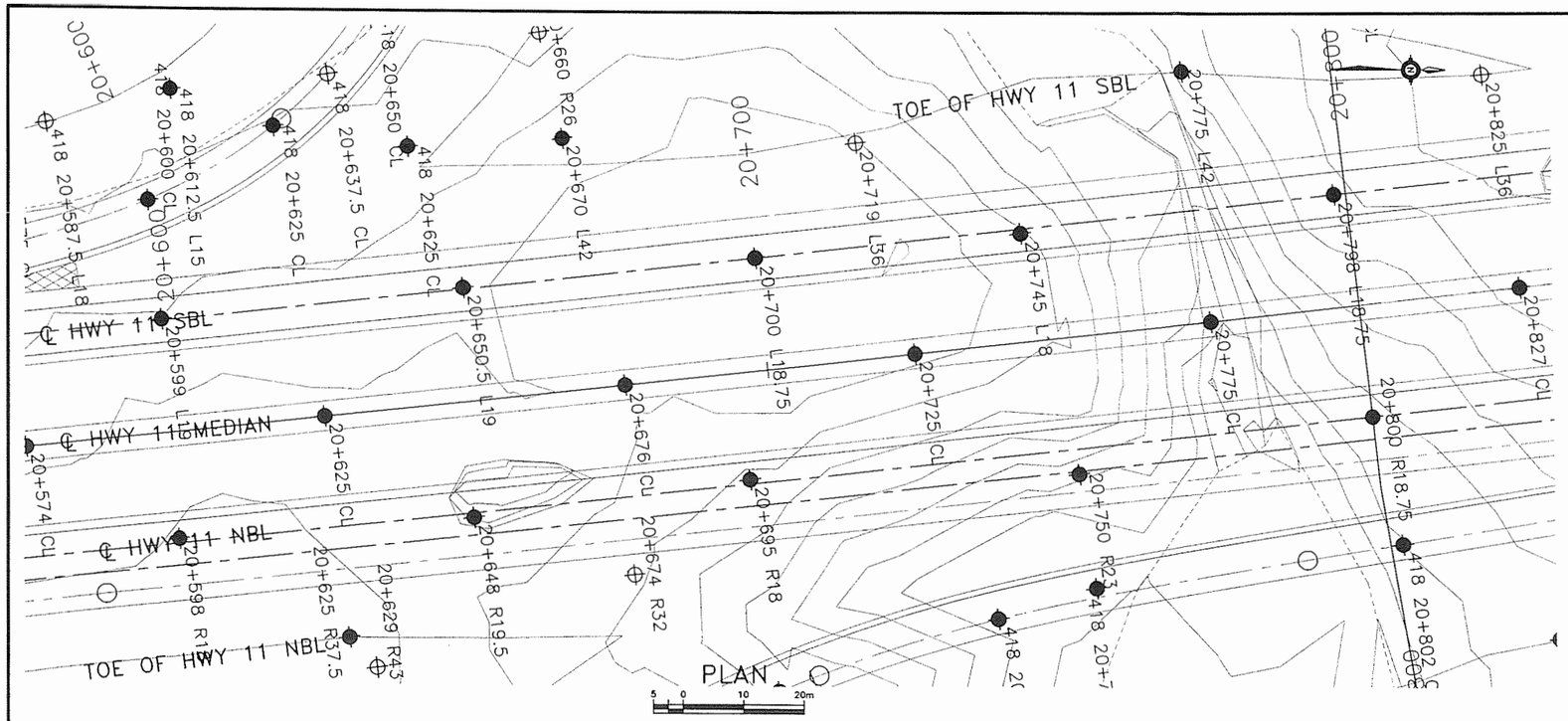
NOTE

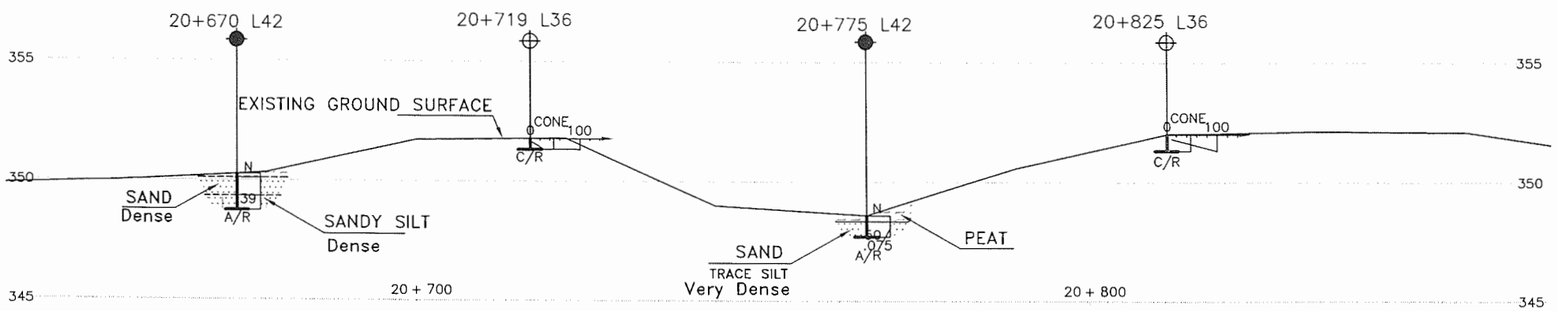
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07	SS	FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

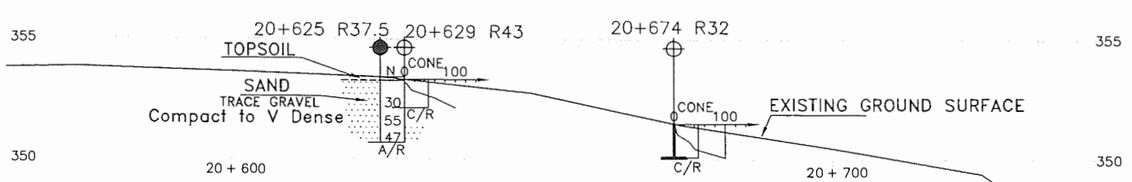
DESIGN SKP	CHK PJB	CODE CHBDL	LOAD	DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG B2





PROFILE TOE OF HWY 11 SBL

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE TOE OF HWY 11 NBL

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+600 TO 20+850
EAST (NBL) AND WEST(SBL) TOE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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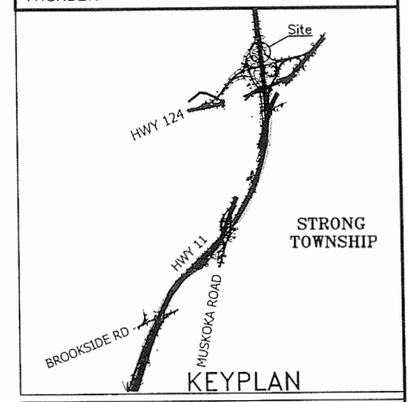
THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water
▼	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

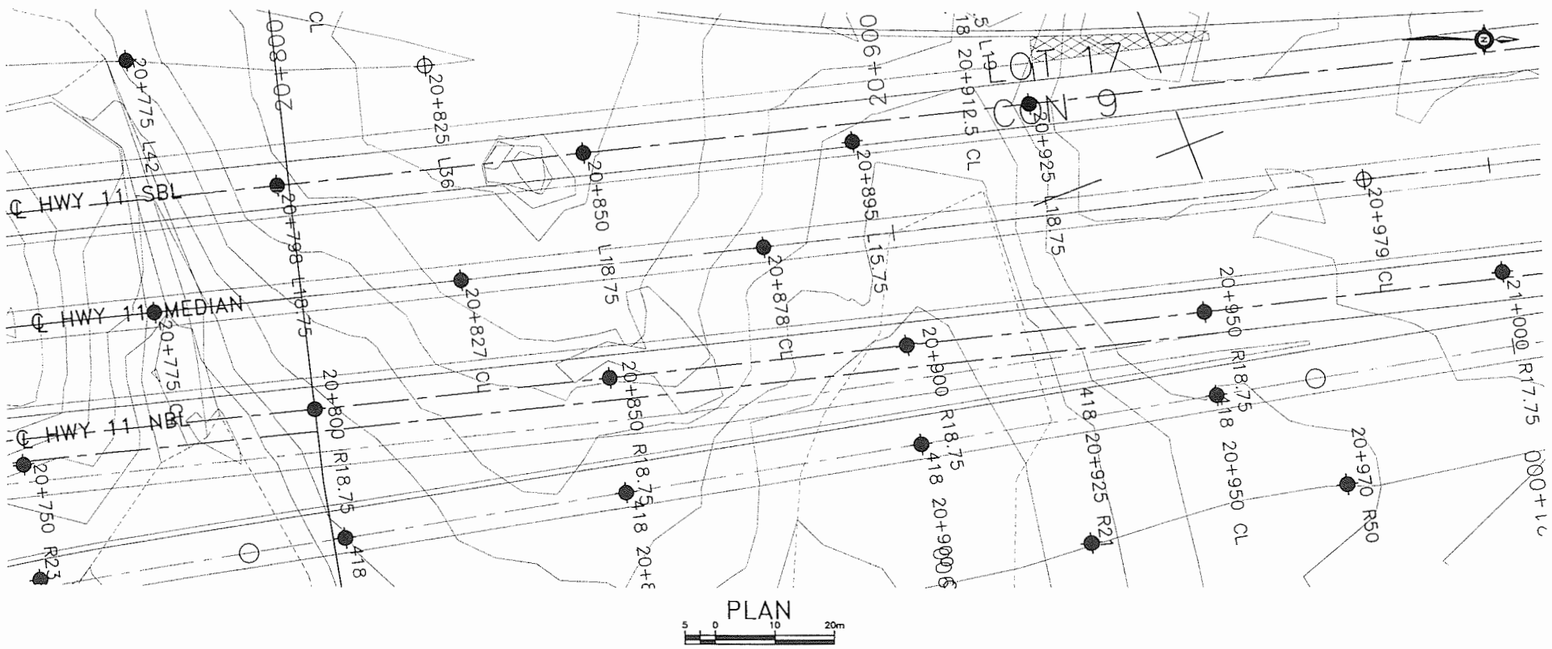
NO	STATION	OFFSET FROM MEDIAN CL
20+625 R37.5	20 + 625	R37.5
20+629 R43	20 + 629	R43
20+670 L42	20 + 670	L42
20+674 R32	20 + 674	R32
20+719 L36	20 + 719	L36
20+775 L42	20 + 775	L42
20+825 L36	20 + 825	L36

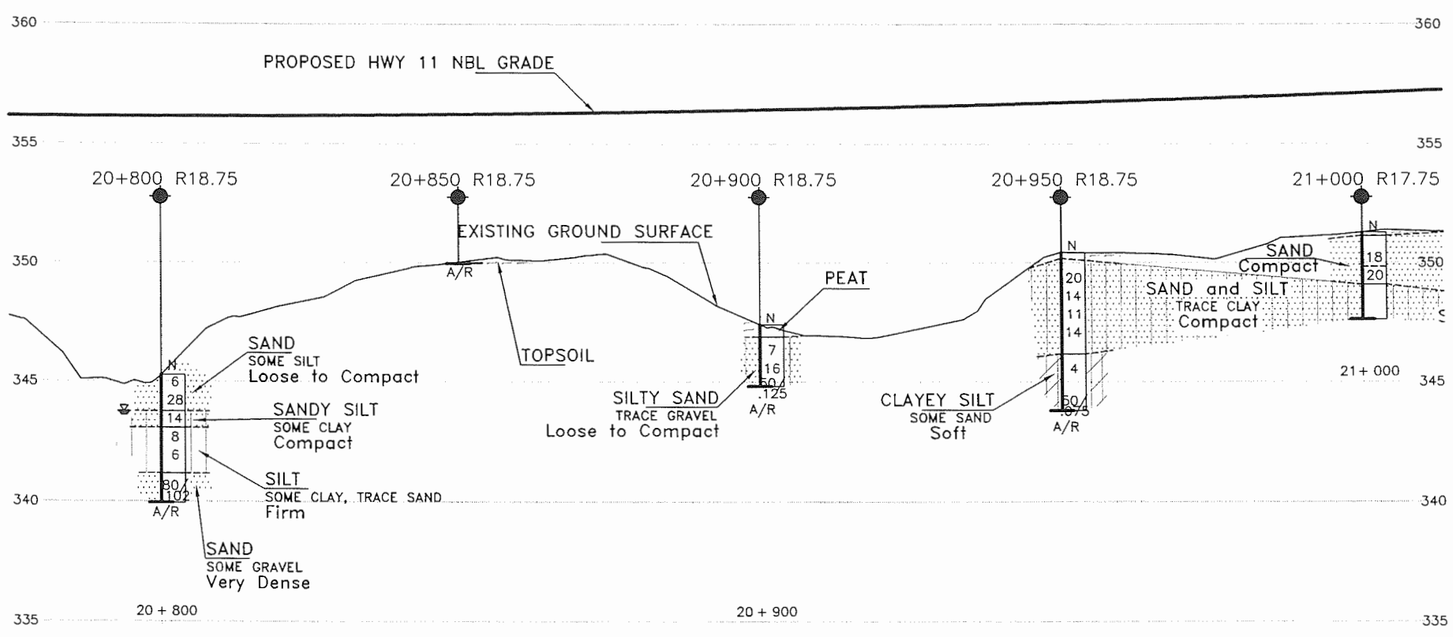
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE CHBDL	LOAD		DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG B3





METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+775 TO 21+000
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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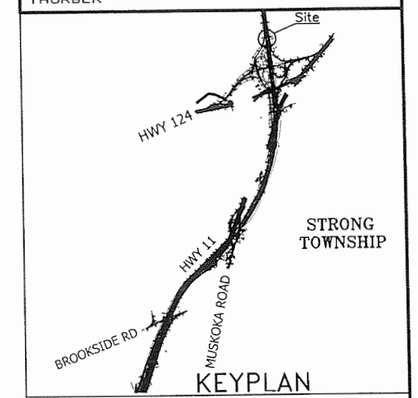

KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
20+800 R18.75	20 + 800	R18.75
20+850 R18.75	20 + 850	R18.75
20+900 R18.75	20 + 900	R18.75
20+950 R18.75	20 + 950	R18.75
21+000 R17.75	21 + 000	R17.75

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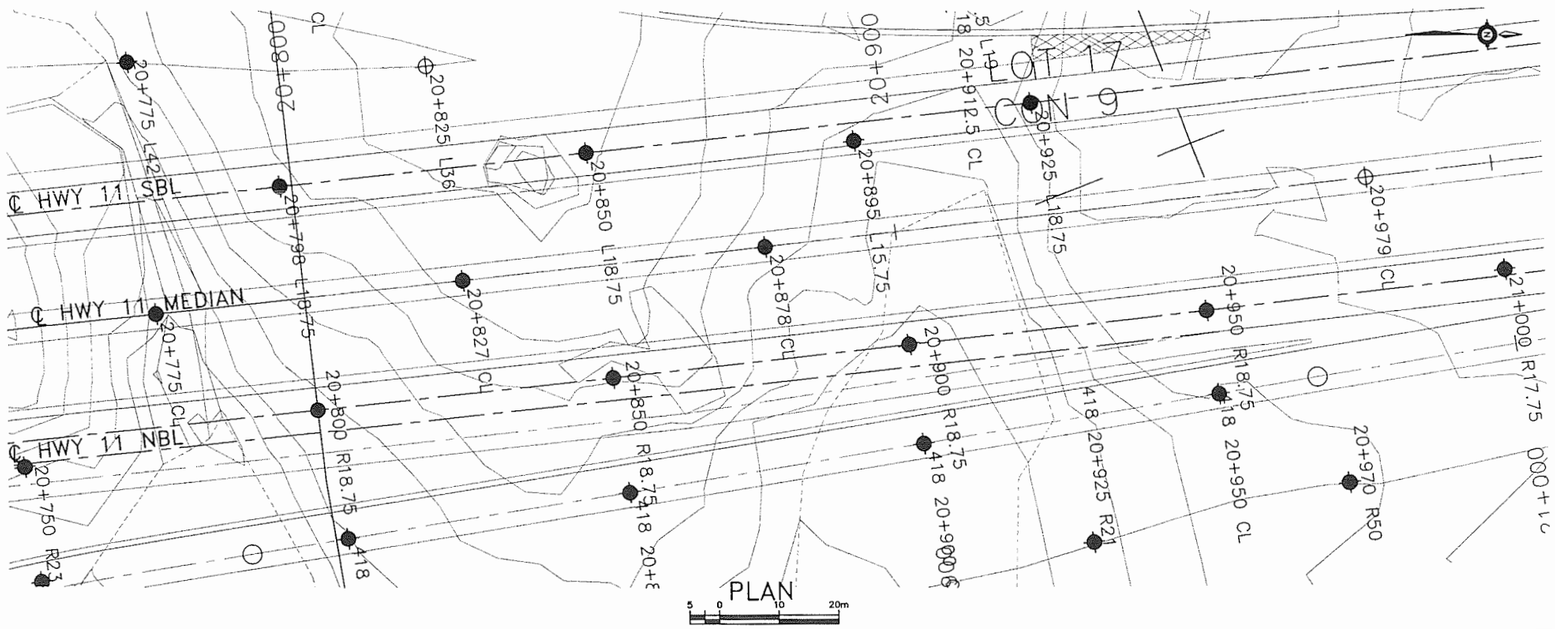
LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

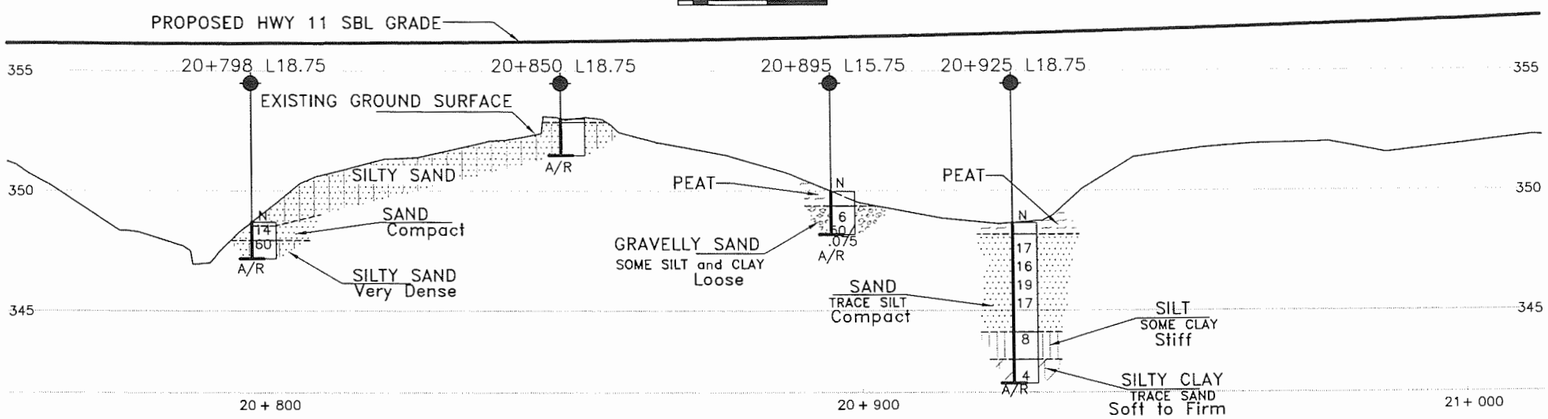
LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

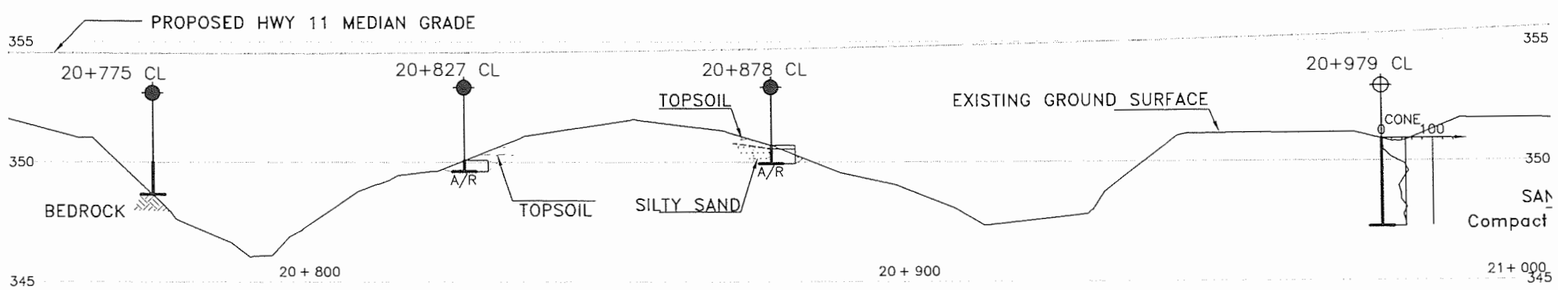
DESIGN SKP	CHK PJB	CODE CHBDL	LOAD		DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG B4





PROFILE ℄ HWY 11 SBL

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE ℄ HWY 11 MEDIAN

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

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

HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+775 TO 21+000
SBL CENTRELINE AND MEDIAN
BOREHOLE LOCATIONS AND SOIL STRATA

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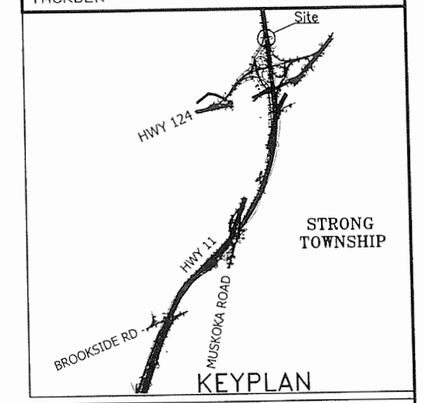


KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water
┃	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

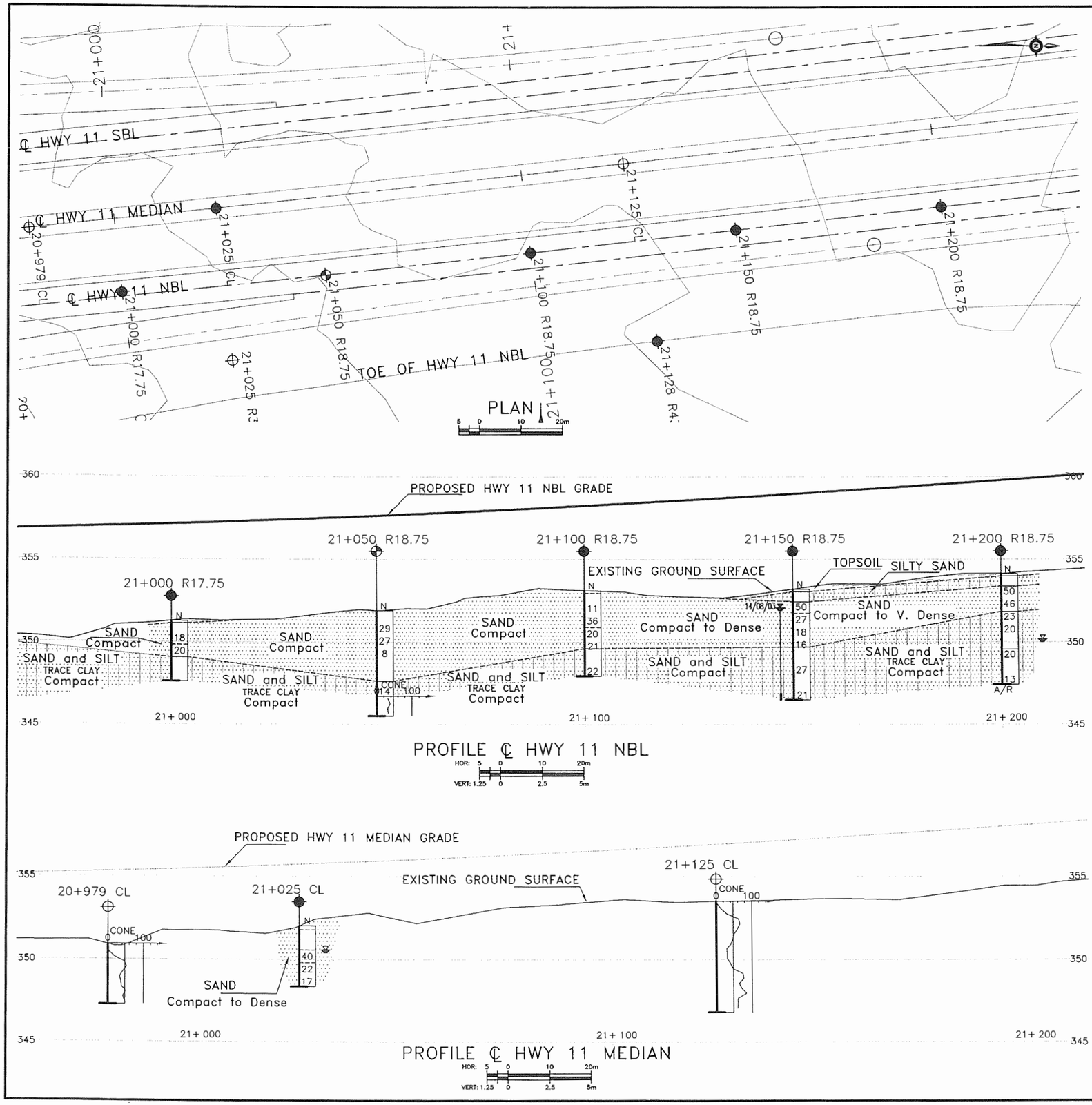
NO	STATION	OFFSET FROM MEDIAN CL
20+775 CL	20 + 775	0
20+798 L18.75	20 + 798	L18.75
20+827 CL	20 + 827	0
20+850 L18.75	20 + 850	L18.75
20+878 CL	20 + 878	0
20+895 L15.75	20 + 895	L15.75
20+925 L18.75	20 + 925	L18.75
20+979 CL	20 + 979	0

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS

DATE	BY	DESCRIPTION
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW

DESIGN SKP	CHK PJB	CODE	LOAD		DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG B5



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 21+000 TO 21+200
NBL CENTRELINE AND MEDIAN
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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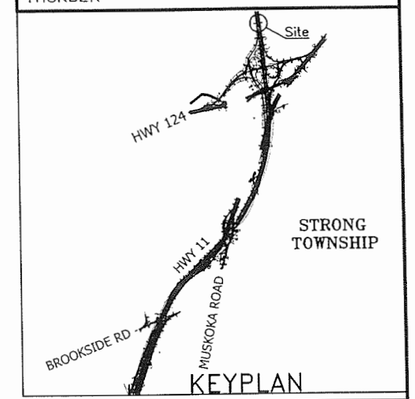
THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊤	Head Artesian Water
⊥	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
21+025 CL	21 + 025	0
21+050 R18.75	21 + 050	R18.75
21+100 R18.75	21 + 100	R18.75
21+125 CL	21 + 125	0
21+150 R18.75	21 + 150	R18.75
21+200 R18.75	21 + 200	R18.75

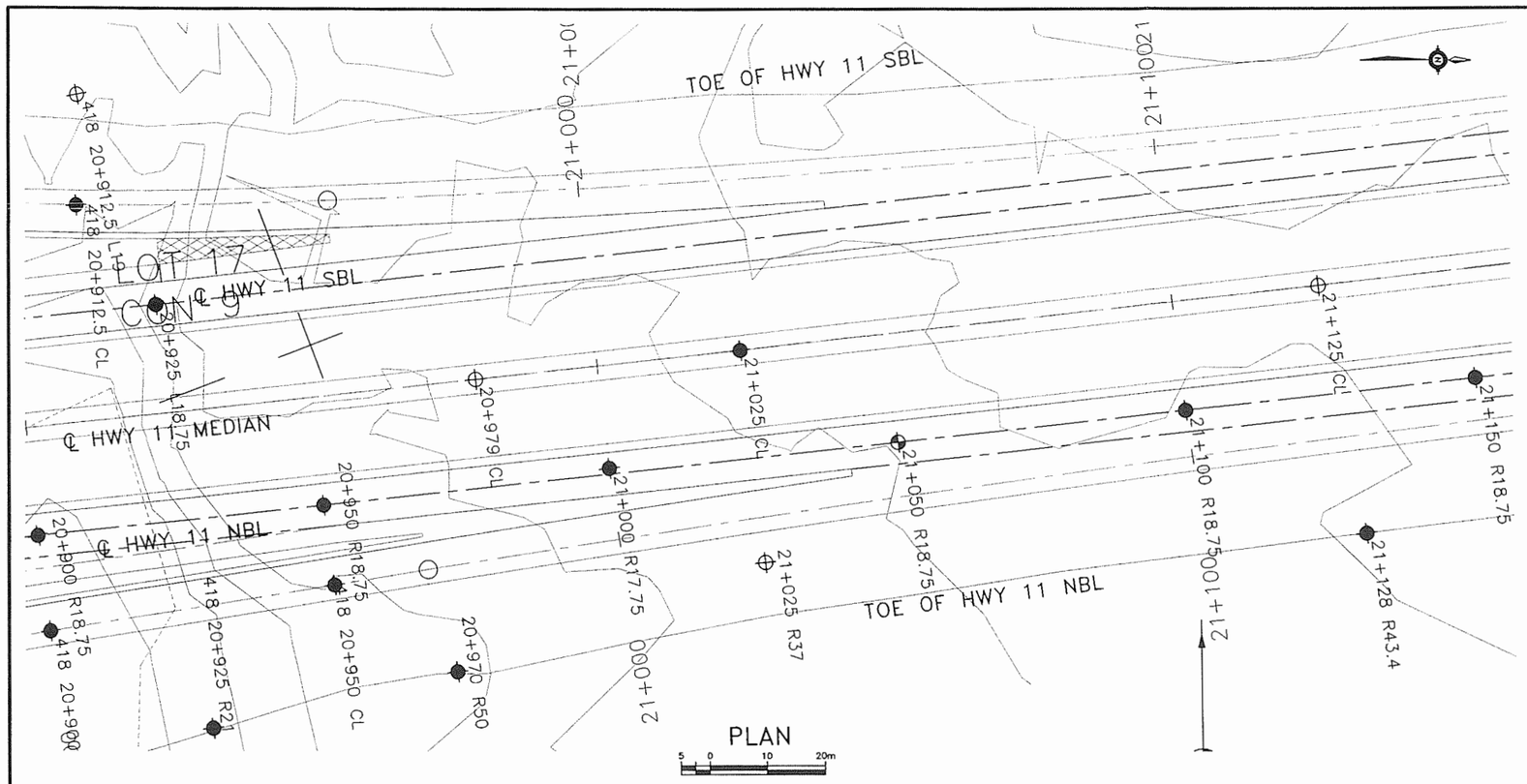
— NOTE —

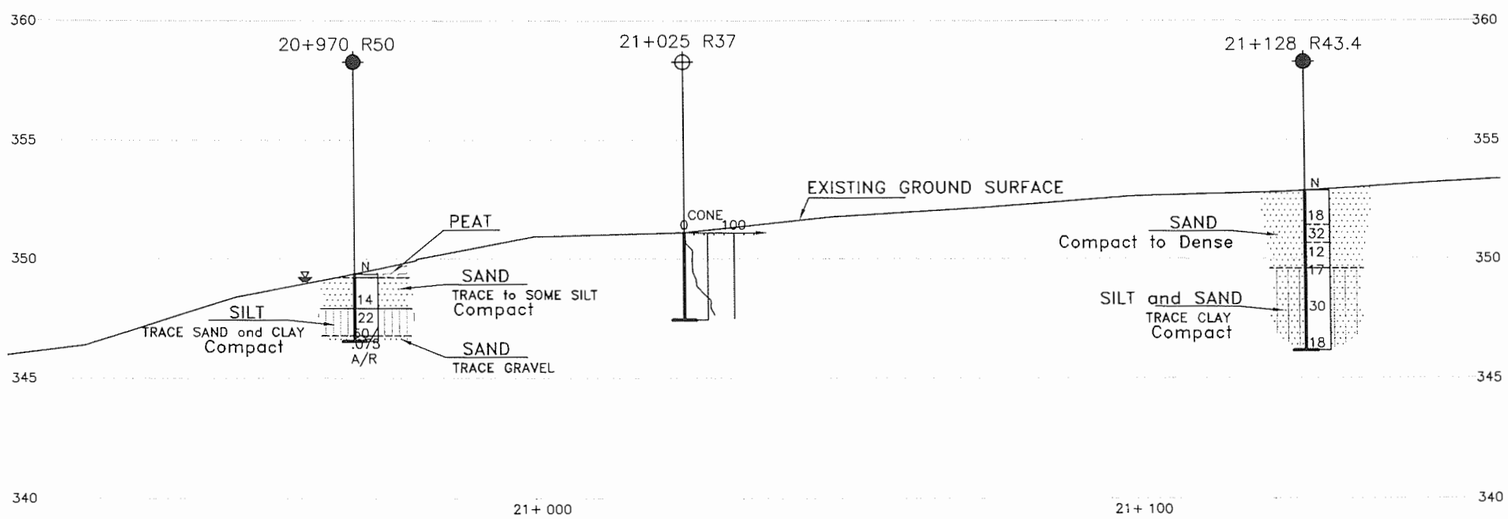
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE	LOAD	DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME / DWG B6





PROFILE TOE OF HWY 11 NBL

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

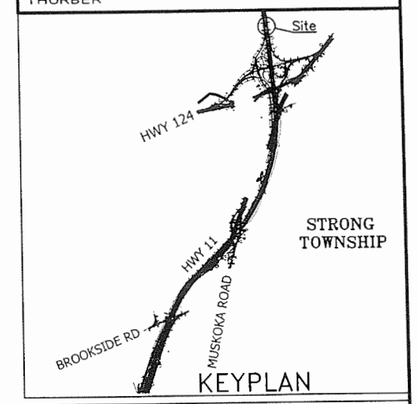
HWY 11
CONT No
GWP No759-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 20+950 TO 21+150
EAST (NBL) TOE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water
	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
20+970 R50	20 + 970	R50
21+025 R37	21 + 025	R37
21+128 R43.4	21 + 128	R43.4

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK PJB	CODE	LOAD		DATE FEB 2007
DRAWN TF	CHK SKP	SITE	STRUCT	SCHEME	DWG B7

FOUNDATION INVESTIGATION REPORT
HIGH EMBANKMENTS AND SWAMPS
MUSKOKA CONNECTION TO HIGHWAY 124
HIGHWAY 11 FOUR LANING
BURK'S FALLS TO SOUTH RIVER, ONTARIO
G.W.P. 759-93-00
VOLUME 2

Geocres Number: 31E-220

Report to

Marshall Macklin Monaghan

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
Phone: (905) 829 8666
Fax: (905) 829 1166

February 7, 2007
File: 19-1423-12
sms/ Embankment4.FINAL.doc

Appendix C
Highway 124/Highway 11 Interchange Ramps

THURBER

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+450 L22 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+450, 22L ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 20.11.03 - 20.11.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Sandy **TOPSOIL** Very Loose Dark Brown Moist		1	SS	3	▽			○		
0.5	Silty **SAND**, fine grained, occasional cobbles Very Dense Brown Wet		2	SS	70/ .254				○		0 80 20 (SI+CL)
			3	SS	50/ .150				○		
1.7	END OF BOREHOLE AT 1.68 m. AUGER REFUSAL AT 1.68 m OM PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.61 m AND WATER LEVEL AT 0.61 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+475 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+475, CL ORIGINATED BY DP
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 30.10.03 - 30.10.03 CHECKED BY JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	TOPSOIL										
0.1	SAND, fine grained, some silt, some organics										
0.5	Brown										
	SAND, fine grained, some silt Dense Brown Moist becoming some gravel		1	SS	45						
			2	SS	50/ .150						
1.8	END OF BOREHOLE AT 1.83 m. AUGER REFUSAL AT 1.83 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.83 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+525 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 N-E Ramp, ST. 20+525, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 30.10.03 - 30.10.03 | CHECKED BY JL

SOIL PROFILE: 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
0.0	Sandy **TOPSOIL**										
0.1	**SAND**, very fine grained, some silt, some organics										
0.5	Brown										
	SAND, fine grained, some silt Compact Brown Moist		1	SS	18				○		
1.3	some medium grained sand										
	END OF BOREHOLE AT 1.27 m. PROBABLE BEDROCK AUGER REFUSAL AT 1.27 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.27 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+575 R2.5 1 OF 1 METRIC

W.P. 759-93-00 | LOCATION 418 N-E Ramp, ST. 20+575, O/S 2.5R | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 30.10.03 - 30.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sandy TOPSOIL										
0.1	SAND, fine grained, some organics										
	Brown										
0.3	SAND, fine to medium grained, some silt										
	Loose to Dense										
	Brown										
	Moist to Wet		1	SS	5				○		
			2	SS	17				○		0 89 11 (SI+CL)
			3	SS	15				○		0 5 64 31
			4	SS	32				○		
3.6	END OF BOREHOLE AT 3.61 m. AUGER REFUSAL AT 3.61 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.61 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+625 R1.5 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+625, O/S 1.5R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 30.10.03 - 30.10.03 CHECKED BY JL

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						
0.0	Sandy **TOPSOIL** Brown										
0.2	**SAND**, fine grained, some rootlets Brown										
0.5	**SAND**, fine to medium grained Loose Brown Wet		1	SS	8				○		
1.5	Clayey **SILT**, trace sand Very Stiff to Stiff Grey Wet		2	SS	15	▽			○		
			3	SS	8				○		0 4 76 19
3.0	**SILT and CLAY** layers, some fine sand Stiff to Very Stiff Grey Wet		4	SS	8				○		
								>>4.64			
4.3	**SAND**, fine grained, some gravel Loose Brown Wet		1	GS							
			5	SS	54/.076				○		
4.8	END OF BOREHOLE AT 4.83 m. SPLIT SPOON BOUNCING AND REFUSAL AT 4.83m. PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.90 m AND WATER LEVEL AT 1.60 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND BENTONITE TO SURFACE.										

÷³, ×³: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+650 L27.1 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+650, O/S 27.1L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 30.10.03 - 30.10.03 CHECKED BY JL

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						
0.0	DCPT from surface.										
1.2	END OF DCPT AT 1.17 m. CONE REFUSAL AT 1.17 m ON PROBABLE VERY DENSE SAND.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+675 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+675, CL ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 10.12.03 - 10.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**PEAT**, fibrous Dark Brown to Black													
0.3	Sandy **SILT** Compact Brown Moist		1	SS	16				o					
1.4	Clayey **SILT**, trace sand Stiff Grey Moist becoming firm		2	SS	10				o					
	thin sand seams		3	SS	3				o					
			4	SS	2	▽			o					
	trace gravel		5	SS	4				o H		1	5	73	22
5.0	**SAND**, some gravel Compact Brown Wet													
6.0	END OF BOREHOLE AT 5.97 m. AUGER REFUSAL AT 5.97 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.26 m AND WATER LEVEL AT 3.12 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+712.5 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+712.5, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 10.12.03 - 10.12.03 CHECKED BY AEG

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
0.0	**PEAT**, fibrous Dark Brown to Black										
0.5	Sand, trace silt Loose Brown Wet		1	SS	7				○		
1.2	Clayey **SILT**, trace to some sand, with thin sand seams Stiff to Firm Grey Moist		2	SS	5				○		
			3	SS	2				H ○		
			4	SS	1			3.7	H ○		0 5 69 26
			5	SS	4	▽			○		
			6	SS	50/ .102				○		
6.3	END OF BOREHOLE AT 6.35 m. AUGER REFUSAL AT 6.35 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.18 m AND WATER LEVEL AT 4.72 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+725 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+725, CL ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 10.12.03 - 10.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous Dark Brown to Black										
0.5	Sandy **SILT**, trace clay Compact to Loose Brown to Grey Wet		1	SS	10	▽					
	thin clay seams		2	SS	6						
2.4	Clayey **SILT**, trace sand, with sand seams, some silt & clay laminations Firm Grey Wet		3	SS	3				H		0 6 68 25
			4	SS	2						
			5	SS	3			3.4			
			1	TW	PH						
7.1	END OF BOREHOLE AT 7.09 m. AUGER REFUSAL AT 7.09 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.71 m AND WATER LEVEL AT 0.55 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

÷³, ×³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+737.5 L22 1 OF 1 METRIC

W.P. 759-93-00 | LOCATION 418 N-E Ramp, ST. 20+737.5, O/S 22L | ORIGINATED BY SL
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 05.05.04 - 05.05.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous Black										
0.5	**SAND**, some silt Compact Brown Wet		1	SS	18						
1.5	**SILT and SAND**, trace clay, trace gravel Dense Brown Wet		2	SS	35						1 39 53 7
2.4	Silty **CLAY**, trace sand, some sand seams Firm to Soft Grey Wet		3	SS	7						
			4	SS	7						0 6 73 21
			5	SS	2	▽					
5.4	END OF BOREHOLE AT 5.44 m. AUGER REFUSAL AT 5.44 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.95 m AND WATER LEVEL AT 4.65 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+737.5 R25 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+737.5, O/S 25R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 05.05.04 - 05.05.04 CHECKED BY JL

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						
0.0	DCPT from surface.										
3.2	END OF DCPT AT 3.23 m. CONE REFUSAL AT 3.23 m ON PROBABLE BEDROCK OR BOULDER.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+750 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+750, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 04.05.04 - 04.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous Black										
0.9	**SILT**, trace clay, trace sand Compact Brown to Grey Wet		1	SS	10				○		
1.5	Clayey **SILT**, trace sand Firm to Soft Grey Wet		2	SS	4				○		
2.2	Silty **CLAY**, trace sand Soft Grey Wet		3	SS	2				○		0 7 67 26
	occasional sand seams		4	SS	2				○		
4.3	**SILT**, some clay, trace sand Soft Grey Wet		5	SS	3				○		
5.5	Silty **SAND**, some clay seams Loose Grey Wet		6	SS	50/075				○		
6.6	END OF BOREHOLE AT 6.55 m. AUGER REFUSAL AT 6.55 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

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

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+762.5 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+762.5, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 04.05.04 - 04.05.04 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous Black										
0.9	**SILT**, some sand, trace clay Compact Brown Wet		1	SS	12				○		
1.5	Silty **CLAY**, some sand, occasional sand seams Stiff to Soft Grey Wet		2	SS	9				○		
			3	SS	5				⊢○		0 12 67 21
			4	SS	3				○		
			5	SS	4	▽			○		
6.0	END OF BOREHOLE AT 6.02 m. AUGER REFUSAL AT 6.02 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.56 m AND WATER LEVEL AT 5.0 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³ : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+800 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+800, CL ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.05.04 - 04.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous Black										
0.5	**SAND**, trace silt Compact Brown Wet		1	SS	15				○		
1.5	Clayey **SILT**, trace sand Soft to Stiff Grey Wet		2	SS	3				○		
			3	SS	6	▽			○		0 2 83 15
			4	SS	9						
3.8	END OF BOREHOLE AT 3.84 m. AUGER REFUSAL AT 3.84 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.82 m AND WATER LEVEL AT 2.74 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY 124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+912.5 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+912.5, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 16.12.03 - 16.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous, Dark Brown to Black										
0.3	**SILT and SAND**, Compact, Brown, Wet		1	SS	16				○		
			2	SS	16				○		
			3	SS	24				○		0 43 57 (SI+CL)
			4	SS	17	▽			○		
4.5	Clayey **SILT**, trace to some sand, Stiff, Brown, Wet		5	SS	12				○		
	with thick sand seams		6	SS	3			7.2	H ○		0 8 66 26
7.0	END OF BOREHOLE AT 7.01 m. BOREHOLE OPEN TO 5.64 m AND WATER LEVEL AT 3.15 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-E 20+912.5 L19 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 N-E Ramp, ST. 20+912.5, O/S 19L ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 16.12.03 - 16.12.03 CHECKED BY AEG

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
0.0	DCPT from surface.										
6.1	END OF DCPT AT 6.10 m.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-W 20+486 R2.5 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 N-W Ramp, ST. 20+486, O/S 2.5R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 31.10.03 - 31.10.03 | CHECKED BY JL

SOIL PROFILE 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
0.0	**TOPSOIL**										
0.2	**SAND**, fine grained Compact Brown Moist		1	SS	66/ 0.127				○		
1.1	END OF BOREHOLE AT 1.07 m. AUGER REFUSAL AT 1.07 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.07 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3 . × 3 . Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-W 20+525 CL 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 N-W Ramp, ST. 20+525, CL ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 31.10.03 - 31.10.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Sandy TOPSOIL with organics										
0.2	SAND, fine grained, trace to some gravel, trace silt Very Dense Brown Moist		1	SS	57/ .076						No Recovery in SS#1
			1	GS					○		
			2	SS	66				○		
2.2	END OF BOREHOLE AT 2.21 m. AUGER REFUSAL AT 2.21 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.21 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 N-W 20+542 L26 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 N-W Ramp, ST. 20+542, O/S 26L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 31.10.03 - 31.10.03 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Sandy **TOPSOIL**										
0.2	**SAND**, fine grained, some silt Brown Moist		1	GS					○		
0.5	END OF BOREHOLE AT 0.46 m. AUGER REFUSAL AT 0.46 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.46 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+537.5 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+537.5, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 21.05.04 - 21.05.04 | CHECKED BY JL

ELEV / DEPTH	SOIL PROFILE 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
0.0	**TOPSOIL**										
0.1	Silty **SAND**, fine grained Loose Brown Moist		1	SS	9						
0.8	Sandy **SILT**, trace to some clay Laminated Compact Grey Wet		2	SS	19						0 18 72 9
			3	SS	16						
			4	SS	14						
3.1	Clayey **SILT**, trace sand Stiff to Firm Grey Wet		5	SS	8						0 8 72 20
	Becoming Brown		6	SS	7	▽					
5.5	END OF BOREHOLE AT 5.49 m. BOREHOLE OPEN TO 5.49 m AND WATER LEVEL AT 4.88 m. AUGER REFUSAL AT 5.49 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+550 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+550, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 26.05.04 - 26.05.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, some rootlets Loose Dark Brown										
0.3	Silty **SAND**, fine grained, occasional silt lumps, occasional iron oxide staining Compact Brown Wet		1	SS	6				22%		
			2	SS	22						
1.5	**SILT**, some clay, some sand Laminated Compact to Loose Grey Wet		3	SS	14						0 17 69 14
			4	SS	6						
3.1	Silty **CLAY**, trace sand Laminated Stiff to Firm Brown Wet		5	SS	8						
			6	SS	6	▽					0 4 73 23
5.3	END OF BOREHOLE AT 5.33 m. BOREHOLE OPEN TO 5.16 m AND WATER LEVEL AT 4.57 m UPON COMPLETION. AUGER REFUSAL AT 5.33 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+570 L18 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+570, O/S 18L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	Dark Brown		1	SS	9						
	SAND, trace silt, trace gravel, occasional iron oxide staining										
	Loose										
	Brown										
0.9	Moist to Wet		2	SS	9				○		
	Sandy **SILT**, some clay										
	Loose										
	Brown										
1.5	Wet										
	Silty **CLAY**, trace sand		3	SS	9				⊢⊕		0 9 69 22
	Varved										
	Stiff to Firm										
	Grey										
	Wet		4	SS	6				○		
			5	SS	6				○		
4.6	**SILT**, some clay, trace sans										
	Loose		6	SS	53/				○		
4.9	Brown				.150						
	Wet										
	END OF BOREHOLE AT 4.88 m. AUGER REFUSAL AT 4.88 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.88 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+575 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+575, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 26.05.04 - 26.05.04 | CHECKED BY JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, some rootlets, occasional wood fibers										
0.3	Dark Brown		1	SS	8				20		
	SILT, some clay, trace sand, occasional iron oxide staining, Loose to Compact, Brown, Wet		2	SS	14						
1.5	Silty **CLAY**, trace sand, Varved, Stiff to Soft, Brown, Wet		3	SS	8						
			4	SS	6						
			5	SS	4						
						▽					
			6	SS	50/.075						No Recovery in SS#6
4.8	END OF BOREHOLE AT 4.80 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.80 m AND WATER LEVEL AT 3.96 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+587.5 L18 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+587.5, O/S 18L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
5.1	END OF DCPT AT 5.08 m. CONE REFUSAL AT 5.08 m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+600 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+600, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 26.05.04 - 26.05.04 | CHECKED BY JL

ELEV / DEPTH	SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	**SAND**, fine grained, some silt, occasional iron oxide staining Loose Brown Wet		1	SS	7				○		
			2	SS	9				○		0 85 15 (SI+CL)
1.5	Silty **CLAY**, trace sand Varved Firm Brown Wet		3	SS	6	▽			⊢⊕		0 5 65 29
2.3	**SAND**, trace silt, trace gravel, Compact Brown Wet		4	SS	28				○		
2.9	END OF BOREHOLE AT 2.90 m. AUGER REFUSAL AT 2.90 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.44 m AND WATER LEVEL AT 2.13 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

÷ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+612.5 L15 1 OF 1 METRIC

W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+612.5, O/S 15L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 26.05.04 - 26.05.04 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	Shear Strength kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	Water Content (%) (Wp, w, WL)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**								
0.1	Clayey **SILT** mixed with organics, trace iron oxide staining Dark Brown	1	SS	6					
0.6	Clayey **SILT** to Silty **CLAY**, trace sand, occasional oxide staining Firm to Very Stiff Brown Wet	2	SS	8					0 8 74 19
		3	SS	9					
		4	SS	7					
		5	SS	24	▽				
3.8	END OF BOREHOLE AT 3.81 m. AUGER REFUSAL AT 3.81 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.66 m AND WATER LEVEL AT 3.35 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.								

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+625 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+625, CL ORIGINATED BY GA
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Silty **TOPSOIL**, ~~occasional sand~~, trace rootlets, occasional wood fibers										
0.2	Dark Brown		1	SS	6				164		
	SILT, mixed with organics, trace clay, trace iron oxide staining										
	Loose										
	Dark Brown		2	SS	7				○		
	Moist										
1.2	**SILT**, trace clay, occasional iron oxide staining										
	Loose		3	SS	50/				○		
1.7	Brown				.150						
	Wet										
	END OF BOREHOLE AT 1.68 m. AUGER REFUSAL AT 1.68 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.68 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

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

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+637.5 L20 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+637.5, O/S 20L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
4.0	END OF DCPT AT 4.01 m. CONE REFUSAL AT 4.01 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+637.5 R18 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+637.5, O/S 18R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**TOPSOIL**													
0.1	Silty **SAND**, some rootlets, occasional wood fibers, occasional organics Loose Dark Brown Wet		1	SS	6				○					
0.8	Clayey **SILT** to Silty **CLAY**, some sand, trace iron oxide staining Very Stiff Mottled Brown-Grey Moist to Wet		2	SS	16				○		0	12	70	17
1.5	END OF BOREHOLE AT 1.52 m. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.52 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+650 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+650, CL ORIGINATED BY GA
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Silty **TOPSOIL**, trace sand, trace rootlets, trace wood fibers										
0.1	Dark Brown		1	SS	7				8		
	SILT, mixed with organics, trace clay, trace iron oxide staining										
0.8	Loose										
	Mottled Brown-Grey		2	SS	6				○		0 5 67 29
	Silty **CLAY** to Clayey **SILT**, trace sand, trace iron oxide staining										
	Firm to Stiff										
	Grey to Brown										
	Wet		3	SS	6	▽			○		
	Varved		4	SS	10				○		0 3 77 19
3.1	END OF BOREHOLE AT 3.05 m. AUGER REFUSAL AT 3.05 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.05 m AND WATER LEVEL AT 2.13 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+660 R26 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+660, O/S 26R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 26.05.04 - 26.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
1.4	END OF DCPT AT 1.42 m. CONE REFUSAL AT 1.42 m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3: Numbers refer to Sensitivity

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

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+689 L24 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+689, O/S 24L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 27.05.04 - 27.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
6.9	END OF DCPT AT 6.86 m. CONE REFUSAL AT 6.86 m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+692 R25 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+692, O/S 25R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 27.05.04 - 27.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**TOPSOIL**, trace rootlets										
0.1	Dark Brown **SAND**, fine grained, trace silt Loose to Compact Wet		1	SS	8						
			2	SS	10						
1.5	Silty **CLAY**, trace sand Varved Firm Grey		3	SS	6						
			4	SS	4						0 5 65 30
			5	SS	6						
4.6	**SILT**, trace sand Compact Brown Wet		6	SS	10	▽					
5.9	END OF BOREHOLE AT 5.94 m. AUGER REFUSAL AT 5.94 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.94 m AND WATER LEVEL AT 4.88 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS. Note: Water coming in from near surface.										

÷ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+700 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+700, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 11.12.03 - 11.12.03 CHECKED BY AEG

ELEV / DEPTH	DESCRIPTION	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)	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
0.0	**PEAT**, fibrous Dark Brown to Black									
0.5	**SAND**, trace gravel Loose Brown Wet	1	SS	7	▽					
1.5	Clayey **SILT**, trace sand, with thin sand seams Firm to Stiff Grey Wet	2	SS	8						0 4 70 26
		3	SS	2						
		4	SS	1			6.7			
4.3	**SILT**, some clay, trace sand Soft to Firm Brown Wet	5	SS	1						0 2 86 12
5.8	Clayey **SILT**, trace sand, with thin sand seams, laminated Soft to Firm Grey Wet	6	SS	1						
7.0	**SAND**, trace gravel, occasional cobbles Compact Brown Wet									
7.5	END OF BOREHOLE AT 7.52 m. AUGER REFUSAL AT 7.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.37 m AND WATER LEVEL 1.07 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.									

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4 418HWY124-I.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+725 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+725, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 11.12.03 - 11.12.03 CHECKED BY AEG

ELEV / DEPTH	SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous Dark Brown to Black										
0.6	Sandy **SILT** Compact Grey Wet		1	SS	17				○		
1.4	Clayey **SILT**, with thin sand seams Firm Grey Wet		2	SS	5	▽			○		
			3	SS	3				H ○		0 4 67 29
			4	SS	1				○		
								+3.2			
4.3	**SILT**, trace clay, trace sand Loose Brown Wet		5	SS	1				○		0 1 90 9
5.8	Silty **SAND**, trace gravel Very Dense Brown Wet		6	SS	50/ .127				○		
6.9	END OF BOREHOLE AT 6.86 m. AUGER REFUSAL AT 6.86 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.18 m AND WATER LEVEL AT 1.93 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE
20
10

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+775 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+775, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 30.10.03 - 30.10.03 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	WATER CONTENT (%) (PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**								
0.1	**SAND**, fine grained, some rootlets Brown								
0.5	Dry **SAND**, fine grained, some silt Compact Brown Moist to Wet	1	SS	19			○		
		2	SS	18			○		
		3	SS	18	▽		○		0 82 18 (SI+CL)
		4	SS	28			○		
4.1	Clayey **SILT**, trace sand Stiff Grey Wet	5	SS	9			⊢⊕		0 6 70 23
						5.8 +			
		6	SS	8			○		
						3.1 +			
7.3	**SAND**, very fine to medium grained, trace to some gravel, occasional cobbles Dense Brown Wet	7	SS	39			○		
		1	GS				○		
8.2	END OF BOREHOLE AT 8.23 m. AUGER REFUSAL AT 8.23 m . BOREHOLE OPEN TO 7.72 m AND WATER LEVEL AT 2.64 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND BENTONITE TO SURFACE.								

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+825 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+825, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 30.10.03 - 30.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**SAND**, fine grained, some rootlets Brown										
0.6	Sandy **SILT**, some clay, oxide staining Very Loose to Loose Brown Moist to Wet		1	SS	3				○		
			2	SS	7				○		
			3	SS	58/.150	▽			○		0 24 65 11
2.6	Gravelly **SAND**, some cobbles or boulders Very Dense		4	SS	50/.025						No Recovery in SS#4
			5	SS	50/.00						No Recovery in SS#5
4.7	END OF BOREHOLE AT 4.72 m. AUGER REFUSAL AT 4.72 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.96 m AND WATER LEVEL AT 2.64 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+850 L33.1 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+850, O/S 33.1L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 30.10.03 - 30.10.03 | CHECKED BY JL

SOIL PROFILE 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
0.0	**TOPSOIL**										
0.1	**SAND**, fine grained, some rootlets Brown										
0.3	Sandy **SILT**, trace clay Compact to Dense Brown Moist to Wet		1	SS	22				○		
			2	SS	25	▽			○ ○		
			3	SS	31				○		0 35 58 7
			4	SS	35				○		
3.7	END OF BOREHOLE AT 3.66 m. BOREHOLE OPEN TO 3.66 m AND WATER LEVEL AT 1.91 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+852 L32 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+852, O/S 32L | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 31.10.03 - 31.10.03 | CHECKED BY JL

SOIL PROFILE: ELEV / DEPTH	DESCRIPTION	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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	TOPSOIL									
0.1	SAND, fine grained, some rootlets Brown									
0.3	Sandy SILT, trace clay Compact to Dense Brown Moist to Wet				▽					
3.7	SILT, some clay, trace sand Stiff Grey Wet	1	SS	12				○		0 8 76 16
							>>4.8			
5.6	Clayey SILT, trace to some sand Firm/ Stiff Grey Wet	2	SS	8				○		
7.0	Gravelly SAND						+2			
7.5	END OF BOREHOLE AT 7.47 m. AUGER REFUSAL AT 7.47 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 6.71 m AND WATER LEVEL AT 3.05 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.									

+ 3, × 3 : Numbers refer to Sensitivity

20 15 ⊕ 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+875 R1.5 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+875, O/S 1.5R | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 30.10.03 - 30.10.03 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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
0.0	**TOPSOIL**										
0.1	**SAND**, fine grained, some rootlets Brown										
0.3	**SAND**, fine to medium grained, some silt Loose Brown Wet		1	SS	9				○		
			2	SS	11				○		
			3	SS	22	▽			○		0 84 16 (SI+CL)
	some gravel		4	SS	34				○ ○		
3.4	**SILT**, some sand, trace clay Dense Grey Wet										
4.0	Gravelly **SAND**, some cobbles										
4.6	END OF BOREHOLE AT 4.57 m. AUGER REFUSAL AT 4.57 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.20 m AND WATER LEVEL AT 2.59 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.		5	SS	50/.000						No Recovery in SS#5

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

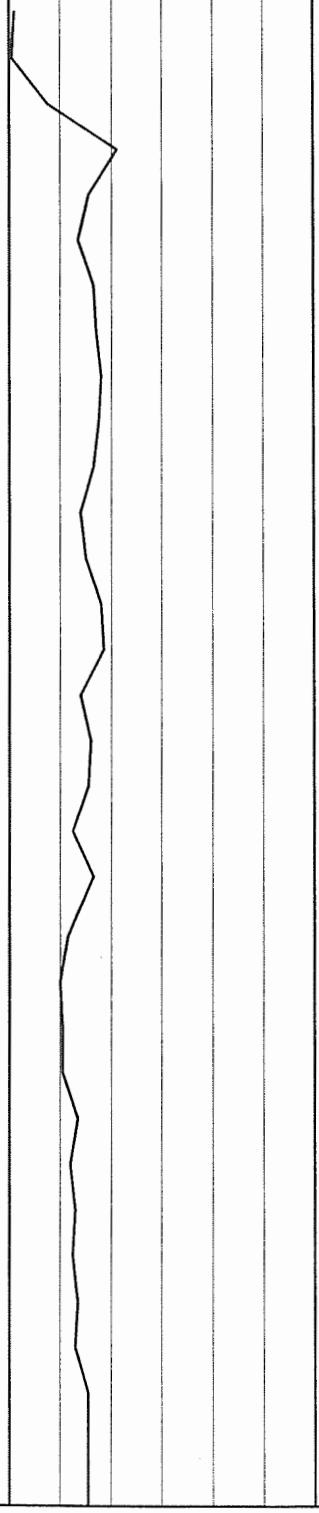
RECORD OF BOREHOLE No 418 E-S 20+916 L35 1 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+916, O/S 35L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 31.10.03 - 31.10.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										



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

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+916 L35 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+916, O/S 35L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 31.10.03 - 31.10.03 CHECKED BY JL

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
											
11.7	END OF DCPT AT 11.68m. CONE BOUNCING AND REFUSAL AT 11.68m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-S 20+925 CL 1 OF 2 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-S Ramp, ST. 20+925, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM
DATUM Geodetic | DATE 27.05.04 - 27.05.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0											
0.1	Silty **TOPSOIL**, trace rootlets, occasional wood fibers, Dark Brown		1	SS	5						
	SAND, some silt, trace gravel, occasional iron oxide staining, Compact, Brown, Wet		2	SS	14						
1.5	Clayey **SILT**, trace to some sand, occasional iron oxide staining, Compact, Brown, Wet		3	SS	18						
			4	SS	15						
	Becoming Loose, Grey		5	SS	8						0 12 75 13
			6	SS	5	▽					
6.1	Silty **CLAY**, trace sand, Varved, Soft to Firm, Grey, Wet		7	SS	4						
			8	SS	7						0 9 55 36
			9	SS	6						
9.8	END OF SAMPLING AT 9.75 m.										

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 418 E-S 20+925 CL 2 OF 2 METRIC

G.W.P. 759-93-00 LOCATION 418 E-S Ramp, ST. 20+925, CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 27.05.04 - 27.05.04 CHECKED BY JL

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						
	DCPT started from 9.75 m.										
12.7	END OF DCPT AT 12.73 m. CONE REFUSAL AT 12.73 m. BOREHOLE BACKFILLED AS FOLLOWS: Depth (m) Material 0-6.1 Drill Cuttings 6.1-9.75 Bentonite WATER LEVEL AT 5.79 m UPON COMPLETION. Note: - Probable Bedrock first encountered at 7.16 m with augers starting to deflect along side of rock. - Probable Bedrock dipping sharply to the east.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 S-S 20+862.5 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 S-S Ramp, ST. 20+862.5, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 29.10.03 - 29.10.03 | CHECKED BY JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	**SAND**, fine grained, some rootlets Brown										
0.5	**SAND**, fine grained Compact to Dense Brown Moist		1	SS	16				○		
	trace rootlets from 1.45m to 2.21m		2	SS	34				○		
	coarse grained sand on rock		3	SS	33				○		
2.8	END OF BOREHOLE AT 2.77 m. AUGER REFUSAL AT 2.74 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.77 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+050 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-S Ramp, 20+050 CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.03.04 - 03.03.04 CHECKED BY JL

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
0.0	**BEDROCK** at surface.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+100 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-S Ramp, 20+100 CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 02.03.04 - 02.03.04 CHECKED BY JL

SOIL PROFILE			SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE	w_P — w — w_L; WATER CONTENT (%) (20 40 60)	γ kN/m³	GR SA SI CL
0.0	**SILT**, some sand, trace rootlets Compact Brown Wet		1	SS	10	▽			○		
0.8	END OF BOREHOLE AT 0.76 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.76 m AND WATER LEVEL AT 0.61 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+130 CL 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 W-S Ramp, 20+130 CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 02.03.04 - 02.03.04 CHECKED BY JL

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						
0.0	**WATER**										
0.5	END OF BOREHOLE AT 0.46 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.46 m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+225 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-S Ramp, ST. 20+225, CL ORIGINATED BY MF
HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS
DATUM Geodetic DATE 13.11.03 - 13.11.03 CHECKED BY JL

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						
0.0	**TOPSOIL** Dark Brown		1	SS	15				○		
0.5	Silty **SAND**, fine grained, trace gravel, occasional silt layers Compact Brown Wet		2	SS	14				○		
			3	SS	19				○		0 65 35 (SI+CL)
			4	SS	27				○		
3.2	Sandy, Clayey, **SILT**, trace gravel, with brown sand layers Very Stiff Grey Wet		5	SS	29				○		
			6	SS	17				○		1 23 55 21
5.6	Silty **SAND**, trace gravel Compact Brown Wet		7	SS	24				○		
6.9	END OF BOREHOLE AT 6.86m. AUGER REFUSAL AT 6.86 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m)										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+250 R13 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 W-S Ramp, ST. 20+250, O/S 13R | ORIGINATED BY MF
HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 14.11.03 - 14.11.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	Dark Brown Silty **SAND**, fine grained Very Loose to Dense Brown Wet some topsoil above 0.76m		1	SS	4	▽			○		
			2	SS	33				○		
1.5	Clayey **SILT**, some sand, some visible sand layers Hard to Very Stiff Grey		3	SS	47				○		
			4	SS	18				○		0 11 65 24
			5	SS	14						No Recovery in SS#5
4.6	Silty **SAND**, fine grained, some gravel, occasional cobbles Very Dense Brown Wet		6	SS	100/ .102				○		
4.9	END OF BOREHOLE AT 4.88 m. AUGER REFUSAL AT 4.88 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.88 m AND WATER LEVEL AT 0.61 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3 . × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+250 L19 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-S Ramp, ST. 20+250, O/S 19L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 18.05.04 - 18.05.04 CHECKED BY JL

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						
0.0	DCPT from surface.										
7.1	END OF DCPT AT 7.11 m. CONE REFUSAL AT 7.11 m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+275 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 W-S Ramp, ST. 20+275, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 18.05.04 - 18.05.04 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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
0.0	**PEAT**, silty Dark Brown										
0.3	Clayey **SILT**, some sand, occasional iron oxide staining Firm to Stiff Brown Wet		1	SS	2				30		
			2	SS	4						
			3	SS	10						
			4	SS	11						0 16 71 13
3.1	Silty, **CLAY**, trace sand Varved Stiff to Very Stiff Brown Wet		5	SS	12						
			6	SS	15	▽					0 5 70 25
			7	SS	16						
7.6	END OF BOREHOLE AT 7.62 m. AUGER REFUSAL AT 7.62 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 7.62 m AND WATER LEVEL AT 5.49 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+325 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 W-S Ramp, ST. 20+325, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 18.05.04 - 18.05.04 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	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)	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
0.0	**TOPSOIL**, trace rootlets, occasional wood fibers Very Loose Dark Brown Moist	1	SS	2				○		
0.6	**SAND** , trace silt Loose Brown Wet	2	SS	4				○		
1.5	Clayey **SILT** to Silty **CLAY**, mixed with organics, trace sand, occasional wood fibers Firm Dark Brown Wet	3	SS	4				○		
2.4	Silty **CLAY**, trace sand, occasional sand seams Varved Firm to Very Stiff Grey Wet	4	SS	7	▽			○		
		5	SS	15				⊢⊕		0 8 68 23
		6	SS	24				○		
5.2	END OF BOREHOLE AT 5.18 m. AUGER REFUSAL AT 5.18 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.18 m AND WATER LEVEL AT 2.74 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.									

÷ 3 , × 3 : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+350 R28 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-S Ramp, ST. 20+350, O/S 28R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 18.05.04 - 18.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	w_P — w — w_L WATER CONTENT (%) 20 40 60	γ kN/m^3	GR SA SI CL
0.0	DCPT from surface.										
8.0	END OF DCPT AT 7.95 m. CONE REFUSAL AT 7.95 m ON PROBABLE BEDROCK OR BOULDER.										

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

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-S 20+375 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-S Ramp, ST. 20+375, CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 18.05.04 - 18.05.04 CHECKED BY JL

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						
0.0	**PEAT**, some rootlets, occasional wood fibers, trace rootlets Dark Brown		1	SS	2				448		
0.6	**SAND**, trace silt, occasional iron oxide staining Compact Brown to Grey Wet		2	SS	22				○		
1.5	**SILT**, trace to some clay, trace to some sand, occasional iron oxide staining Loose to Compact Brown Wet		3	SS	9	▽			○		
			4	SS	10				○		
2.9	END OF BOREHOLE AT 2.90 m. AUGER REFUSAL AT 2.90 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.90 m AND WATER LEVEL AT 1.83 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+067 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 W-N Ramp, ST. 20+067, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 24.10.03 - 24.10.03 | CHECKED BY JL

SOIL PROFILE 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
0.0	Sandy **TOPSOIL**										
0.2	Silty **SAND**, fine grained Compact Brown Wet		1	SS	25				○		
1.5	**SILT**, trace clay, laminated Compact Grey Wet		2	SS	16	▽			○		
2.2	END OF BOREHOLE AT 2.21 m. AUGER REFUSAL AT 2.21 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.21 m AND WATER LEVEL AT 1.52 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+087.5 R20.3 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-N Ramp, ST. 20+087.5, O/S 20.3R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 23.10.03 - 23.10.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
2.5	END OF DCPT AT 2.51 m. CONE BOUCING AND REFUSAL AT 2.51 m ON PROBABLE BEDROCK OR BOULDER.										

÷ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+112.5 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 W-N Ramp, ST. 20+112.5, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 23.10.03 - 23.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**		1	GS							
0.3	**SAND**, fine grained, trace silt, oxide staining Compact Brown Wet		1	SS	21						
1.5	**SILT**, some sand, trace clay Compact Grey and Brown Wet		2	SS	18						
2.2	Clayey **SILT**, trace sand Firm Grey and Brown Wet		3	SS	5						0 3 77 20
3.0	Sandy **SILT**, some clay Firm / Loose to Compact Brown and Grey Wet		4	SS	4						
	some clay to clayey, trace gravel Very Stiff					▽		4			
			5	SS	22						2 23 61 14
5.6	**SAND**, some gravel, trace to some silt Very Dense Grey		6	SS	69						
6.7	END OF BOREHOLE AT 6.71m. BOREHOLE OPEN TO 6.71 m AND WATER LEVEL AT 4.32 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

÷ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+350 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-N Ramp, ST. 20+350, CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 20.05.04 - 20.05.04 CHECKED BY JL

SOIL PROFILE			SAMPLES					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	GROUND WATER CONDITIONS	ELEVATION SCALE	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
0.0	**SAND**, trace to some silt Compact Brown Wet		1	SS	11	▽			○				
0.8	END OF BOREHOLE AT 0.76 m. AUGER REFUSAL AT 0.76 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.76 m AND WATER LEVEL AT 0.61 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.												

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+400 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-N Ramp, ST. 20+400, CL ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 20.05.04 - 20.05.04 CHECKED BY JL

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						
0.0	Silty **TOPSOIL**, occasional sand, trace rootlets										
0.2	Dark Brown **SAND**, trace to some silt, occasional iron oxide staining		1	SS	2	▽					
	Very Loose Brown Moist		2	SS	50/.150						
1.1	END OF BOREHOLE AT 1.07 m. AUGER REFUSAL AT 1.07 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.07 m AND WATER LEVEL AT 0.61 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

÷ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY 124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+425 R17 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-N Ramp, ST. 20+425, O/S 17R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 20.05.04 - 20.05.04 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**TOPSOIL**										
0.1	END OF BOREHOLE AT 0.05 m. AUGER REFUSAL AT 0.05 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.05 m AND DRY UPON COMPLETION.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 W-N 20+459 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-N Ramp, ST. 20+459, CL ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 13.11.03 - 13.11.03 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous										
0.1	Dark Brown Silty **SAND**, fine grained, some topsoil inclusion Very Loose to Very Dense Brown Wet		1	SS	3				○		
			2	SS	60	▽			○		0 63 36 (SI+CL)
1.5	Sandy **SILT**, trace clay, occasional sand lenses Dense Brown Wet		3	SS	33				○		
2.2	Clayey **SILT**, trace sand, occasional brown sand lenses Stiff to Very Stiff Grey Wet		4	SS	13				○		0 8 64 28
			5	SS	15				○		
4.1	END OF BOREHOLE AT 4.11 m. AUGER REFUSAL AT 4.11 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.11 m AND WATER LEVEL AT 1.22 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+694 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-N Ramp, ST. 20+694, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 28.10.03 - 28.10.03 | CHECKED BY JL

SOIL PROFILE 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
0.0	Sandy **TOPSOIL** Brown										
0.2	**SAND**, fine grained, trace gravel Dense Brown Moist		1	SS	33				○		
1.5	**SAND** and layers of grey silty clay Dense Brown Moist		2	SS	36				○		
2.2	END OF BOREHOLE AT 2.24m. AUGER REFUSAL AT 2.24 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.24 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY 124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+725 R24 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 W-N Ramp, ST. 20+725, O/S 24R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 29.10.03 - 29.10.03 CHECKED BY JL

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
0.0	DCPT from surface.										
3.8	CONE BOUCING AND REFUSAL AT 3.81 m ON PROBABLE BEDROCK OR BOULDER. END OF DCPT AT 3.81m.										

÷ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+739 CL 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-N Ramp, ST. 20+739, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 28.10.03 - 28.10.03 | CHECKED BY JL

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
0.0	**PEAT**, fibrous Dark Very Loose Wet										
	thin layers of silty sand or sand		1	SS	0						No Recovery in SS#1
1.7	**SAND**, fine grained Grey Very Loose Wet becoming brown at 1.98 m		2	SS	2	▽			○ ○		
3.1	**SILT**, some clay, trace sand Stiff Brown Wet		3	SS	9				○ ○		0 6 78 16
4.0	END OF BOREHOLE AT 3.96m. AUGER REFUSAL AT 3.96 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.96 m AND WATER LEVEL AT 2.44 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+750 L1.5 1 OF 1 METRIC

G.W.P. 759-93-00 | LOCATION 418 E-N Ramp, ST. 20+750, O/S L1.5 | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 28.10.03 - 28.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous Dark Brown to Black Very Loose Wet some layers of silty sand										
			1	SS	2				85		
1.2	**SAND**, fine grained, trace organics Grey										
1.5	Very Loose Wet										
			2	SS	6						
1.8	Sandy **SILT** Grey Loose Wet										
	SILT, some clay, trace sand Soft to Very Stiff Grey to Brown Wet		3	SS	2						
								>>6.2			
			4	SS	7	▽					0 2 82 15
4.4	END OF BOREHOLE AT 4.42 m. AUGER REFUSAL AT 4.42 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.42 m AND WATER LEVEL AT 3.96 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+802 CL 1 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+802, CL ORIGINATED BY MF
HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS
DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	Dark Brown Silty **SAND**, fine grained, some organics Very Loose		1	SS	3				○		
0.7	Reddish Brown Moist **SAND**, fine to medium grained, trace silt Compact		2	SS	28	▽			○		
1.5	Brown Wet Sandy **SILT**, some clay, some silt lenses Compact to Very Loose Grey Wet		3	SS	14				○		
			4	SS	3				○		
2.9	Clayey **SILT**, trace sand Soft Grey Wet		5	SS	4				H ○		0 9 69 22
	brown medium grained sand layer		6	SS	4				○		
6.1	**SILT**, some clay, trace sand Firm Grey Wet		7	SS	8				○		
7.2	Silty **SAND**, fine grained, some gravel, some cobbles Compact Brown Wet		8	SS	18				○		12 62 26 (SI+CL)
			9	SS	80/ .076				○		
9.2	END OF BOREHOLE AT 9.22m. BOREHOLE OPEN TO 7.62 m AND WATER LEVEL AT 1.22 m UPON COMPLETION. BOREHOLE BACKFILLED WITH										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+802 CL 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+802, CL ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	DRILL CUTTINGS TO SURFACE.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

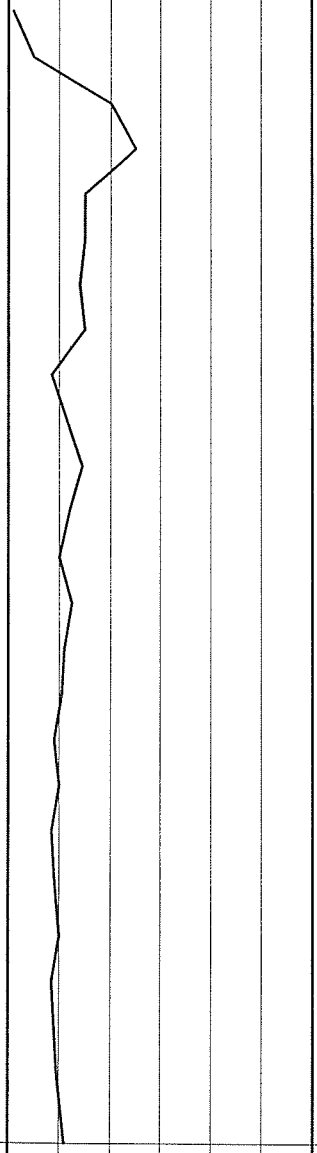
RECORD OF BOREHOLE No 418 E-N 20+825 R20 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+825, O/S 20R ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
7.6	END OF DCPT AT 7.62m.										



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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+850 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+850, CL ORIGINATED BY MF
HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS
DATUM Geodetic DATE 18.11.03 - 18.11.03 CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	Dark Brown Silty **SAND**, fine grained, some topsoil Loose Reddish Brown to Grey		1	SS	3				○		
0.8	Wet Sandy **SILT**, fine grained, trace clay Dense Grey		2	SS	42				○		0 36 60 5
1.5	Wet Silty **SAND**, some grey silt lenses Dense to Compact Brown Wet		3	SS	34	▽			○		
	Compact		4	SS	14				○		
3.1	**SILT**, some clay, some sand Stiff to Firm Grey Wet		5	SS	13				○		0 13 71 16
	occasional sand lenses		6	SS	6				○		
5.6	END OF BOREHOLE AT 5.64 m. AUGER REFUSAL AT 5.64 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.83 m AND WATER LEVEL AT 1.83 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+900 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+900, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 15.12.03 - 15.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**PEAT**, fibrous Dark Brown to Black													
0.7	Silty **SAND** Loose Grey Wet		1	SS	5				○					
1.5	Clayey **SILT**, trace sand Soft Grey Wet		2	SS	2	▽			○		0	2	72	26
2.2	Sandy **SILT**, trace clay, trace gravel Compact Brown Wet		3	SS	12				○					
			~~4~~	~~SS~~	~~50/~~				○					
3.1	END OF BOREHOLE AT 3.10 m. AUGER REFUSAL AT 3.10 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.18 m AND WATER LEVEL AT 1.68 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.				.024									

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 19/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+925 R21 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+925, O/S 21R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 15.12.03 - 15.12.03 CHECKED BY AEG

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						
0.0	**PEAT**, fibrous										
0.2	Dark Brown to Black										
	SAND, trace silt Compact Brown Wet										
			1	SS	20				○		
			2	SS	14	▽			○		
	some silt to silty, trace gravel Very Dense										
			3	SS	50/				○		
2.5	END OF BOREHOLE AT 2.49 m. AUGER REFUSAL AT 2.49 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.34 m AND WATER LEVEL AT 1.85 m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.				.0.15						

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 E-N 20+950 CL 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 E-N Ramp, ST. 20+950, CL ORIGINATED BY SL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 15.12.03 - 15.12.03 CHECKED BY AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous										
0.1	Dark Brown to Black										
	SAND, trace silt, trace gravel Compact Brown Wet		1	SS	19	▽			○		
1.4	Silty **SAND** Compact Brown Wet		2	SS	18				○		
2.3	**SILT**, trace clay, trace sand Compact Brown Wet		3	SS	10				○		
			4	SS	9				○		0 4 86 10
	sandy, trace gravel		5	SS	20				○		
5.4	END OF BOREHOLE AT 5.41 m. AUGER REFUSAL AT 5.41 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.81 m AND WATER LEVEL AT 1.12 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

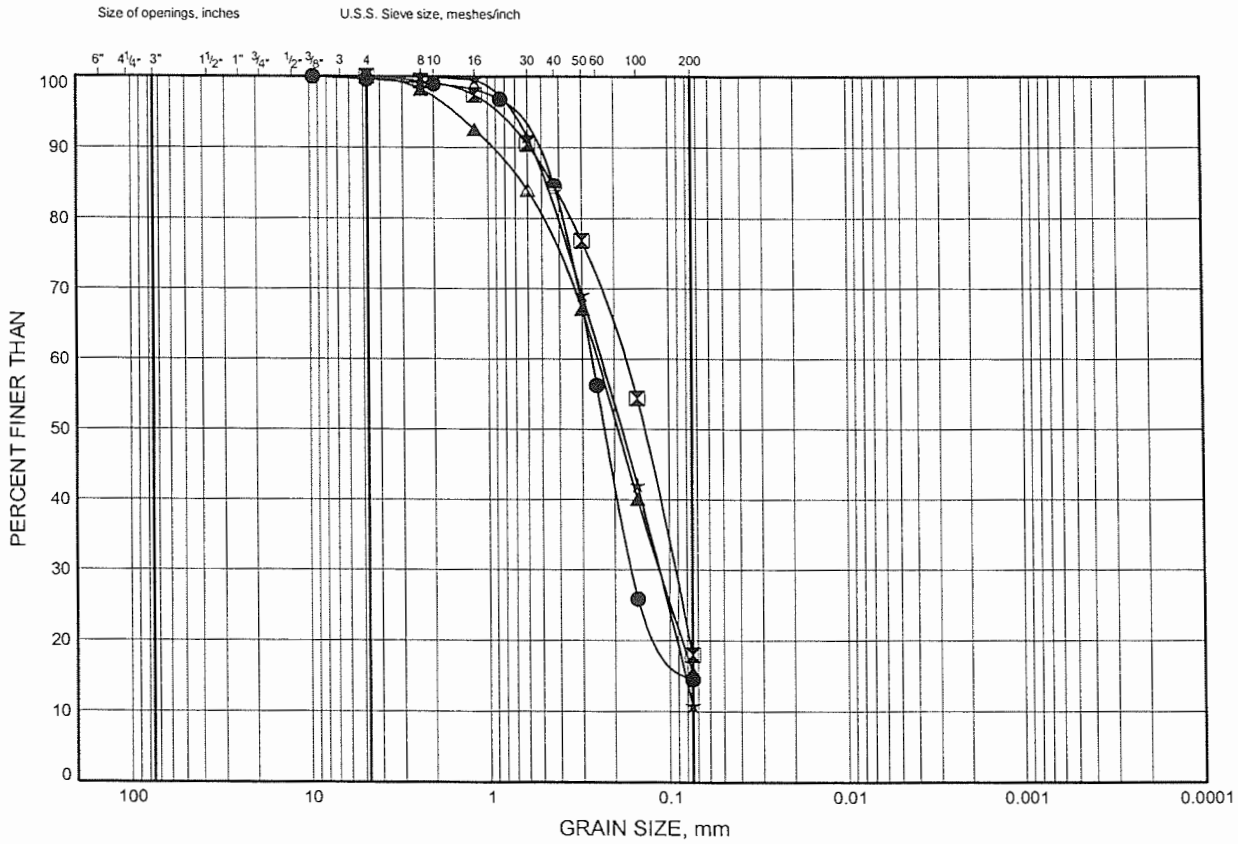
ONTMT4 418HWY124-I.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C1

Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-S 20+600 CL	1.07	
⊠	418 E-S 20+775 CL	2.59	
▲	418 E-S 20+875 R1.5	2.59	
★	418 N-E 20+575 R2.5	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

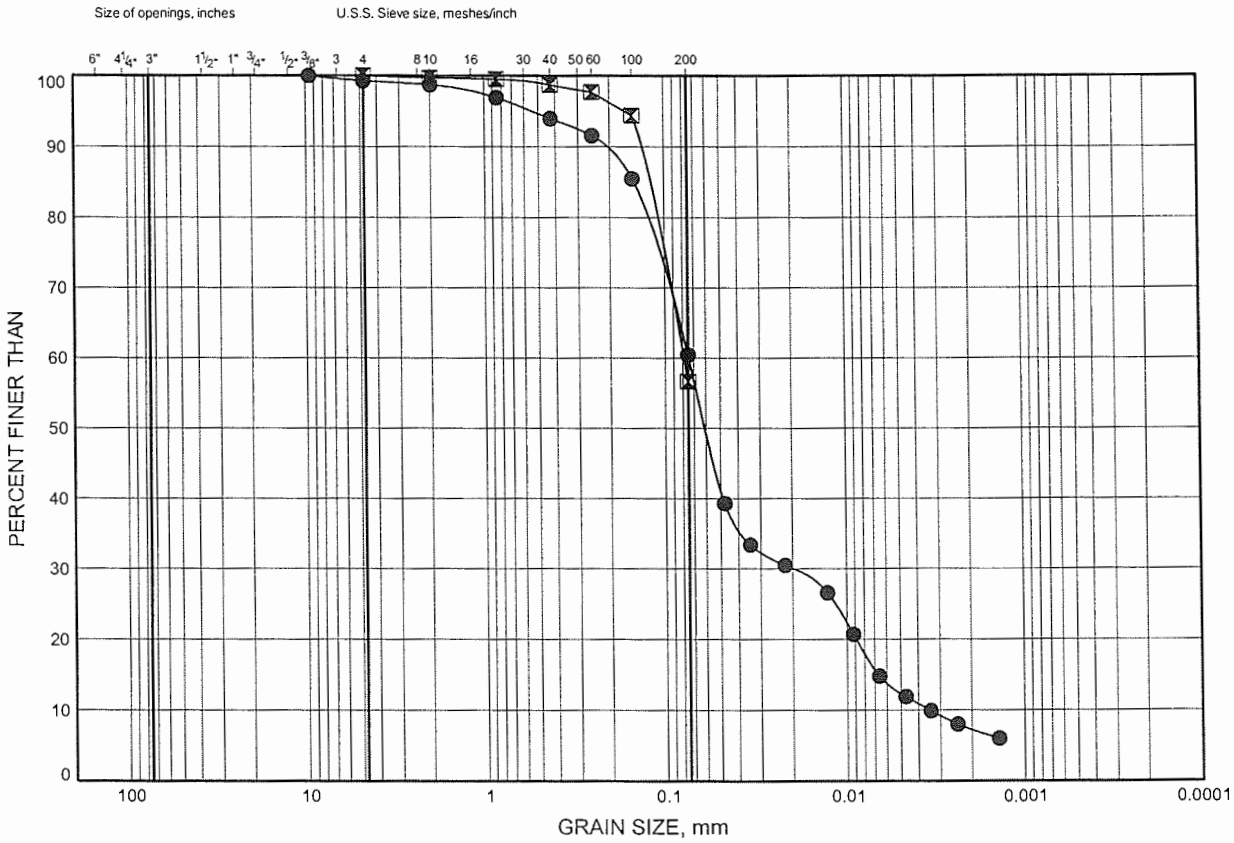
THURBGSD 418HWY124.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C2

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 N-E 20+737.5 L22	1.83	
⊠	418 N-E 20+912.5 CL	2.59	

Date December 2004

Project 759-93-00

THURBER

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Chkd. JL

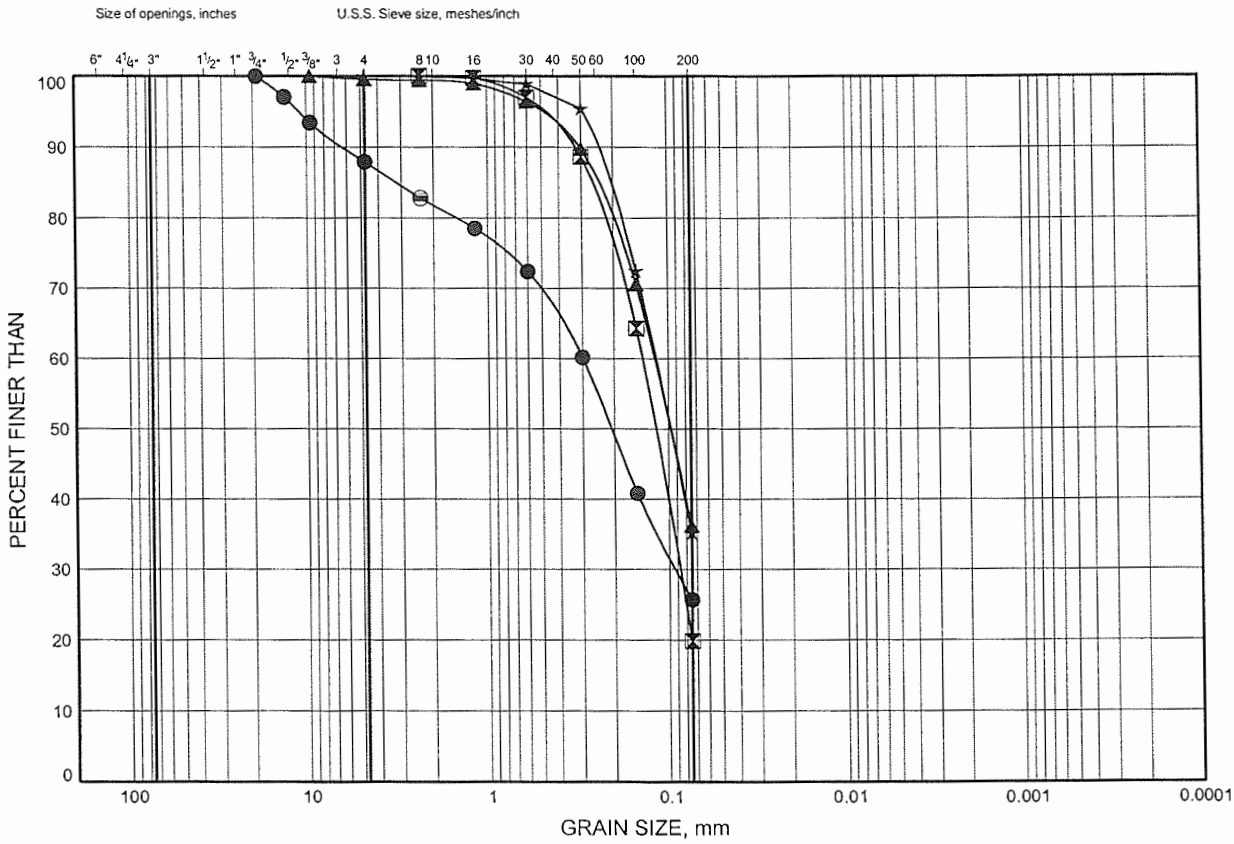
THURBGSD 418HWY124.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C3

Silty Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-N 20+802 CL	7.92	
⊠	418 N-E 20+450 L22	0.97	
▲	418 W-N 20+459 CL	1.07	
★	418 W-S 20+225 CL	1.83	

Date December 2004

Project 759-93-00

THURBER

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Chkd. JL

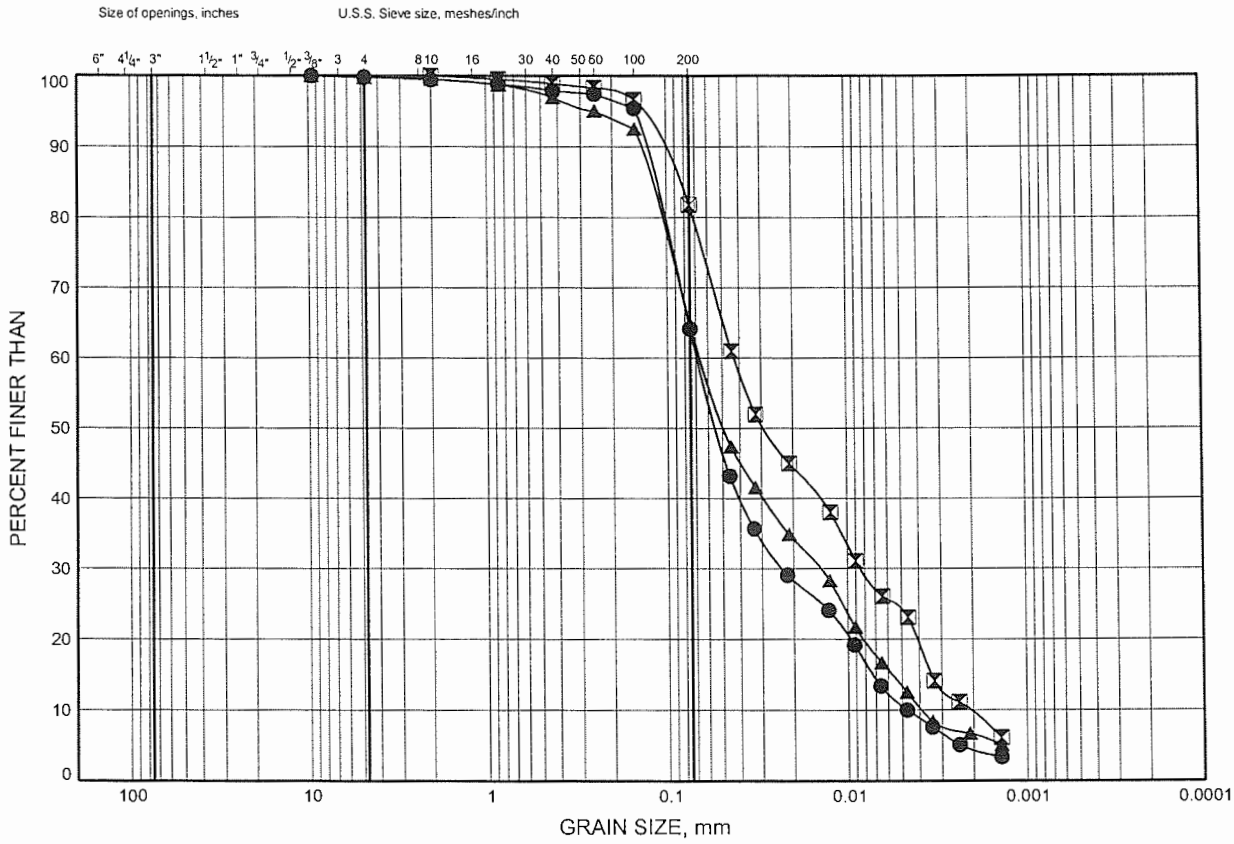
THURBGSD 418HWY124.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C4

Sandy Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-N 20+850 CL	1.07	
⊠	418 E-S 20+537.5 CL	1.07	
▲	418 E-S 20+850 L33.1	2.59	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

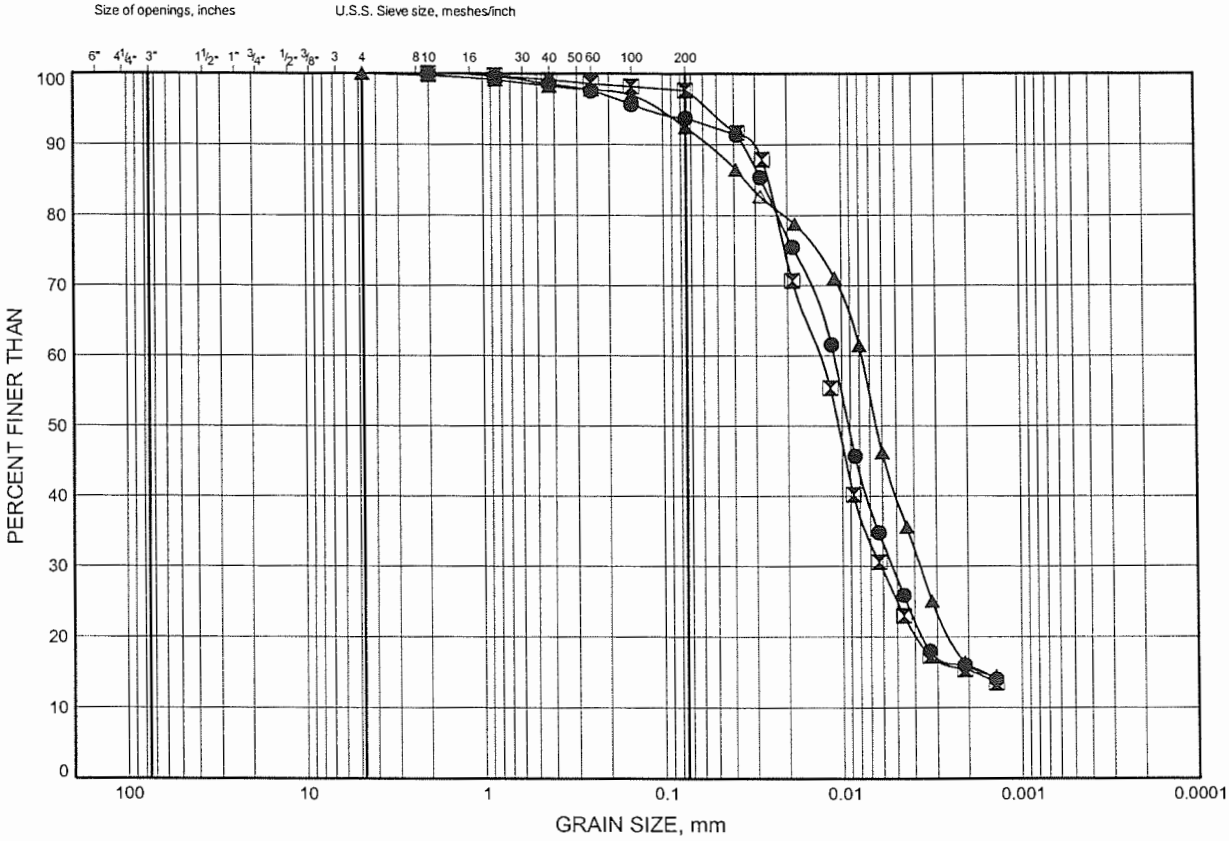
THURBGSD 418HWY124.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C5

Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-N 20+739 CL	3.35	
⊠	418 E-N 20+750 L1.5	3.96	
▲	418 E-S 20+852 L32	4.88	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

Chkd. SMS

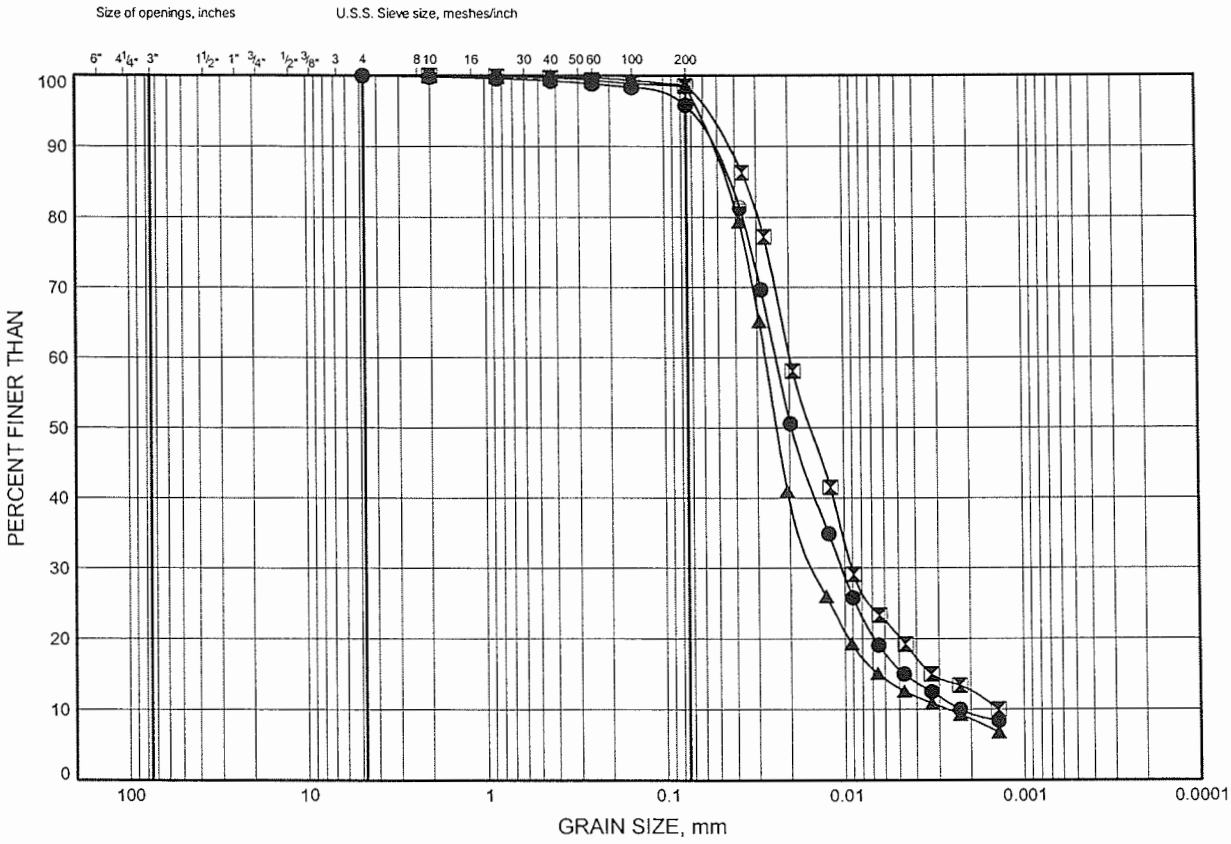
THURBGSD 418HWY124.GPJ 12/01/05

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C6

Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-N 20+950 CL	3.35	
⊠	418 E-S 20+700 CL	4.88	
▲	418 E-S 20+725 CL	4.88	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

Chkd. SMS

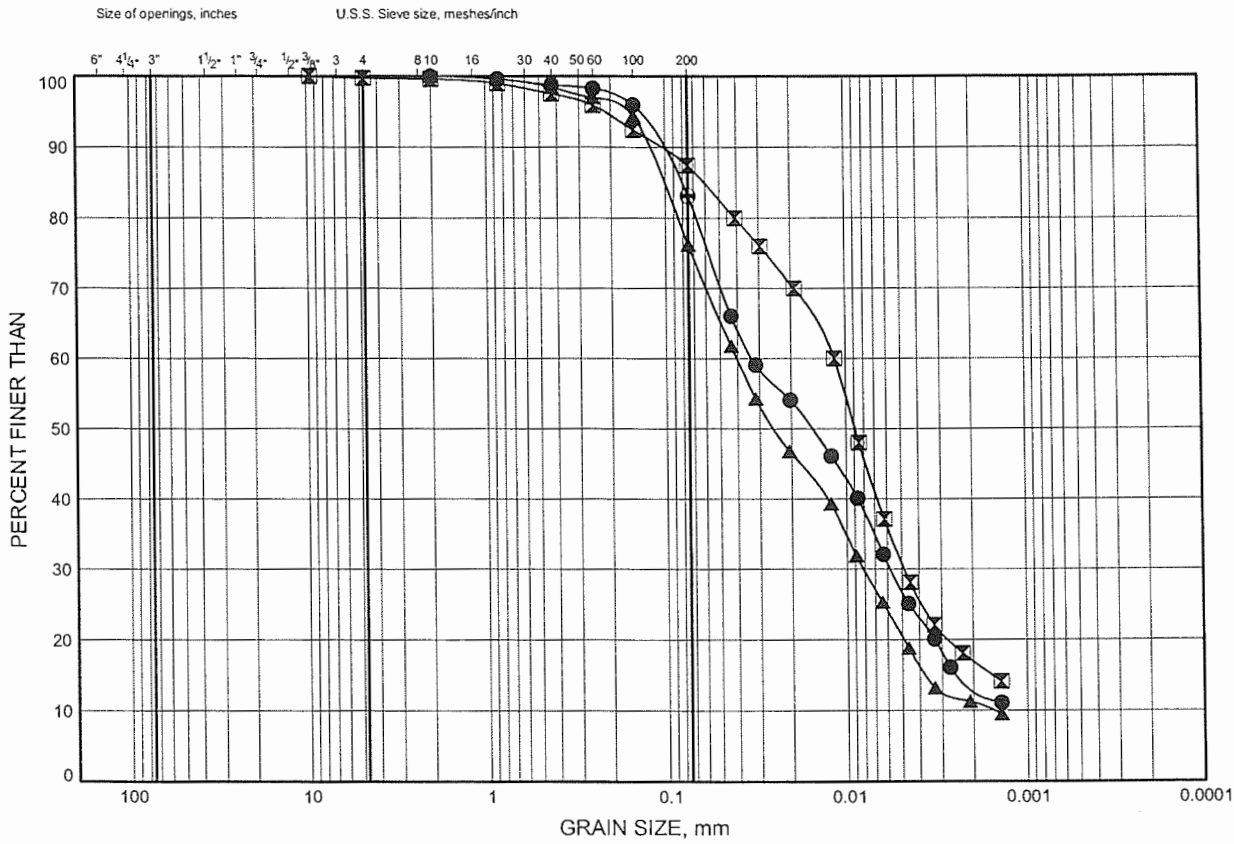
THURBGSD 418HWY124-I.GPJ 12/01/05

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C7

Silt, some clay to clayey, some sand to sandy



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-S 20+550 CL	1.83	
⊠	418 E-S 20+637.5 R18	1.07	
▲	418 E-S 20+825 CL	2.44	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

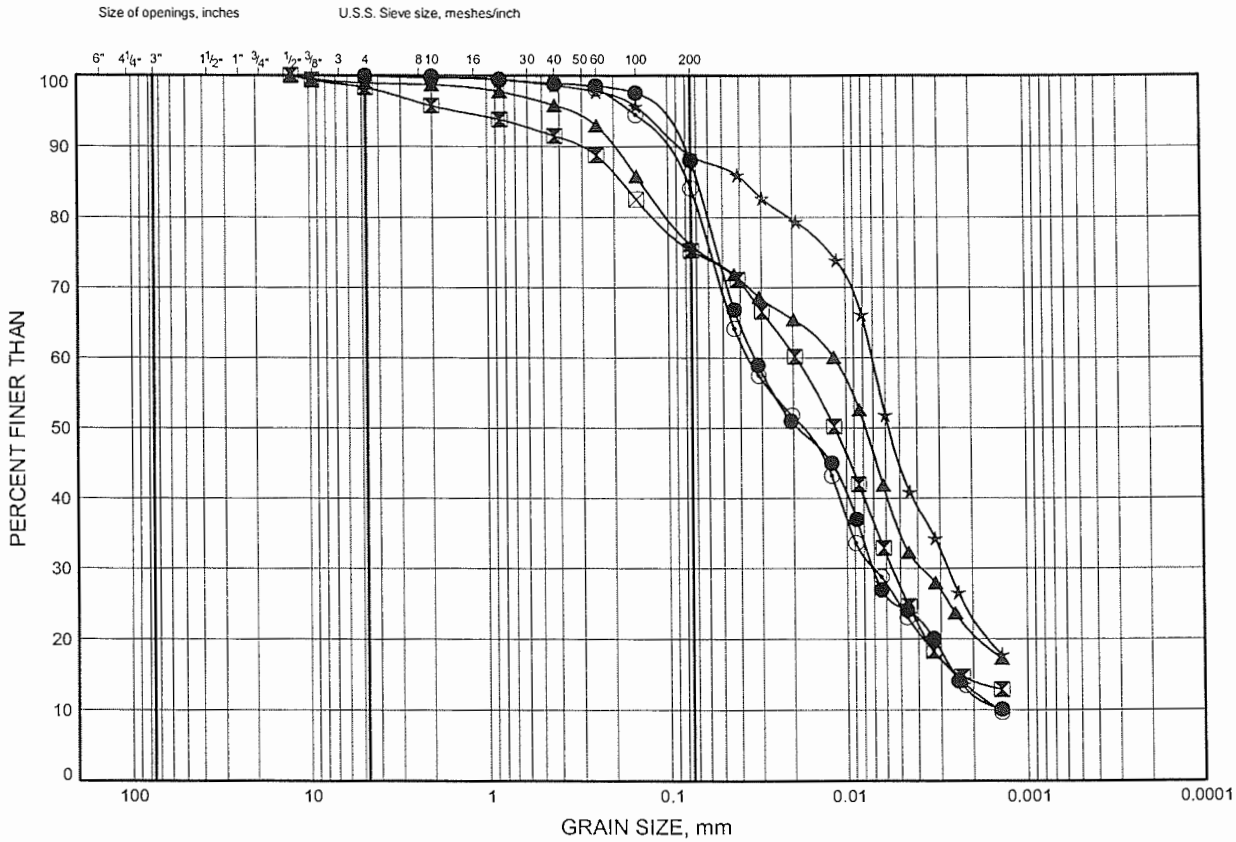
THURBGSD 418HWY124.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C8

Silt, some clay to clayey, some sand to sandy



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-S 20+925 CL	3.35	
⊠	418 W-N 20+112.5 CL	4.88	
▲	418 W-S 20+225 CL	4.88	
★	418 W-S 20+250 R13	2.59	
⊙	418 W-S 20+275 CL	2.59	

Date December 2004

Project 759-93-00

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Chkd. JL

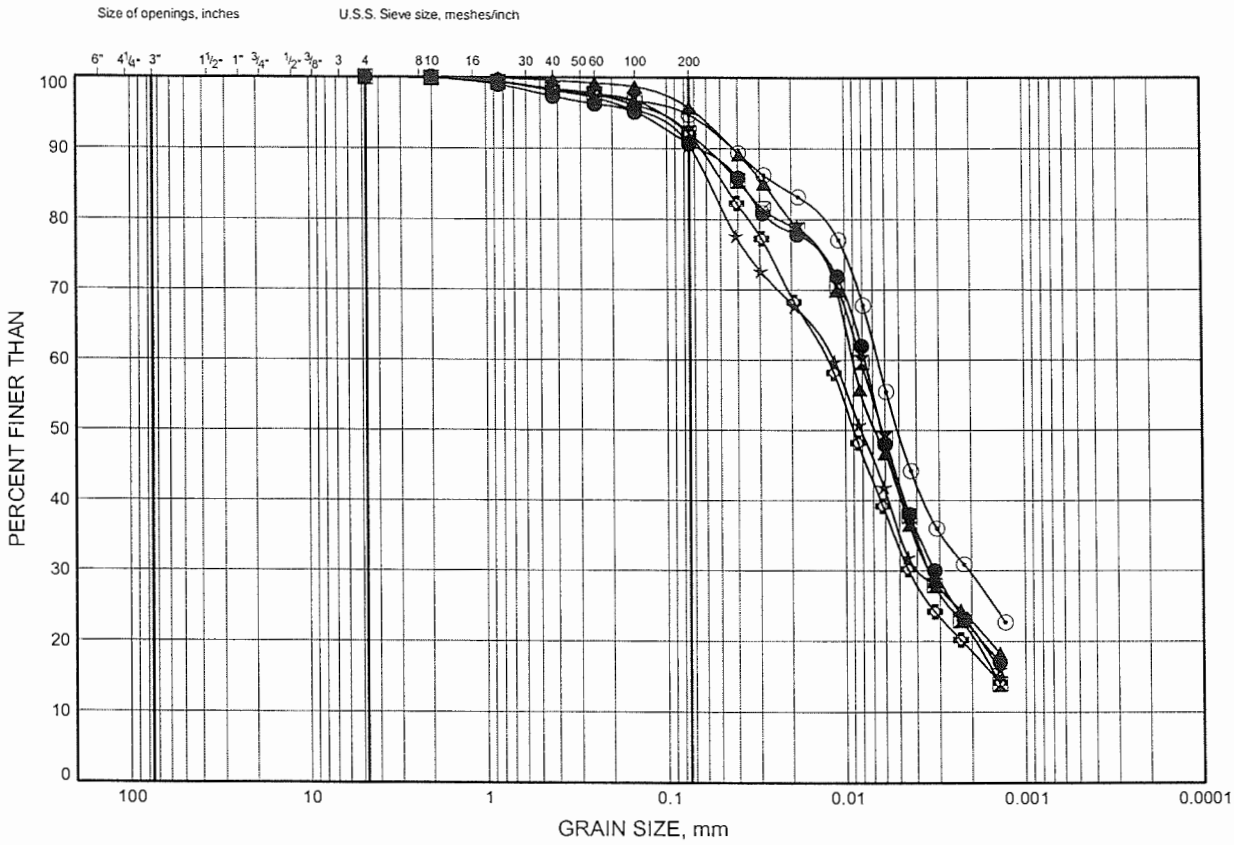
THURBGSD 418HWY124.GPJ 19/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C9

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-N 20+802 CL	3.35	
⊠	418 E-S 20+537.5 CL	3.35	
▲	418 E-S 20+550 CL	4.88	
★	418 E-S 20+570 L18	1.83	
⊙	418 E-S 20+600 CL	1.83	
✿	418 E-S 20+612.5 L15	1.07	

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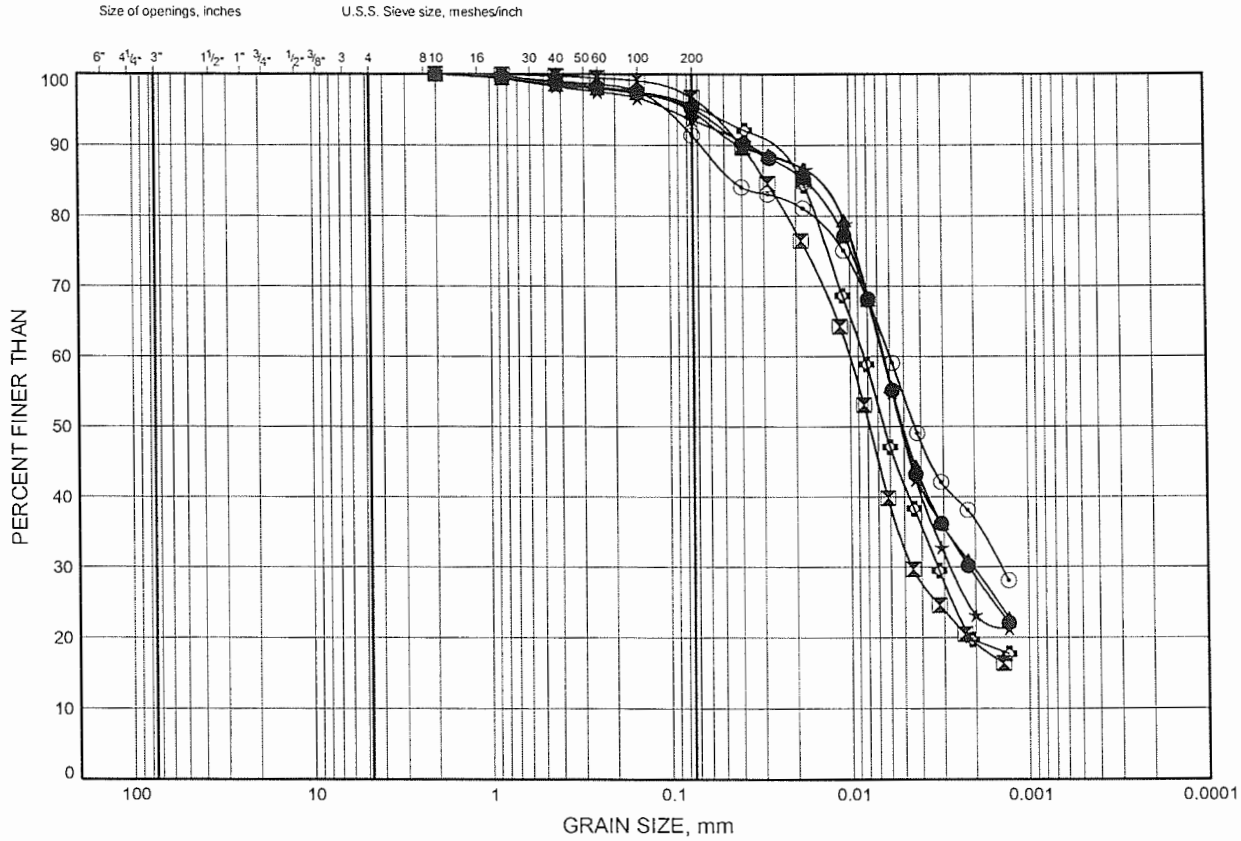
Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C10

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-S 20+650 CL	1.07	
⊠	418 E-S 20+650 CL	2.59	
▲	418 E-S 20+692 R25	2.59	
★	418 E-S 20+775 CL	4.88	
⊙	418 E-S 20+925 CL	7.92	
✿	418 N-E 20+625 R1.5	2.59	

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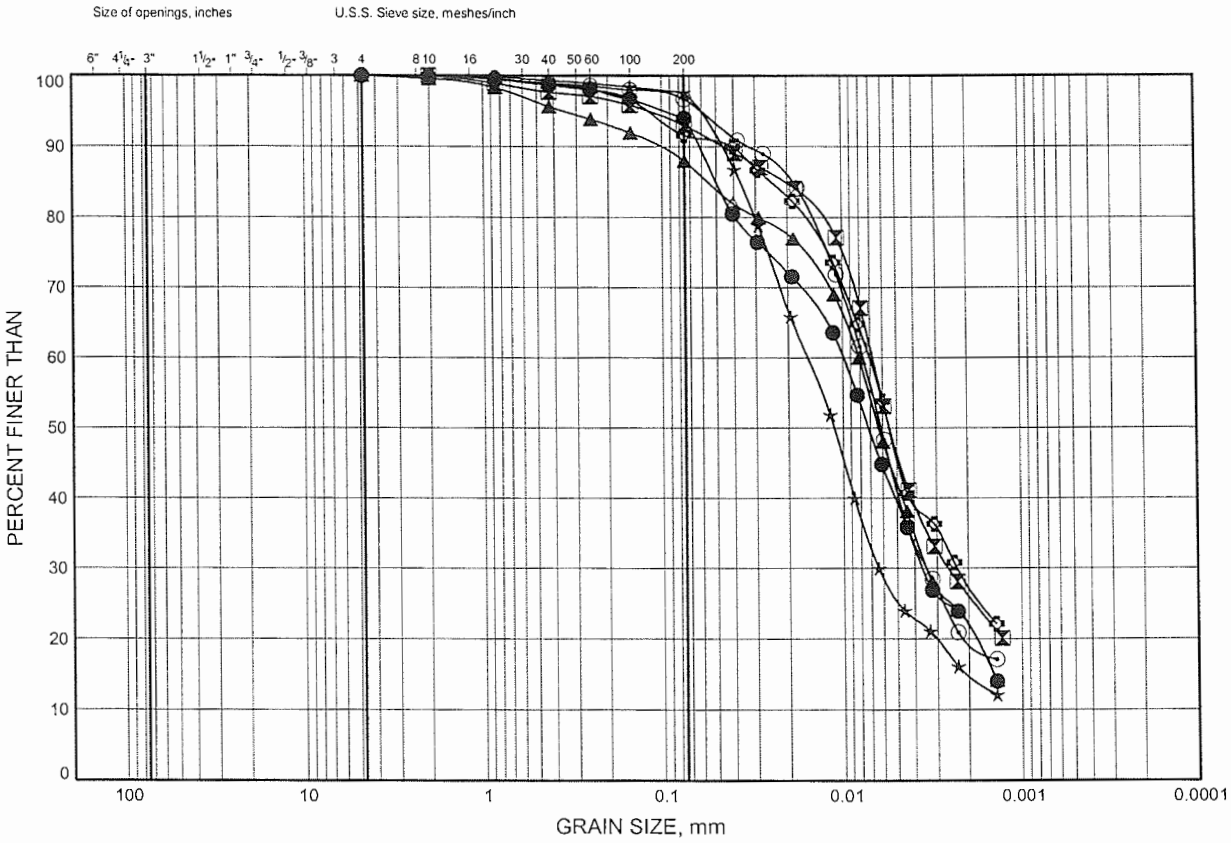
GRAIN SIZE DISTRIBUTION

FIGURE C11

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 N-E 20+737.5 L22	3.35	
⊠	418 N-E 20+750 CL	2.59	
▲	418 N-E 20+762.5 CL	2.59	
★	418 N-E 20+800 CL	2.59	
⊙	418 W-N 20+112.5 CL	2.59	
⌬	418 W-N 20+459 CL	2.59	

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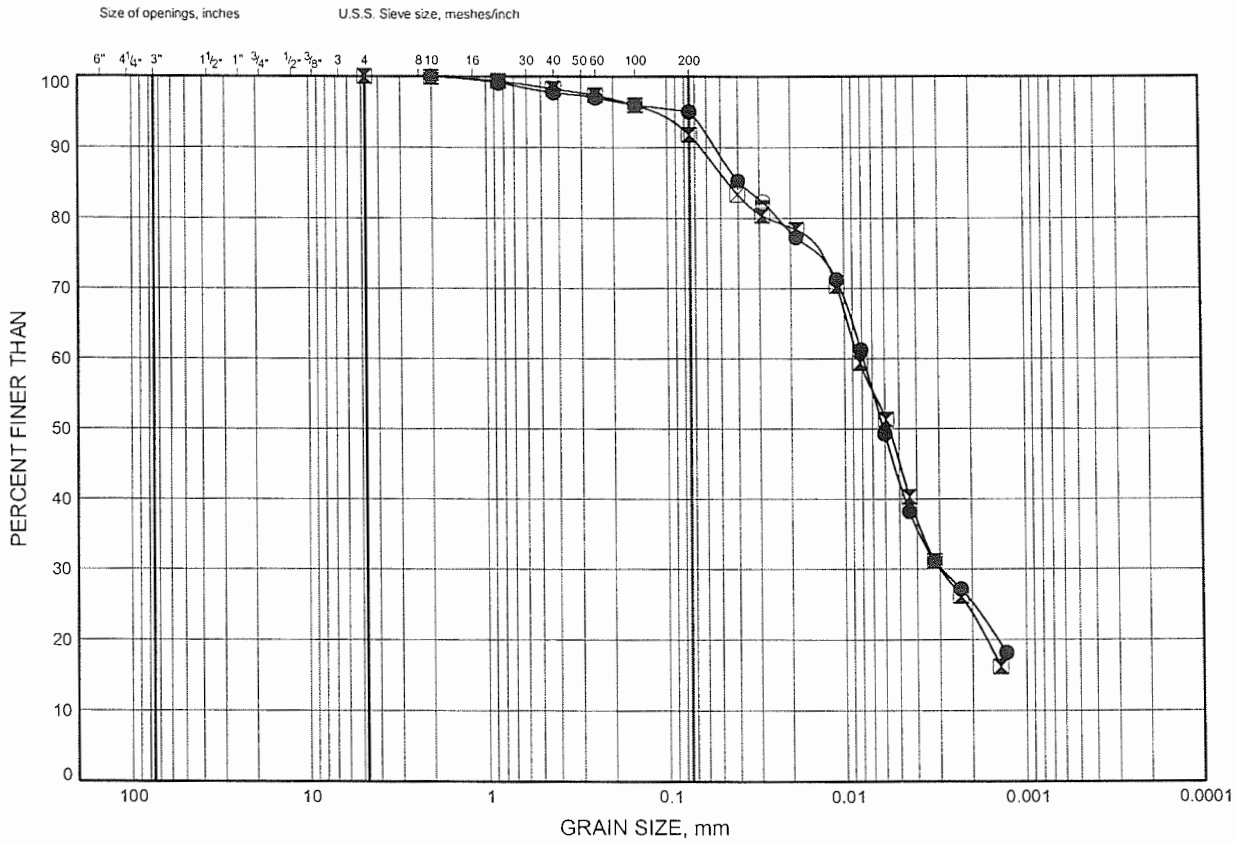
THURBGSD 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C12

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 W-S 20+275 CL	4.88	
⊠	418 W-S 20+325 CL	3.35	

Date December 2004

Project 759-93-00

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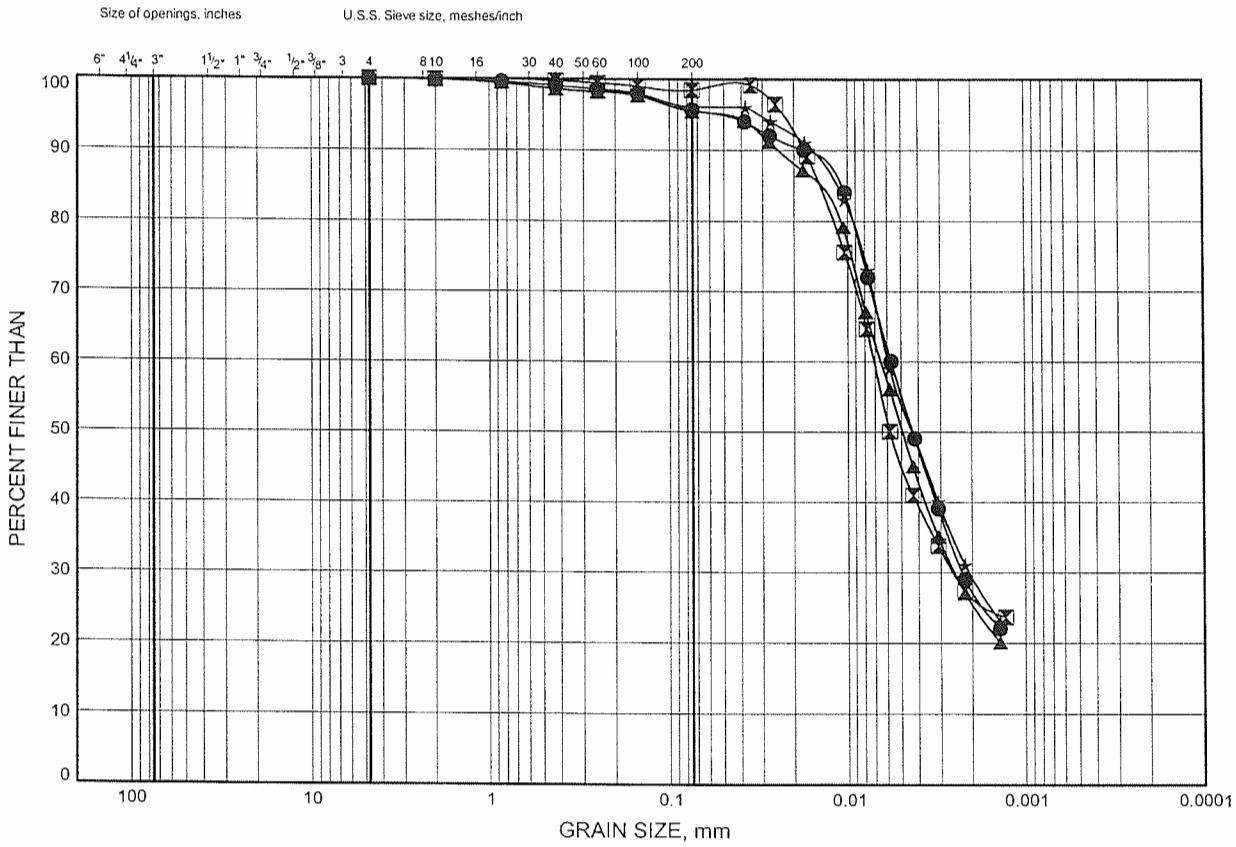
THURBGSD 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C13

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+862.5 R43.5	6.40	
⊠	418 E-N 20+900 CL	1.83	
▲	418 E-S 20+700 CL	1.83	
★	418 E-S 20+725 CL	2.59	

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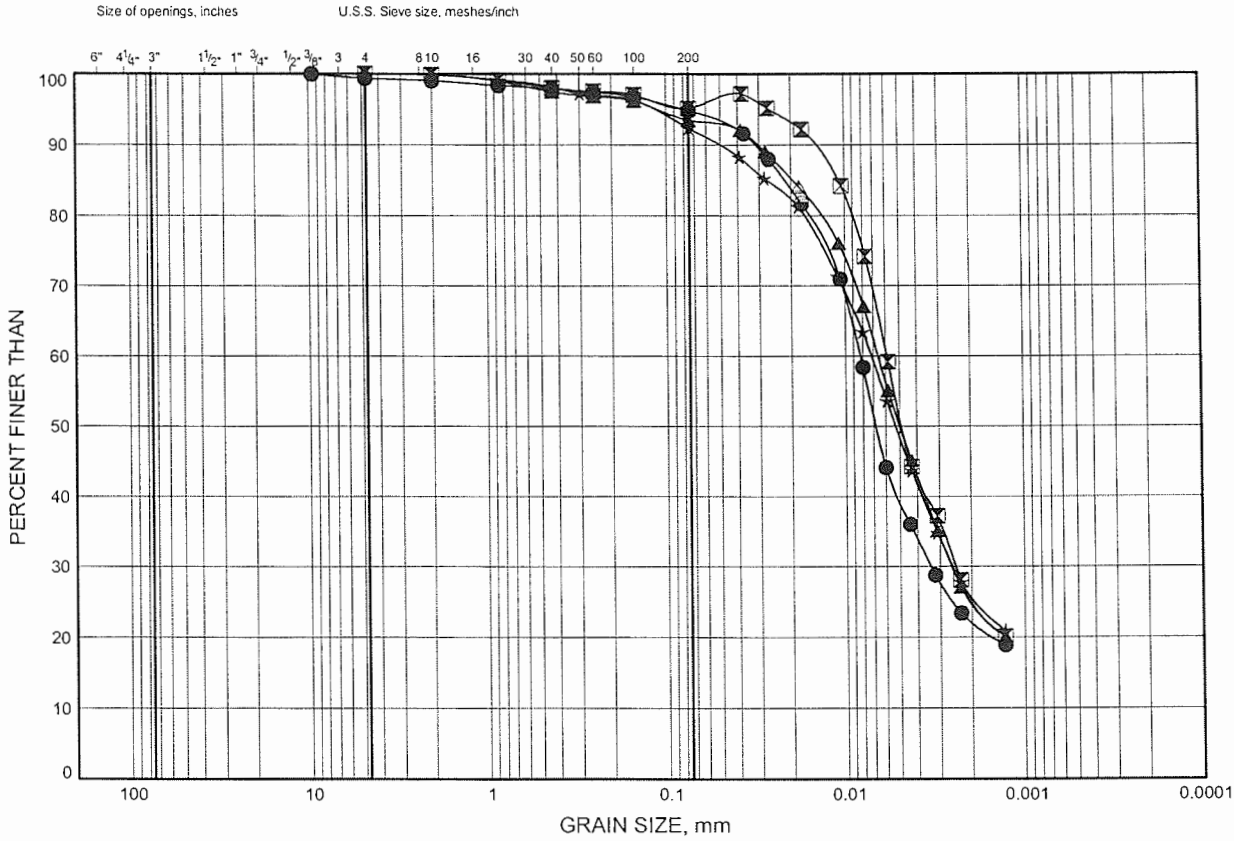
THURBGSD 418HWY124-I.GPJ 20/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE C14

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 N-E 20+675 CL	4.80	
⊠	418 N-E 20+712.5 CL	3.35	
▲	418 N-E 20+725 CL	2.59	
★	418 N-E 20+912.5 CL	6.40	

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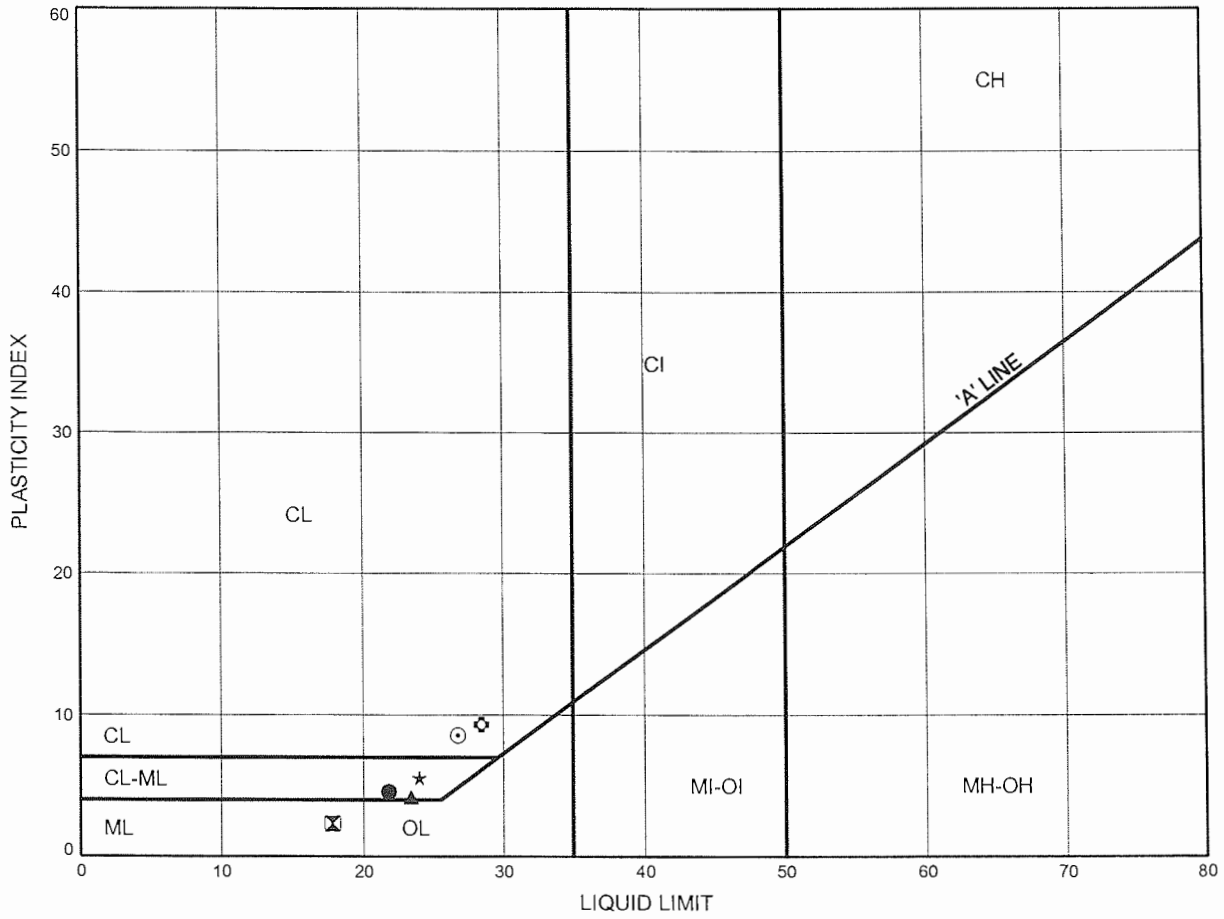
Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE C15



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-N 20+802 CL	3.35	
⊠	418 E-N 20+850 CL	3.35	
▲	418 W-N 20+112.5 CL	2.59	
★	418 W-N 20+459 CL	2.59	
⊙	418 W-S 20+275 CL	4.88	
✿	418 W-S 20+325 CL	3.35	

Date December 2004

Project 759-93-00

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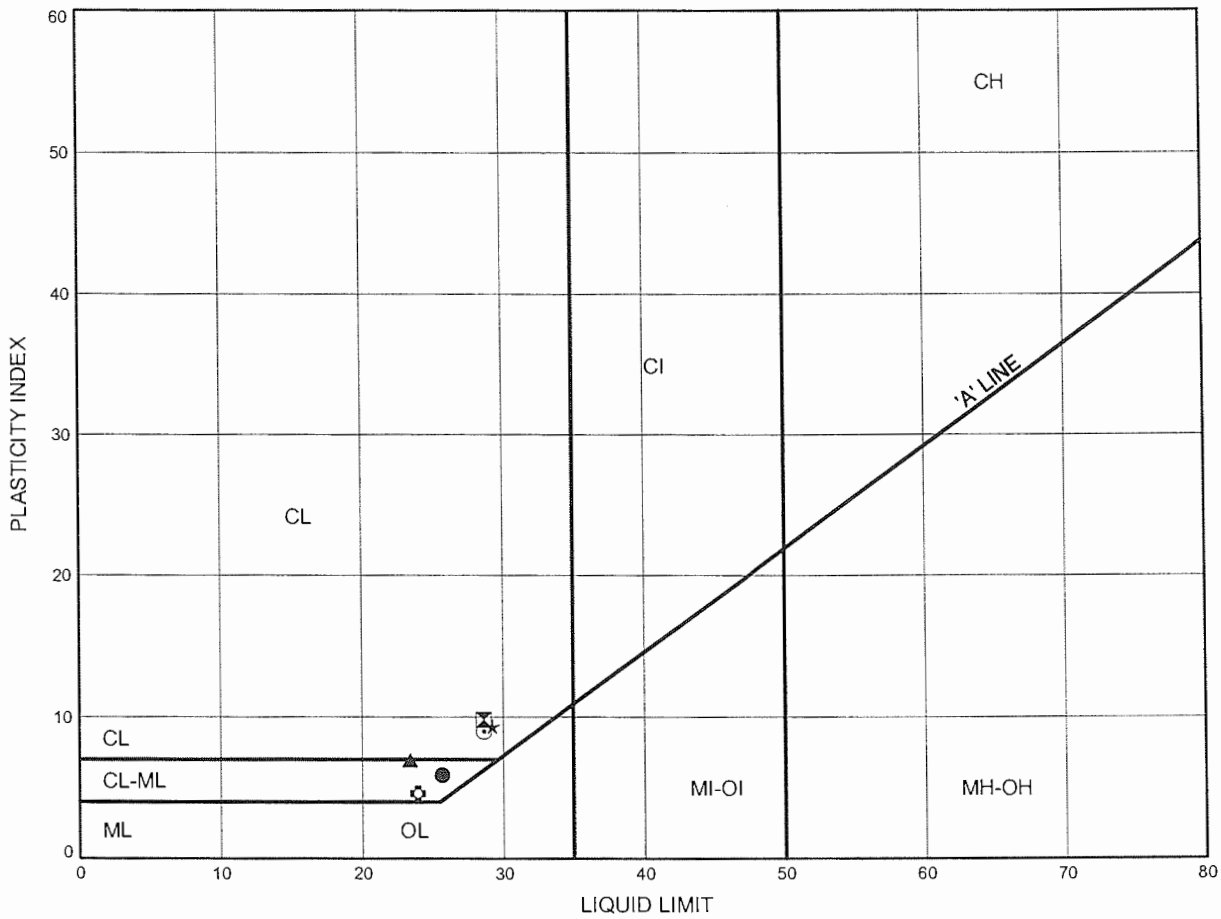
THURBALT 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE C16



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-S 20+537.5 CL	3.35	
⊠	418 E-S 20+550 CL	4.88	
▲	418 E-S 20+570 L18	1.83	
★	418 E-S 20+575 CL	2.59	
⊙	418 E-S 20+600 CL	1.83	
✪	418 E-S 20+612.5 L15	2.59	

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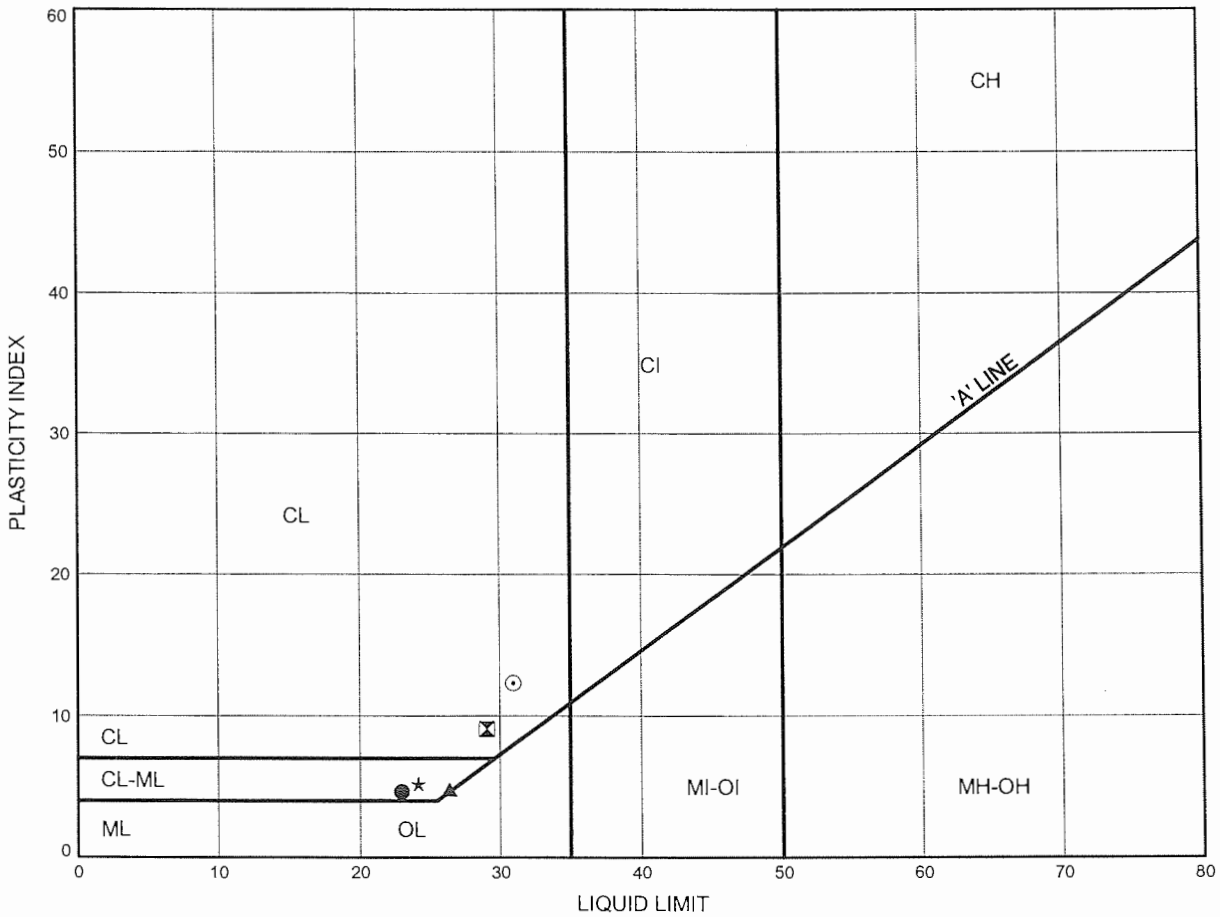
Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE C17



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 E-S 20+650 CL	2.59	
⊠	418 E-S 20+692 R25	2.59	
▲	418 E-S 20+725 CL	2.59	
★	418 E-S 20+775 CL	4.88	
⊙	418 E-S 20+925 CL	7.92	

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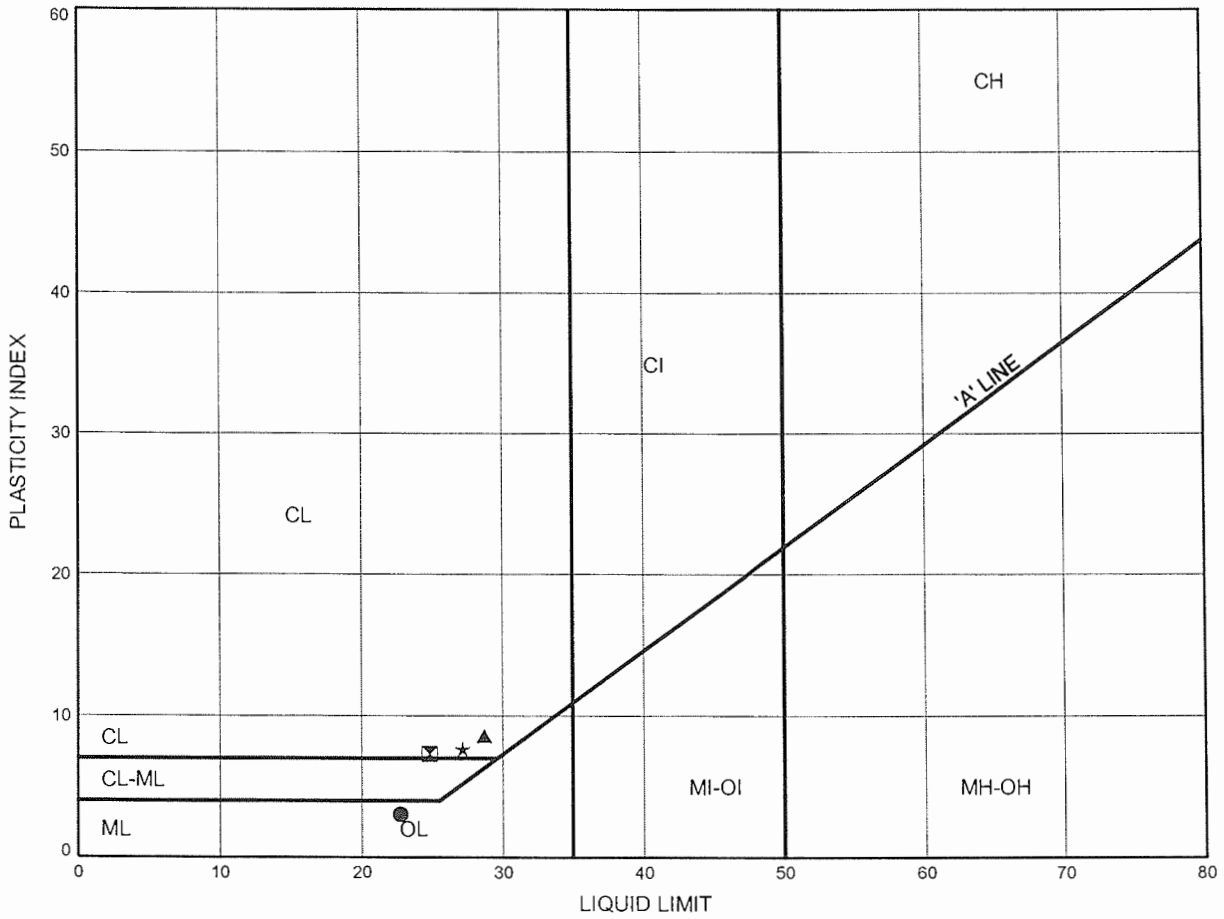
Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE C18



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 N-E 20+625 R1.5	2.59	
⊠	418 N-E 20+737.5 L22	3.35	
▲	418 N-E 20+750 CL	2.59	
★	418 N-E 20+762.5 CL	2.59	

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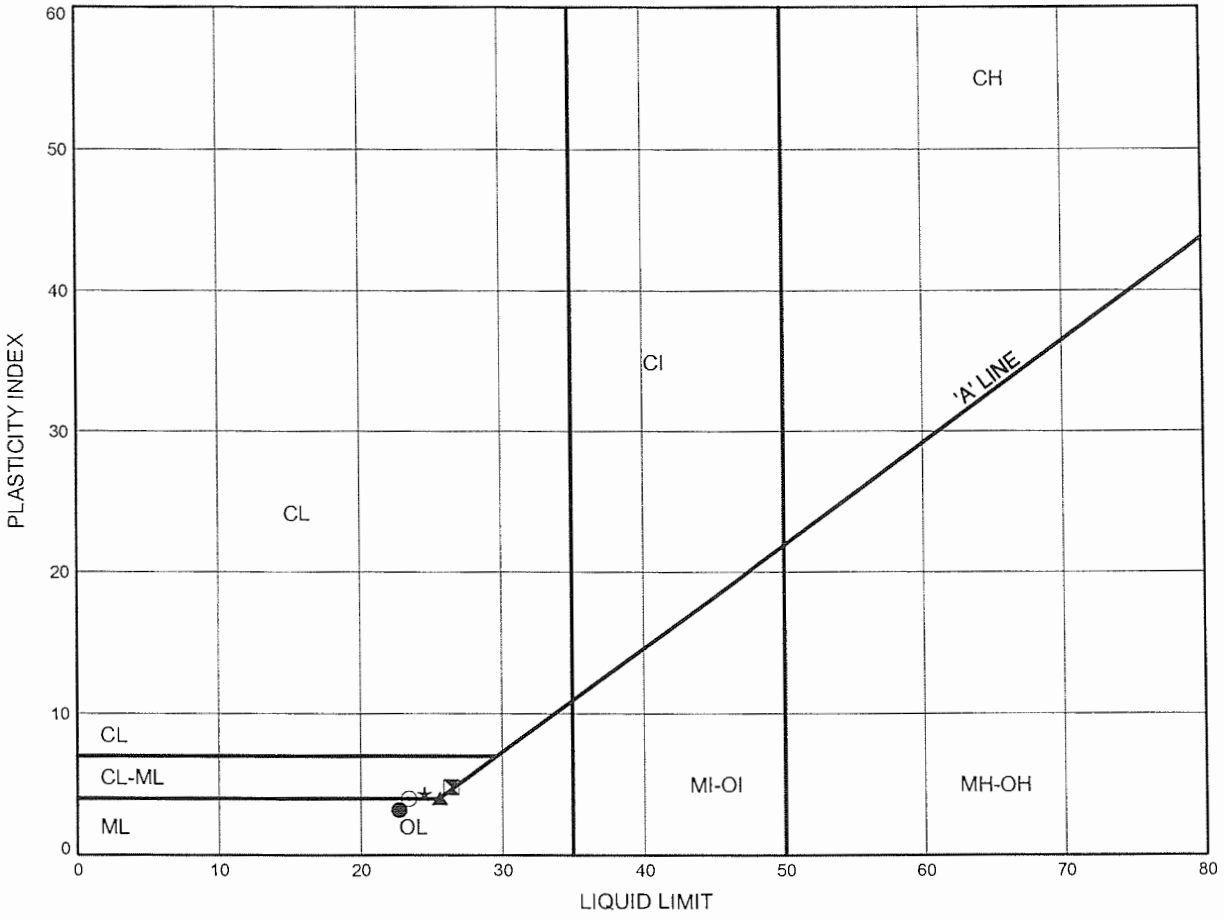
THURBALT 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE C19



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 N-E 20+675 CL	4.80	
⊠	418 N-E 20+712.5 CL	2.59	
▲	418 N-E 20+712.5 CL	3.35	
★	418 N-E 20+725 CL	2.59	
⊙	418 N-E 20+912.5 CL	6.40	

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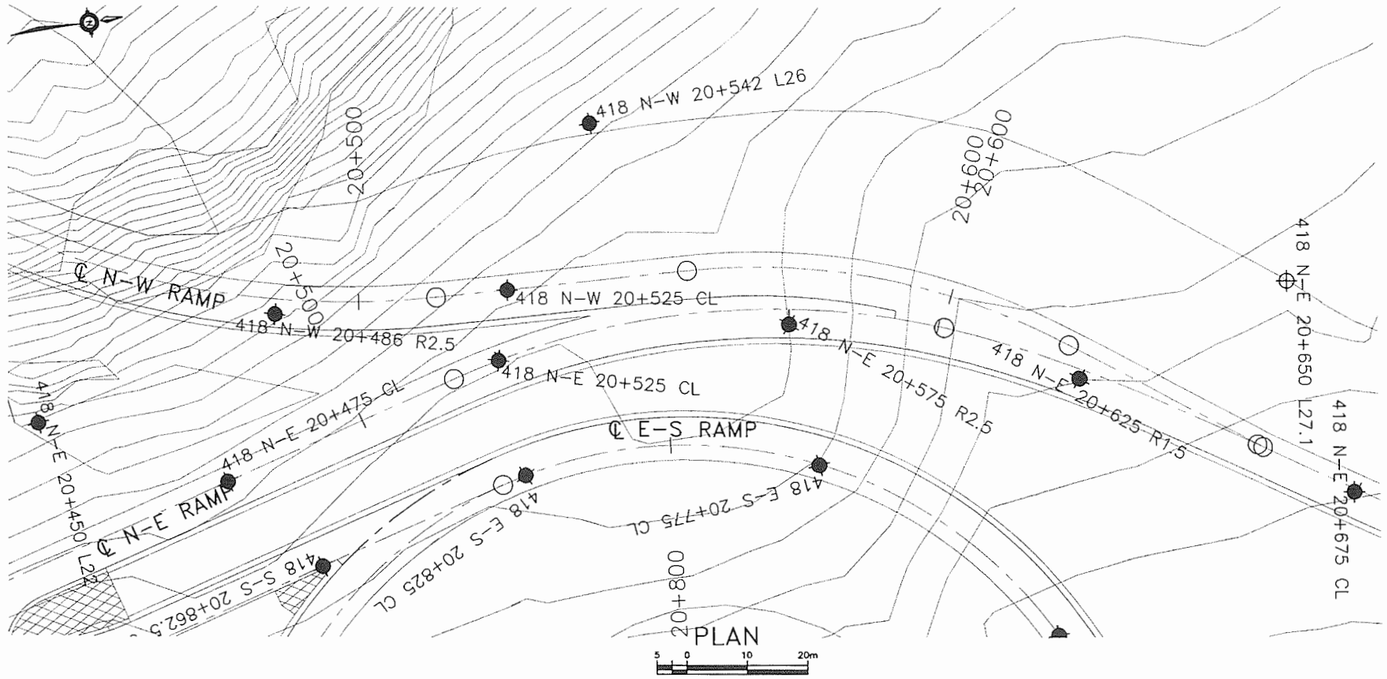
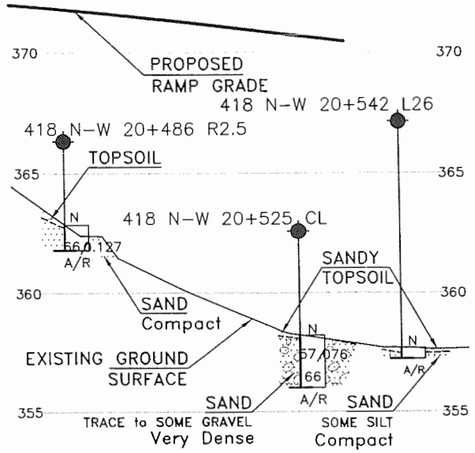
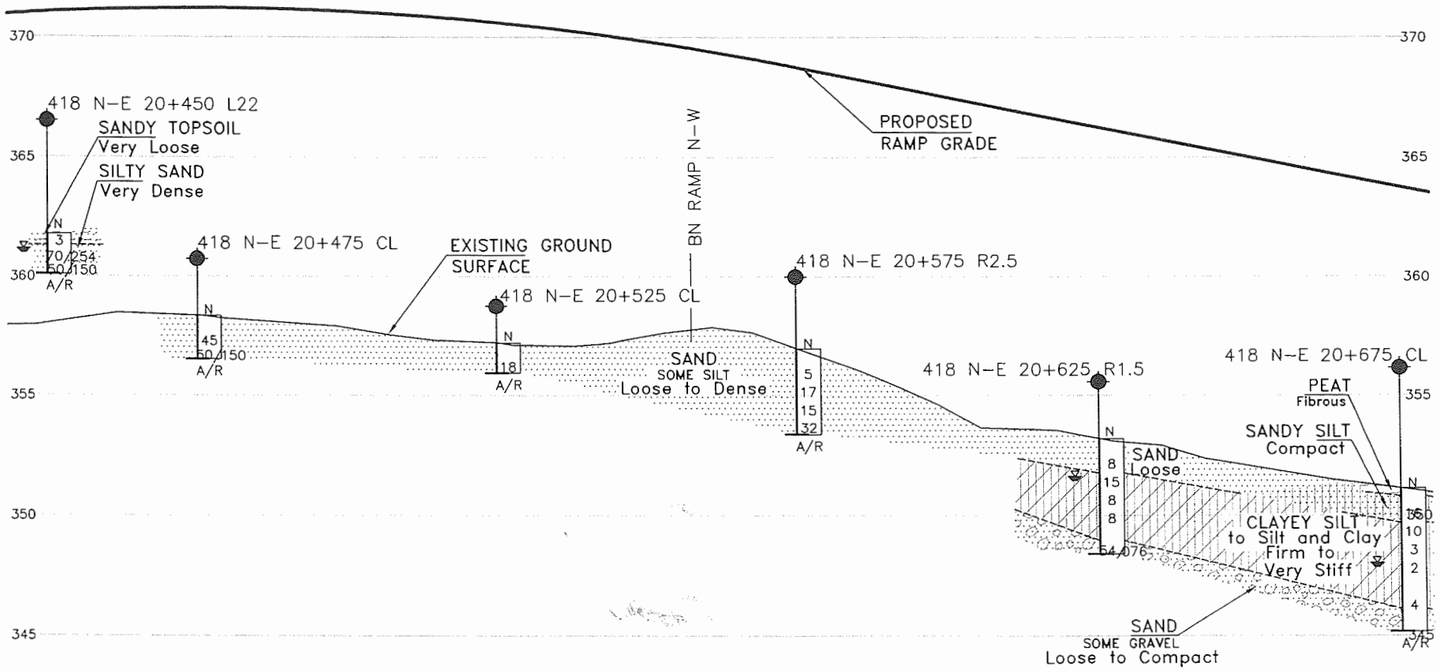






PROFILE N-E RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

PROFILE N-W RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

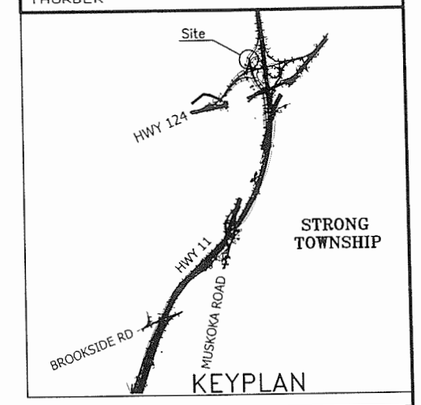
HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
N-E & N-W RAMPS CENTRELINE
N-E : STATIONS 20+450 TO 20+675
N-W : STATIONS 20+486 TO 20+542
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetrotion Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water
▼	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 N-E 20+450 L22	20+450	L22
418 N-E 20+475 CL	20+475	0
418 N-E 20+525 CL	20+525	0
418 N-E 20+575 R2.5	20+575	R2.5
418 N-E 20+625 R1.5	20+625	R1.5
418 N-E 20+675 CL	20+675	0
418 N-W 20+486 R2.5	20+486	R2.5
418 N-W 20+525 CL	20+825	0
418 N-W 20+542 L26	20+542	L26

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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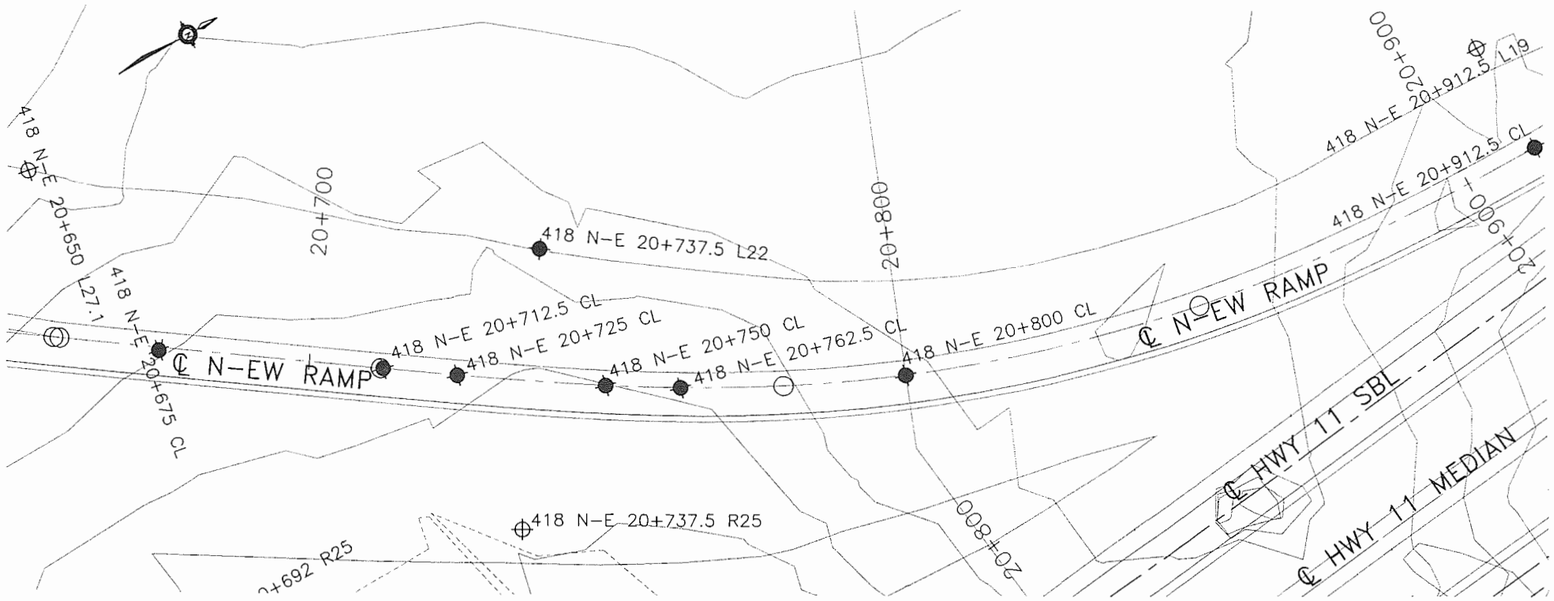
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

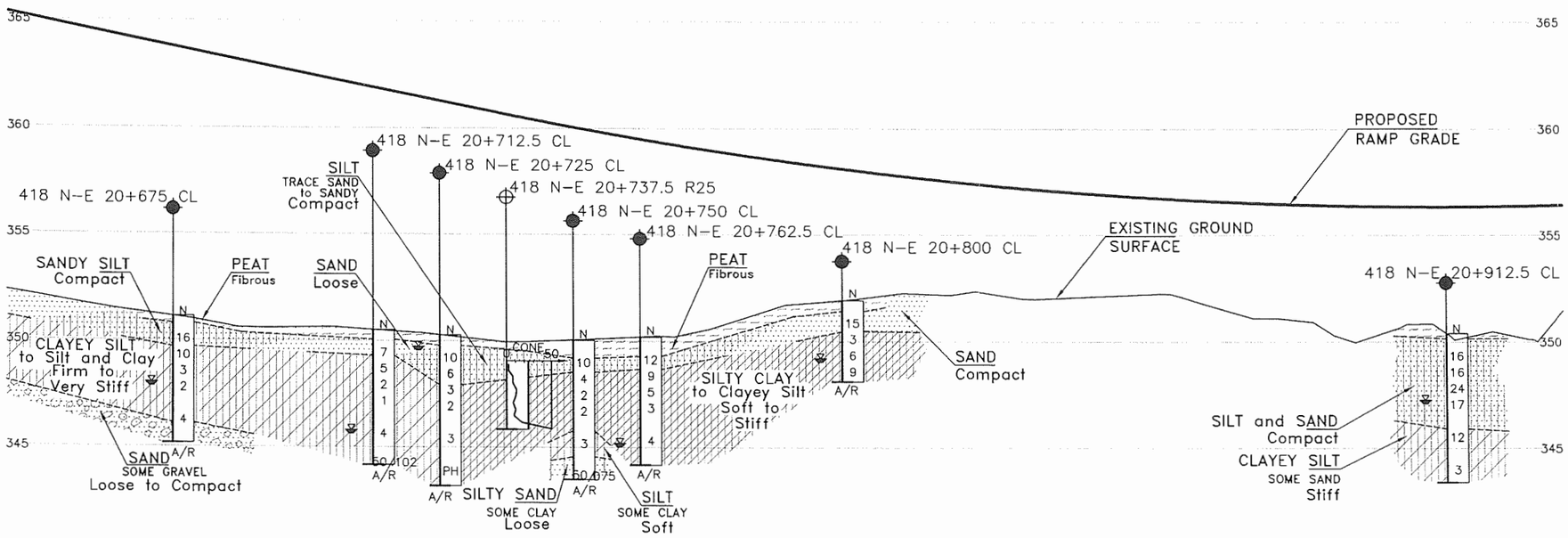
REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E1



PLAN

5 0 10 20m



PROFILE ℄ N-EW RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
N-EW RAMP CENTRELINE
STATIONS 20+675 TO 20+913
BOREHOLE LOCATIONS AND SOIL STRATA

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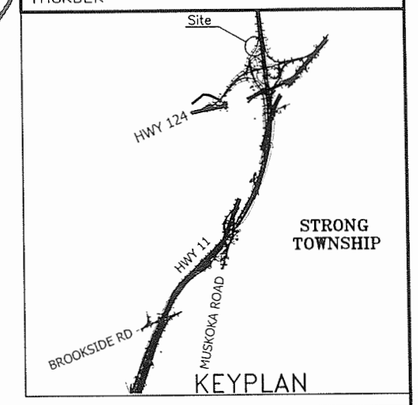
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

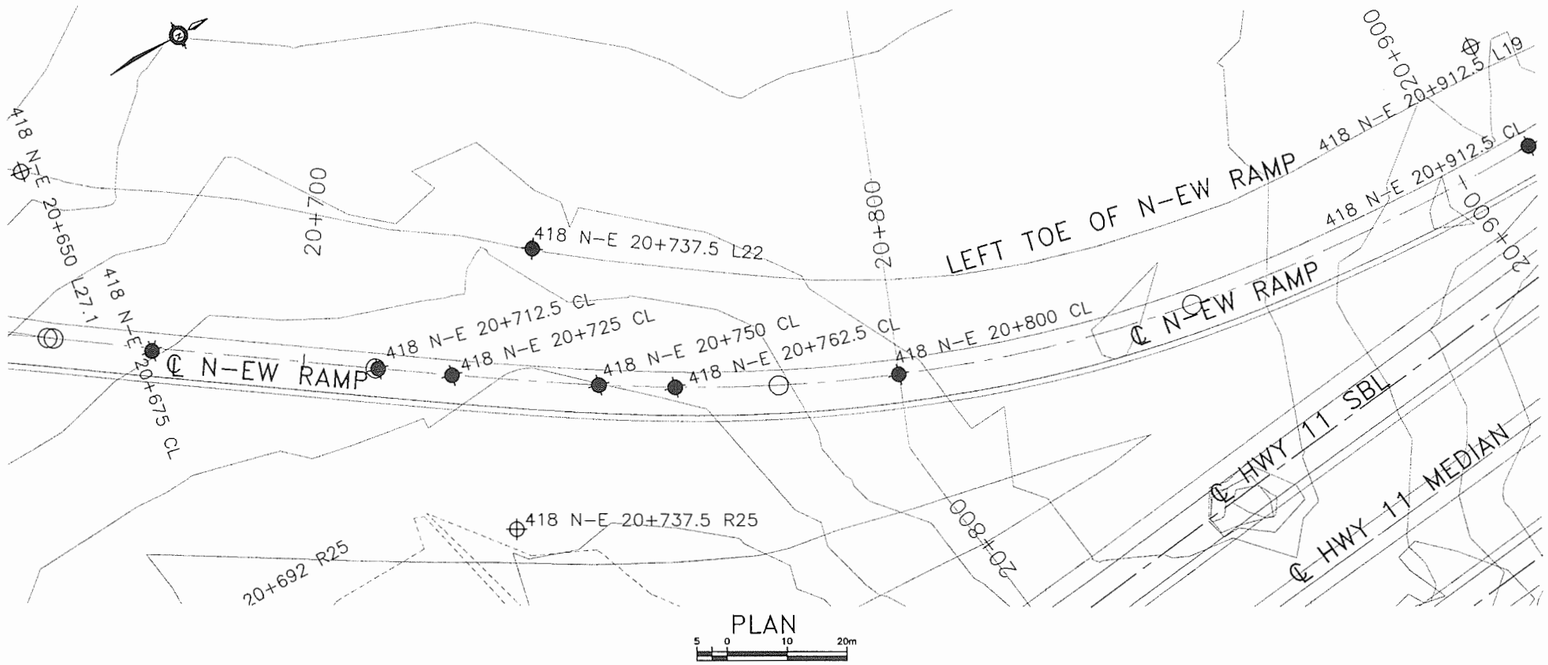
NO	STATION	OFFSET FROM MEDIAN CL
418 N-E 20+675 CL	20+675	0
418 N-E 20+712.5 CL	20+712.5	0
418 N-E 20+725 CL	20+725	0
418 N-E 20+737.5 L22	20+737.5	L22
418 N-E 20+737.5 R25	20+737.5	R25
418 N-E 20+750 CL	20+750	0
418 N-E 20+762.5 CL	20+762.5	0
418 N-E 20+800 CL	20+800	0
418 N-E 20+912.5 L19	20+912.5	L19
418 N-E 20+912.5 CL	20+912.5	0

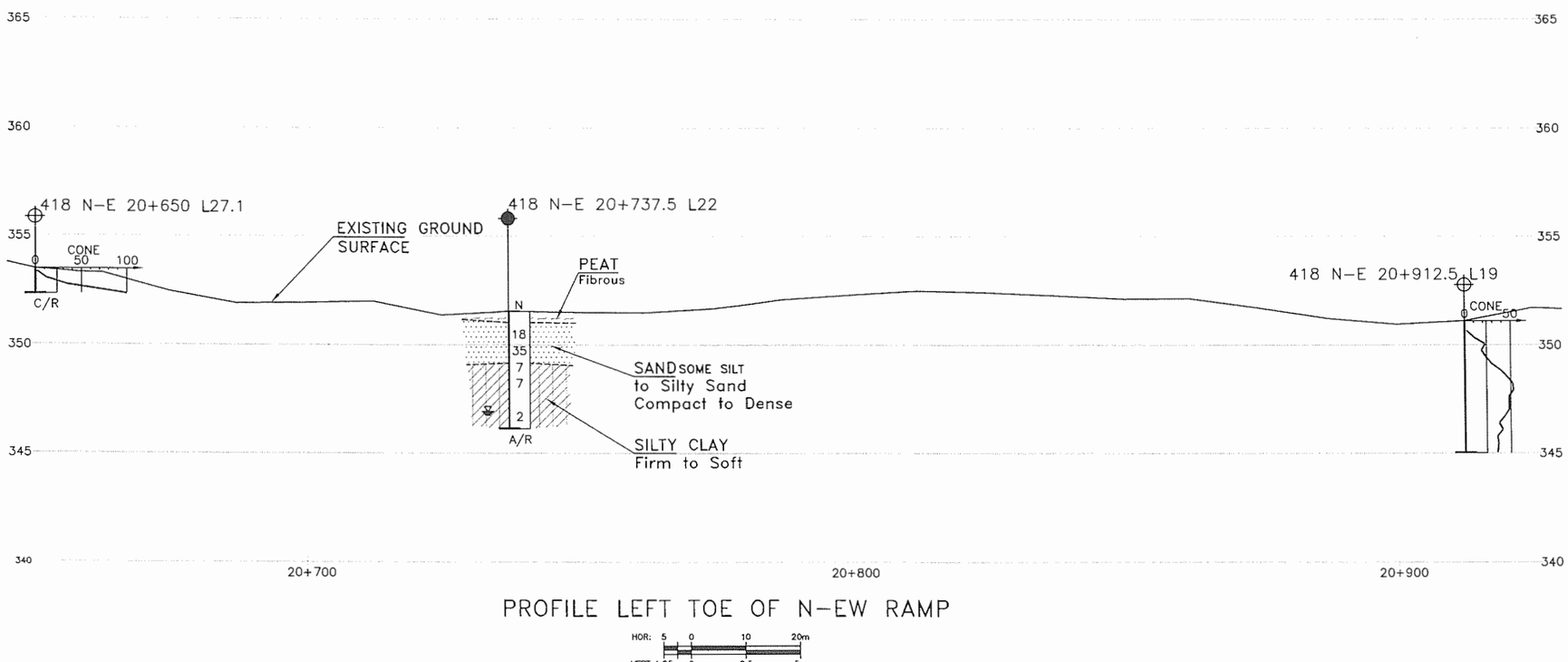
NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E2





METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
N-EW RAMP LEFT TOE
STATIONS 20+650 TO 20+913
BOREHOLE LOCATIONS AND SOIL STRATA

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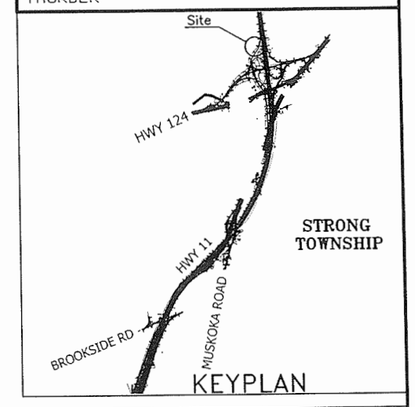
Feb 7/07
PROVINCE OF ONTARIO



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesion Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 N-E 20+650 L27.1	20+650	L27.1
418 N-E 20+675 CL	20+675	0
418 N-E 20+712.5 CL	20+712.5	0
418 N-E 20+725 CL	20+725	0
418 N-E 20+737.5 L22	20+737.5	L22
418 N-E 20+737.5 R25	20+737.5	R25
418 N-E 20+750 CL	20+750	0
418 N-E 20+762.5 CL	20+762.5	0
418 N-E 20+800 CL	20+800	0
418 N-E 20+912.5 L19	20+912.5	L19
418 N-E 20+912.5 CL	20+912.5	0

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E3

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

HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
W-S RAMP CL & RIGHT TOE
STATIONS 20+050 TO 20+375
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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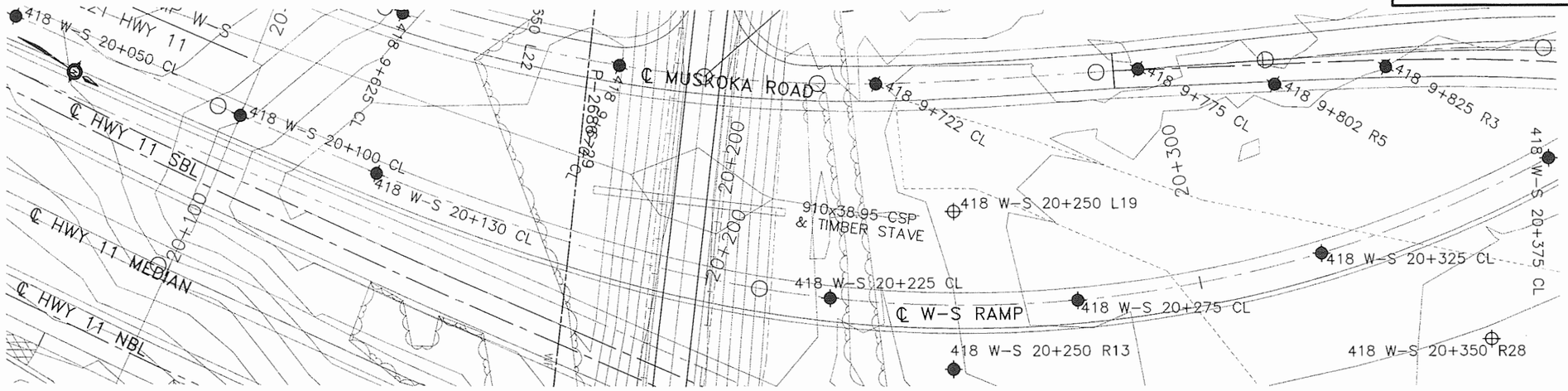
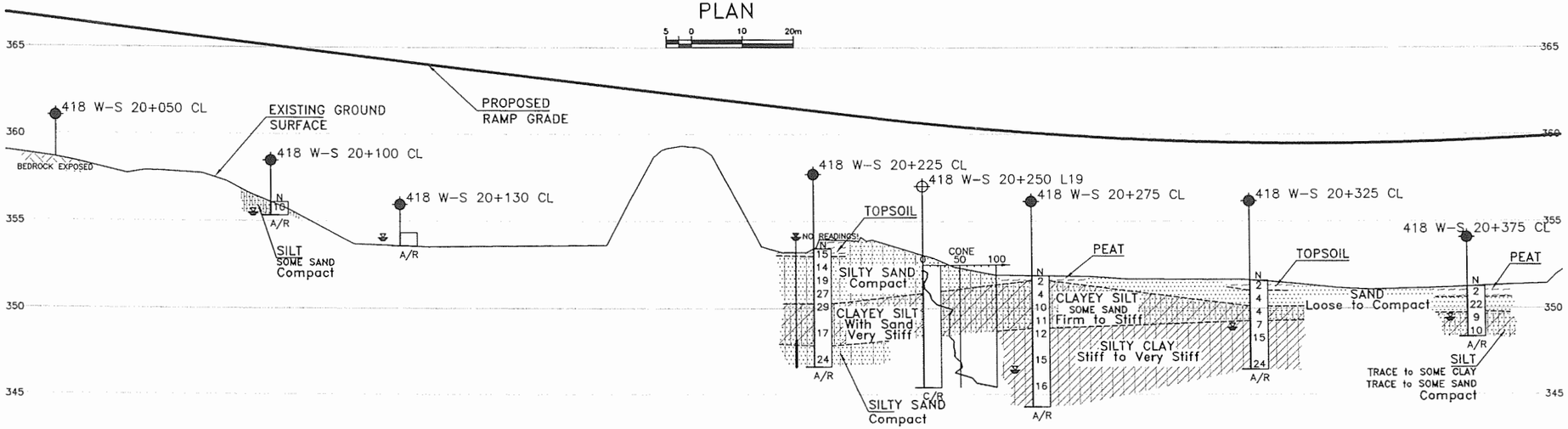
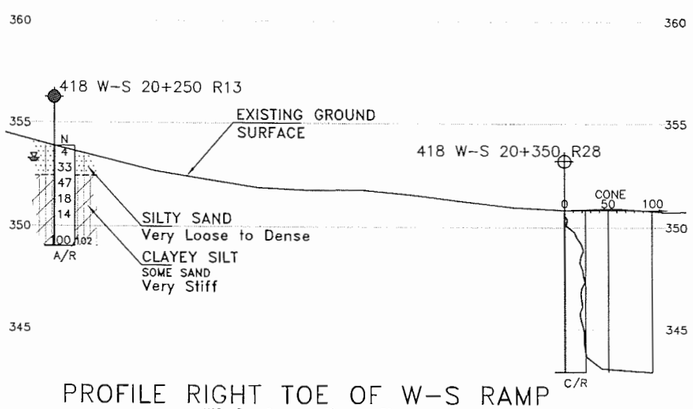


PLAN



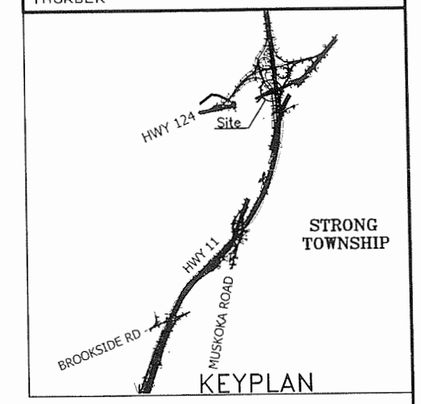
PROFILE ℄ W-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE RIGHT TOE OF W-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 W-S 20+050 CL	20+050	0
418 W-S 20+100 CL	20+100	0
418 W-S 20+130 CL	20+130	0
418 W-S 20+225 CL	20+225	0
418 W-S 20+250 L19	20+250	L19
418 W-S 20+250 R13	20+250	R13
418 W-S 20+275 CL	20+275	0
418 W-S 20+325 CL	20+325	0
418 W-S 20+350 R28	20+350	R28
418 W-S 20+375 CL	20+375	0

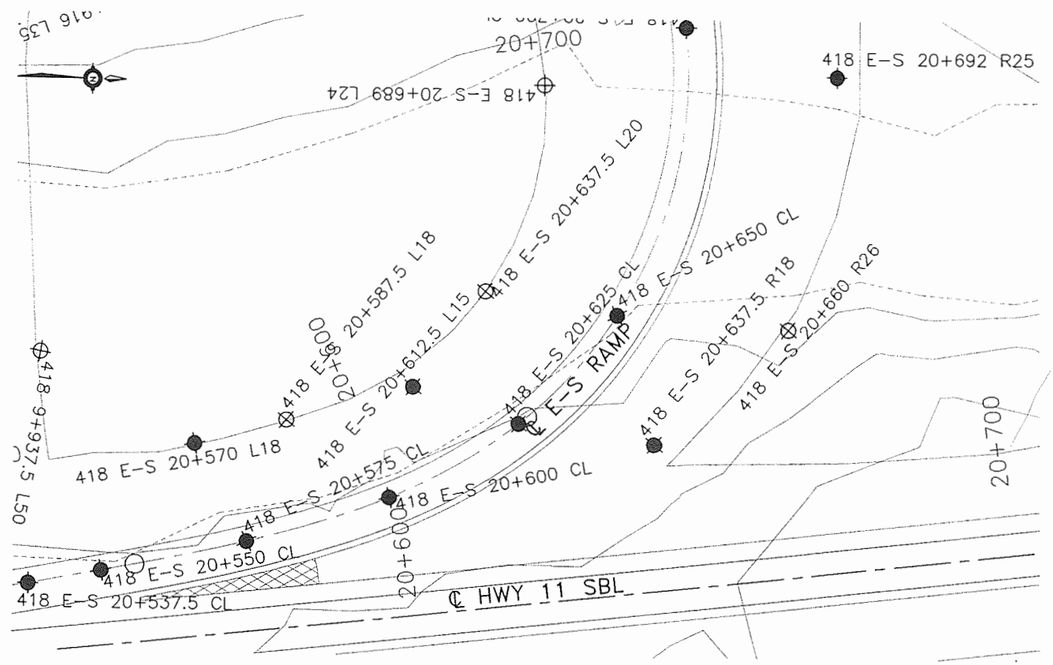
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

ORAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

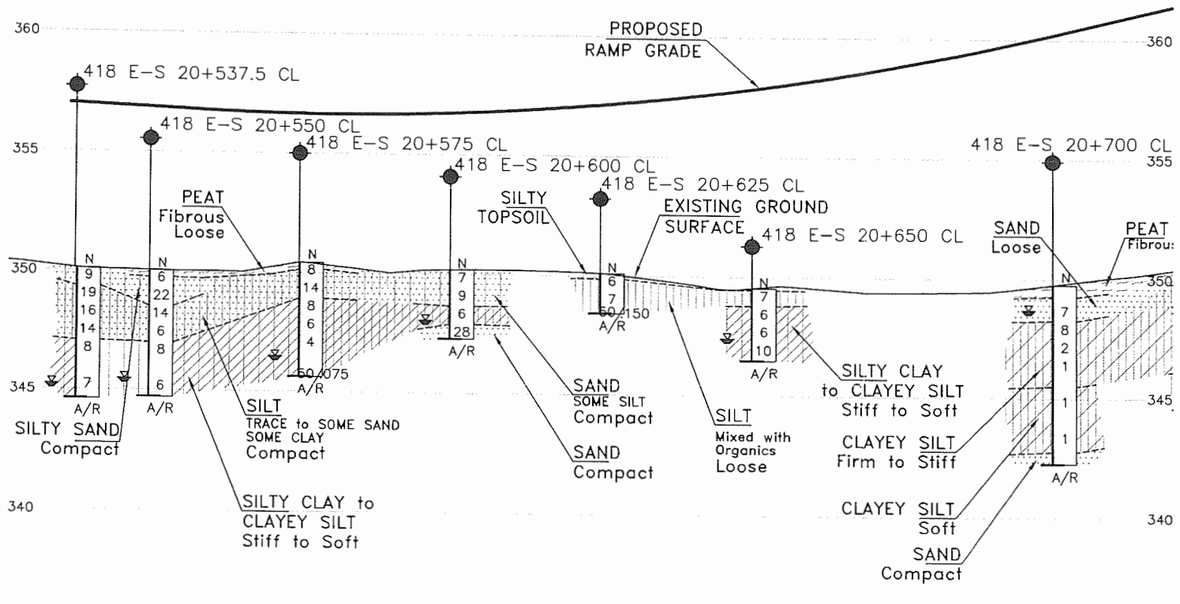
REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E4



PLAN

5 0 10 20m



PROFILE ℄ E-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

NO	STATION	OFFSET FROM MEDIAN CL
418 E-S 20+692 R25	20+692	R25
418 E-S 20+700 CL	20+700	0

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

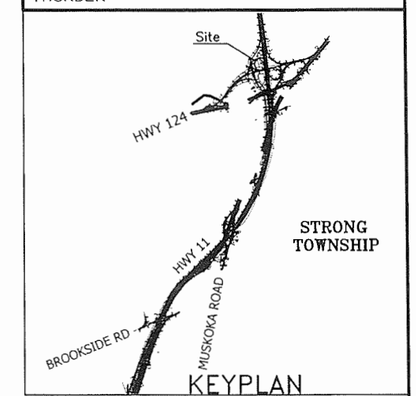
HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
E-S RAMP CENTRELINE
STATIONS 20+537 TO 20+700
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
⊥	Head Artesian Water
↓	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 E-S 20+537.5 CL	20+537.5	0
418 E-S 20+550 CL	20+550	0
418 E-S 20+570 L18	20+570	L18
418 E-S 20+575 CL	20+575	0
418 E-S 20+587.5 L18	20+587.5	L18
418 E-S 20+600 CL	20+600	0
418 E-S 20+612.5 L15	20+612.5	L15
418 E-S 20+625 CL	20+625	0
418 E-S 20+637.5 L20	20+637.5	L20
418 E-S 20+637.5 R18	20+637.5	R18
418 E-S 20+650 CL	20+650	0
418 E-S 20+660 R26	20+660	R26
418 E-S 20+689 L24	20+689	L24

— NOTE —

The boundaries between soil strata have been established only ot Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD		DATE FEB 2007
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E5

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
E-S RAMP LEFT&RIGHT TOE
STATIONS 20+500 TO 20+700
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Marshall Macklin Monaghan
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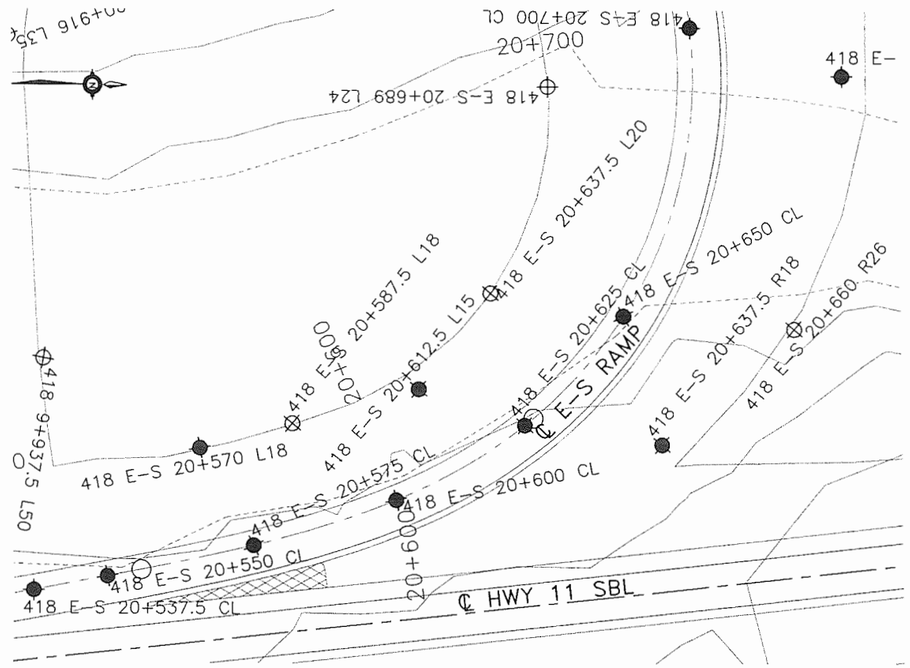
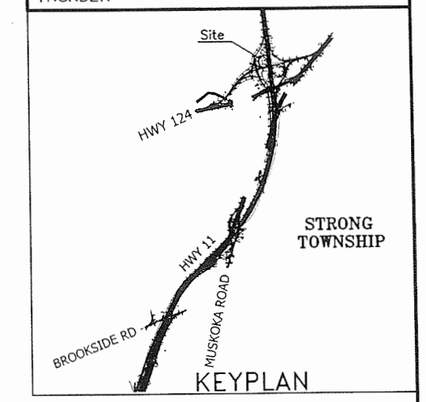
NO	STATION	OFFSET FROM MEDIAN CL
418 E-S 20+692 R25	20+692	R25
418 E-S 20+700 CL	20+700	0

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANDO
Feb 7/07
PROVINCE OF ONTARIO



PLAN



KEYPLAN

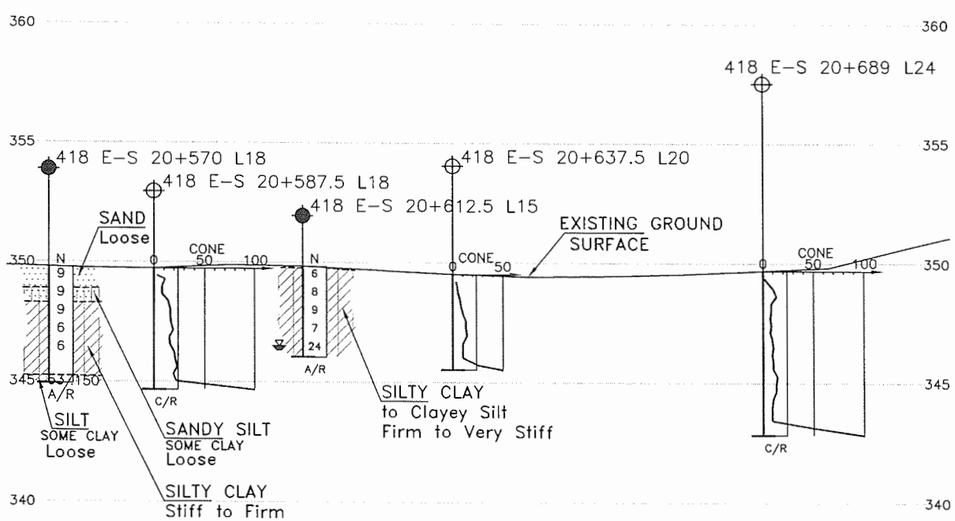
LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 E-S 20+537.5 CL	20+537.5	0
418 E-S 20+550 CL	20+550	0
418 E-S 20+570 L18	20+570	L18
418 E-S 20+575 CL	20+575	0
418 E-S 20+587.5 L18	20+587.5	L18
418 E-S 20+600 CL	20+600	0
418 E-S 20+612.5 L15	20+612.5	L15
418 E-S 20+625 CL	20+625	0
418 E-S 20+637.5 L20	20+637.5	L20
418 E-S 20+637.5 R18	20+637.5	R18
418 E-S 20+650 CL	20+650	0
418 E-S 20+660 R26	20+660	R26
418 E-S 20+689 L24	20+689	L24

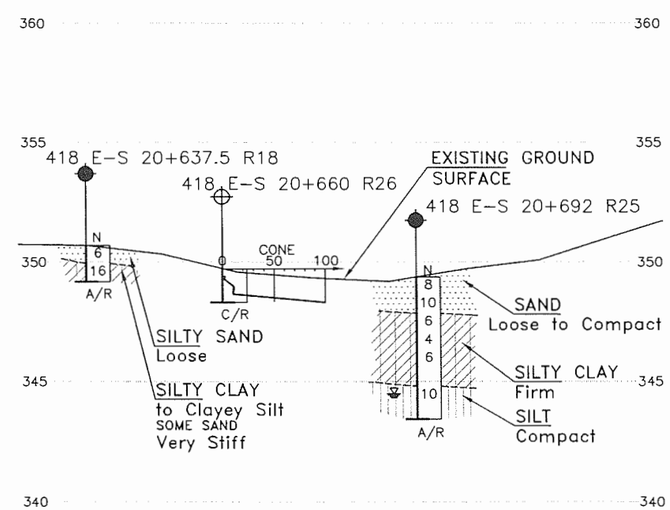
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



PROFILE LEFT TOE OF E-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE RIGHT TOE OF E-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E6

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

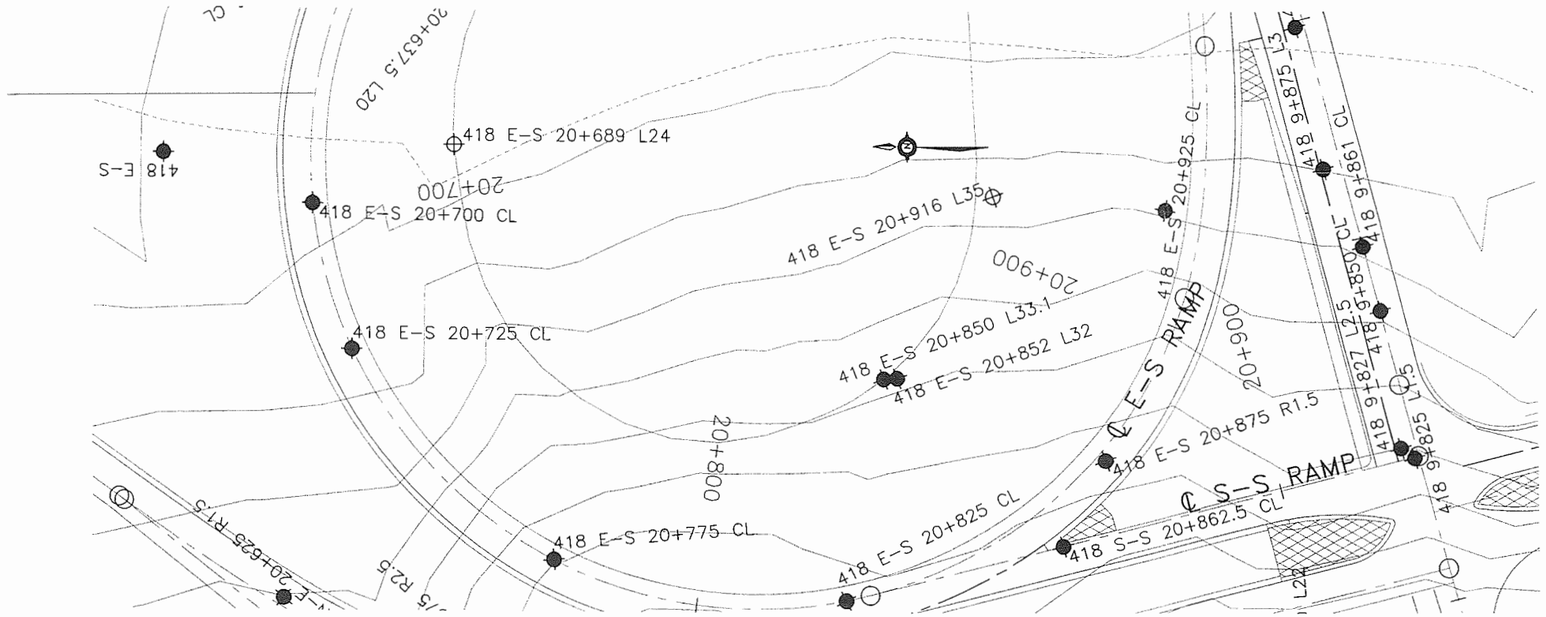
HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
E-S & S-S RAMPS CENTRELINE
STATIONS 20+694 TO 20+950
BOREHOLE LOCATIONS AND SOIL STRATA

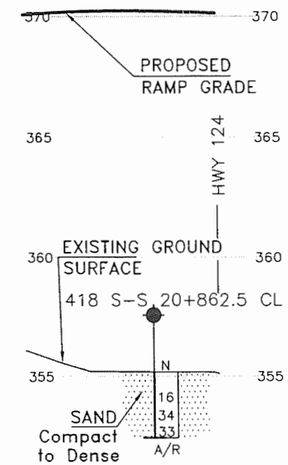
SHEET

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

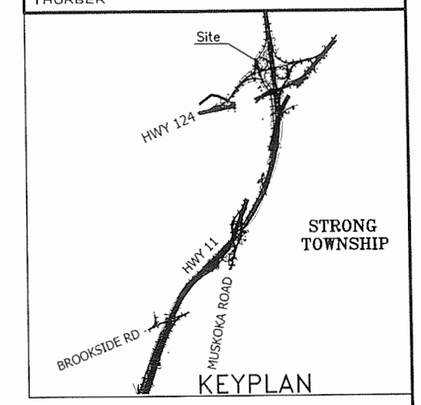


PLAN

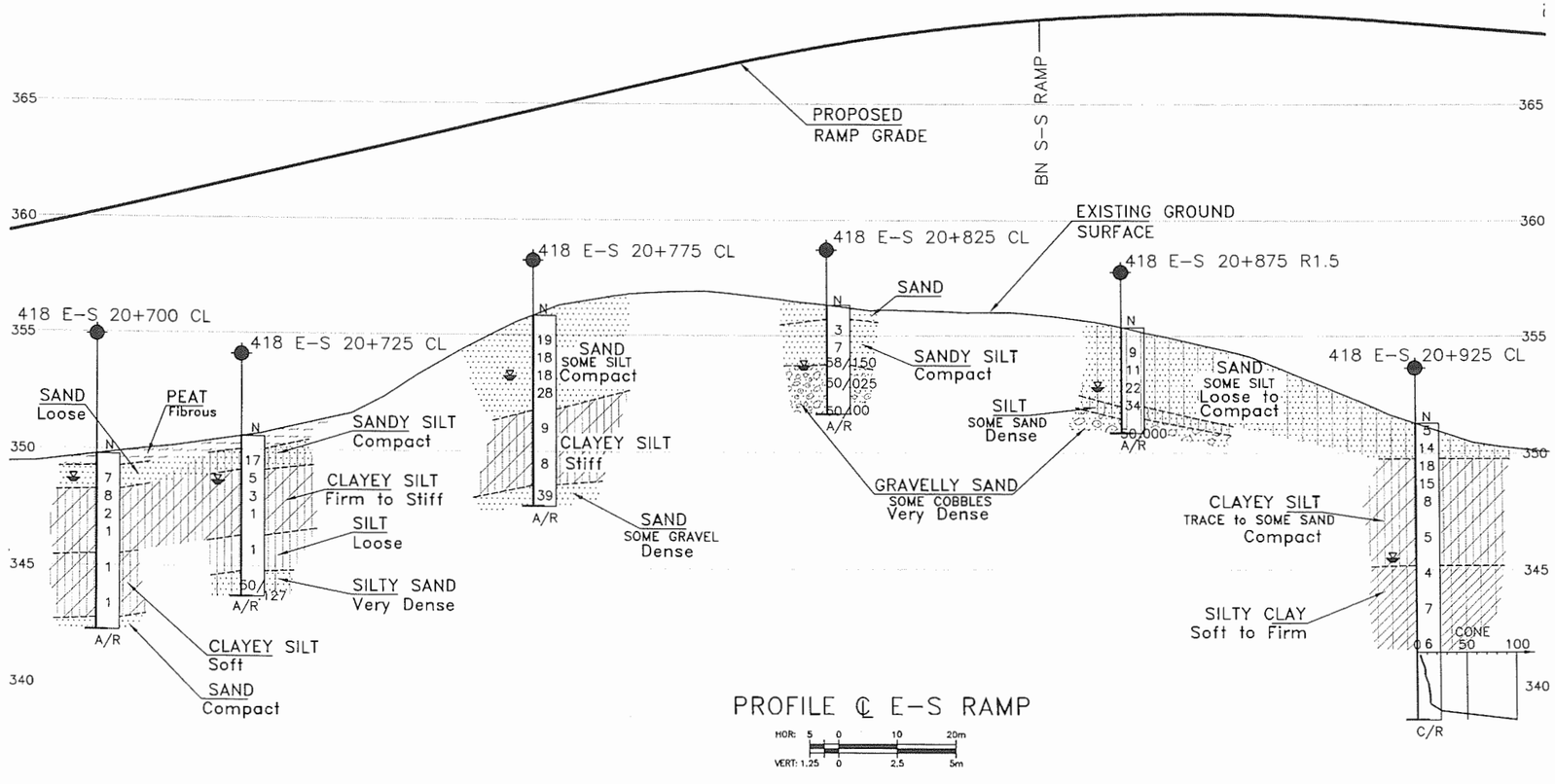


PROFILE S-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



KEYPLAN



PROFILE ℄ E-S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
1 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydroulic
▼	WL in Piezometer at Time of Investigation (Dote)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 E-S 20+689 L24	20+689	L24
418 E-S 20+692 R25	20+692	R25
418 E-S 20+700 CL	20+700	0
418 E-S 20+725 CL	20+725	0
418 E-S 20+775 CL	20+775	0
418 E-S 20+825 CL	20+825	0
418 E-S 20+850 L33.1	20+850	L33.1
418 E-S 20+852 L32	20+852	L32
418 E-S 20+875 R1.5	20+875	R1.5
418 E-S 20+916 L35	20+916	L35
418 E-S 20+925 CL	20+925	0
418 S-S 20+862.5 CL	20+862.5	0

NOTE—

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E7

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

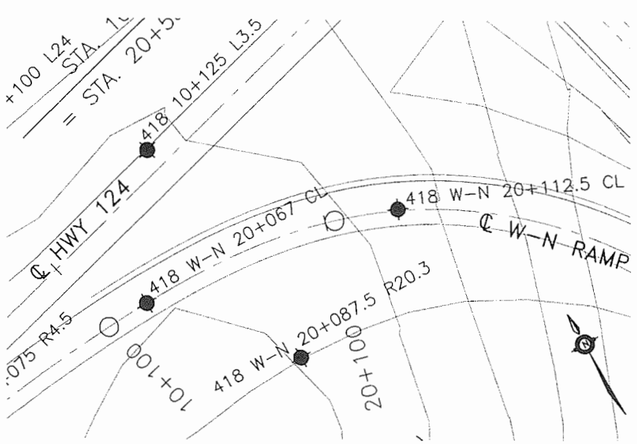
HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
W-N RAMP CENTRELINE
STATIONS 20+067 TO 20+459
BOREHOLE LOCATIONS AND SOIL STRATA

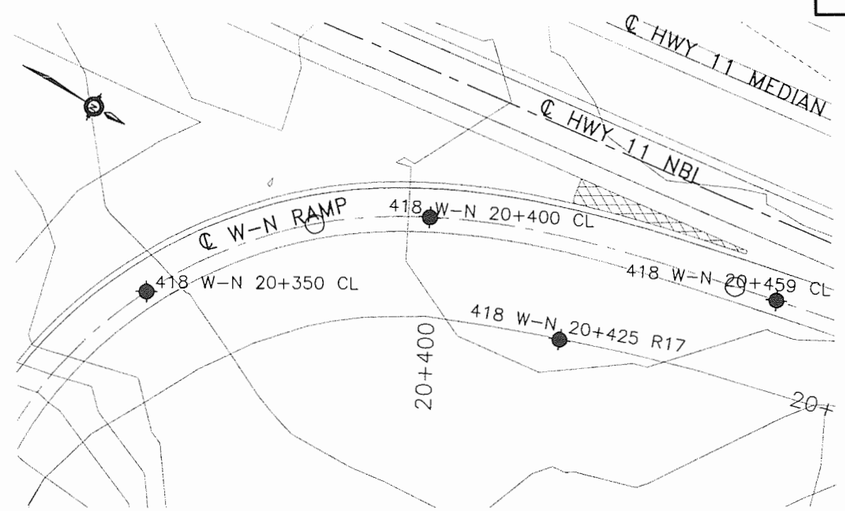
SHEET

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

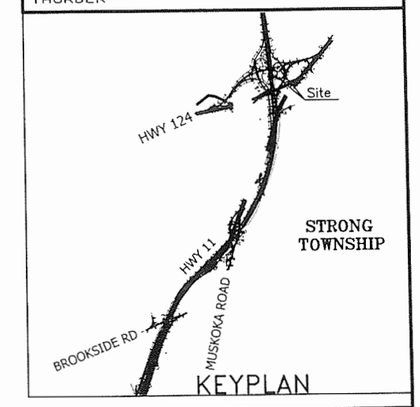
THURBER ENGINEERING LTD.



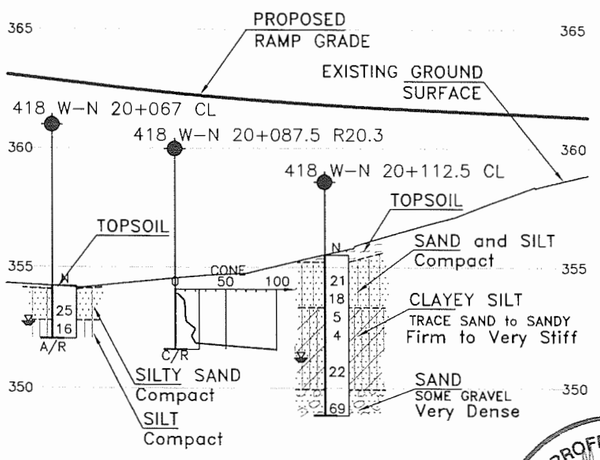
PLAN



PLAN

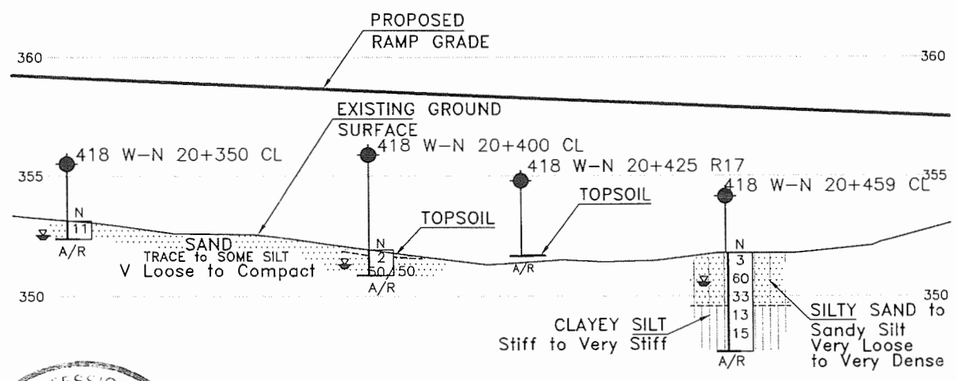


KEYPLAN



PROFILE ℄ W-N RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE ℄ W-N RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 W-N 20+067 CL	20+067	0
418 W-N 20+087.5 R20.3	20+087.5	R20.3
418 W-N 20+112.5 CL	20+112.5	0
418 W-N 20+350 CL	20+350	0
418 W-N 20+400 CL	20+400	0
418 W-N 20+425 R17	20+425	R17
418 W-N 20+459 CL	20+459	0

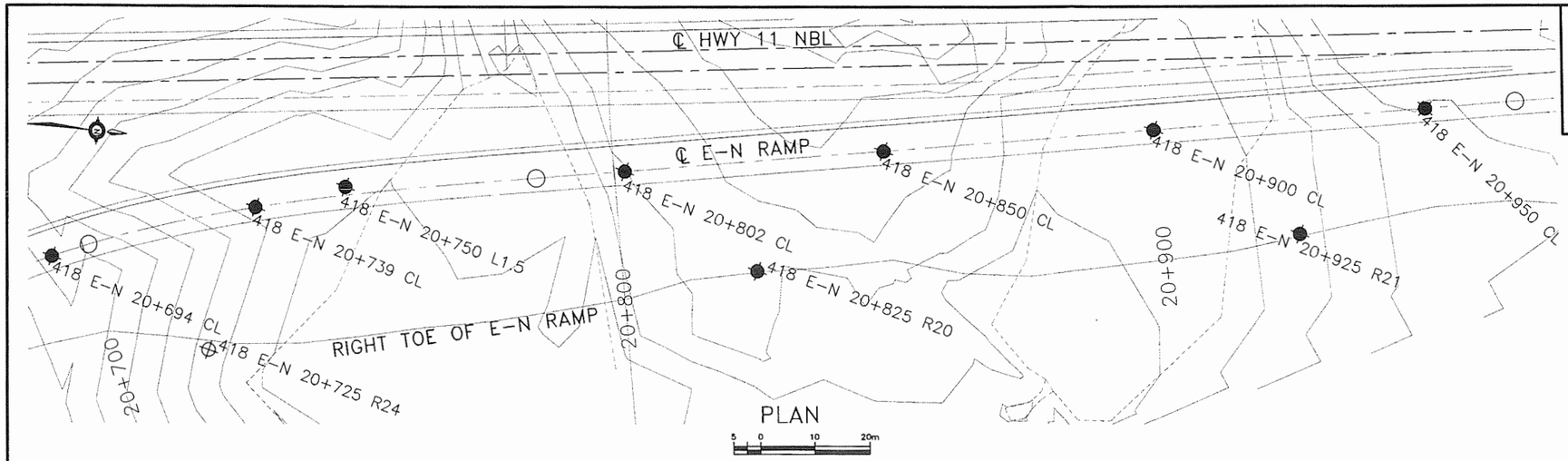
— NOTE —

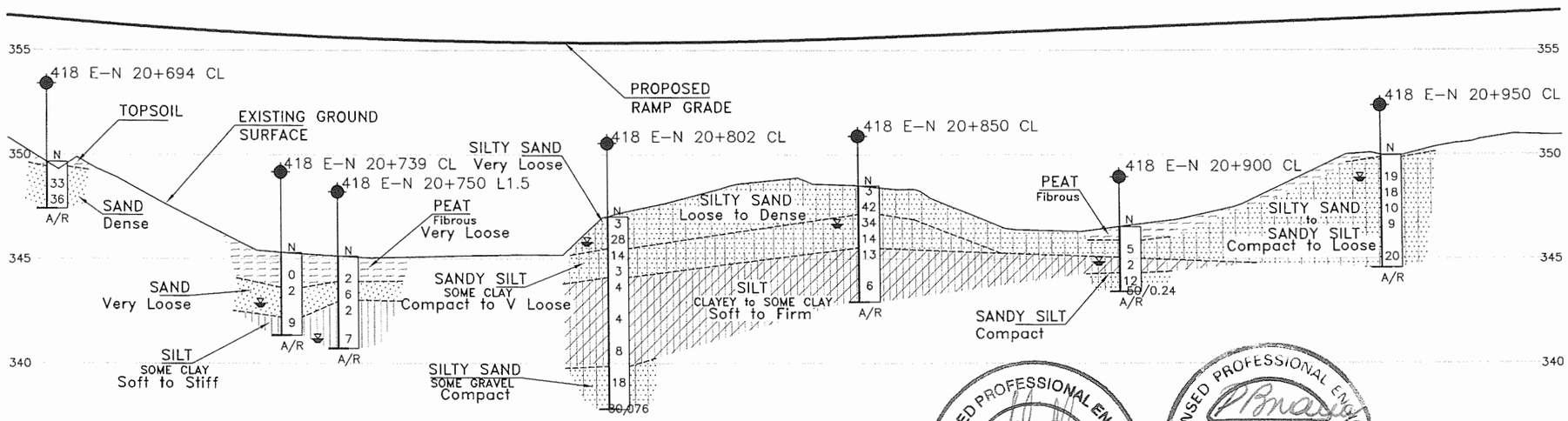
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

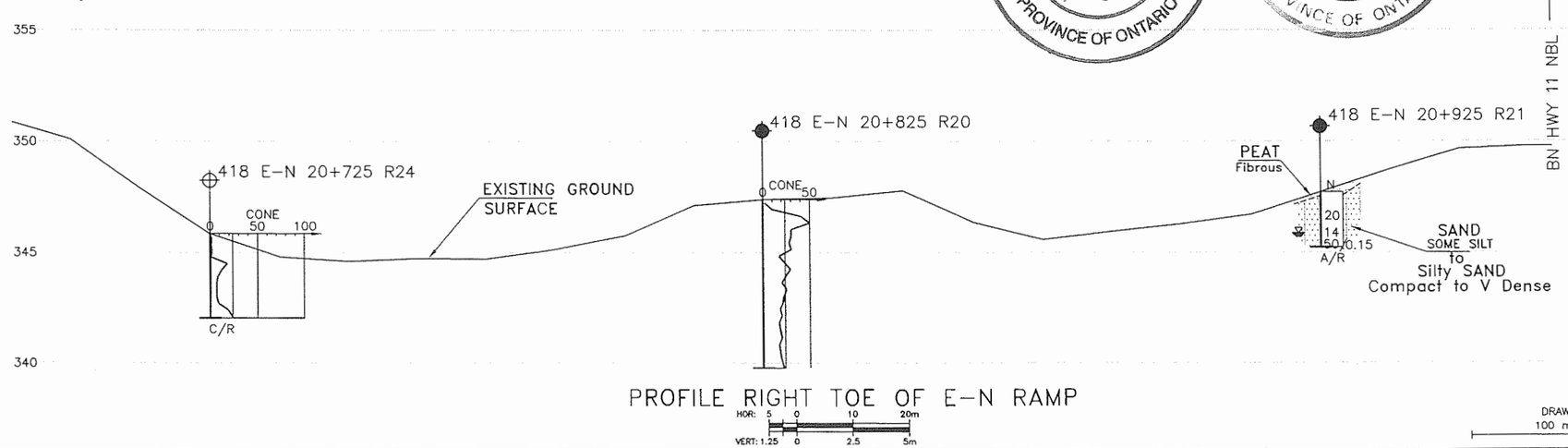
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007
DRAWN TF/WW	CHK PJB	SITE	STRUCT / SCHEME	DWG E9







LICENSED PROFESSIONAL ENGINEER S.M. SATHER 7 Feb 07 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER P. J. BRANCO Feb 7/07 PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

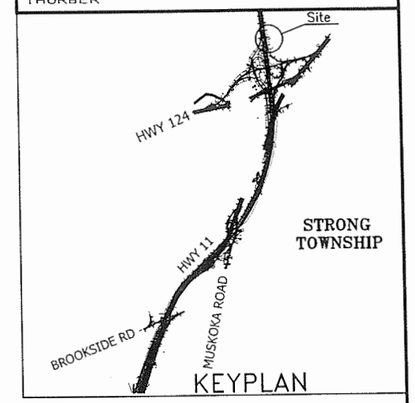
HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
E-N RAMP
CENTRELINE & RIGHT TOE
STATIONS 20+694 TO 20+950
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Coner Refusal

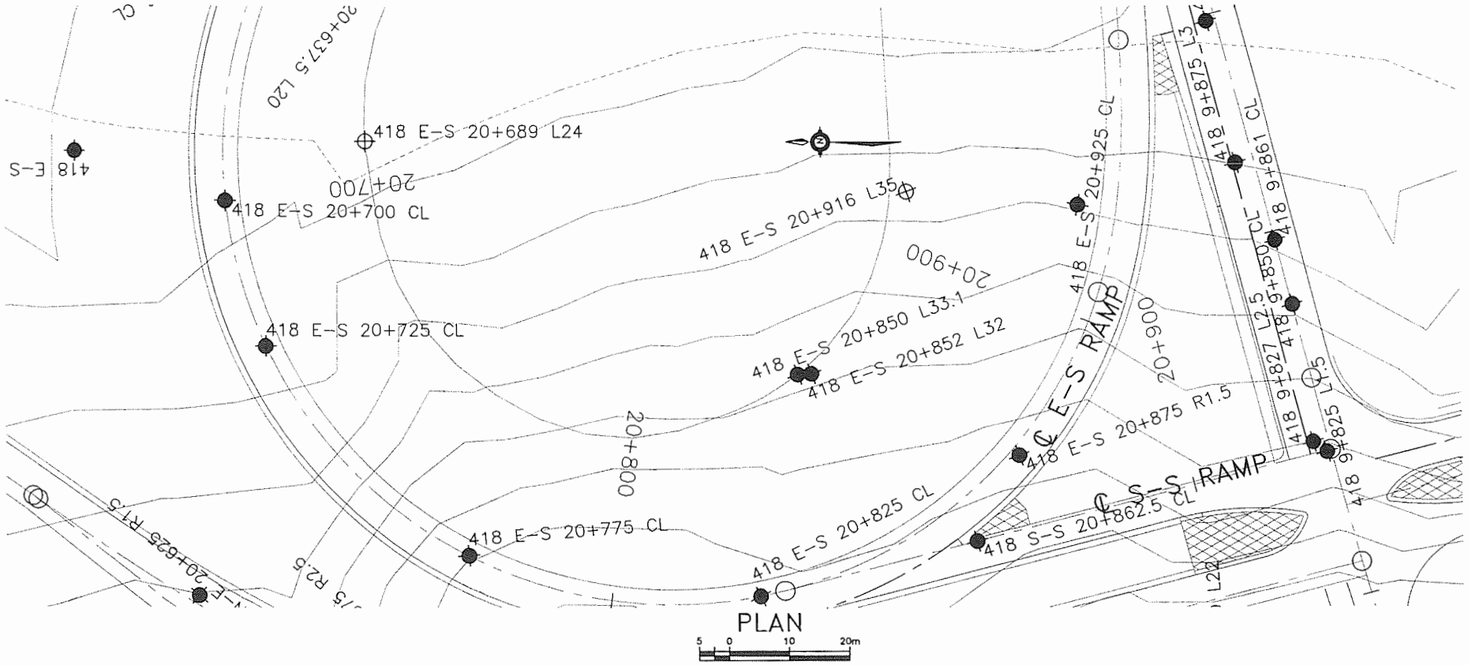
NO	STATION	OFFSET FROM MEDIAN CL
418 E-N 20+694 CL	20+694	0
418 E-N 20+725 R24	20+725	R24
418 E-N 20+739 CL	20+739	0
418 E-N 20+750 L1.5	20+750	L1.5
418 E-N 20+802 CL	20+802	0
418 E-N 20+825 R20	20+825	R20
418 E-N 20+850 CL	20+850	0
418 E-N 20+900 CL	20+900	0
418 E-N 20+925 R21	20+925	R21
418 E-N 20+950 CL	20+950	0

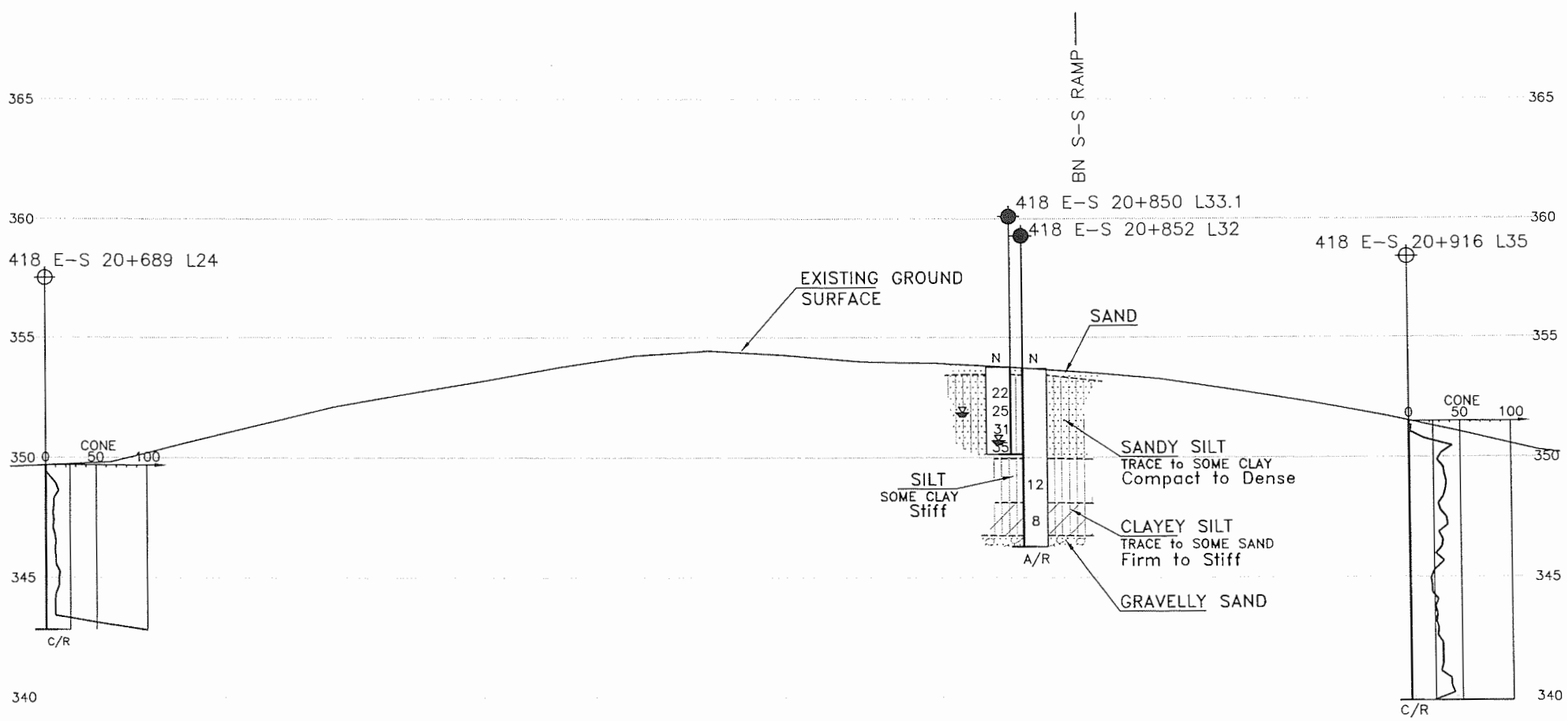
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME DWG E10





PROFILE LEFT TOE OF E-S RAMP

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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

HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
E-S RAMP LEFT TOE
STATIONS 20+689 TO 20+925
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
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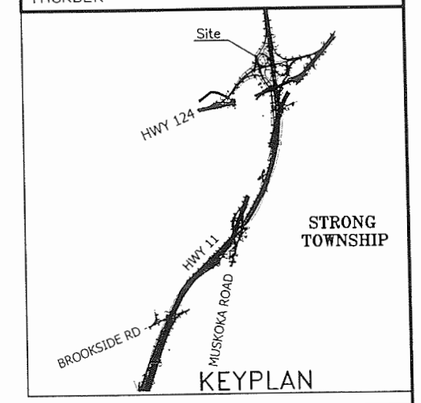


LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 E-S 20+689 L24	20+689	L24
418 E-S 20+692 R25	20+692	R25
418 E-S 20+700 CL	20+700	0
418 E-S 20+725 CL	20+725	0
418 E-S 20+775 CL	20+775	0
418 E-S 20+825 CL	20+825	0
418 E-S 20+850 L33.1	20+850	L33.1
418 E-S 20+852 L32	20+852	L32
418 E-S 20+875 R1.5	20+875	R1.5
418 E-S 20+916 L35	20+916	L35
418 E-S 20+925 CL	20+925	0
418 S-S 20+862.5 CL	20+862.5	0

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS

DATE	BY	DESCRIPTION
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG E8

Appendix D
Highway 124

THURBER

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+105 CL

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+105 CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**WATER**										
0.1	Silty **SAND**, trace rootlets, occasional wood fibers Compact Brown Moist		1	SS	12	▽			w_P w w_L		
0.6	**SAND**, fine to coarse grained, trace silt Dense Brown Wet		2	SS	39				○		0 96 4 (SI+CL)
1.8	END OF BOREHOLE AT 1.79 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.57 m AND WATER LEVEL ON 1.07 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+112.5 R12 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 Hwy 124, 9+112.5, O/S 12R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 29.02.04 - 29.02.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
0.8	END OF DCPT AT 0.79 m. CONE REFUSAL ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+115 L14

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+115, O/S 14L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Sandy **SILT**, trace rootlets, occasional wood fibers Loose Brown Moist		1	SS	7				○		
0.5	END OF BOREHOLE AT 0.46 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.46 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+125 CL

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+125 CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

SOIL PROFILE: 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
0.0	**PEAT**, fibrous, trace rootlets, occasional wood fibers								225		
0.3	Very Loose, Dark Brown, Wet		1	SS	2				○		
			2	SS	56/.100						
0.9	**SAND and GRAVEL**, trace silt, Compact, Brown, Wet										
	END OF BOREHOLE AT 0.87 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.87 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+135 R18

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+135, O/S 18R | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

SOIL PROFILE: ELEV / DEPTH	SOIL PROFILE: 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
0.0	Silty **SAND** mixed with **PEAT**, occasional rootlets, occasional wood fibers Loose Brown Moist		1	SS	6				○		
1.1	Silty **SAND**, fine grained Loose Brown Wet		2	SS	6	▽			○		
1.8	END OF BOREHOLE AT 1.83 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.06 m AND WATER LEVEL AT 1.06 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+137.5 L13.5 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 Hwy 124, 9+137.5, O/S 13.5L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 29.02.04 - 29.02.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	DCPT from surface.										
0.2	END OF DCPT AT 0.15 m. CONE REFUSAL ON PROBABLE BEDROCK OR BOULDER. (100 blows for 0.15 m) Note: - DCPT performed 6 times in 4 square meter area - same depth to bedrock										

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+145 CL

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+145 CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**PEAT**, fibrous, trace rootlets Very Loose Dark Brown Wet		1	SS	2									
0.5	**SILT and SAND**, trace gravel Compact Brown Wet		2	SS	12				○		2	42	53	3
1.3	END OF BOREHOLE AT 1.32 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.32 m AND WATER LEVEL AT SURFACE UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.													

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+160 L15 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 Hwy 124, 9+160, O/S 15L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 29.02.04 - 29.02.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**PEAT**, fibrous										
0.2	Dark Brown Wet										
	SAND, fine grained, some silt, trace gravel Loose Brown		1	SS	8				○		
1.1	Wet		2	SS	50/						
	Silty **SAND**				.075						
1.3	Loose Brown Wet										
	END OF BOREHOLE AT 1.29 m. AUGER REFUSAL AT 1.29 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.4 m AND WATER LEVEL AT SURFACE UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+189 R20

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+189, O/S 20R | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

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
0.0	**WATER**					▽					
0.3	Sandy **SILT**, trace rootlets Loose Grey Wet		1	SS	8				○		
1.2	END OF BOREHOLE AT 1.22 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.77 m AND WATER LEVEL AT 0.31 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY 124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+203 L2

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+203, O/S 2L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**WATER**										
0.2	**PEAT**, fibrous, trace rootlets Very Loose Dark Brown Wet		1	SS	3						
0.8	**SAND and GRAVEL**, trace silt Compact Brown Wet		2	SS	71/				○		
1.3	END OF BOREHOLE AT 1.27 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.15 m AND WATER AT SURFACE UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.				.200						

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+214 R14

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+214, O/S 14R | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM

DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
1.6	END OF DCPT AT 1.60 m. CONE REFUSAL ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3 : Numbers refer to Sensitivity

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

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+215.5 L16 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 Hwy 124, 9+215.5, O/S 16L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 29.02.04 - 29.02.04 CHECKED BY JL

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
0.0	**PEAT**, fibrous, trace rootlets, some wood fibers		1	SS	2				118		
0.3	Very Loose Dark Brown Wet										
	SAND, some silt, trace rootlets Very Loose Brown Wet		2	SS	2						
1.3	**SAND and GRAVEL**, trace silt Compact Brown Wet		3	SS	50/ .050						
1.4	END OF BOREHOLE AT 1.43 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.61 m AND WATER LEVEL AT SURFACE ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+225 CL

METRIC

W.P.	759-93-00	LOCATION	418 Hwy 124, 9+225, CL	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	29.02.04 - 29.02.04	CHECKED BY	JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	Silty **SAND**, trace rootlets, occasional wood fibers Loose Brown Moist		1	SS	9						
0.2	END OF BOREHOLE AT 0.15 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.15 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+237.5 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, 9+237.5 CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 29.02.04 - 29.02.04 | CHECKED BY JL

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**BEDROCK** at surface.										

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

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+772 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+772, CL | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 20.11.03 - 20.11.03 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**SAND**, fine grained, trace silt Compact to Very Dense Brown Moist to Wet		1	SS	17	▽			o		
			2	SS	62/254				o		
1.4	END OF BOREHOLE AT 1.37m. AUGER REFUSAL AT 1.37 m ON PROBABLE BEDROCK OR BOULDER. (BEDROCK OUTCROP IN VICINITY) BOREHOLE OPEN TO 0.61 m AND WATER LEVEL AT 0.61 m UPON COMPLETION . BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+³, ×³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+825 L1.5

METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+825, O/S 1.5L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 29.10.03 - 29.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	**SAND**, fine grained, some organics and rootlets Compact Brown Moist		1	SS	18	▽			○		
1.5	**SAND and SILT** Dense Brown Dry		2	SS	45				○ ○		
2.0	**SILT**, some clay, trace to some sand Dense Brown Wet		3	SS	74/ .150				○		0 10 74 16
2.5	**SAND**, coarse grained										
2.6	END OF BOREHOLE AT 2.59 m. PROBABLE BEDROCK OR BOULDERS. BOREHOLE OPEN TO 1.83 m AND WATER LEVEL AT 1.32 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

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

15 ⊕ 5 (%) STRAIN AT FAILURE (20, 10)

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+827 L2.5 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+827, O/S 2.5L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 29.10.03 - 29.10.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	TOPSOIL										
0.1	SAND, fine grained, some organics and rootlets										
0.4	Brown										
	SAND, fine grained, some silt Brown		1	GS		▽			○		
1.5	SAND and SILT										
1.8	SILT, some clay, trace to some sand										
2.9	END OF BOREHOLE AT 2.9 m. PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.59 m AND WATER LEVEL AT 2.44 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+850 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+850, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 29.10.03 - 29.10.03 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	WATER CONTENT (%) (PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**								
0.1	**SAND**, fine grained, trace to some silt Loose to Dense Brown Moist to Wet								
		1	SS	7	▽				
		2	SS	50					
		3	SS	39					
3.0	Sandy **SILT** Dense to Compact Brown Wet	4	SS	37					0 34 66 (SI+CL)
		5	SS	13					
5.0	Silty **CLAY**, trace sand Stiff to Very Stiff Grey Wet (CL)								
		6	SS	6		3.5			
		7	SS	3		5.8			0 5 70 26
9.5	**SAND**, some gravel, trace silt Compact to Dense Grey to Brown	8	SS	21					

Continued Next Page

÷ 3, × 3: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+850 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+850, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 29.10.03 - 29.10.03 | CHECKED BY JL

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
	Wet		9	SS	68				○		
10.9	END OF BOREHOLE AT 10.9 m. AUGER REFUSAL AT 10.9 m ON PROBABLE BEDROCK OR BOULDER . BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 0.91 m UPON COMPLETION.. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH ASPHALT AT SURFACE.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+861 CL

METRIC

G.W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+861, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 29.10.03 - 29.10.03 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	**SAND**, fine grained, some organics Brown										
0.4	**SAND**, fine grained, trace silt Compact to Dense Brown Moist to Wet		1	SS	26				○		
			2	SS	34				○		
2.2	**SAND and SILT** Compact to Dense Brown Wet		3	SS	28	▽			○		
			4	SS	33				○		
3.7	END OF BOREHOLE AT 3.66 m. BOREHOLE OPEN TO 3.66 m AND WATER LEVEL AT 2.44 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+862.5 R43.5 1 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+862.5, O/S 43.5R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 12.12.03 - 12.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**PEAT**, fibrous Dark Brown to Black										
0.6	Silty **SAND** Compact Brown Wet		1	SS	12						
1.4	**SILT**, some clay, some sand Loose Brown to Grey Wet		2	SS	7	▽					
			3	SS	5						0 18 71 11
			4	SS	4						
4.1	Clayey **SILT**, trace sand, with thin sand seams Soft Grey Wet		5	SS	3			4.9 +			
			6	SS	2						0 4 68 28
			7	SS	2						
8.5	**SAND**, some silt, occasional cobbles Compact Brown Wet										
8.9	END OF BOREHOLE AT 8.92 m. AUGER REFUSAL AT 8.92 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 8.64 m AND										

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 418 9+862.5 R43.5 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+862.5, O/S 43.5R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 12.12.03 - 12.12.03 CHECKED BY AEG

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 (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	WATER LEVEL AT 1.63 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND BENSEAL TO SURFACE.										

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

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+875 L3

METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+875, O/S 3L | ORIGINATED BY SL
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 11.12.03 - 11.12.03 | CHECKED BY AEG

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
0.0	**PEAT**, fibrous Dark Brown to Black							
0.4	**SAND**, trace silt Loose Brown Wet	1	SS	7				
1.5	Sandy **SILT**, with trace of sand seams, some clay Compact to Loose Brown Wet	2	SS	11				
		3	SS	7	0	24	63	14
		4	SS	9				
	trace clay seams	5	SS	4				
5.8	**SILT and CLAY**, trace sand, with thin sand seams Firm Grey Wet	6	SS	1				
		1	TW	PH				
		7	SS	1	0	4	56	40
		8	SS	3				

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 (%)

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 418 9+875 L3 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+875, O/S 3L ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 11.12.03 - 11.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
								4.1 +			
10.5	Clayey **SILT**, laminated Soft to Firm Grey Wet		9	SS	4			2.9 +	○		
11.9	Sandy **SILT**, trace gravel Very Dense Brown Wet		~~10~~	~~SS~~	~~50/~~ .025				○		
12.3	END OF BOREHOLE AT 12.32 m. AUGER REFUSAL AT 12.32 m ON PROBABLE BEDROCK OR BOULDER.. BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 1.98 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+887.5 R44

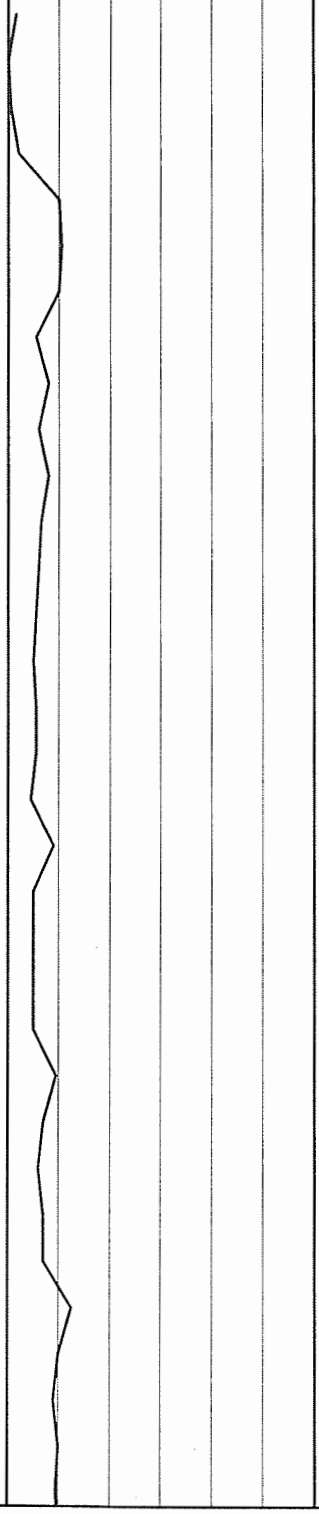
METRIC

W.P. 759-93-00 | LOCATION 418 Hwy 124, ST. 9+887.5, O/S 44R | ORIGINATED BY SL

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY SS

DATUM Geodetic | DATE 12.12.03 - 12.12.03 | CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	DCPT from surface.										



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+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

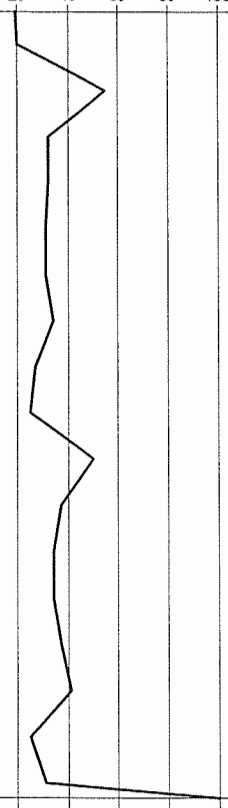
THURBER

RECORD OF BOREHOLE No 418 9+887.5 R44 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+887.5, O/S 44R ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 12.12.03 - 12.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100; ○ UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100	w_P w w_L; 20 40 60	γ kN/m³	GR SA SI CL
											
15.2	END OF DCPT AT 15.19 m. CONE REFUSAL AT 15.19 m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+899 L1.5 1 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+899, O/S 1.5L ORIGINATED BY DP
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 15.12.03 - 16.12.03 CHECKED BY AEG

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, some rootlets Dark Brown to Black Wet				
0.6	**SAND**, trace silt Compact Grey Wet	1	SS	17	
1.4	**SAND**, trace rootlets (organics) Compact Brown Wet	2	SS	16	
1.8	Sandy **SILT**, some clay Loose Grey Wet	3	SS	8	0 20 66 14
2.9	**SILT**, trace sand, trace clay Loose Grey Wet	4	SS	5	
3.7	Clayey **SILT**, trace sand, occasional silt layers Firm to Stiff Grey Wet	1	TW		No Recovery in TW#1
		2	TW		No Recovery in TW#2
		5	SS	1	
		3	TW		No Recovery in TW#3
		4	TW		
		6	SS	3	0 3 62 35

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

2.6
5.2

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 418 9+899 L1.5 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+899, O/S 1.5L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 15.12.03 - 16.12.03 CHECKED BY AEG

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
								3.3			
			5	TW							No Recovery in TW#5
			6	TW							No Recovery in TW#6
			7	SS	4				○		
13.1	**SAND** fine grained Very Dense Brown Wet							8			
			~~8~~	~~SS~~	~~50/~~				○		
13.8	END OF BOREHOLE AT 13.79 m. AUGER REFUSAL AT 13.79 m ON PROBABLE BEDROCK OR BOULDER. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH				.076						

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+912.5 R41 1 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+912.5, O/S 41R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.12.03 - 18.12.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	**PEAT**, fibrous, some rootlets Dark Brown to Black Wet										
0.9	**SAND**, trace to some silt Compact Grey Wet		1	SS	14						
			2	SS	17						
2.2	Sandy **SILT**, trace to some clay, occasional sand layers Loose Grey Wet		3	SS	9						
			4	SS	8						
			5	SS	7	▽		5.2			
5.7	Clayey **SILT**, occasional sand & silt layers Firm to Stiff Grey Wet		6	SS	2			3.5			
			7	SS	1			4.7			
			8	SS	3						

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 22/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+912.5 R41 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+912.5, O/S 41R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 18.12.03 - 18.12.03 CHECKED BY AEG

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						
								4.6			
			9	SS	1				○		
								2.4			
			10	SS	3				○		
								2.5			
			11	SS	3				○		
									○		
14.8	**SAND**, medium grained, trace gravel Very Dense Grey Wet		1	GS							
			12	SS	70/ .203				○		
15.6	END OF BOREHOLE AT 15.60 m. AUGER REFUSAL AT 15.60 m ON PROBABLE BEDROCK OR BOULDER. WATER LEVEL AT 5.49 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND BENSEAL TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 07/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+929 R3

METRIC

W.P.	759-93-00	LOCATION	418 Hwy 124, ST. 9+929, O/S 3R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	16.12.03 - 16.12.03	CHECKED BY	AEG

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, some rootlets Dark Brown to Black										
0.8	**SAND**, trace silt Compact Grey Wet		1	SS	14						
1.4	Sandy **SILT**, some clay, with fine sand layers Compact Grey Wet		2	SS	11						
			3	SS	10						
3.0	Clayey **SILT**, trace sand, with thin sand layers Stiff to Soft Grey Wet		4	SS	11						0 11 62 27
			5	SS	3			3.4			
			1	TW							No Recovery in TW#1
			2	TW							
			6	SS	2			1.8			
			3	TW							No Recovery in TW#3

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 418 9+929 R3 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 9+929, O/S 3R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 16.12.03 - 16.12.03 CHECKED BY AEG

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"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
								2.6 +			
10.4	**SILT**, trace sand, some clay Loose Grey Wet		7	SS	3				○		0 1 86 13
								2.8 +			
11.9	Clayey **SILT**, trace sand Soft Grey Wet		8	SS	3				○		
13.0	**SAND**, trace to some gravel Grey Wet										
13.6	END OF BOREHOLE AT 13.64 m. AUGER REFUSAL AT 13.64 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND BENSEAL GROUT TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE

ONTMT4 418HWY124-I.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

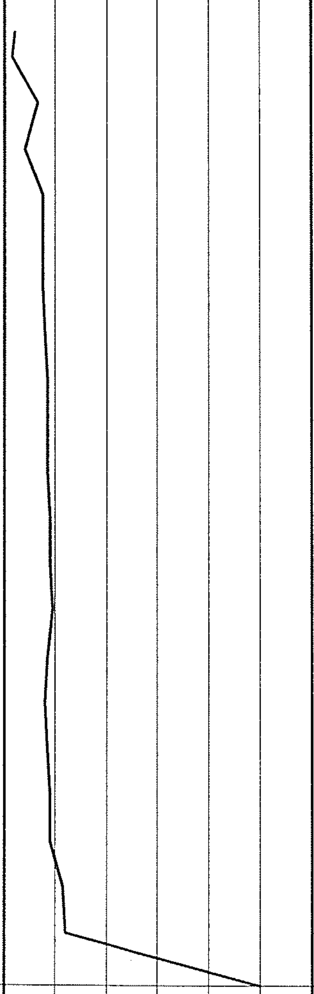
RECORD OF BOREHOLE No 418 9+937.5 L50

1 OF 1

METRIC

W.P. 759-93-00
LOCATION 418 ST. 9+937.5, O/S 50 L
ORIGINATED BY GA
HWY 11
BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT)
COMPILED BY WM
DATUM Geodetic
DATE 27.05.04 - 27.05.04
CHECKED BY JL

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						
0.0	DCPT from surface.										
6.6	END OF DCPT AT 6.60 m. CONE REFUSAL AT 6.60 m ON PROBABLE BEDROCK OR BOULDER.										



ONTMT4 418HWY124.GPJ 21/09/04

+ ³, × ³ : Numbers refer to Sensitivity

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+937.5 R35 1 OF 2 METRIC

G.W.P. 759-93-00 LOCATION 418 ST. 9+937.5, O/S 43R ORIGINATED BY GA
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 27.05.04 - 27.05.04 CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
0.0	Sandy **PEAT**, fibrous, some rootlets Very Loose Dark Brown Wet	1	SS	2					
0.8	**SAND**, fine grained, some silt, occasional rootlets Compact Grey Wet	2	SS	10					
1.5	**SILT**, trace sand Compact Grey Wet	3	SS	13					
2.3	Sandy **SILT**, some clay Compact Grey Wet	4	SS	15		0	22	67	11
		5	SS	18					
4.6	Clayey **SILT**, trace sand Laminated Stiff Grey Wet	6	SS	10					
6.1	Silty **CLAY**, trace sand Laminated Stiff to Firm Grey Wet	7	SS	9		0	5	65	30
		8	SS	6					
9.1	Clayey **SILT**, trace sand Laminated Firm to Stiff Grey Wet	9	SS	6		0	2	84	14

SOIL PROFILE: 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

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

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+937.5 R35 2 OF 2 METRIC

G.W.P. 759-93-00 | LOCATION 418 ST. 9+937.5, O/S 43R | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Holloe Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 27.05.04 - 27.05.04 | CHECKED BY JL

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						
			10	SS	8				○		
12.2	END OF BOREHOLE AT 12.19 m. AUGER REFUSAL AT 12.19 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 12.19 m AND IN ARTESIAN CONDITION. BOREHOLE BACKFILLED AS FOLLOWS TO SEAL ARTESIAN FLOW: DEPTH (m) MATERIAL; 0-9.14 Drill Cuttings; 9.14-12.19 Bentonite										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 21/12/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 10+075 R4.5 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 10+075, O/S 4.5R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 24.10.03 - 24.10.03 CHECKED BY JL

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/m³	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
0.0	Sandy **TOPSOIL**		1	GS							
0.5	**SAND**, fine grained Brown										
0.7	END OF BOREHOLE AT 0.69 m. AUGER REFUSAL AT 0.69 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.69 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 10+100 L24.1 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 10+100, O/S 24.1L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 24.10.03 - 24.10.03 CHECKED BY JL

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
0.0	DCPT from surface.										
0.5	END OF DCPT AT 0.51m. CONE REFUSAL AT 0.51 m ON PROBABLE BEDROCK OR BOULDER.										

÷ 3, × 3 : Numbers refer to Sensitivity

15 20 25 10 (%) STRAIN AT FAILURE

ONTMT4 418HWY124.GPJ 18/09/04

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 10+125 L3.5 1 OF 1 METRIC

G.W.P. 759-93-00 LOCATION 418 Hwy 124, ST. 10+125, O/S 3.5L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 24.10.03 - 24.10.03 CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)			
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
0.0	**TOPSOIL**													
0.2	**SAND**, fine grained Compact Brown Wet		1	SS	16	▽			○					
1.7	Silty **CLAY**, trace sand Very Stiff Grey Wet		2	SS	16				○					
			3	SS	16				○		0	6	67	27
			4	SS	9				○					
4.4	END OF BOREHOLE AT 4.42 m. AUGER REFUSAL AT 4.42 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 4.42 m AND WATER LEVEL AT 0.91 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

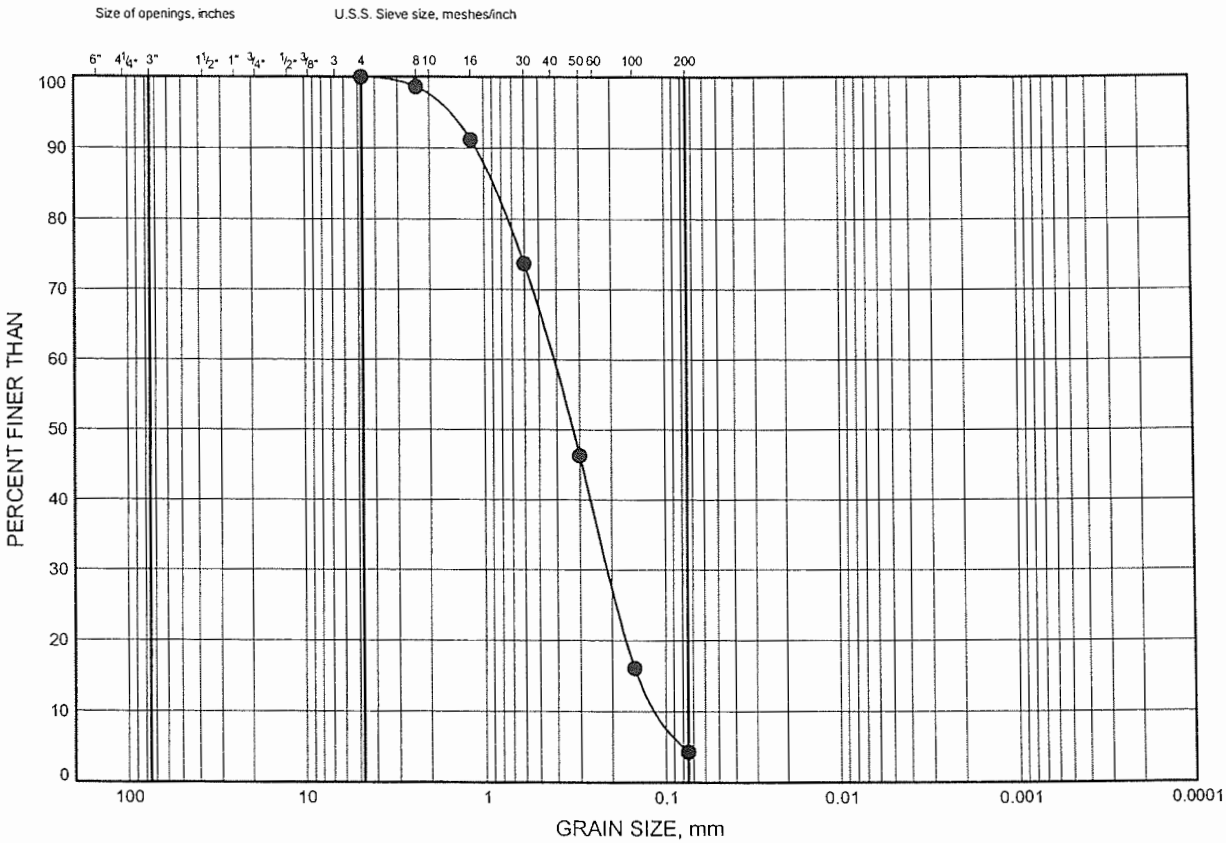
ONTMT4 418HWY124.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D1

Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+105 CL	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

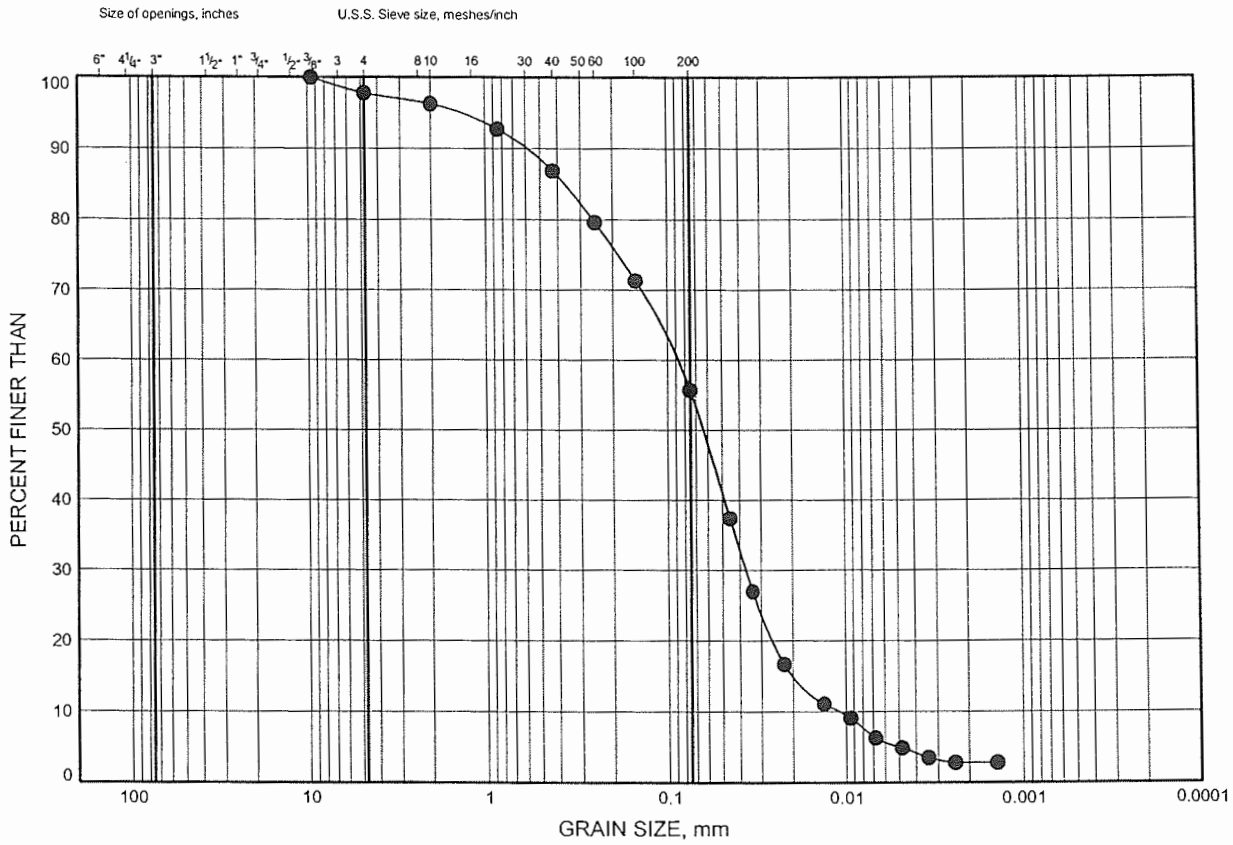
THURBGSD 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D2

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+145 CL	1.07	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

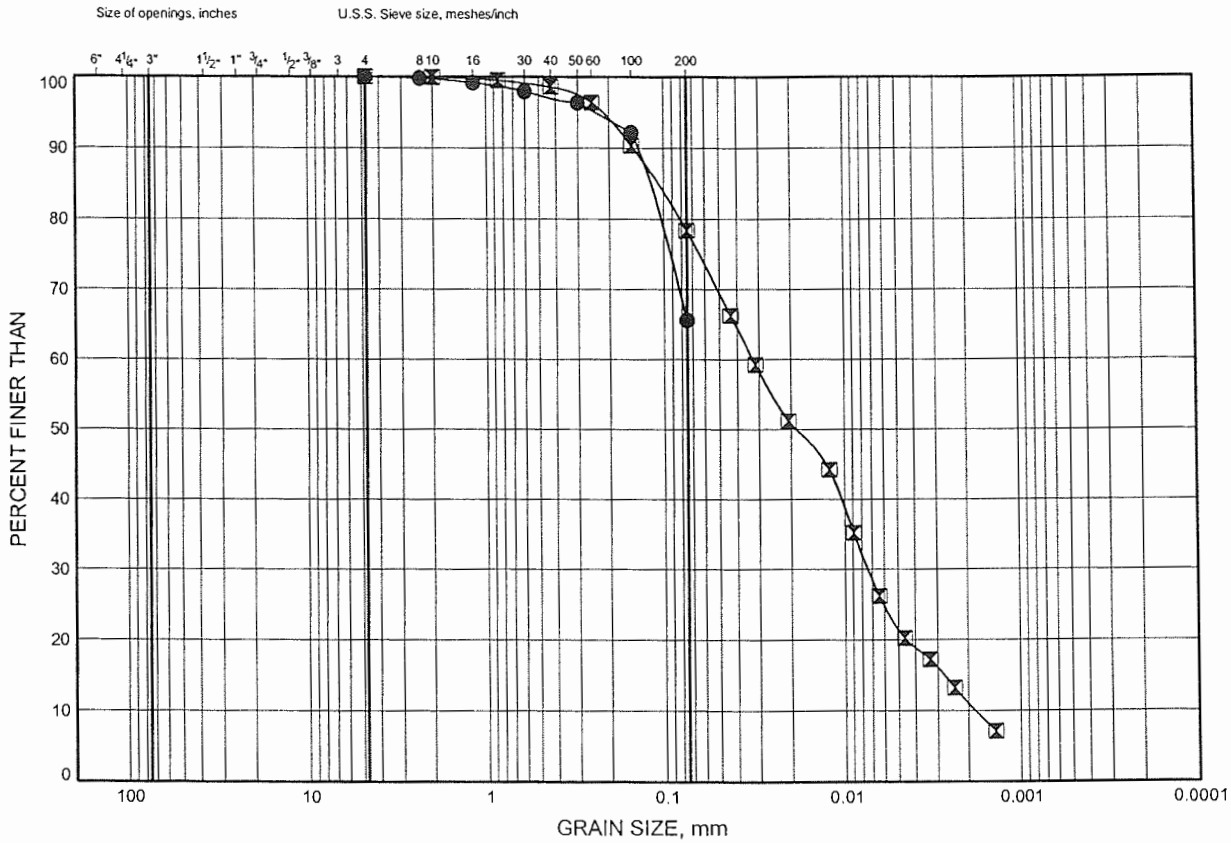
THURBGSD 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D3

Sandy Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+850 CL	3.35	
⊠	418 9+937.5 R35	2.59	

Date December 2004

Project 759-93-00

THURBER

Prep'd WM

Chkd. JL

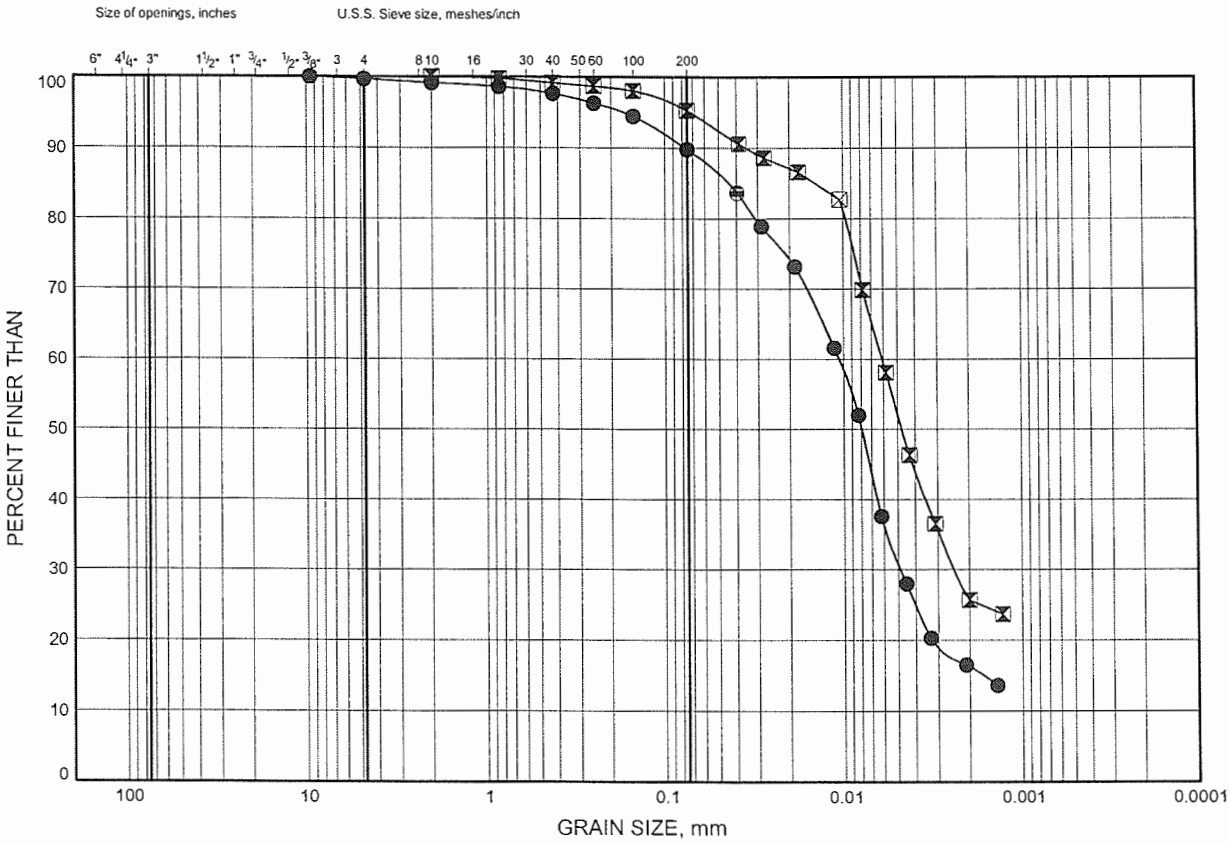
THURBGSD 418HWY124.GPJ 20/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D4

Silt, some clay to clayey, some sand to sandy



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+825 L1.5	2.29	
⊠	418 9+850 CL	7.92	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

Chkd. SMS

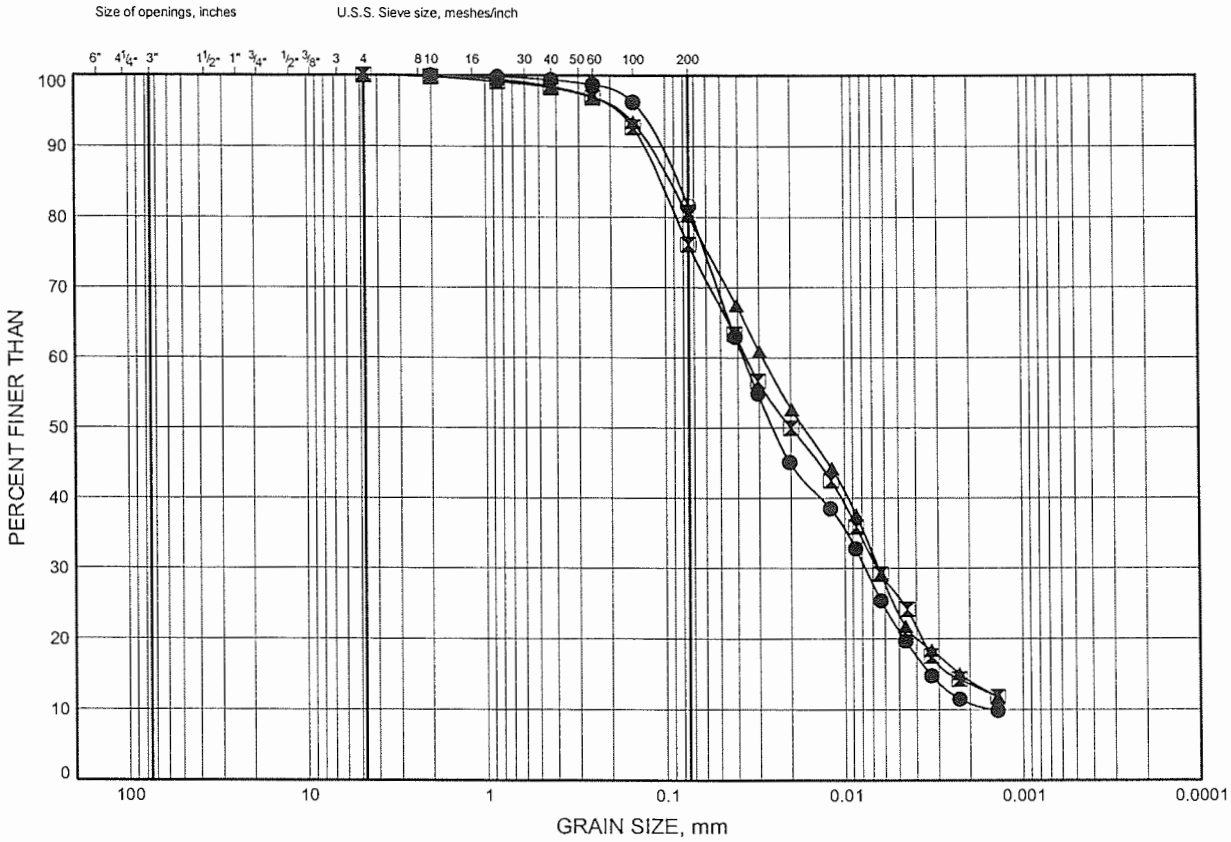
THURBGSD 418HWY124.GPJ 12/01/05

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D5

Silt, some clay to clayey, some sand to sandy



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+862.5 R43.5	2.59	
⊠	418 9+875 L3	2.59	
▲	418 9+899 L1.5	2.59	

Date January 2005

Project 759-93-00

THURBER

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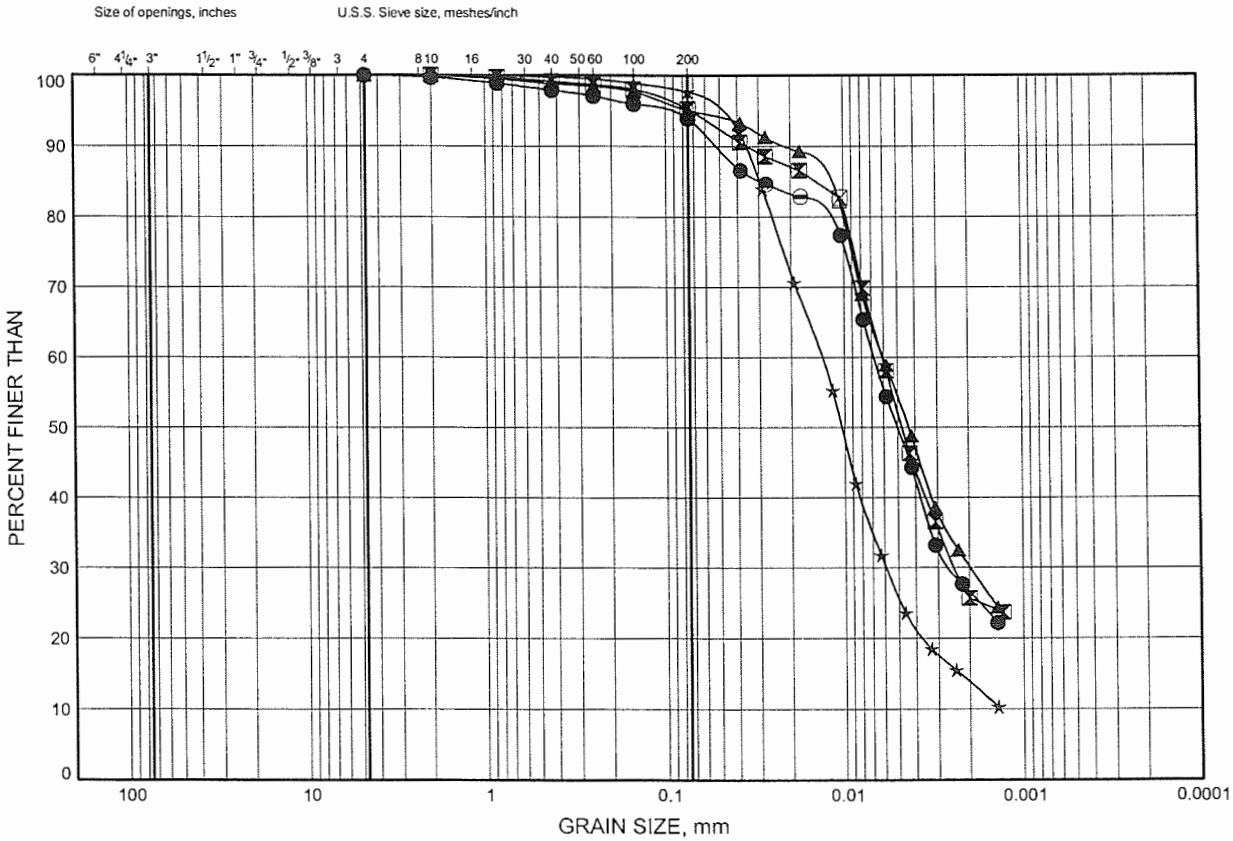
THURBGSD 418HWY124-I.GPJ 12/01/05

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D6

Clayey Silt to Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 10+125 L3.5	2.59	
⊠	418 9+850 CL	7.92	
▲	418 9+937.5 R35	6.40	
★	418 9+937.5 R35	9.45	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

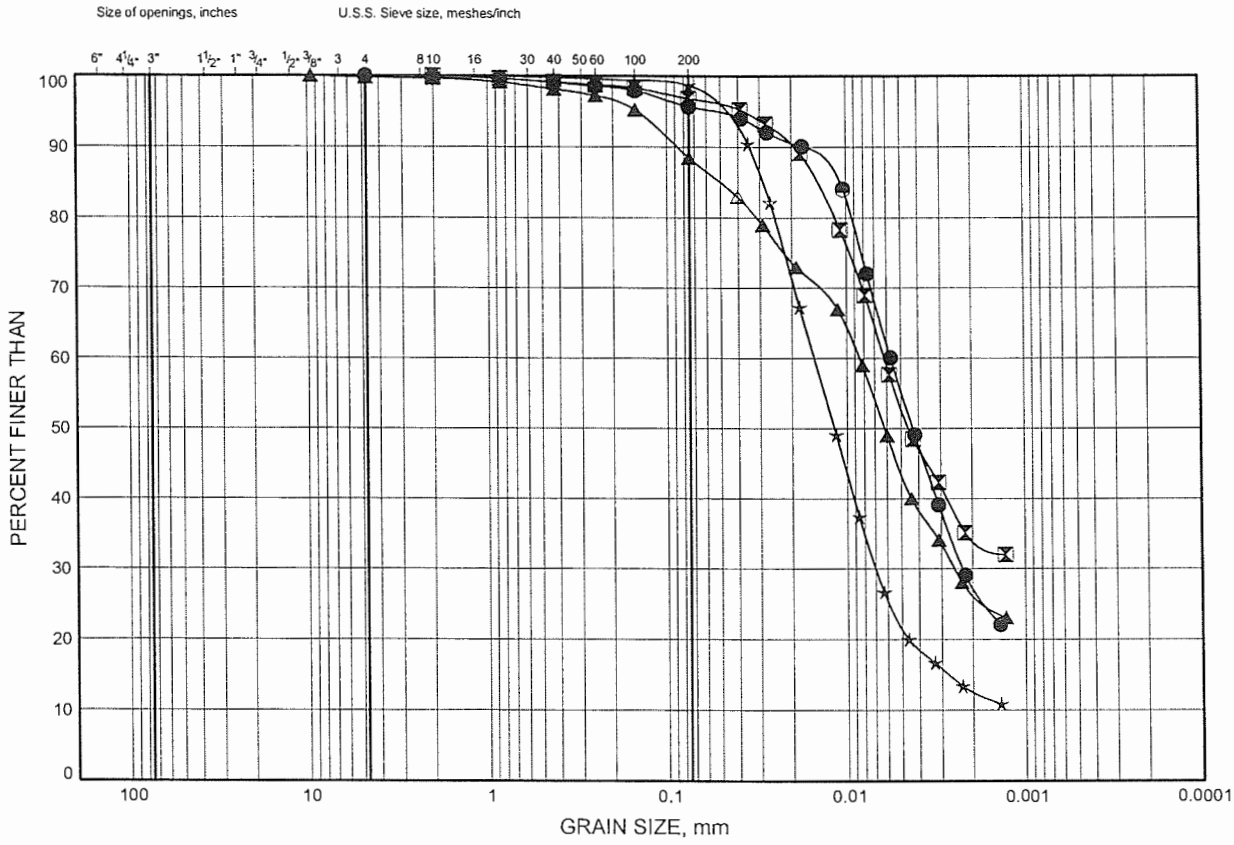
Chkd. SMS

THURBGSD 418HWY124.GPJ 12/01/05

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE D7



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+862.5 R43.5	6.40	
⊠	418 9+899 L1.5	9.45	
▲	418 9+929 R3	3.35	
★	418 9+929 R3	10.97	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

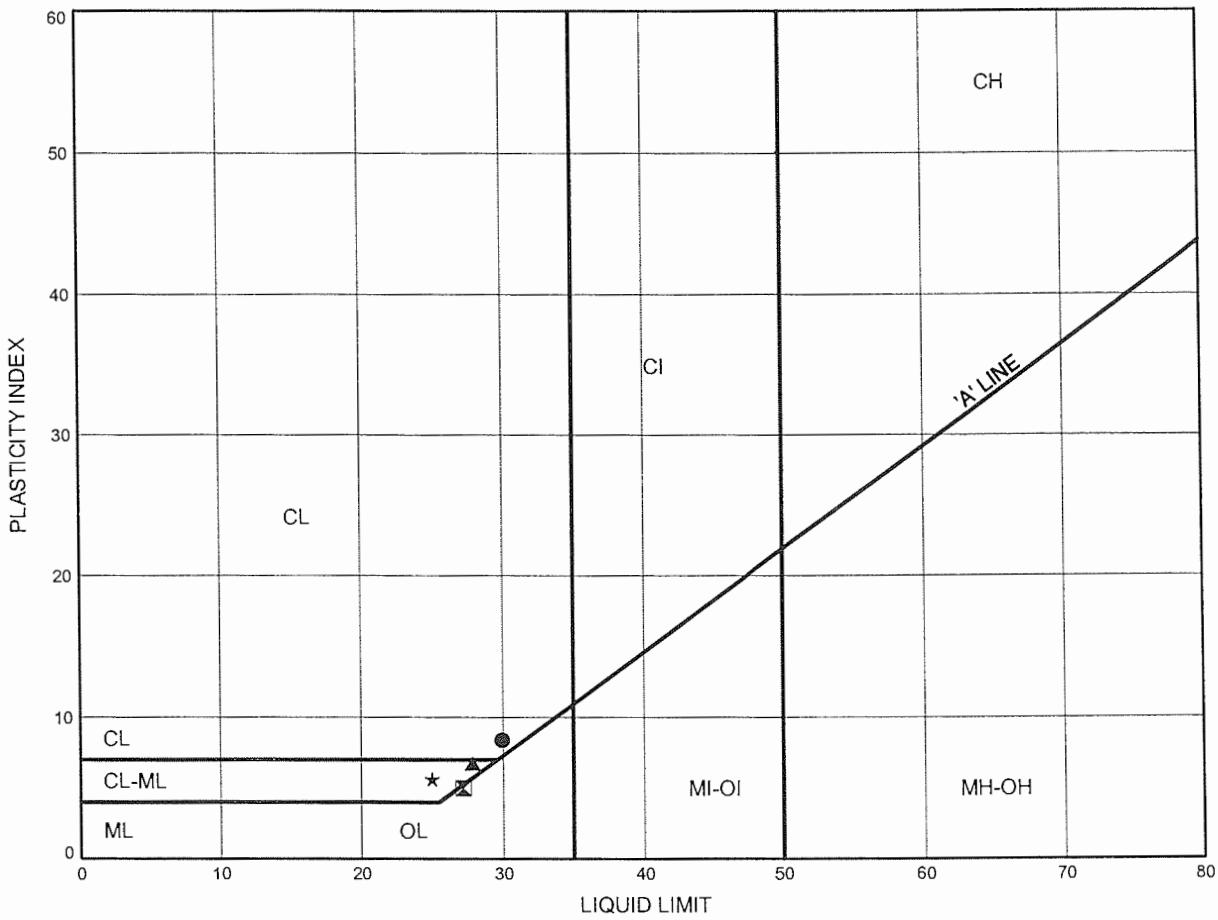
Chkd. SMS

THURBGSD 418HWY124-I.GPJ 12/01/05

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE D8



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+850 CL	7.92	
⊠	418 9+862.5 R43.5	6.40	
▲	418 9+875 L3	8.53	
★	418 9+899 L1.5	9.45	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

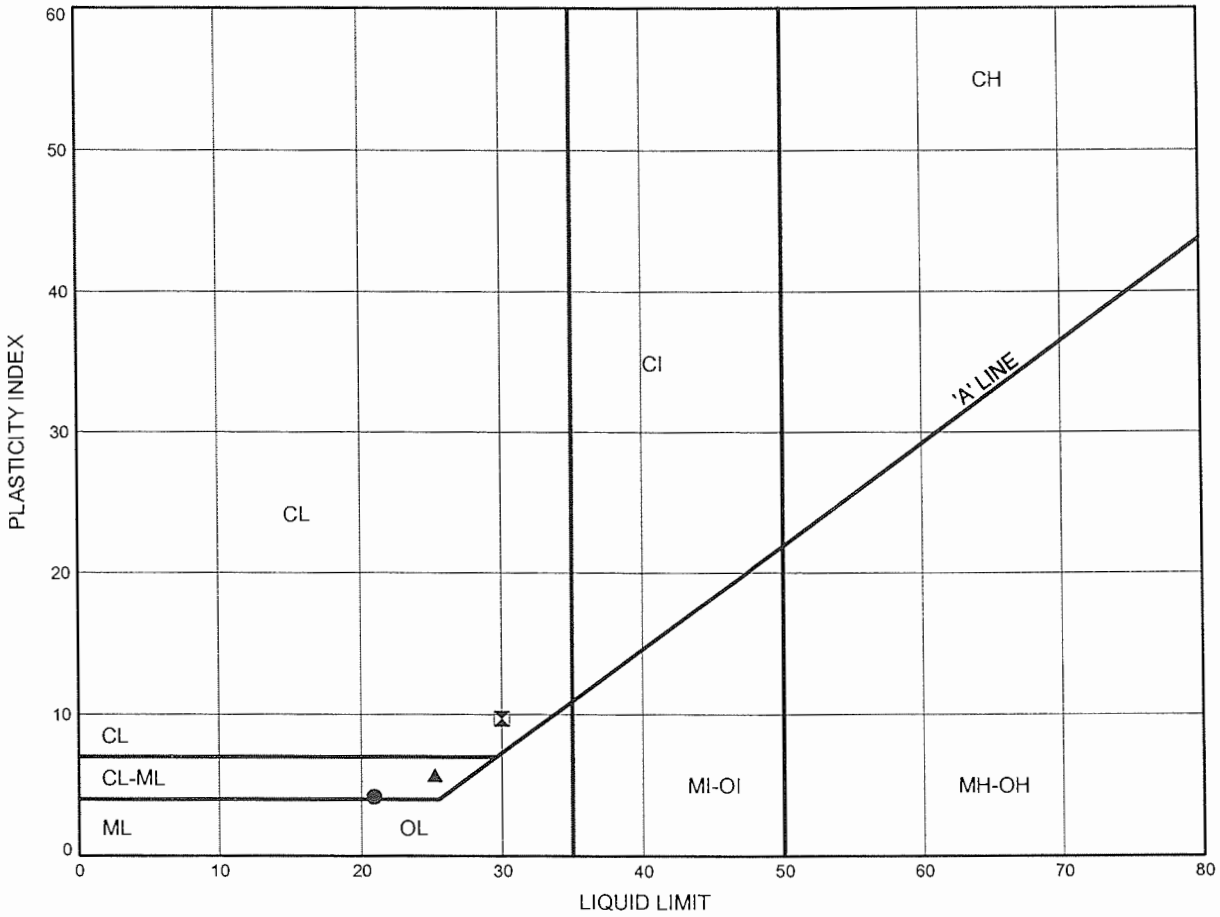
Chkd. SMS

THURBALT 418HWY124-I.GPJ 12/01/05

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE D9



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+929 R3	3.35	
⊠	418 9+937.5 R35	6.40	
▲	418 9+937.5 R35	9.45	

Date January 2005

Project 759-93-00

THURBER

Prep'd WM

Chkd. SMS

THURBALT 418HWY124-I.GPJ 12/01/05

Consolidation Test Report

CLIENT: **MMM** FILE NUMBER: 19-1423-12

PROJECT: HWY 11, Burke's Falls - HWY 124 REPORT DATE: 20-Jan-05

TEST DATES: Jan 4, 2005 - Jan 19, 2005

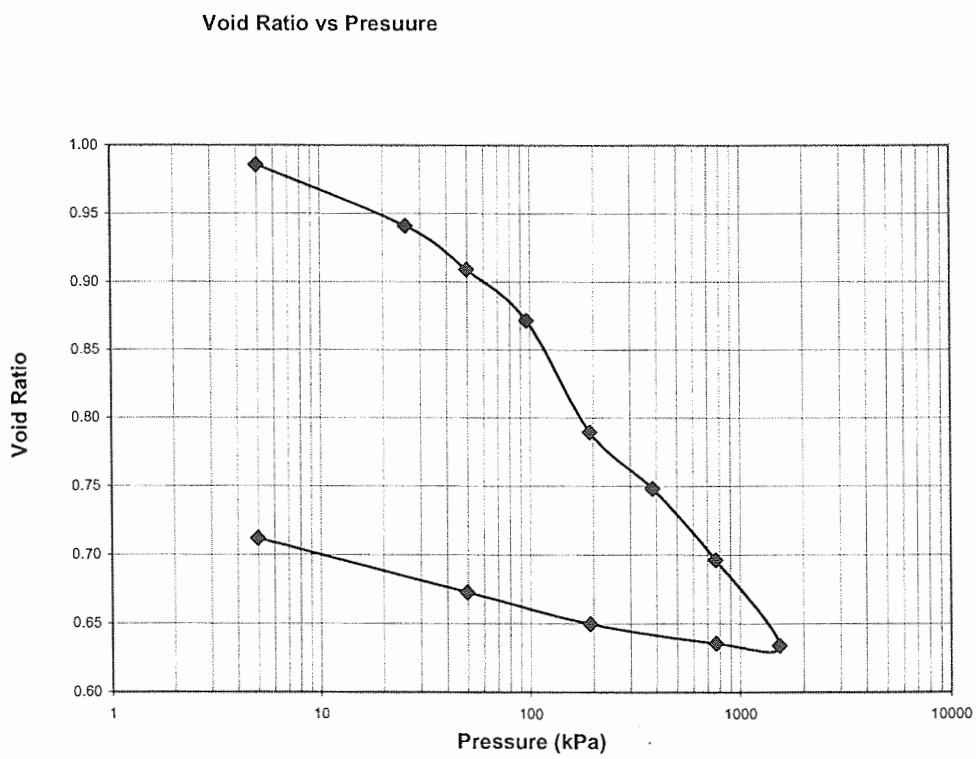
SAMPLE: 9+899 L1.5, ST-4, 28'-29'8"ft.

PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-90, method A

	Start of Test	End of Test
Wet Dens. (kg/m^3)	1848.5	2061.0
Dry Dens. (kg/m^3)	1370.7	1600.8
Moisture Cont. (%)	34.9	28.8
Saturation(%)	95.3	110.1
Void Ratio	1.006	0.718

Note:

A Specific Gravity of 2.75 was assumed for the void ratio and saturation calculations



Consolidation Test Report

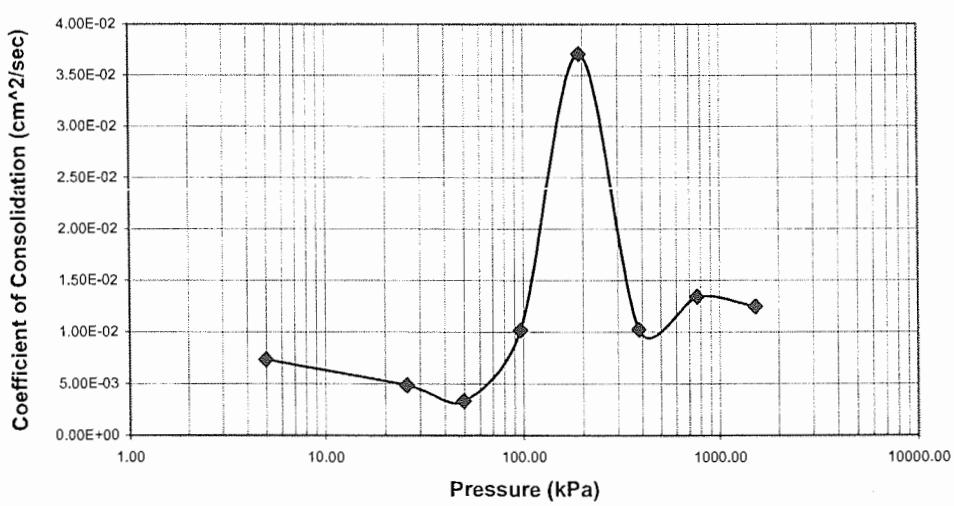
TRIMMING: The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

LOADING: A seating load of 5 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied and the duration of each load step was 24 hours except the 4th and 6th loadings were 48 hours for Secondary Compression Calculations

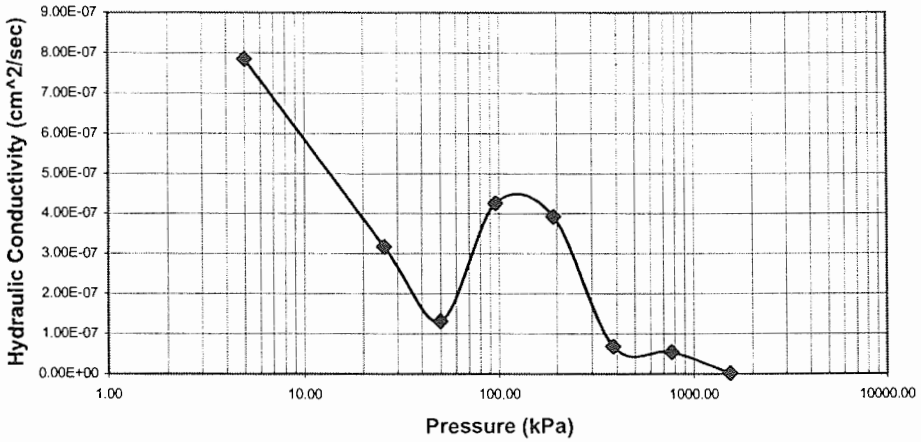
CALCULATIONS: Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Sa. Hgt. (mm)	Corr. Hgt (mm)	D90 (mm)	T90 (min)	Cv cm^2/sec	Void Ratio	mv (m^2/kN)	k (cm/s)
0.00	25.45	25.45				1.006		
5.00	25.19	25.19	-0.217	3.0625	7.32E-03	0.986	1.094E-03	7.85E-07
25.68	24.608	24.617	-0.482	4.41	4.85E-03	0.941	6.658E-04	3.17E-07
49.83	24.202	24.211	-0.295	6.25	3.31E-03	0.909	4.037E-04	1.31E-07
96.54	23.721	23.736	-0.316	1.96	1.01E-02	0.872	4.285E-04	4.26E-07
192.99	22.677	22.694	-0.835	0.49	3.71E-02	0.789	1.080E-04	3.93E-07
385.21	22.139	22.161	-0.337	1.69	1.02E-02	0.748	6.822E-05	6.85E-08
769.56	21.443	21.4635	-0.427	1.21	1.34E-02	0.696	4.081E-05	5.37E-08
1538.53	20.64	20.67	-0.55	1.21	1.24E-02	0.634	1.032E-06	1.26E-09
769.56	20.71	20.69				0.635		
192.99	20.886	20.8715				0.650		
49.83	21.172	21.162				0.673		
5.00	21.672	21.6595				0.712		

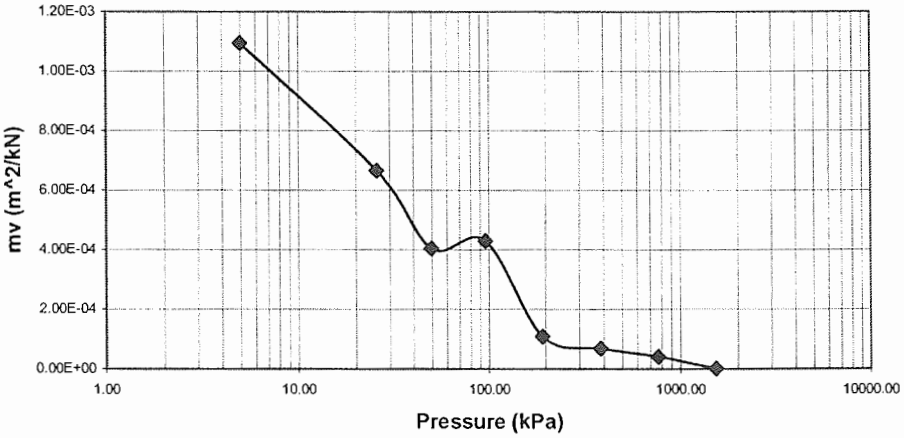
Coefficient of Consoildation vs Pressure

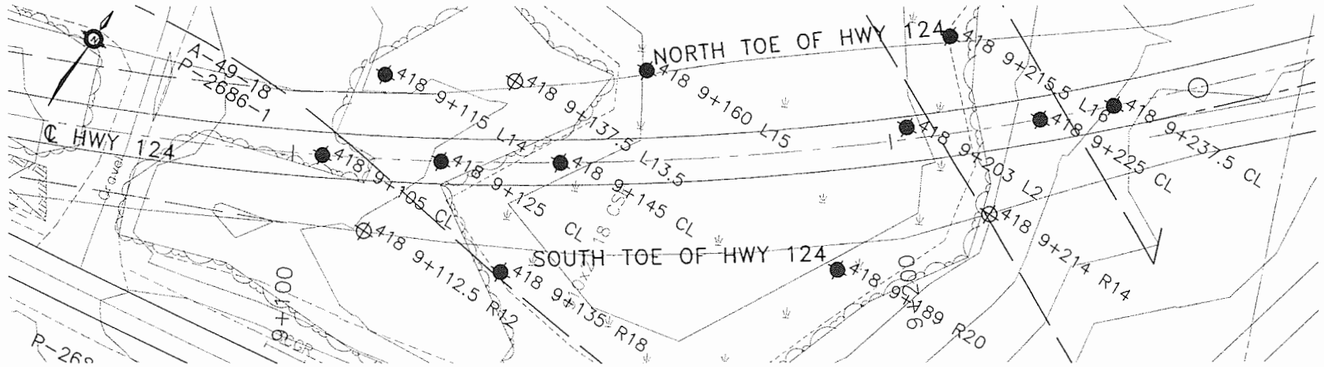


Hydraulic Conductivity vs Pressure



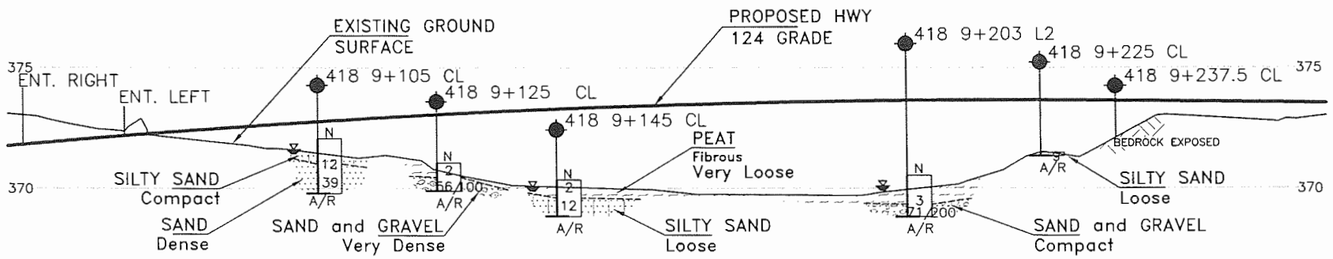
mv vs Pressure





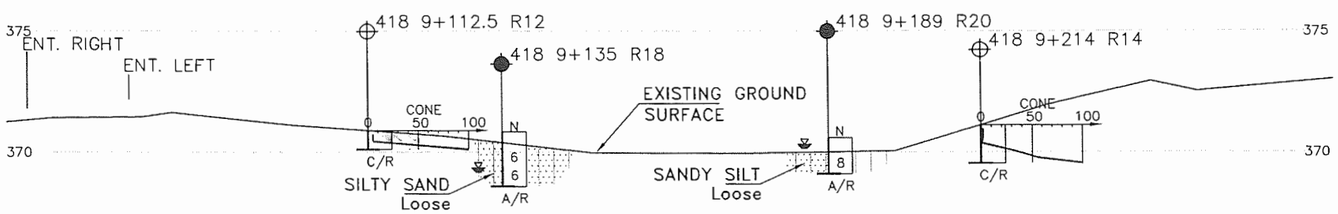
PLAN

5 0 10 20m



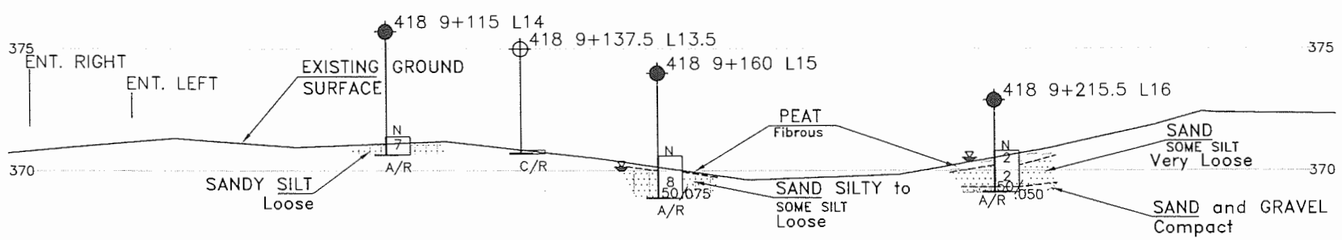
PROFILE HWY 124 CENTRELINE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE HWY 124 SOUTH TOE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



PROFILE HWY 124 NORTH TOE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
HWY 124 CL,SOUTH & NORTH TOE
STATIONS 9+105 TO 9+238
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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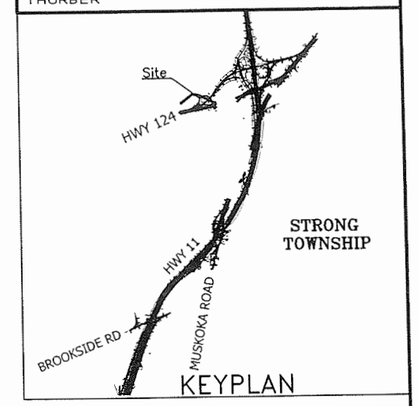
THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

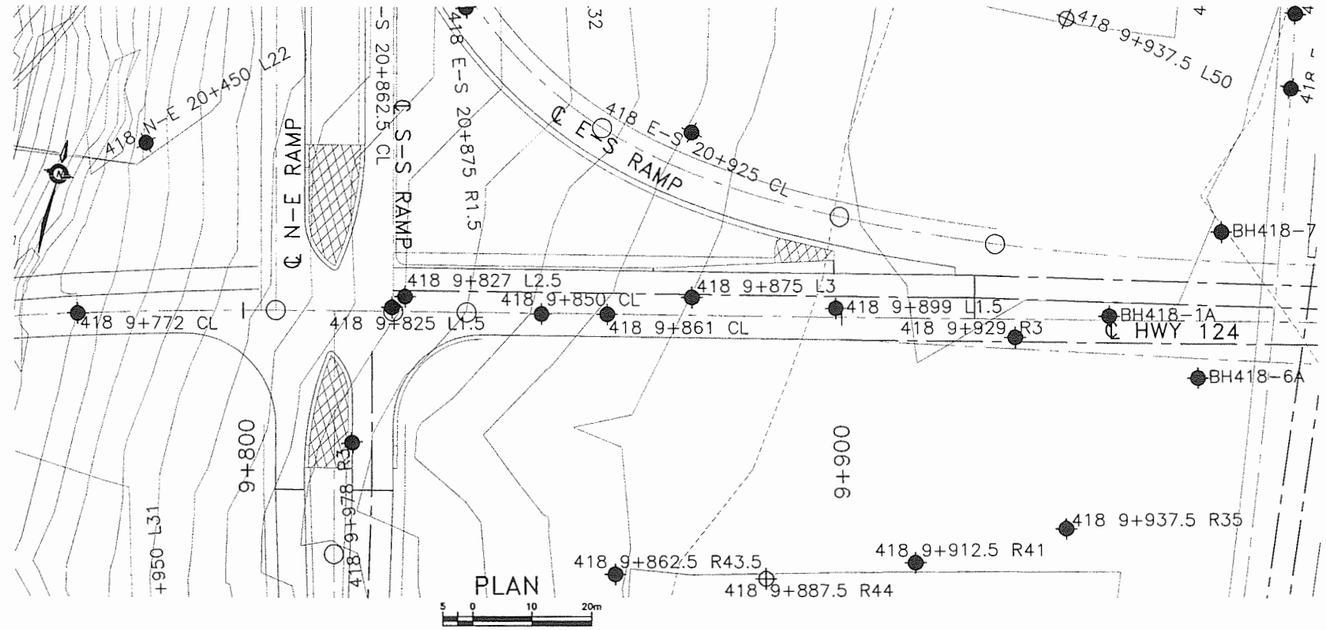
NO	STATION	OFFSET FROM MEDIAN CL
418 9+105 CL	9+105	0
418 9+112.5 R12	9+112.5	R12
418 9+115 L14	9+115	L14
418 9+125 CL	9+125	0
418 9+135 R18	9+135	R18
418 9+137.5 L13.5	9+137.5	L13.5
418 9+145 CL	9+145	0
418 9+160 L15	9+160	L15
418 9+189 R20	9+189	R20
418 9+203 L2	9+203	L2
418 9+214 R14	9+214	R14
418 9+215.5 L16	9+215.5	L16
418 9+225 CL	9+225	0
418 9+237.5 CL	9+237.5	0

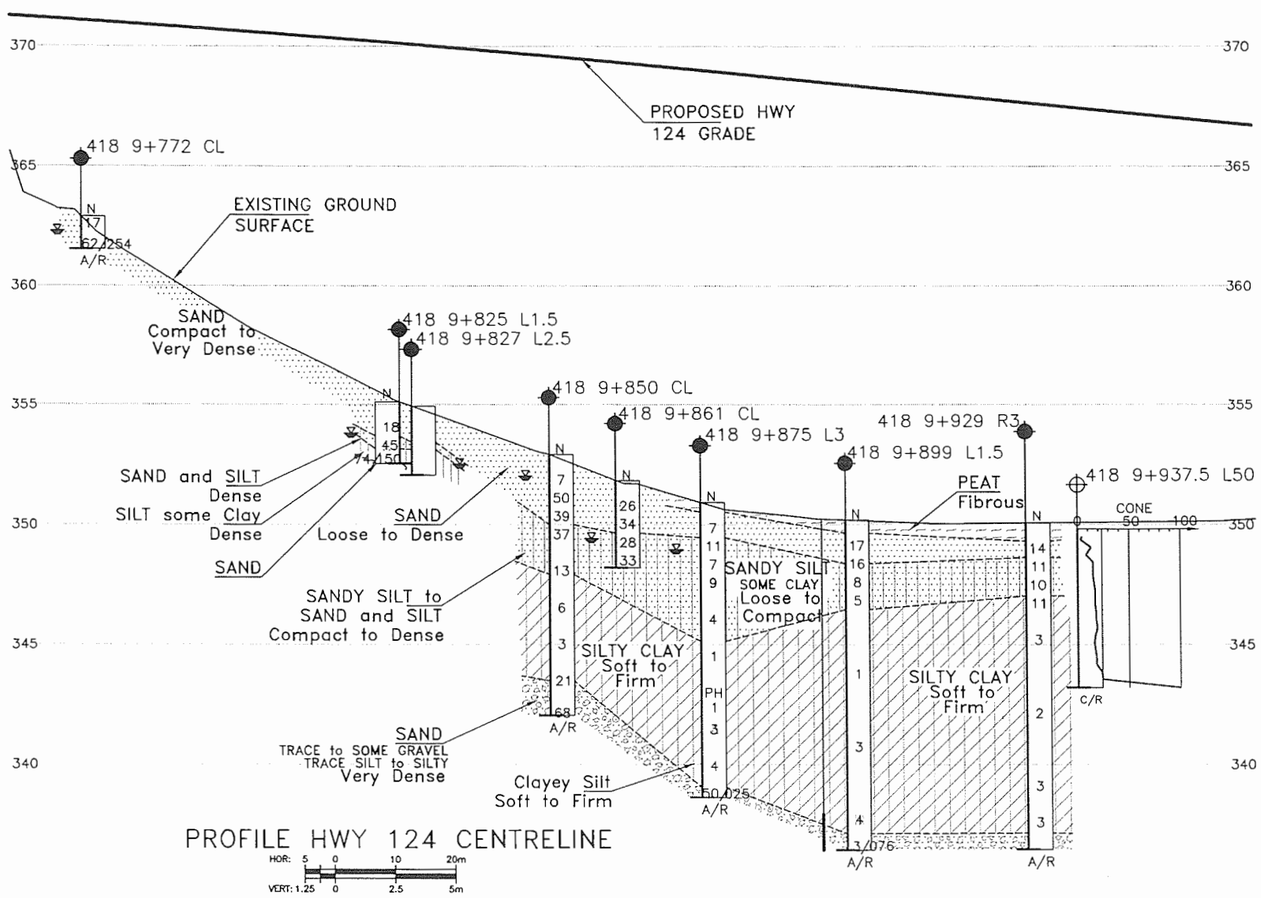
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG D1





PROFILE HWY 124 CENTRELINE

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
HWY 124 CENTRELINE
STATIONS 9+772 TO 9+937
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Marshall Macklin Monaghan
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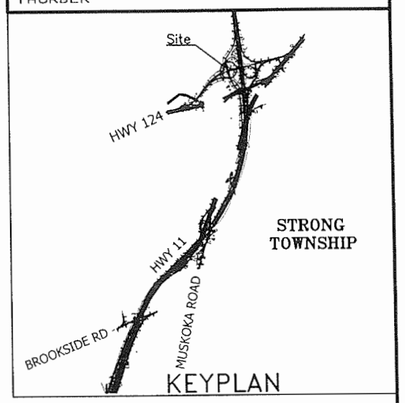
THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+772 CL	9+772	0
418 9+825 L1.5	9+825	L1.5
418 9+827 L2.5	9+827	L2.5
418 9+850 CL	9+850	0
418 9+861 CL	9+861	0
418 9+875 L3	9+875	L3
418 9+899 L1.5	9+899	L1.5
418 9+929 R3	9+929	R3
418 9+862.5 R43.5	9+862.5	R43.5
418 9+887.5 R44	9+887.5	R44
418 9+912.5 R41	9+912.5	R41

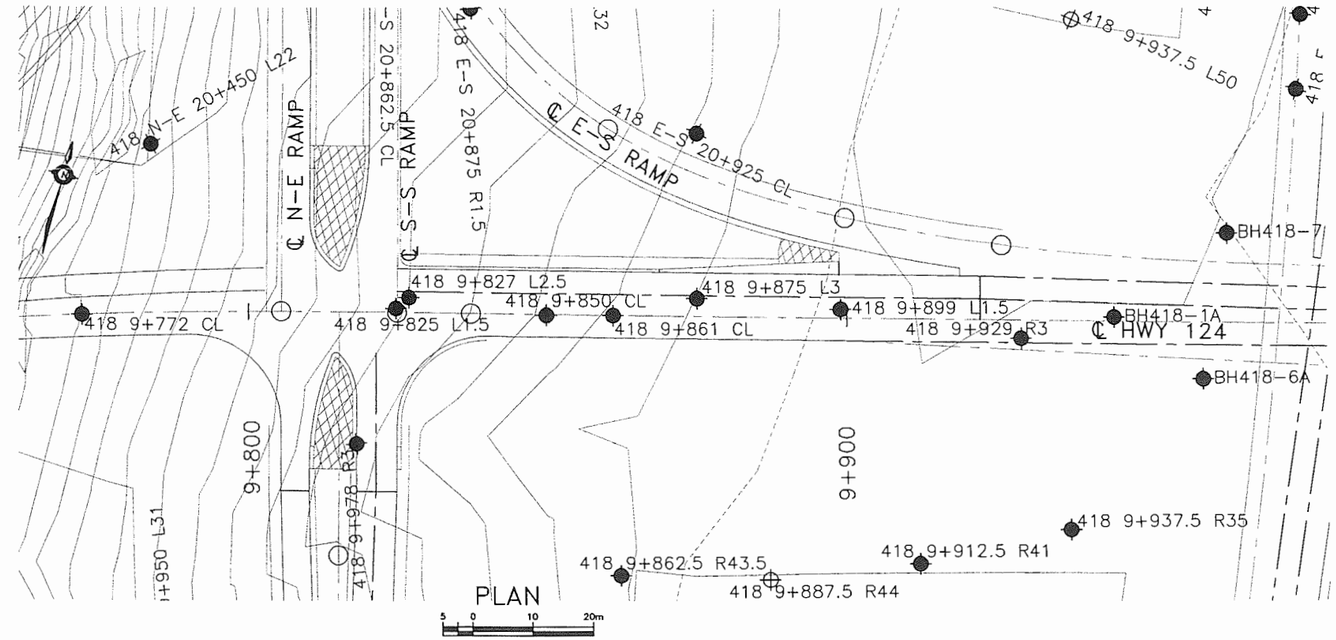
— NOTE —

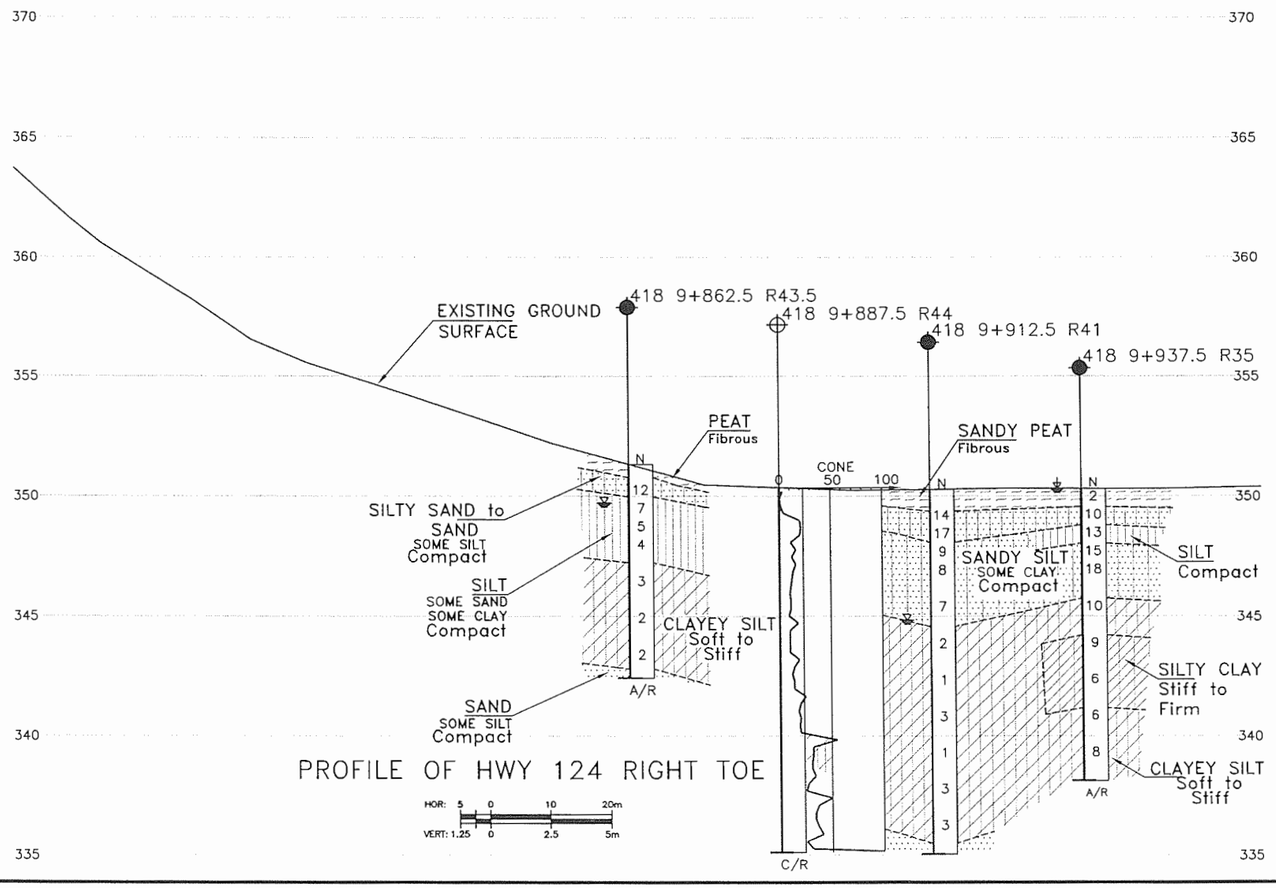
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG D2





METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
HWY 124 RIGHT TOE
STATIONS 9+772 TO 9+937
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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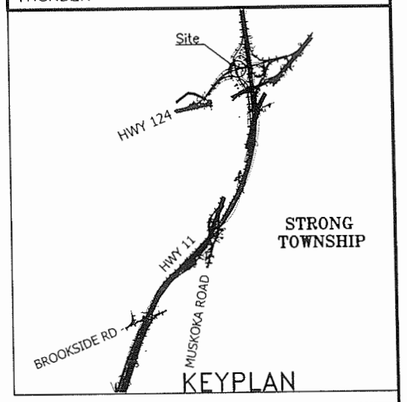


KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydroulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+772 CL	9+772	0
418 9+825 L1.5	9+825	L1.5
418 9+827 L2.5	9+827	L2.5
418 9+850 CL	9+850	0
418 9+861 CL	9+861	0
418 9+875 L3	9+875	L3
418 9+899 L1.5	9+899	L1.5
418 9+929 R3	9+929	R3
418 9+862.5 R43.5	9+862.5	R43.5
418 9+887.5 R44	9+887.5	R44
418 9+912.5 R41	9+912.5	R41

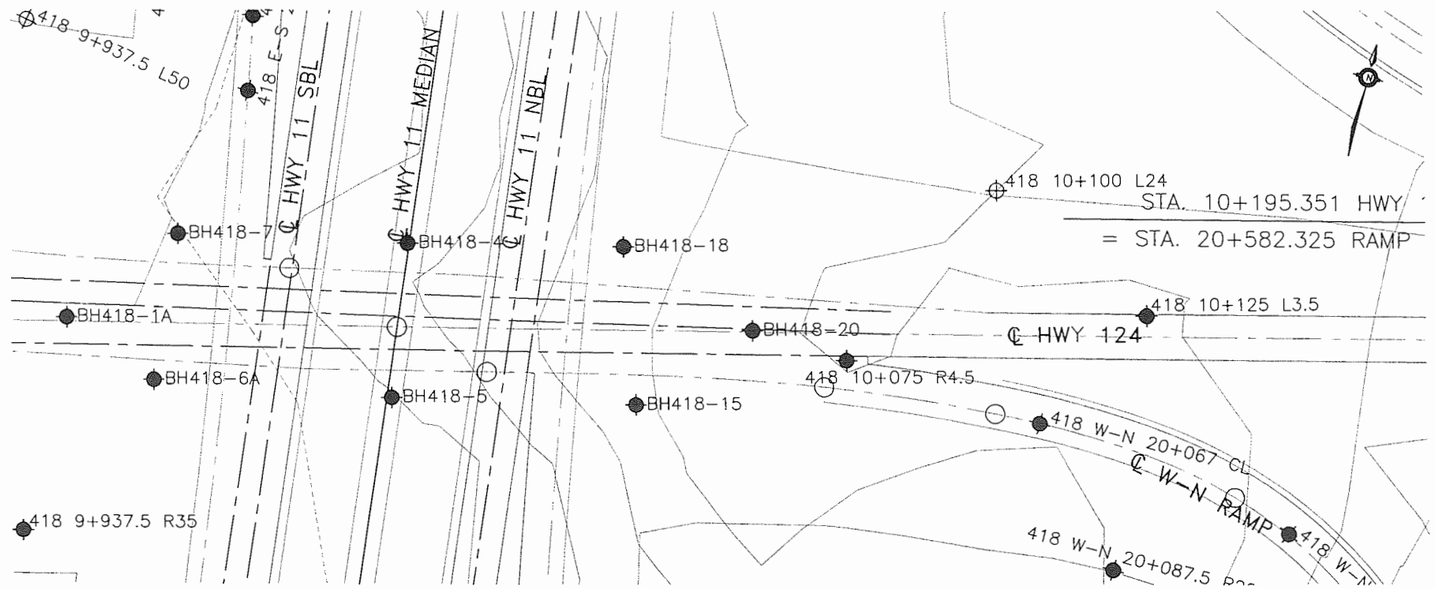
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

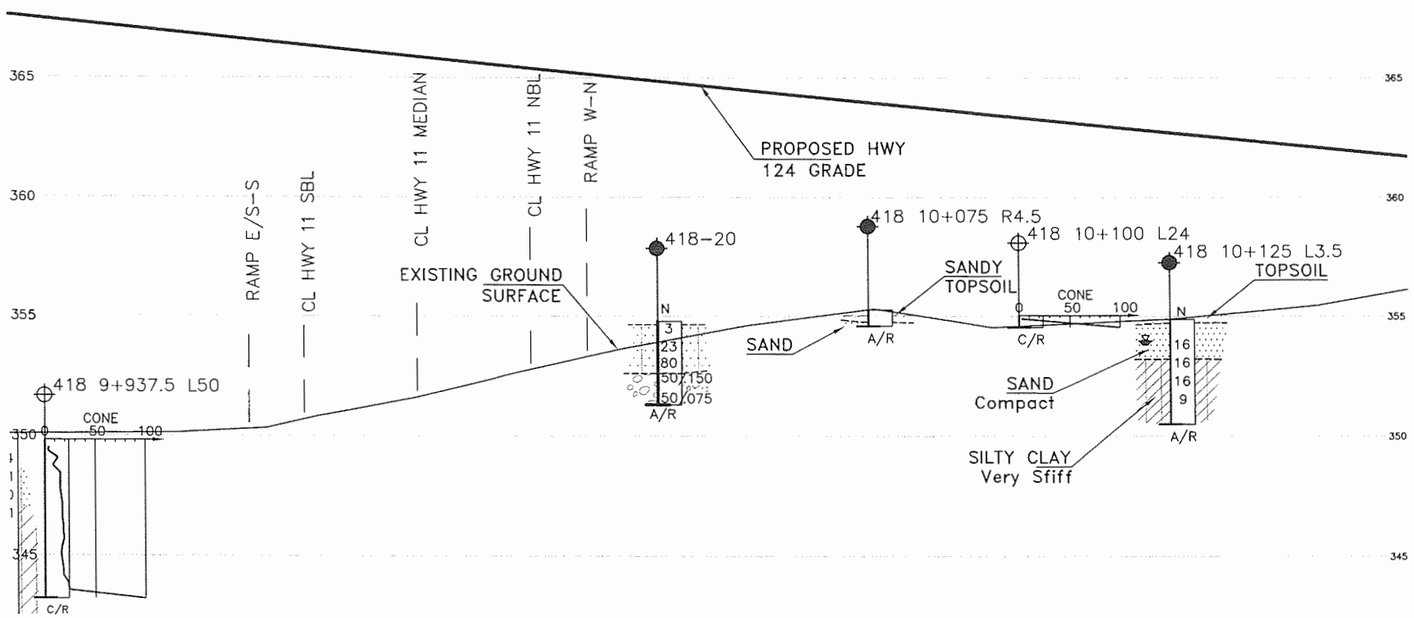
REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG D3



PLAN

5 0 10 20m



PROFILE HWY 124 CENTRELINE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
HWY 124 CENTRELINE
STATIONS 9+937 TO 10+125
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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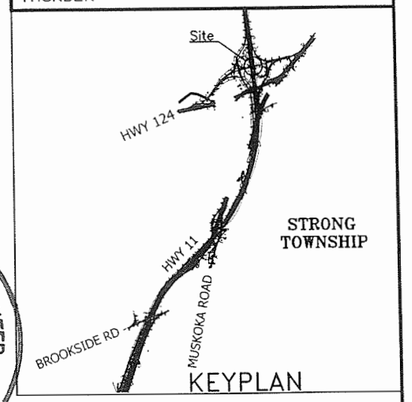


KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Dote)
	Head Artesian Water Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+937.5 L50	9+937.5	L50
418 9+937.5 R35	9+937.5	R35
418 10+075 R4.5	10+075	R4.5
418 10+100 L24	10+100	L24
418 10+125 L3.5	10+125	L3.5

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG D4

Appendix E
Muskoka Road

THURBER

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+250 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+250, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 01.03.04 - 01.03.04 | CHECKED BY AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**SILT**, trace sand, occasional rootlets, occasional iron oxide staining Compact Brown Dry to Moist		1	SS	11				○		
0.7	Sandy **SILT**, trace iron oxide staining Compact Brown Dry		2	SS	22				○		
1.4	Silty **SAND**, trace clay, trace gravel Compact Brown Moist occasional cobbles or boulders		3	SS	25				○		2 66 30 2
			4	SS	22				○		
3.1	**SAND and GRAVEL**, trace silt, occasional cobbles and boulders Very Dense Brown Wet		5	SS	67				○		
3.8	END OF BOREHOLE AT 3.81 m. BOREHOLE OPEN TO 3.81 m AND DRY UPON COMPLETION. AUGER REFUSAL AT 3.81 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+275 L32

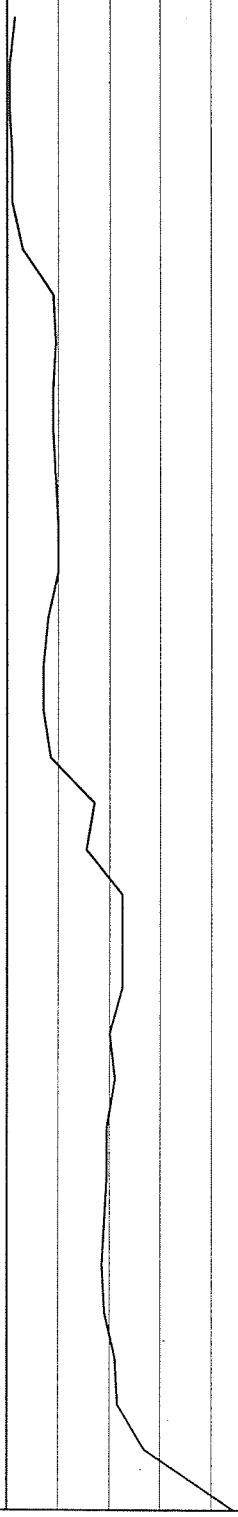
METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+275, O/S 32L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM

DATUM Geodetic | DATE 01.03.04 - 01.03.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										



Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+275 L32 2 OF 2 METRIC

W.P. 759-93-00 LOCATION 418 Muskoka Road, ST. 9+275, O/S 32L ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 01.03.04 - 01.03.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			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
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
10.1	END OF DCPT AT 10.13 m. CONE REFUSAL AT 10.13 m ON PROBABLE BEDROCK OR BOULDER.										

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+275 R18

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+275, 18R | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 01.03.04 - 01.03.04 | CHECKED BY AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.2	Dark Brown Sandy **SILT**, occasional rootlets Loose Brown Wet		1	SS	8				○		
0.7	Silty **SAND**, occasional cobbles, occasional iron oxide staining Compact Brown Wet		2	SS	50/.075				○		
1.5	END OF BOREHOLE AT 1.52 m. BOREHOLE OPEN TO 1.52 m AND DRY UPON COMPLETION. AUGER REFUSAL AT 1.52 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+300 CL

METRIC

W.P.	759-93-00	LOCATION	418 Muskoka Road, ST. 9+300, CL	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	01.03.04 - 01.03.04	CHECKED BY	AEG

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**SAND** mixed with **PEAT**, silty, occasional rootlets, Dark Brown										
0.5	**SAND and SILT**, Loose to Compact, Grey, Wet		1	SS	4				○		
			2	SS	17				○		0 48 48 3
1.8	**SAND**, trace silt, trace gravel, Compact, Grey, Wet		3	SS	14				○		
2.6	Sandy **SILT**, occasional iron oxide staining, Dense, Brown, Wet		4	SS	41				○		
4.1	Silty **SAND**, trace oxide staining, Compact, Brown, Wet		5	SS	23				○		
5.3	END OF BOREHOLE AT 5.33 m. AUGER REFUSAL AT 5.33 m ON PROBABLE BEDROCK OR BOULDER. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

WATER LEVEL READINGS:

DATE	DEPTH (m)
03/03/04	0.30

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+350 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+350, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 01.03.04 - 01.03.04 | CHECKED BY AEG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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
0.0	**SAND**, fine to medium grained, trace silt, occasional iron oxide staining Compact Brown Wet										
			1	SS	10				○		
			2	SS	19				○		
2.0	**SILT**, some clay, some sand, occasional iron oxide staining Stiff Brown Wet		3	SS	21				○		
			4	SS	18				○		0 14 68 17
4.3	Sandy **SILT**, occasional iron oxide staining Compact Brown Wet		5	SS	27				○		
5.3	END OF BOREHOLE AT 5.34 m. AUGER REFUSAL AT 5.34 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.22 m AND WATER LEVEL IN OPEN BOREHOLE AT 0.61 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+400 R1.5 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 Muskoka Road, ST. 9+400, O/S 1.5R ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 01.03.04 - 01.03.04 CHECKED BY AEG

ELEV / DEPTH	SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, silty, fibrous, trace rootlets, trace wood fibers Loose to Very Loose Dark Brown Wet		1	SS	5				88		
			2	SS	3				268		
1.1	**SAND**, fine grained, trace silt Compact Brown Wet		3	SS	24						
2.0	Silty **SAND**, fine grained, trace gravel, trace clay Compact Grey Wet		4	SS	17						6 57 34 4
2.8	Sandy **SILT**, trace clay, occasional clay seams Compact Grey Wet		5	SS	14						
4.3	**SILT**, some sand, some clay, occasional iron oxide staining Very Stiff Brown Wet		6	SS	26						0 18 66 16
5.8	Sandy **SILT**, trace clay Very Loose Brown Wet		7	SS	2						
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 6.71 m AND WATER LEVEL IN OPEN BOREHOLE AT 0.64 m UPON COMPLETION. AUGER REFUSAL AT 6.71 m ON PROBABLE BEDROCK OR BOULDER. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 03/03/04 0.64										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+425 L20

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+425, O/S 20L | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, some rootlets, occasional wood fibers Very Loose Dark Brown Wet								287		
0.9	Sandy **SILT**, trace rootlets Compact Grey Wet		1 2	SS SS	2 13						
1.5	**SILT**, some clay, trace sand, occasional iron oxide staining Hard to Very Stiff Grey Dry to Wet		3 4	SS SS	33 22						0 8 74 18
3.7	END OF BOREHOLE AT 3.67 m. AUGER REFUSAL AT 3.67 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.92 m AND WATER LEVEL IN OPEN BOREHOLE AT GROUND SURFACE. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+425 R22

METRIC

W.P.	759-93-00	LOCATION	418 Muskoka Road, ST. 9+425, O/S 22R	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	WM
DATUM	Geodetic	DATE	01.03.04 - 01.03.04	CHECKED BY	JL

SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	DCPT from surface.										
4.7	END OF DCPT AT 4.72 m. CONE REFUSAL AT 4.72 m ON PROBABLE BEDROCK OR BOULDER.										

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+450 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+450, CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 01.03.04 - 01.03.04 | CHECKED BY AEG

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
0.0	**PEAT**, fibrous, trace rootlets and wood fibers Very Loose Dark Brown Wet	1	SS	2					
1.2	**SAND**, fine to medium grained, trace silt Compact Brown Wet	2	SS	18					
2.0	**SILT**, some clay, trace sand Very Stiff Grey Wet	3	SS	33					
		4	SS	24		0	8	79	13
		5	SS	62					
4.7	END OF BOREHOLE AT 4.73 m. BOREHOLE OPEN TO 3.36 m AND WATER LEVEL IN OPEN BOREHOLE AT GROUND SURFACE. AUGER REFUSAL AT 4.73 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.								

SOIL PROFILE: 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

REMARKS & GRAIN SIZE DISTRIBUTION (%)

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

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+500 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+500, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY AEG

ELEV / DEPTH	SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	WATER										
0.4	PEAT, fibrous, trace rootlets and wood fibers Very Loose Dark Brown Wet		1	SS	2				249		
			2	SS	2						
2.1	SILT, trace sand, some clay, occasional iron oxide staining Stiff Brown Wet		3	SS	26						
			4	SS	22						0 6 81 13
4.1	END OF BOREHOLE AT 4.06 m. BOREHOLE OPEN TO 0.7 m AND WATER LEVEL IN OPEN BOREHOLE AT 0.41m ABOVE GROUND SURFACE. AUGER REFUSAL AT 3.66 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+625 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+625, CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY AEG

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	**SAND and SILT**, trace rootlets, occasional iron oxide staining Compact to Dense Brown Moist to Wet		1	SS	22	▽			○		
			2	SS	49				○		7 55 38 (SI+CL)
1.0	END OF BOREHOLE AT 1.02 m. BOREHOLE OPEN TO 0.26 m AND WATER LEVEL IN OPEN BOREHOLE AT 0.56 m UPON COMPLETION. AUGER REFUSAL AT 1.02 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+650 L22

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+650, O/S 22L | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY JL

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	DCPT from surface.										
1.2	END OF DCPT AT 1.22 m. CONE REFUSAL AT 1.22 m ON PROBABLE BEDROCK OR BOULDER.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+670 CL

1 OF 1

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+670, CL | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 02.03.04 - 02.03.04 | CHECKED BY AEG

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
0.0	**PEAT**, fibrous, trace rootlets and wood fibers Very Loose to Loose Dark Brown Wet		1	SS	2	▽			55		
1.1	Sandy **SILT**, some clay, occasional iron oxide staining Compact Brown Wet		2	SS	5						
			3	SS	17						0 24 60 16
2.6	END OF BOREHOLE AT 2.60 m. AUGER REFUSAL AT 2.60 m ON PROBABLE BEDROCK OR BOULDER. WATER LEVEL IN OPEN BOREHOLE AT 0.46 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+722 CL

METRIC

W.P.	759-93-00	LOCATION	418 Muskoka Road , ST. 9+722, CL	ORIGINATED BY	MF
HWY	11	BOREHOLE TYPE	Solid Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	17.11.03 - 17.11.03	CHECKED BY	AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**SAND and GRAVEL** Loose Brown to Grey Moist to Wet (FILL) silty sand, fine grained, occasional organics below 0.46m.		1	SS	5				○		
			2	SS	4	▽			○		
1.2	**TOPSOIL**, mixed with sand Very Loose to Compact Dark Brown Wet										
			3	SS	23				○		
1.8	**SAND**, fine grained, with silt layers Compact Grey Moist										
2.2	**SILT**, some clay, some sand, with sand layers Very Stiff Grey Wet		4	SS	17				○		
			5	SS	17				○		0 15 69 17
	Becoming Firm, occasional cobbles at 4.57 m		6	SS	5				○		
5.3	Gravelly **SAND**, fine to medium grained, some silt, occasional cobbles Very Dense Brown Wet		7	SS	53				○		25 62 13 (SI+CL)
			8	SS	105/.229				○		
			9	SS	100/.05						
9.2	END OF BOREHOLE AT 9.19m. BOREHOLE OPEN TO 9.19m. WATER LEVEL IN OPEN BOREHOLE AT 1.22m UPON COMPLETION. BOREHOLE BACKFILLED WITH										

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 418 9+722 CL

METRIC

W.P. 759-93-00 LOCATION 418 Muskoka Road , ST. 9+722, CL ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 17.11.03 - 17.11.03 CHECKED BY AEG

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						
	DRILL CUTTINGS.										

+ 3 , × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+775 CL

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+775, CL | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 17.05.04 - 17.05.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sandy **TOPSOIL** with rootlets										
0.2	Dark Brown **SAND**, fine grained, some silt Loose to Compact Brown Wet		1	SS	6				○		
			2	SS	10				○		
			3	SS	8	▽			○		
2.3	**SILT and SAND**, some iron oxide staining Compact Brown Wet		4	SS	10				○		0 49 51 (SI+CL)
3.1	Clayey **SILT**, trace to some sand Stiff to Very Stiff Grey Wet		5	SS	13				○		
			6	SS	16				○		0 10 67 23
5.8	END OF BOREHOLE AT 5.79 m. BOREHOLE OPEN TO 5.79 m AND WATER LEVEL IN OPEN BOREHOLE AT 1.83 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (%) STRAIN AT FAILURE
20
10

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+802 R5

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+802, O/S 5R | ORIGINATED BY GA
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM
DATUM Geodetic | DATE 17.05.04 - 17.05.04 | CHECKED BY JL

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Silty **SAND**, occasional peat and rootlets Loose Dark Brown Wet		1	SS	7				○		
0.8	**SILT and SAND**, fine grained Compact Grey Wet		2	SS	18				○		0 44 56 (SI+CL)
1.5	Clayey **SILT**, trace to some sand Very Stiff to Stiff Grey Wet		3	SS	16				○		
			4	SS	10				○		0 10 61 29
			5	SS	10				○		
3.8	END OF BOREHOLE AT 3.81 m. END OF BOREHOLE AT 3.81 m. AUGER REFUSAL AT 3.81 m ON PROBABLE BEDROCK OR BOULDER. WATER LEVEL IN OPEN BOREHOLE AT 0.91 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 ⟨ 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+825 R3

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road, ST. 9+825, O/S 3R | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 12.05.04 - 12.05.04 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE 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
0.0	Sandy **TOPSOIL**, some rootlets, some peat		1	GS							
0.3	Dark Brown Wet **SAND** fine grained, some silt, trace clay, mixed with peat Loose to Compact Dark Brown Moist		1	SS	9	▽					
			2	SS	10					9.4	
2.6	Silty **SAND**, fine to medium grained, trace gravel Dense Brown Moist		3	SS	30						8 61 31 (SI+CL)
			4	SS	50/.075						
3.4	END OF BOREHOLE AT 3.35 m. AUGER REFUSAL AT 3.35 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.35 m AND WATER LEVEL IN OPEN BOREHOLE AT 1.52 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+878 L5

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road , ST. 9+878, O/S 5L | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 20.11.03 - 20.11.03 | CHECKED BY AEG

ELEV / DEPTH	SOIL PROFILE: 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	Dark Brown Silty **SAND**, fine grained Loose to Compact Reddish Brown to Brown Wet some grey silt layers		1	SS	7	▽			○		
			2	SS	20				○		
			3	SS	17				○		
2.0	Clayey **SILT**, trace sand Stiff Grey Wet to Moist (ML) silt and clay laminated		4	SS	9				○		0 7 69 24
3.4	Silty **SAND**, fine to medium grained, trace to some gravel, occasional cobbles Dense to Very Dense Brown Wet		5	SS	34				○		
			6	SS	75				○		3 65 32 (SI+CL)
			7	SS	50/.102				○		
6.3	**END** OF BOREHOLE AT 6.25 m. AUGER REFUSAL AT 6.25 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.96 m. WATER LEVEL IN OPEN BOREHOLE AT 0.91m DEPTH UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 ⊕ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+927 R2

METRIC

W.P.	759-93-00	LOCATION	418 Muskoka Road , ST. 9+927, O/S 2R	ORIGINATED BY	MF
HWY	11	BOREHOLE TYPE	Solid Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	20.11.03 - 20.11.03	CHECKED BY	AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
0.1	Dark Brown										
	Silty **SAND**, fine grained		1	SS	6				○		
0.3	Loose										
	Reddish Brown										
	Moist										
	SAND and SILT, fine grained, trace gravel, occasional cobbles		2	SS	85				○		
	Very Dense to Compact										
	Brown										
	Moist to Wet										
			3	SS	80				○		1 58 41 (SI+CL)
	occasional grey silt layers beginning at 2.2 m		4	SS	34				○		
			5	SS	24				○		
			6	SS	19				○		
4.9	Clayey **SILT**, trace sand, occasional sand layers										
	Very Stiff										
5.3	Grey										
	Wet										
	Silty **SAND**, fine to medium grained, trace to some gravel, occasional cobbles										
6.1	END OF BOREHOLE AT 6.1m. AUGER REFUSAL AT 6.1 m ON PROBABLE BEDROCK OR BOULDER. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

WATER LEVEL READINGS:
DATE DEPTH (m)

+ 3, × 3 : Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+950 L31 1 OF 1 METRIC

W.P. 759-93-00 LOCATION 418 Muskoka Road , ST. 9+950, O/S 31L ORIGINATED BY MF

HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY SS

DATUM Geodetic DATE 20.11.03 - 20.11.03 CHECKED BY AEG

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						
0.0	TOPSOIL										
0.1	Dark Brown		1	SS	3						
0.3	Silty **SAND**, fine grained Very Loose Reddish Brown Moist		2	SS	50/ .076						
	SAND, fine grained, trace to some silt Very Dense Brown										
1.4	Moist										
	END OF BOREHOLE AT 1.37 m. AUGER REFUSAL AT 1.37 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.37 m AND DRY ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 418 9+978 R3

METRIC

W.P. 759-93-00 | LOCATION 418 Muskoka Road , ST. 9+978, O/S 3R | ORIGINATED BY MF

HWY 11 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 20.11.03 - 20.11.03 | CHECKED BY AEG

SOIL PROFILE 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**										
	Very Loose										
0.3	Dark Brown		1	SS	3				○		
	Wet					▽					
	Silty **SAND**, fine grained, some gravel										
	Very Loose to Very Dense		2	SS	50/						
	Grey				.150						
	Moist								○		
			3	SS	100/						18 52 29
					.150				○		(SI+CL)
2.3	END OF BOREHOLE AT 2.29 m. AUGER REFUSAL AT 2.29 m ON PROBABLE BEDROCK OR BOULDER. PROBABLE BEDROCK. BOREHOLE OPEN TO 2.29 m. WATER LEVEL IN OPEN BOREHOLE AT 0.61m DEPTH UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.										

+ 3, × 3 : Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

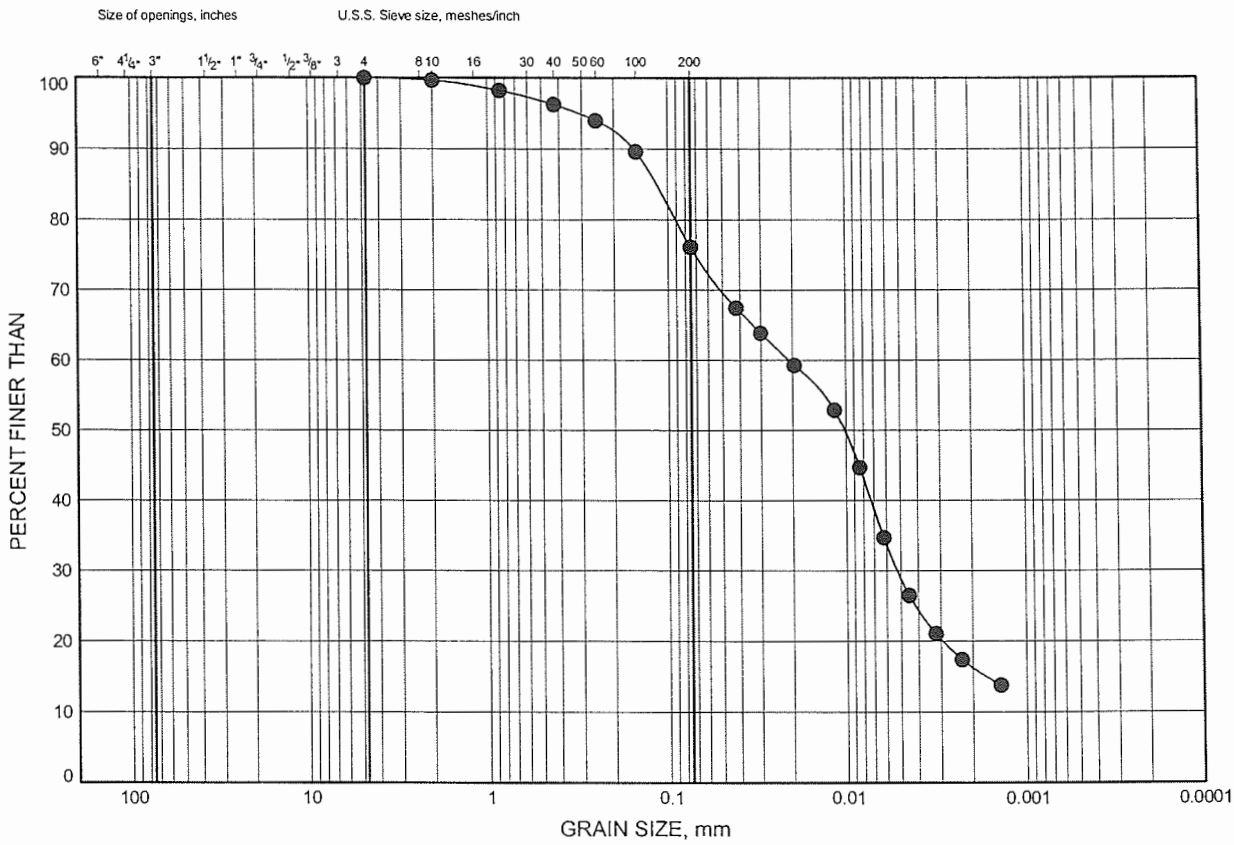
ONTMT4S 418MUSKOKA.GPJ 21/12/04 s

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E1

Sandy Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+670 CL	2.29	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

Chkd. SMS

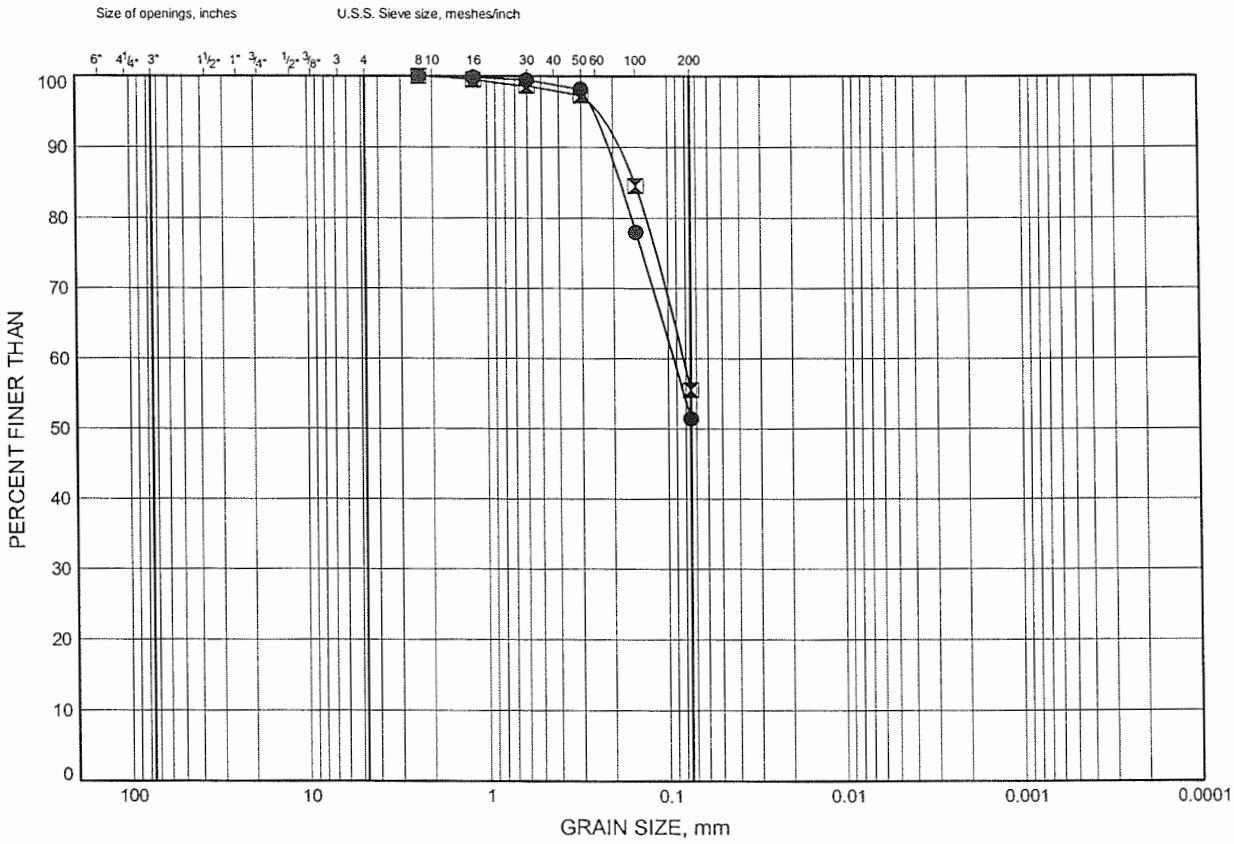
THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E2

Silt and Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+775 CL	2.59	
⊠	418 9+802 R5	1.07	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

Chkd. SMS

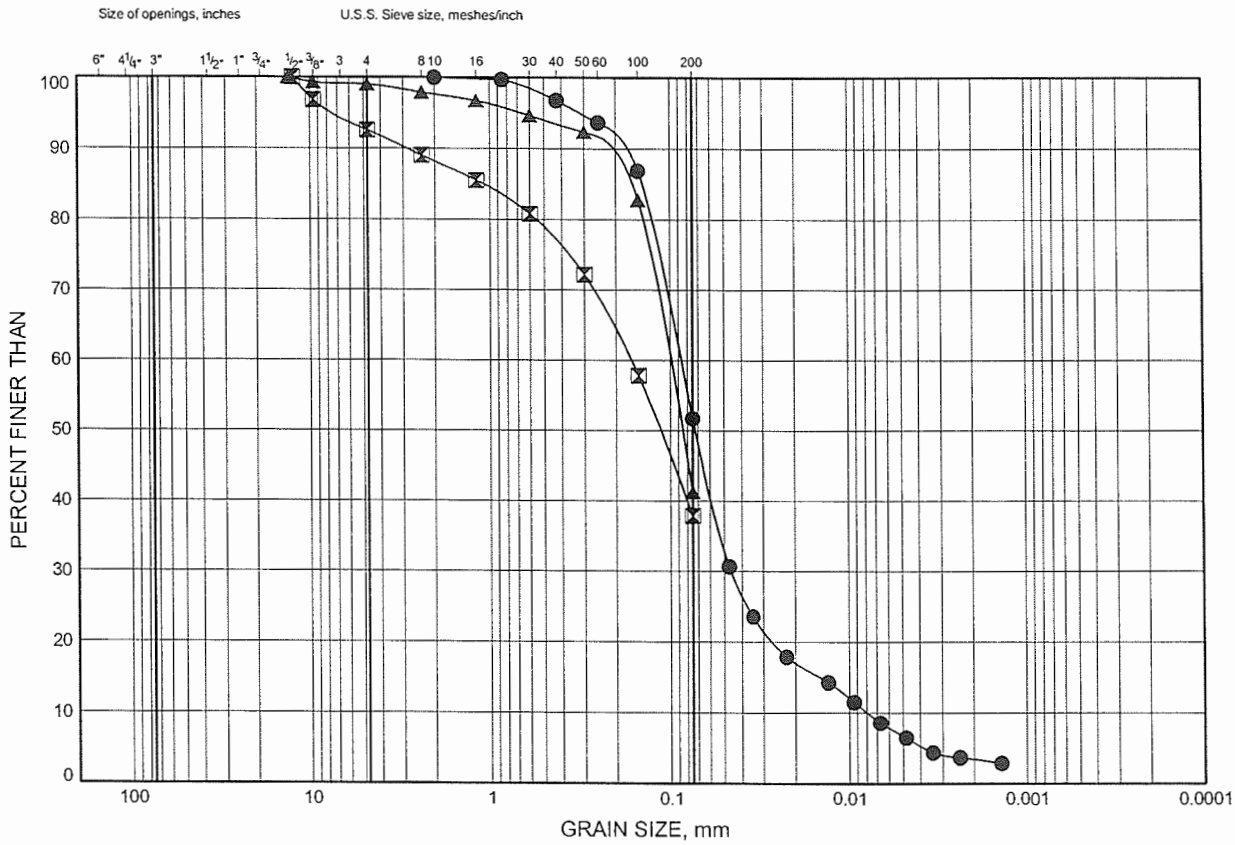
THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E3

Sand and Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+300 CL	1.37	
⊠	418 9+625 CL	0.87	
▲	418 9+927 R2	1.83	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

Chkd. SMS

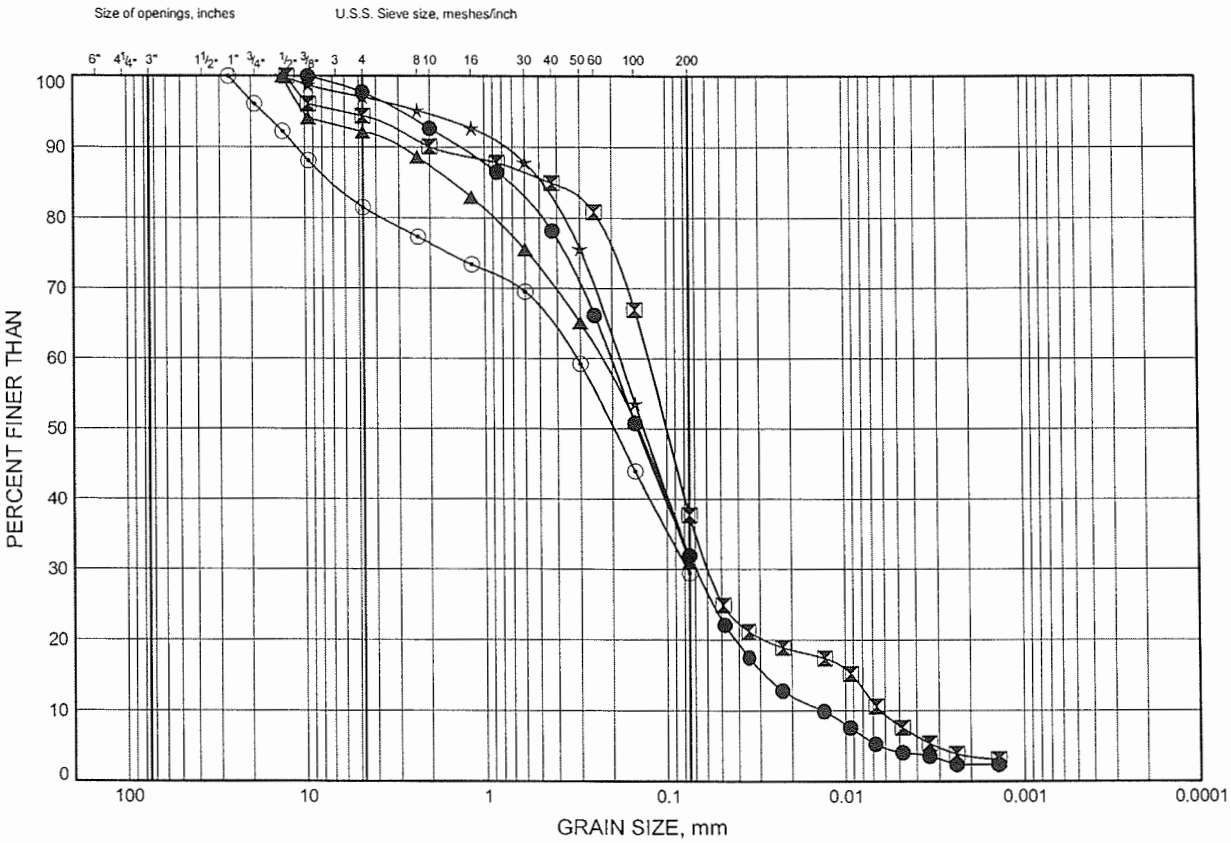
THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E4

Silty Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+250 CL	1.83	
⊠	418 9+400 R1.5	2.29	
▲	418 9+825 R3	2.75	
★	418 9+878 L5	4.88	
⊙	418 9+978 R3	1.60	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

Chkd. SMS

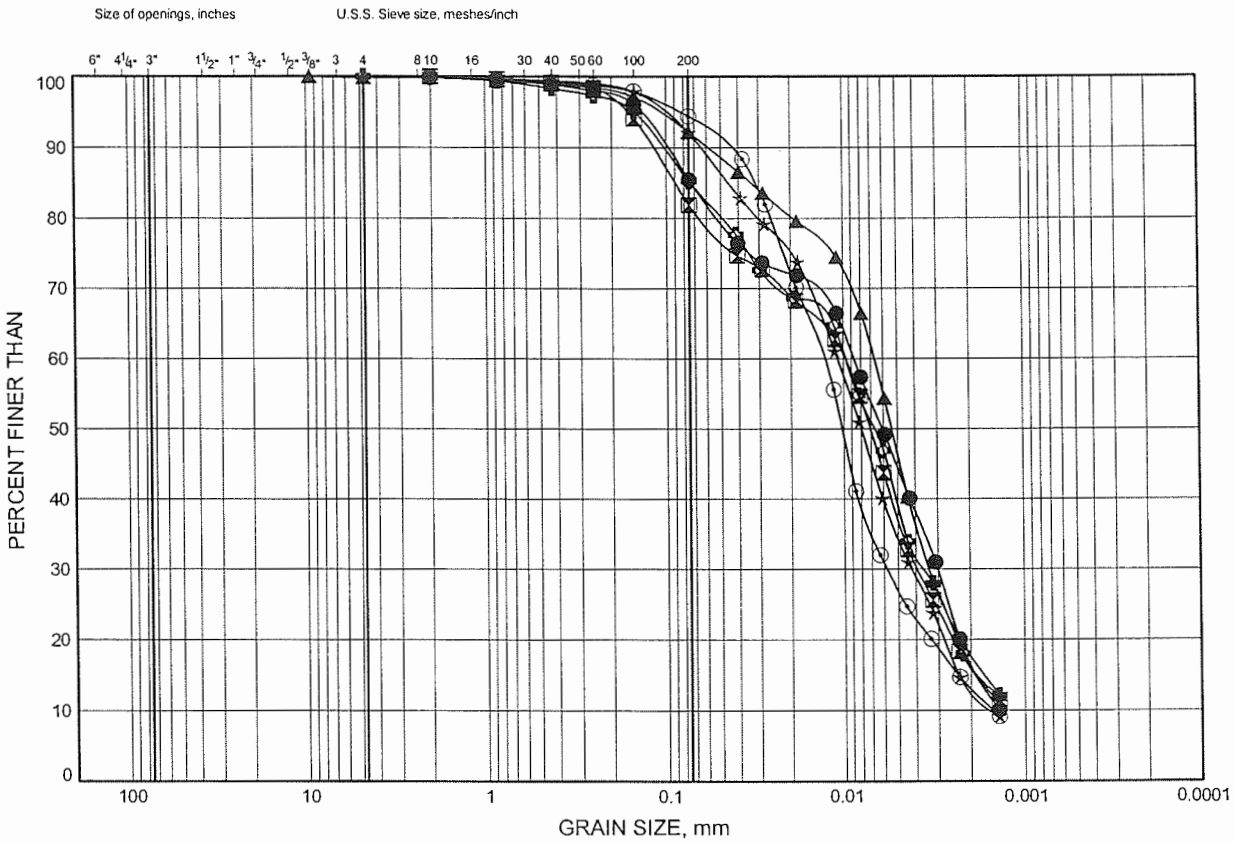
THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E5

Silt, some clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+350 CL	3.05	
⊠	418 9+400 R1.5	4.58	
▲	418 9+425 L20	1.99	
★	418 9+450 CL	3.05	
⊙	418 9+500 CL	2.74	
✪	418 9+722 CL	3.35	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

Chkd. SMS

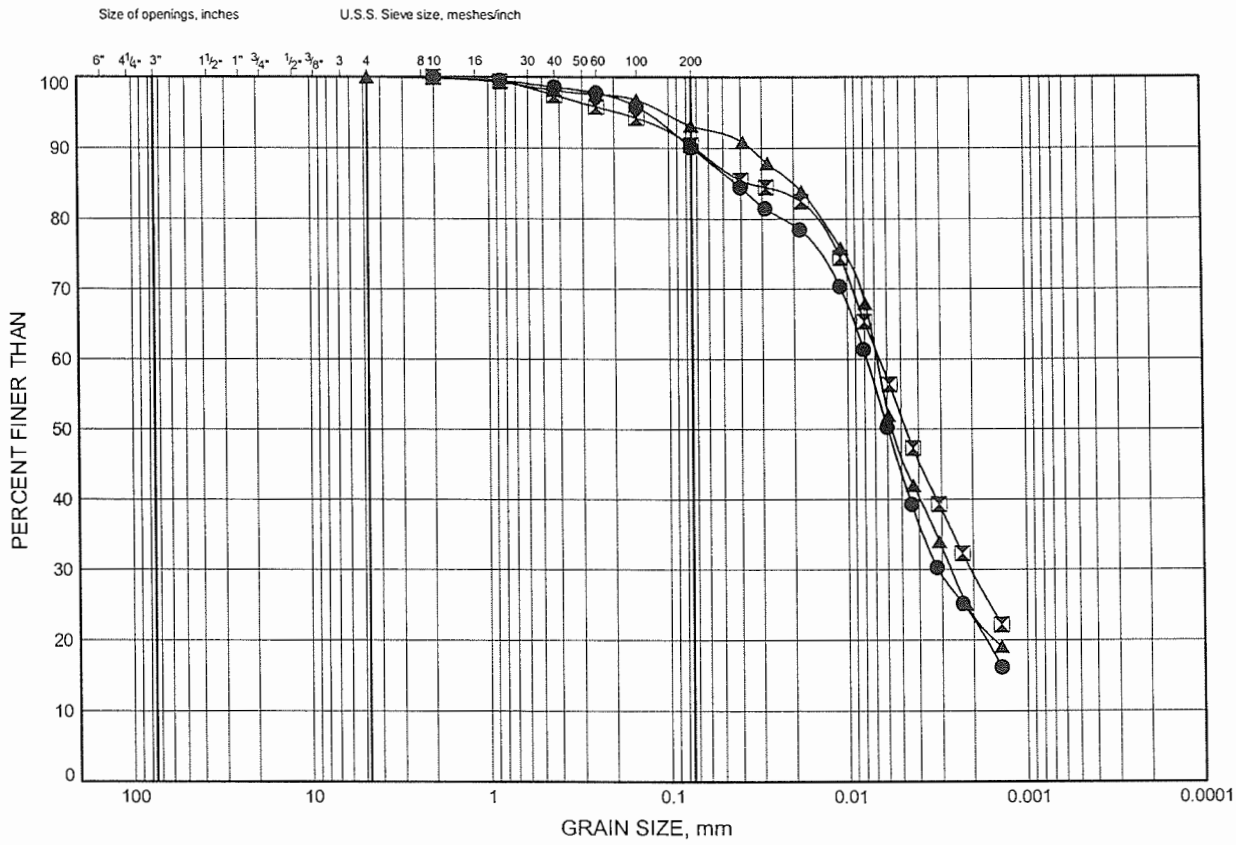
THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E6

Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+775 CL	4.88	
⊠	418 9+802 R5	2.59	
▲	418 9+878 L5	2.59	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

Chkd. SMS

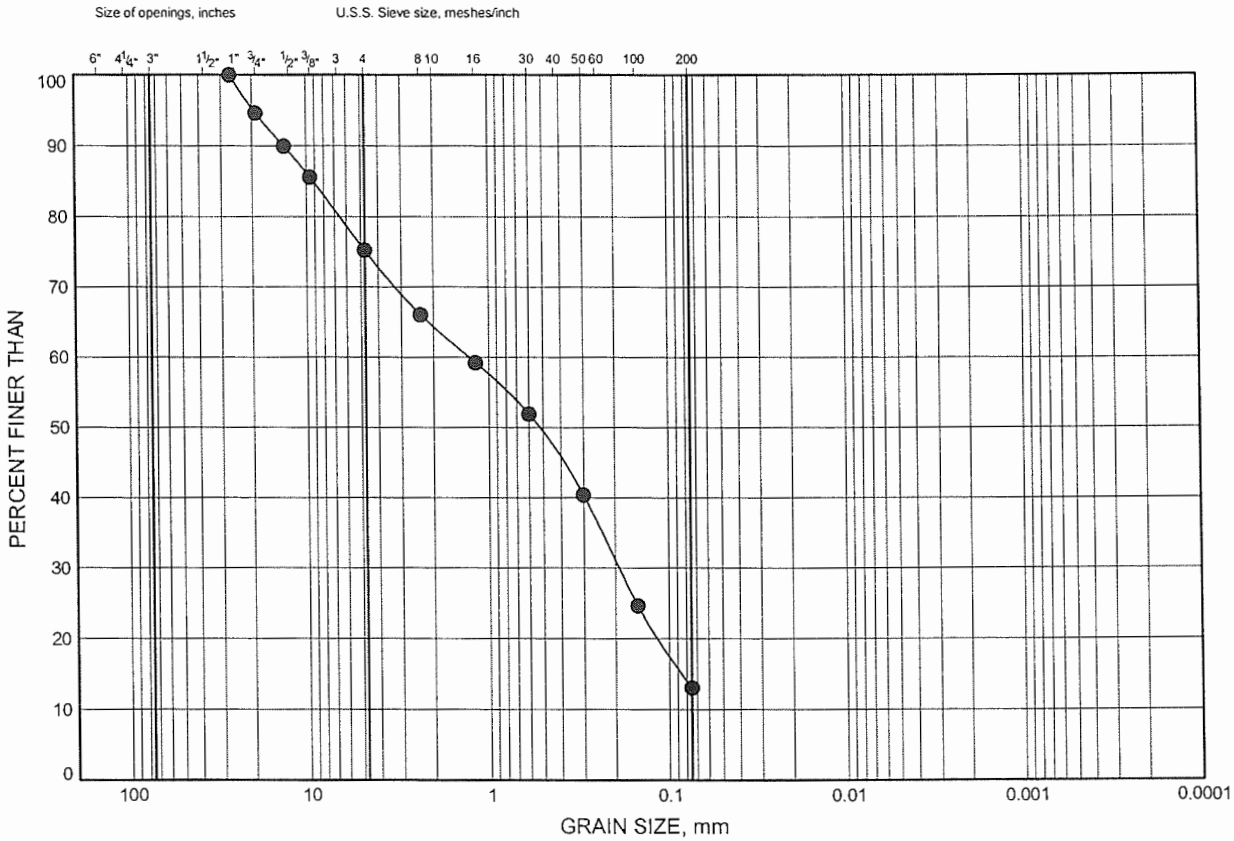
THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE E7

Gravelly Sand



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+722 CL	6.40	

Date December 2004

Project 759-93-00

THURBER

Prep'd HS

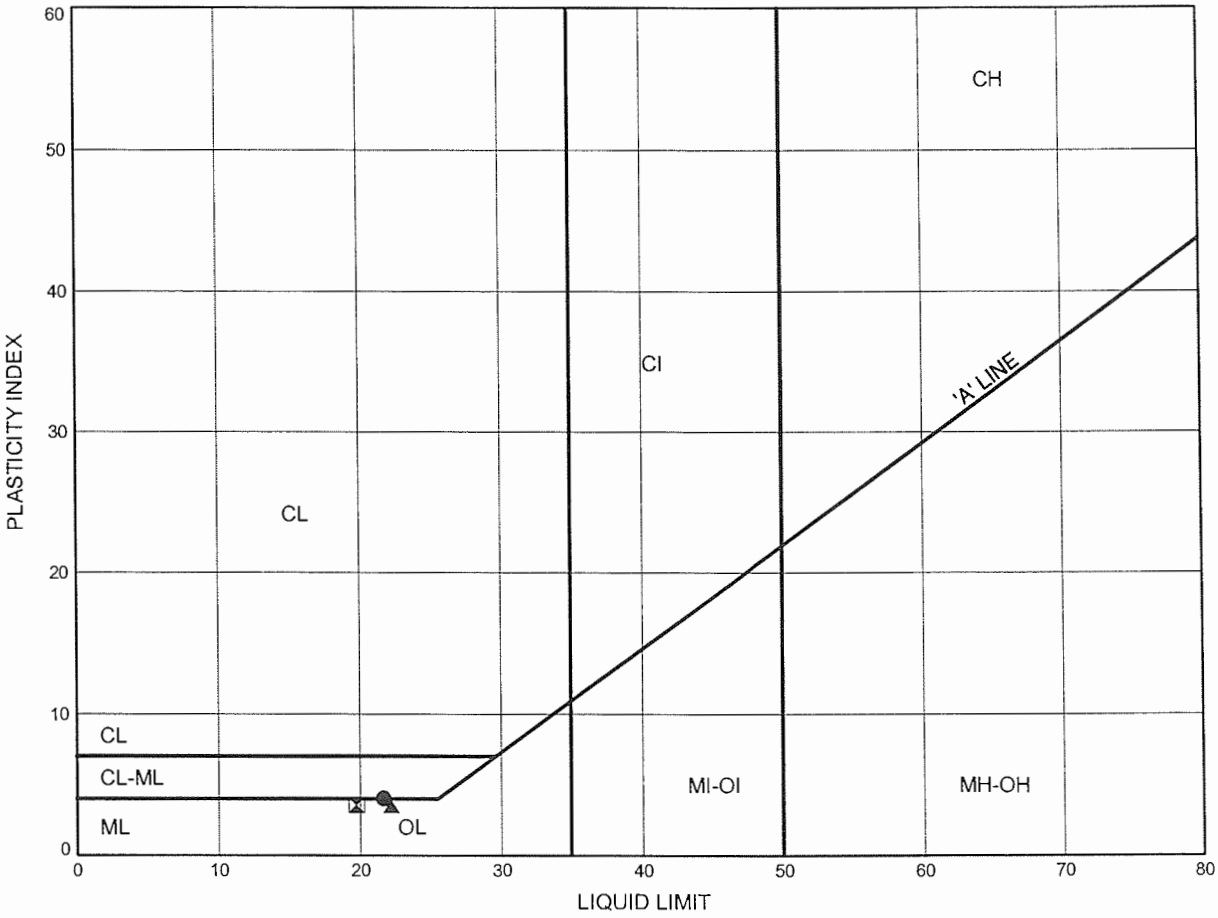
Chkd. SMS

THURBGSD 418MUSKOKA.GPJ 21/12/04

Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE E8



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	418 9+400 R1.5	4.58	
⊠	418 9+722 CL	3.35	
▲	418 9+878 L5	2.59	

Date December 2004

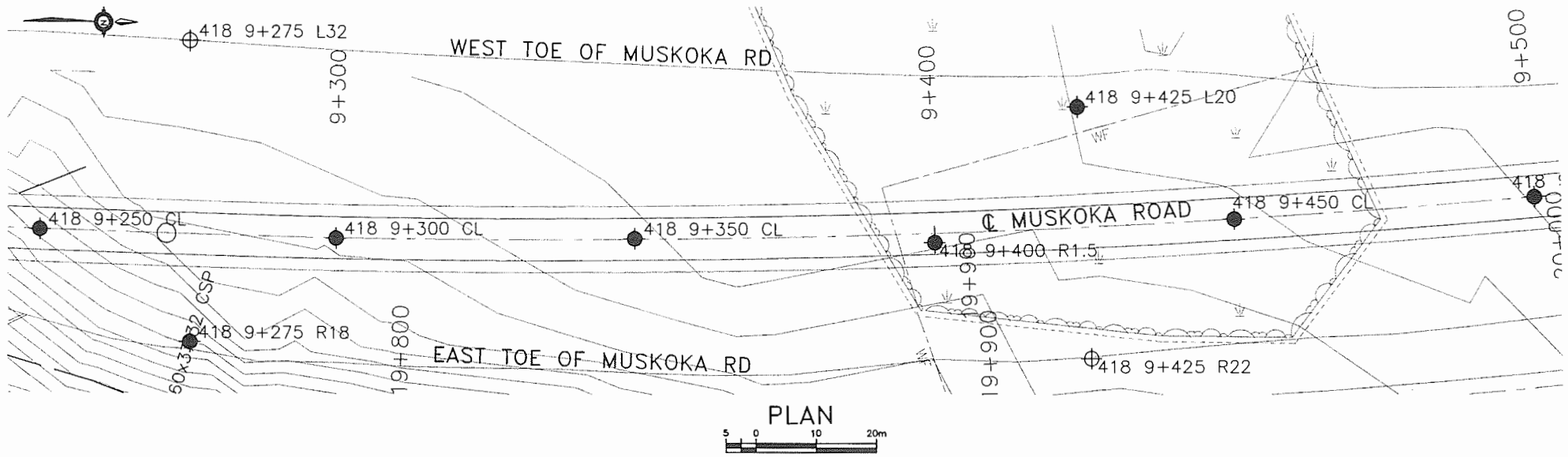
Project 759-93-00

THURBER

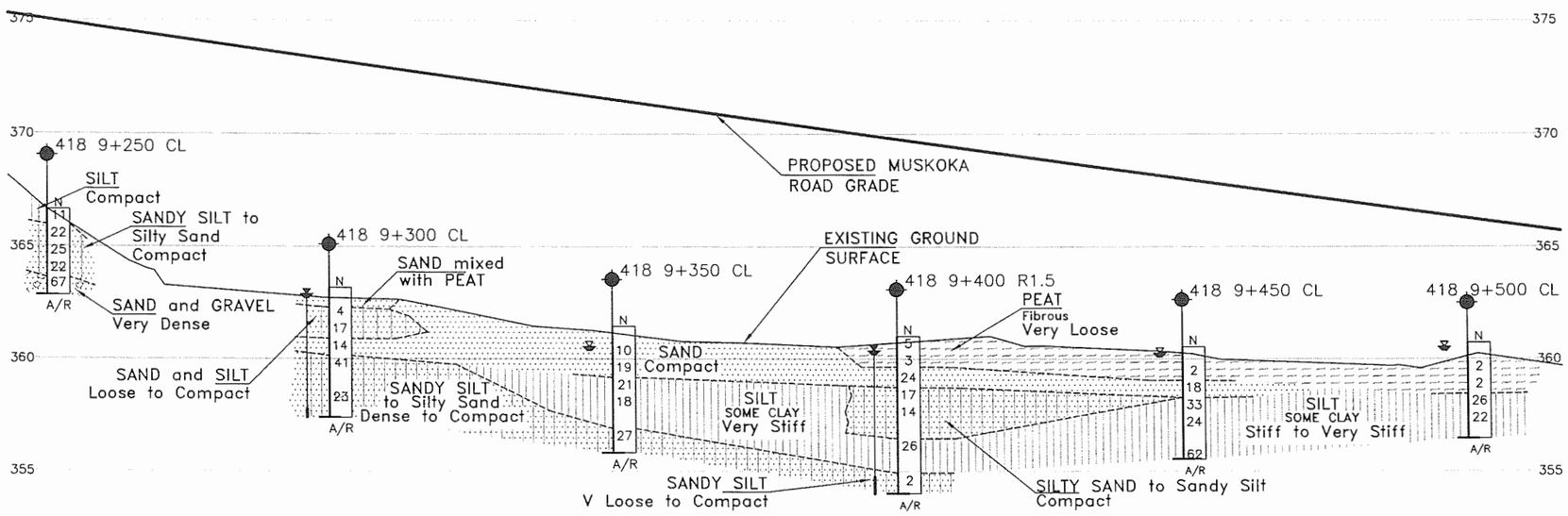
Prep'd HS

Chkd. SMS

THURBALT 418MUSKOKA.GPJ 21/12/04



PLAN



PROFILE ℄ MUSKOKA RD.

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

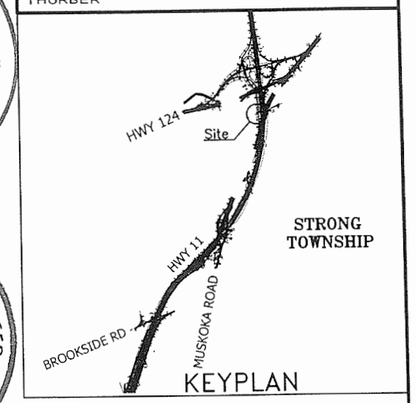
HWY 124 INTERCHANGE
MUSKOKA ROAD CENTRELINE
STATIONS 9+250 TO 9+500
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
↑	Head Artesian Water
▼	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+250 CL	9+250	0
418 9+275 L32	9+275	L32
418 9+275 R18	9+275	R18
418 9+300 CL	9+300	0
418 9+350 CL	9+350	0
418 9+400 R1.5	9+400	R1.5
418 9+425 L20	9+425	L20
418 9+425 R22	9+425	R22
418 9+450 CL	9+450	0
418 9+500 CL	9+500	0

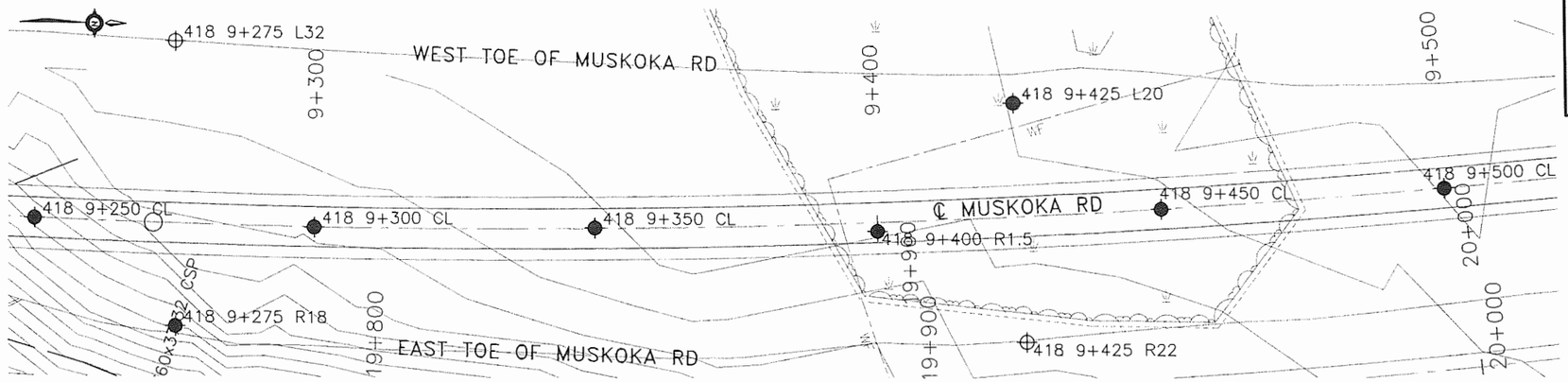
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS

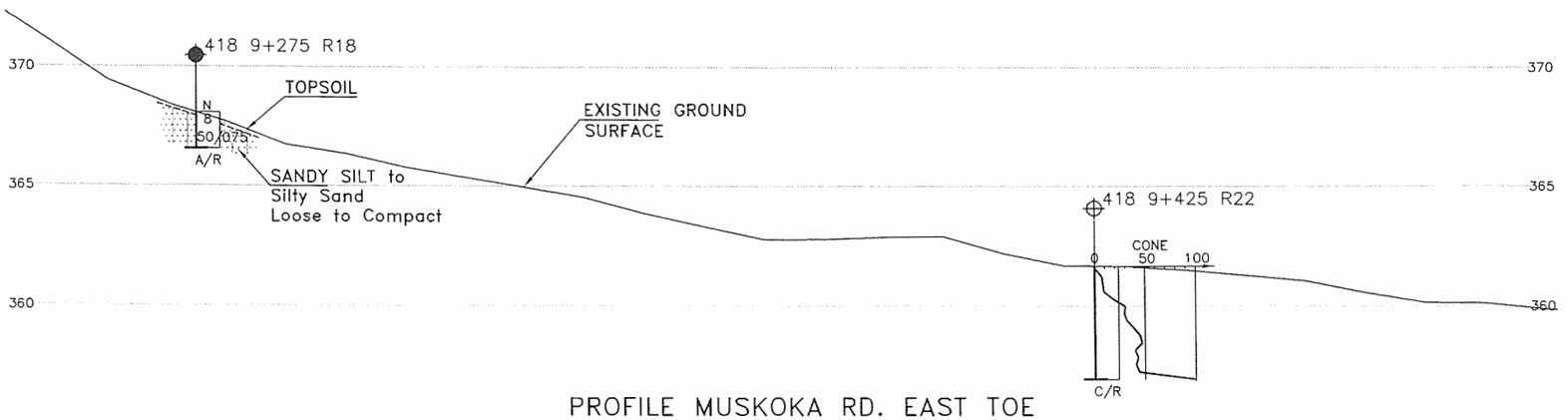
DATE	BY	DESCRIPTION
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007		
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG C1	

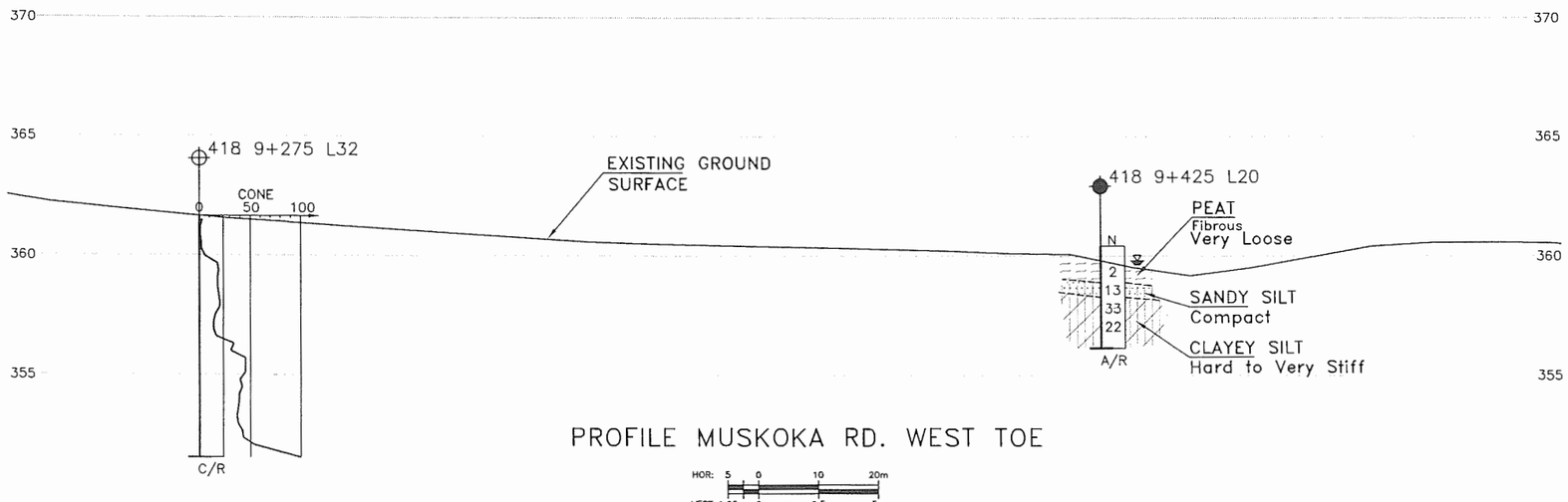


PLAN

5 0 10 20m



PROFILE MUSKOKA RD. EAST TOE



PROFILE MUSKOKA RD. WEST TOE

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
MUSKOKA ROAD EAST & WEST TOE
STATIONS 9+250 TO 9+500
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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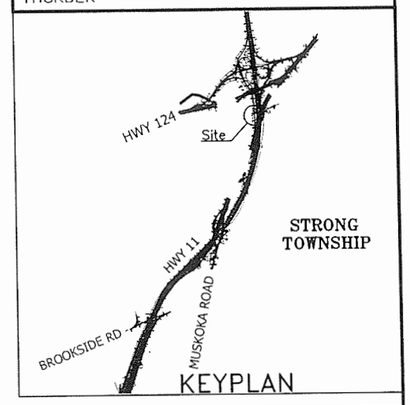

KEYPLAN

LICENSED PROFESSIONAL ENGINEER
S.M. SATHER
7 Feb 07
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+250 CL	9+250	0
418 9+275 L32	9+275	L32
418 9+275 R18	9+275	R18
418 9+300 CL	9+300	0
418 9+350 CL	9+350	0
418 9+400 R1.5	9+400	R1.5
418 9+425 L20	9+425	L20
418 9+425 R22	9+425	R22
418 9+450 CL	9+450	0
418 9+500 CL	9+500	0

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG C2

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

HWY 11
CONT No
GWP No759-93-00

HWY 124 INTERCHANGE
MUSKOKA ROAD CENTRELINE
STATIONS 9+500 TO 9+722
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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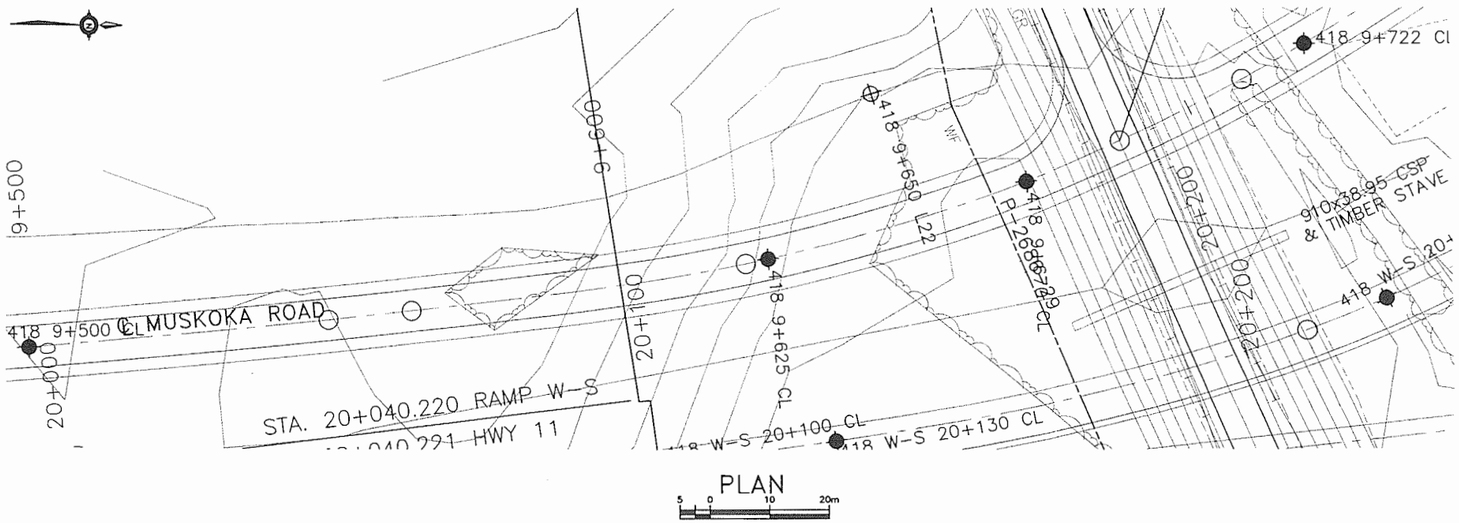
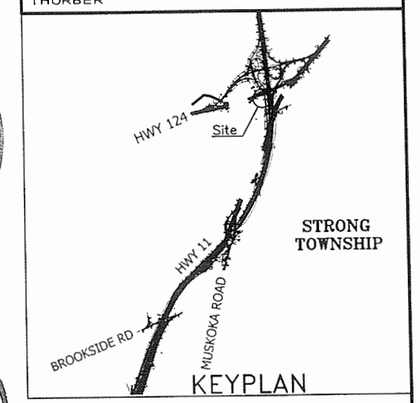


PLAN



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
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PROVINCE OF ONTARIO

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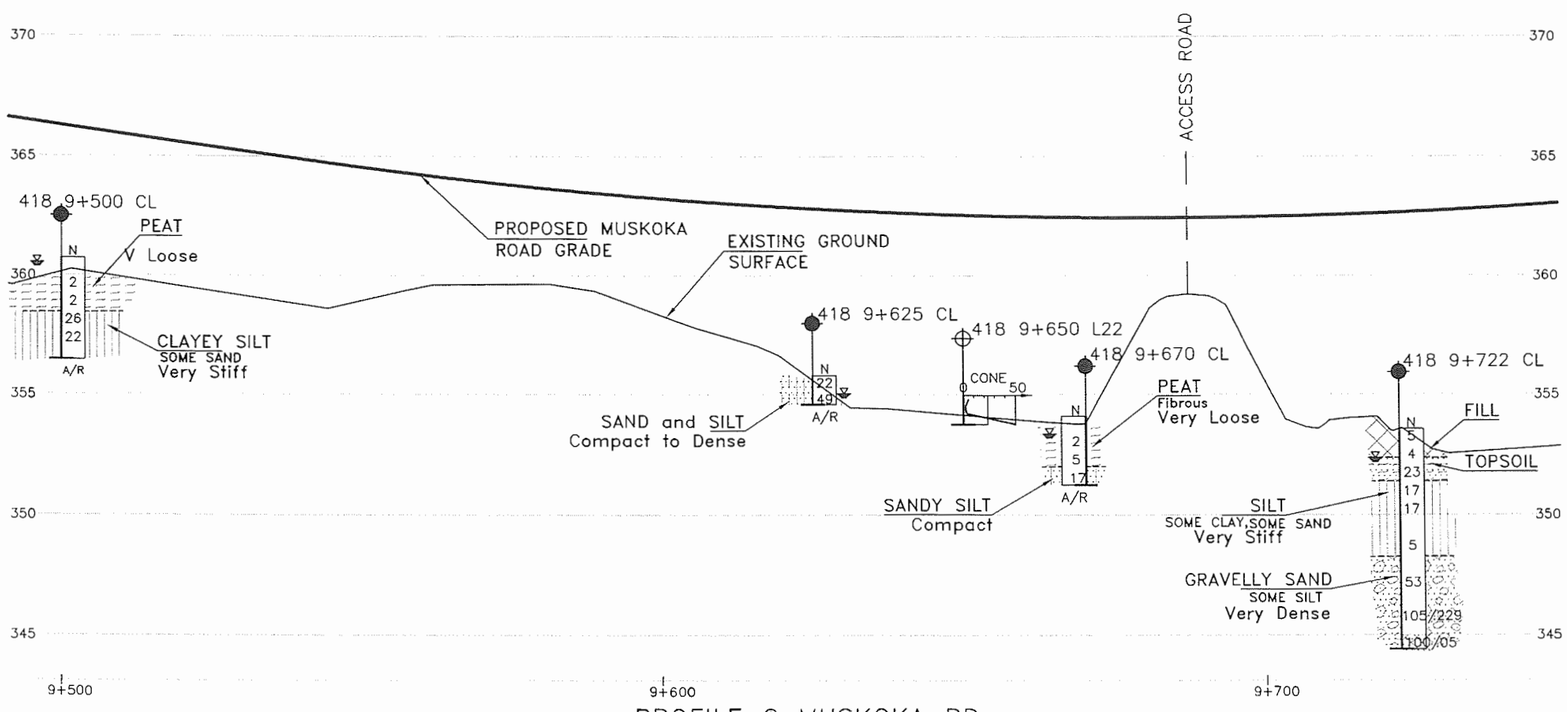

PROFILE ℄ MUSKOKA RD.

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesion Water
┼	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+500 CL	9+500	0
418 9+625 CL	9+625	0
418 9+650 L22	9+650	L22
418 9+670 CL	9+670	0
418 9+722 CL	9+722	0

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD		DATE FEB 2007
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG C3

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
GWP No759-93-00

SHEET

HWY 124 INTERCHANGE
MUSKOKA ROAD CENTRELINE
STATIONS 9+722 TO 9+978
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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PROVINCE OF ONTARIO

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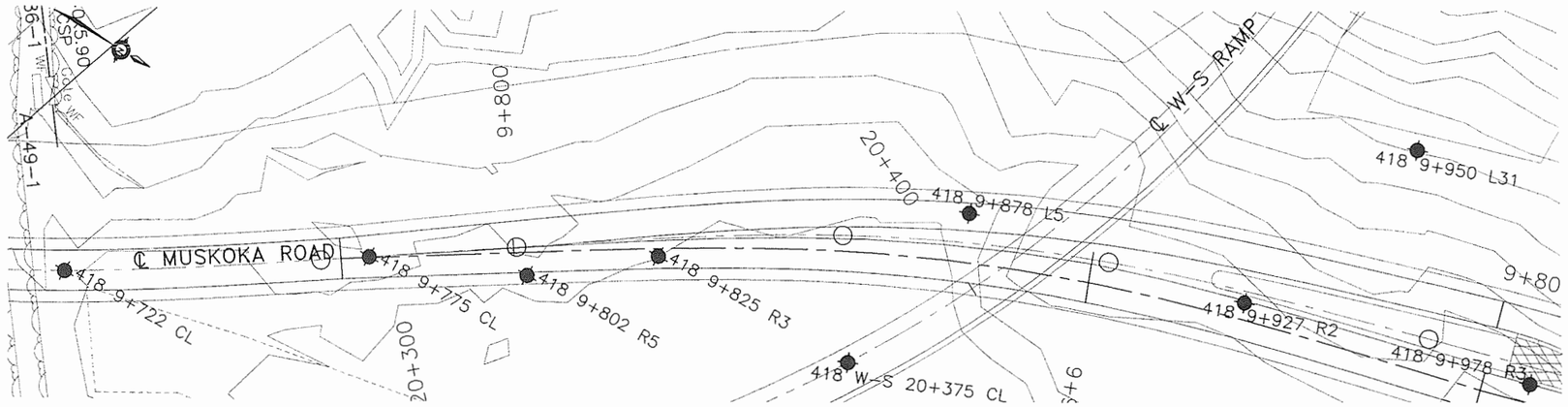
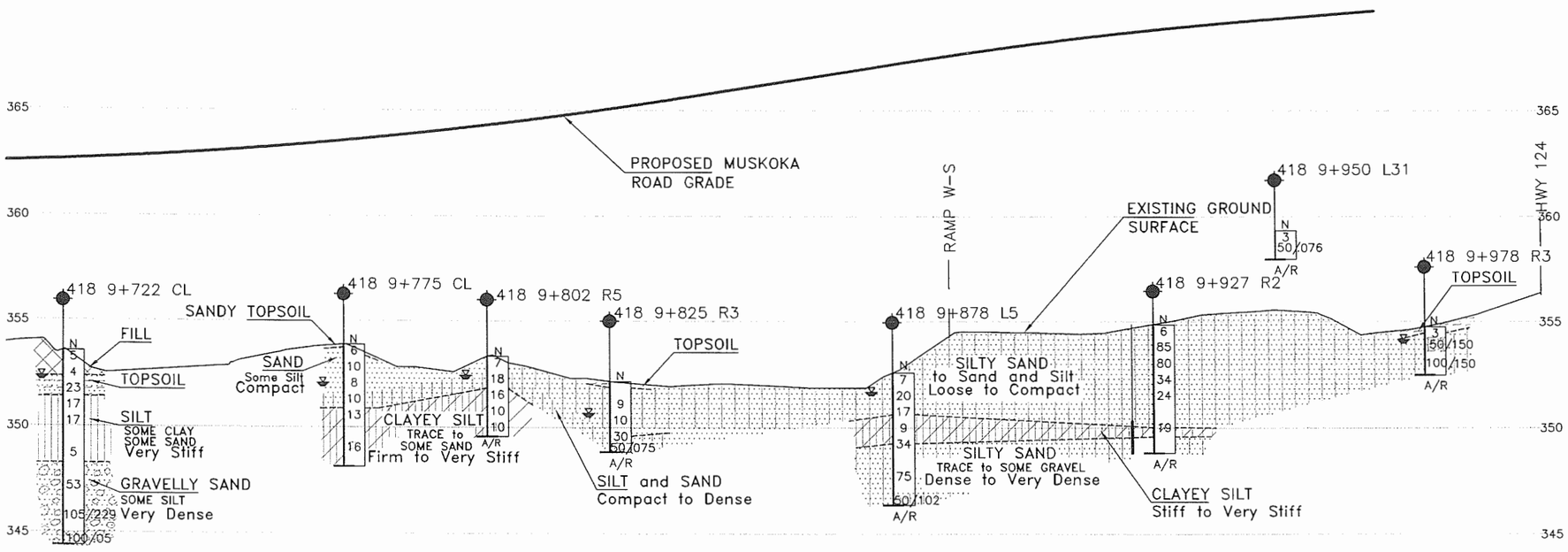
P. J. BRANCO
Feb 7/07
PROVINCE OF ONTARIO



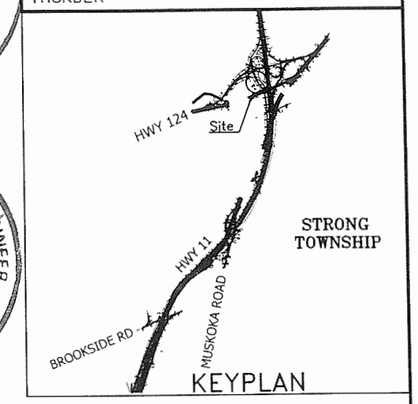
PLAN

5 0 10 20m



PROFILE ℄ MUSKOKA RD

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
▼	Head Artesian Water Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
418 9+722 CL	9+722	0
418 9+775 CL	9+775	0
418 9+802 R5	9+802	R5
418 9+825 R3	9+825	R3
418 9+878 L5	9+878	L5
418 9+927 R2	9+927	R2
418 9+950 L31	9+950	L31
418 9+978 R3	9+978	R3

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
FEB 07		FINAL
NOV 04	SP	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE FEB 2007	
DRAWN TF/WW	CHK PJB	SITE	STRUCT	SCHEME	DWG C4

Appendix F

Stability Analysis

THURBER

HWY 11 - FOUR LANING
MUSKOKA ROAD TO HWY 124

Fig. No	Location	Station		Slope Side	Type of Fill	Embankment Height (m)	Surcharge (m)	Construction Stage	Type of Analysis	Horiz Seismic Accel.	Berms (Width x Height)	Factor of Safety
		From	To									
	HWY 124	9+865	9+950	Both	SSM	18.3	2	-	Short-Term	0	N	**0.84**
	HWY 124	9+865	9+950	Both	Rock	18.3	2	-	Short-Term	0	N	**0.85**
F1A	HWY 124	9+865	9+950	Both	SSM	12	N	1st stage	Short-Term	0	25X6	**1.52**
F1B	HWY 124	9+865	9+950	Both	SSM	18.3	2	2nd stage	Short-Term	0	25X6	**1.31**
	HWY 124	9+865	9+950	Both	Rock	12	N	1st stage	Short-Term	0	25X6	**1.40**
	HWY 124	9+865	9+950	Both	Rock	18.3	2	2nd stage	Short-Term	0	25X6	**1.35**
F2	HWY 124	9+865	9+950	Both	SSM	18.3	2	Final	Long-Term	0	25X6	**2.22**
	HWY 124	9+865	9+950	Both	Rock	18.3	2	Final	Long-Term	0	25X6	**2.29**
	HWY 124	9+865	9+950	Both	SSM	18.3	-	Final	Seismic	0.17g	25X6	**1.27**
	HWY 11	20+400	20+450	Both	SSM	8.3	N		Short-Term	0	N	**1.55**
F3	HWY 11	20+400	20+450	Both	Rock	8.3	N		Short-Term	0	N	**1.59**
	HWY 11	20+400	20+450	Both	SSM	8.3	N		Long-Term	0	N	**1.55**
F4	HWY 11	20+400	20+450	Both	Rock	8.3	N		Long-Term	0	N	**1.59**
	HWY 11	20+400	20+450	Both	SSM	8.3	N		Seismic	0.17g	N	**1.07**
	HWY 11	20+400	20+450	Both	Rock	8.3	N		Seismic	0.17g	N	**1.15**

SUMMARY OF STABILITY ANALYSIS

TABLE F-1

HWY 11 - FOUR LANING
MUSKOKA ROAD TO HWY 124

Fig. No	Location	Station		Slope Side	Type of Fill	Embankment Height (m)	Surcharge (m)	Construction Stage	Type of Analysis	Horiz Seismic Accel.	Berms (Width x Height)	Factor of Safety
		From	To									
	E-S Ramp	20+630	20+720	Both	SSM	11.2	N		Short-Term	0	N	**1.01**
	E-S Ramp	20+630	20+720	Both	Rock	11.2	N		Short-Term	0	N	**1.04**
F5	E-S Ramp	20+630	20+720	Both	SSM	11.2	N		Short-Term	0	12 x 4	**1.33**
	E-S Ramp	20+630	20+720	Both	Rock	11.2	N		Short-Term	0	12 x 4	**1.37**
F6	E-S Ramp	20+630	20+720	Both	SSM	11.2	N		Long-Term	0	12 x 4	**2.10**
	E-S Ramp	20+630	20+720	Both	Rock	11.2	N		Long-Term	0	12 x 4	**2.15**
	E-S Ramp	20+630	20+720	Both	SSM	11.2	N		Seismic	0.17g	12 x 4	**1.21**
	E-S Ramp	20+630	20+720	Both	Rock	11.2	N		Seismic	0.17g	12 x 4	**1.27**
	E-N Ramp	20+740	20+800	East	SSM	10	N		Short-Term	0	N	**0.90**
	E-N Ramp	20+740	20+800	East	Rock	10	N		Short-Term	0	N	**0.87**
	E-N Ramp	20+740	20+800	East	SSM	10	N		Short-Term	0	15 x 4	**1.34**
F7	E-N Ramp	20+740	20+800	East	Rock	10	N		Short-Term	0	15 x 4	**1.36**
	E-N Ramp	20+740	20+800	East	SSM	10	N		Long-Term	0	15 x 4	**2.24**
F8	E-N Ramp	20+740	20+800	East	Rock	10	N		Long-Term	0	15 x 4	**2.34**
	E-N Ramp	20+740	20+800	East	SSM	10	N		Seismic	0.17g	15 x 4	**1.19**
	E-N Ramp	20+740	20+800	East	Rock	10	N		Seismic	0.17g	15 x 4	**1.27**

SUMMARY OF STABILITY ANALYSIS

TABLE F-1

HWY 11 - FOUR LANING
MUSKOKA ROAD TO HWY 124

Fig. No	Location	Station		Slope Side	Type of Fill	Embankment Height (m)	Surcharge (m)	Construction Stage	Type of Analysis	Horiz Seismic Accel.	Berms (Width x Height)	Factor of Safety
		From	To									
	N-E Ramp	20+700	20+760	South	SSM	11.4	N		Short-Term	0	N	**1.03**
	N-E Ramp	20+700	20+760	North	SSM	11.4	N		Short-Term	0	N	**1.18**
	N-E Ramp	20+700	20+760	South	SSM	11.4	N		Short-Term	0	15 x 4	**1.32**
F9	N-E Ramp	20+700	20+760	South	Rock	11.4	N		Short-Term	0	15 x 4	**1.30**
	N-E Ramp	20+700	20+760	North	SSM	11.4	N		Short-Term	0	15 x 1	**1.39**
F10	N-E Ramp	20+700	20+760	North	Rock	11.4	N		Short-Term	0	15 x 1	**1.50**
	N-E Ramp	20+700	20+760	South	SSM	11.4	N		Long-Term	0	15 x 4	**1.95**
	N-E Ramp	20+700	20+760	South	Rock	11.4	N		Long-Term	0	15 x 4	**1.92**
	N-E Ramp	20+700	20+760	North	SSM	11.4	N		Long-Term	0	15 x 1	**1.86**
	N-E Ramp	20+700	20+760	North	Rock	11.4	N		Long-Term	0	15 x 1	**2.12**
	N-E Ramp	20+700	20+760	South	Rock	11.4	N		Seismic	0.17g	15 x 4	**1.20**
	N-E Ramp	20+700	20+760	North	Rock	11.4	N		Seismic	0.17g	15 x 1	**1.30**
F11	Muskoka Rd	9+875	9+960	east	SSM	11	N	1st stage	Short Term	0	25 x 6	**1.64**
F12	Muskoka Rd	9+875	9+960	east	SSM	15	2	2nd stage	Short Term	0	25 x 6	**1.45**
	Muskoka Rd	9+875	9+960	east	SSM	15	2	2nd stage	Long Term	0	25 x 6	**2.04**
	Muskoka Rd	9+875	9+960	east	SSM	15	N	2nd stage	Seismic	0.17g	25 x 6	**1.22**

SUMMARY OF STABILITY ANALYSIS

TABLE F-1

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
SSM Fill	22	0	30	0	1
Silt/Sand	20	0	32	0	1
Silty Clay 1	19	70	0	.2	3
Silty Clay 2	18.5	35	0	.2	4
Silty Clay 3	18	60	0	.2	5
Sand	21	0	33	0	2
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
HWY124 Embankment (Km 9+865 ~ Km 9+950) - SSM Fill- Berms 25x6m
Short Term Analysis - First Stage of Construction upto 15m

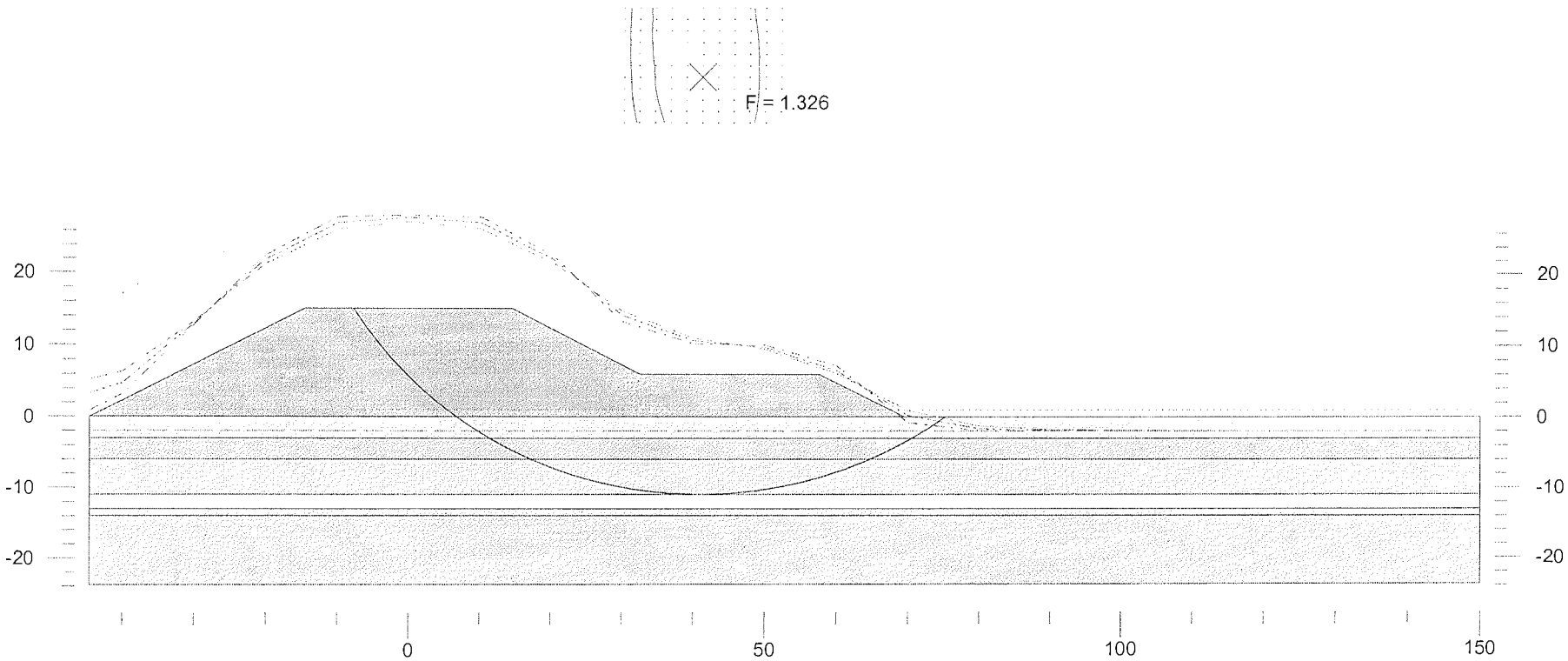


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Fig. F1A

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
Surcharge	22	0	30	0	0
SSM Fill	22	0	30	0	1
SSM Fill	22	0	30	0	1
Silt/Sand	20	0	32	0	1
Silty Clay 1	19	70	0	.2	3
Silty Clay 2	18.5	35	0	.2	4
Silty Clay 3	18	60	0	.2	5
Sand	21	0	33	0	2
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
HWY124 Embankment (Km 9+865 ~ Km 9+950) -SSM Fill- Berms 25x6m
Short Term Analysis - Second Stage of Construction upto 18.3m + 2m Surcharge

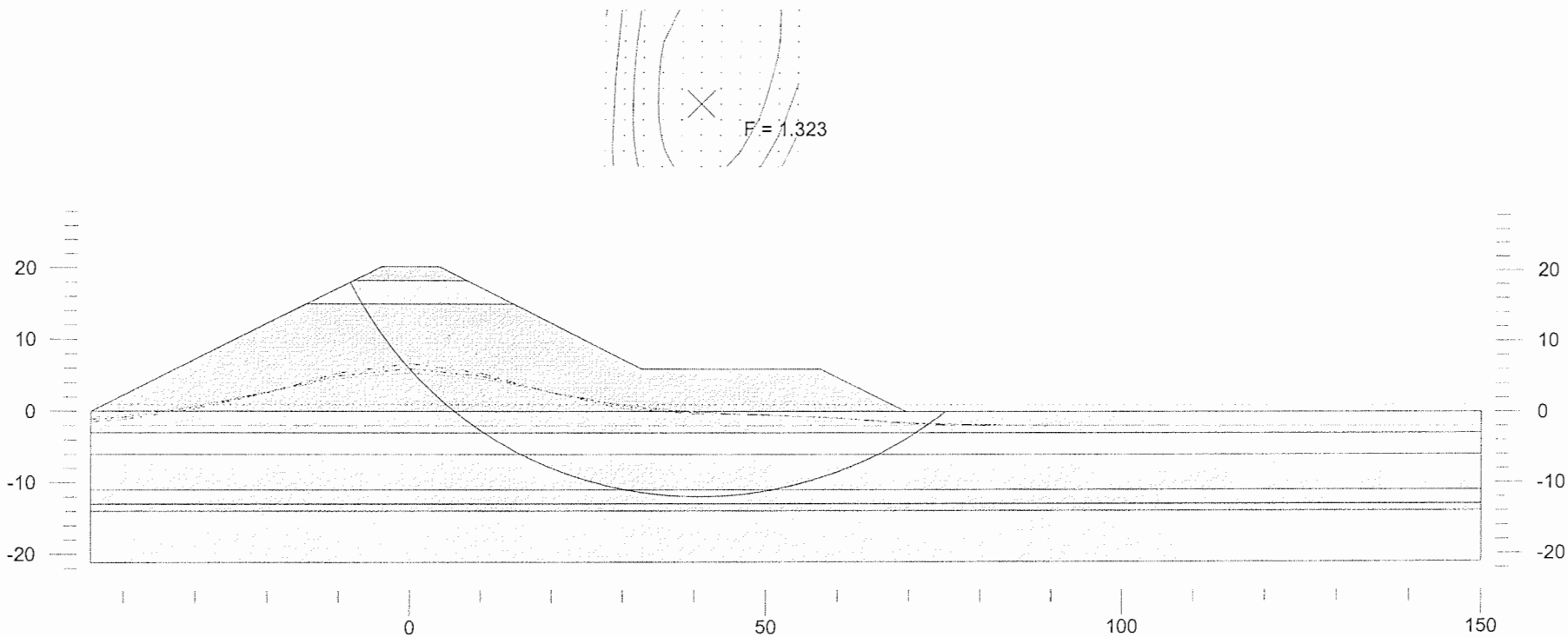

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Fig. F1B

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
Surcharge	22	0	30	0	0
SSM Fill	22	0	30	0	1
SSM Fill	22	0	30	0	1
Silt/Sand	20	0	32	0	1
Silty Clay 1	19	0	28	0	1
Silty Clay 2	18.5	0	28	0	1
Silty Clay 3	18	0	28	0	1
Sand	21	0	33	0	2
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
HWY124 Embankment (Km 9+865 ~ Km 9+950) -SSM Fill- Berms 25x6m
Long Term Analysis - 18.3m Embankment + 2m Surcharge

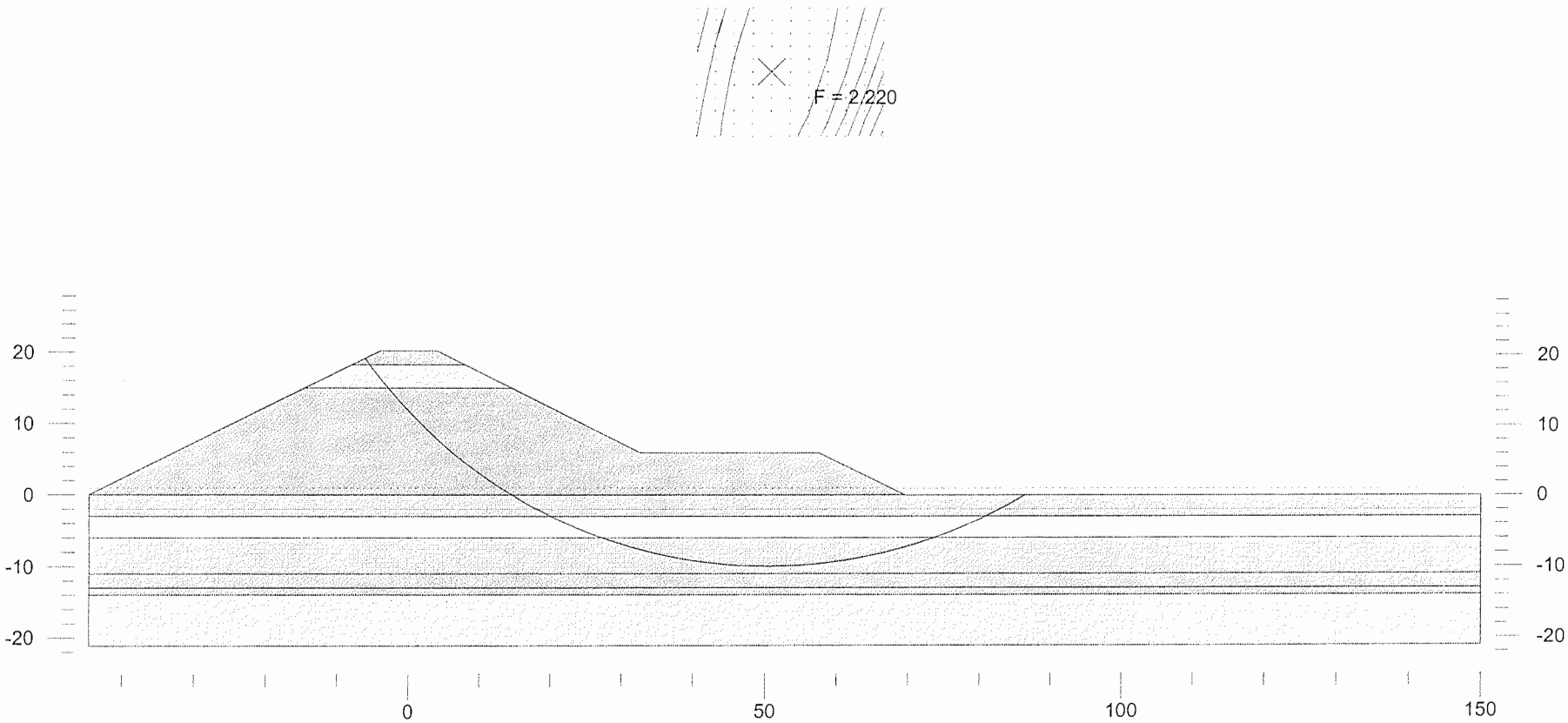

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Fig. F2

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
ROCK FILL	20	0	42	0	0
FILL	22	0	30	0	1
Peat	13	10	0	0	1
Sand/Silt	20	0	32	0	1
Silty Clay 1	20	69	0	0	2
Silty Clay 2	19	72	0	0	3
Silty ClaY 3	19	75	0	0	4
BEDROCK	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
HWY11 Embankment (20+400 ~ 20+450)
Short Term Analysis - Rock Fill

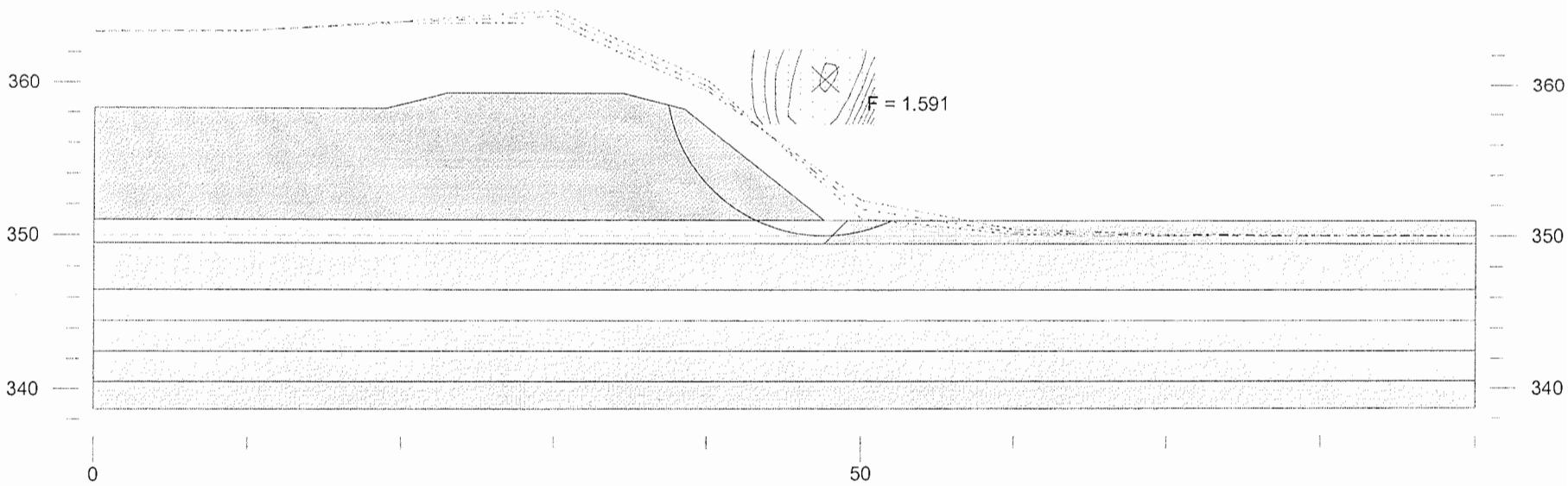

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Fig. F3

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
ROCK FILL	20	0	42	0	0
FILL	22	0	30	0	0
Peat	13	10	0	0	0
Sand/Silt	20	0	32	0	0
Silty Clay 1	20	0	28	0	0
Silty Clay 2	19	0	28	0	0
Silty ClaY 3	19	0	28	0	0
BEDROCK	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
HWY11 Embankment (20+400 ~ 20+450)
Long Term Analysis - Rock Fill

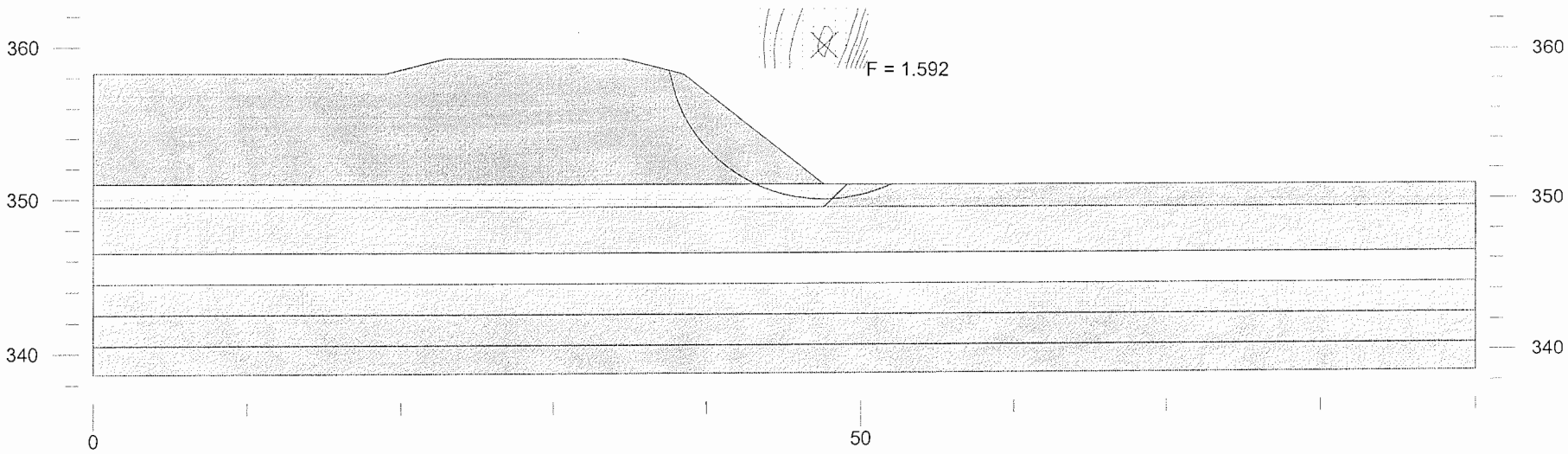

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Fig. F4

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
SSM Fill	22	0	30	0	0
FILL	22	0	30	0	1
Peat	13	10	0	0	1
Sand/Silt	20	0	32	0	1
Silty Clay 1	18.5	50	0	0	3
Silty Clay 2	18	35	0	0	4
Sand/Silt	21	0	33	0	1
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
E-S Ramp Embankment (Km20+630 ~ Km20+720)
Short Term Analysis- SSM Fill + Berms 12x4m

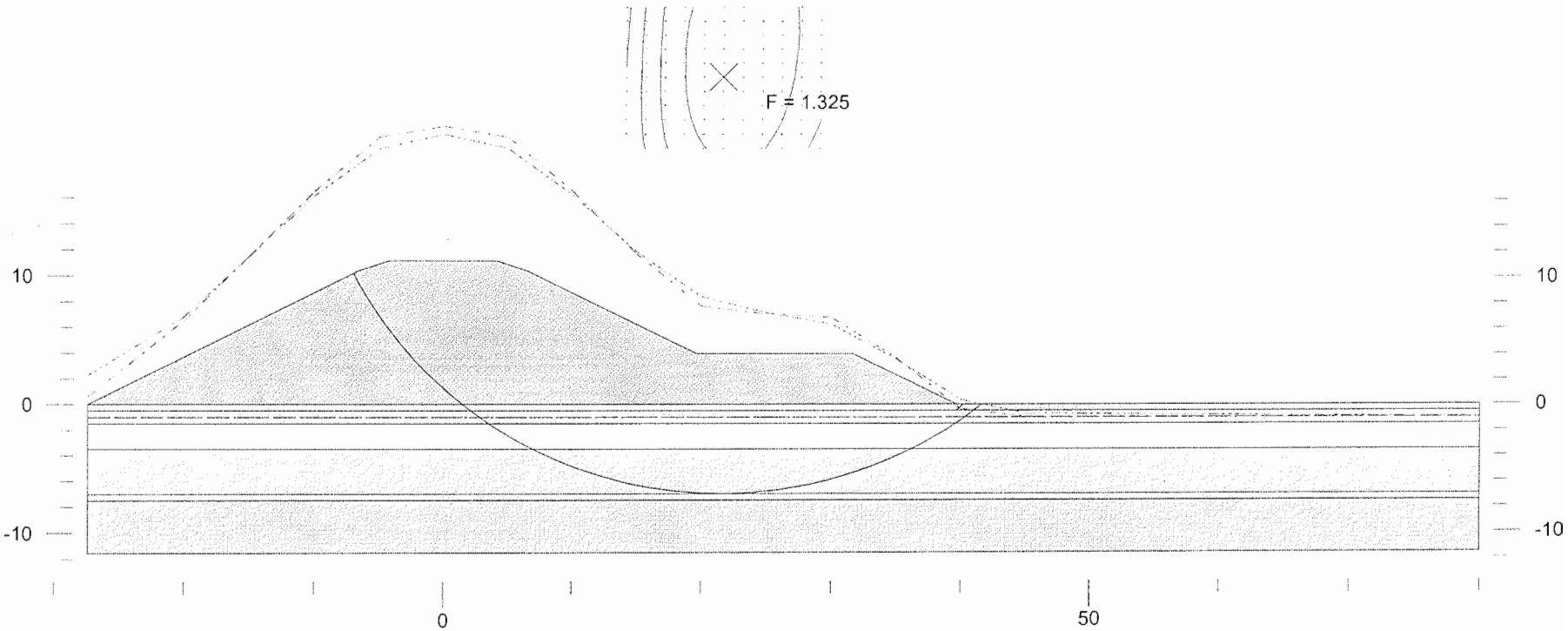

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Fig. F5

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
SSM Fill	22	0	30	0	0
FILL	22	0	30	0	1
Peat	13	10	0	0	1
Sand/Silt	20	0	32	0	1
Silty Clay 1	18.5	0	28	0	1
Silty Clay 2	18	0	28	0	1
Sand/Silt	21	0	33	0	1
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
E-S Ramp Embankment (Km20+630 ~ Km20+720)
Long Term Analysis- SSM Fill + Berms 12x4m

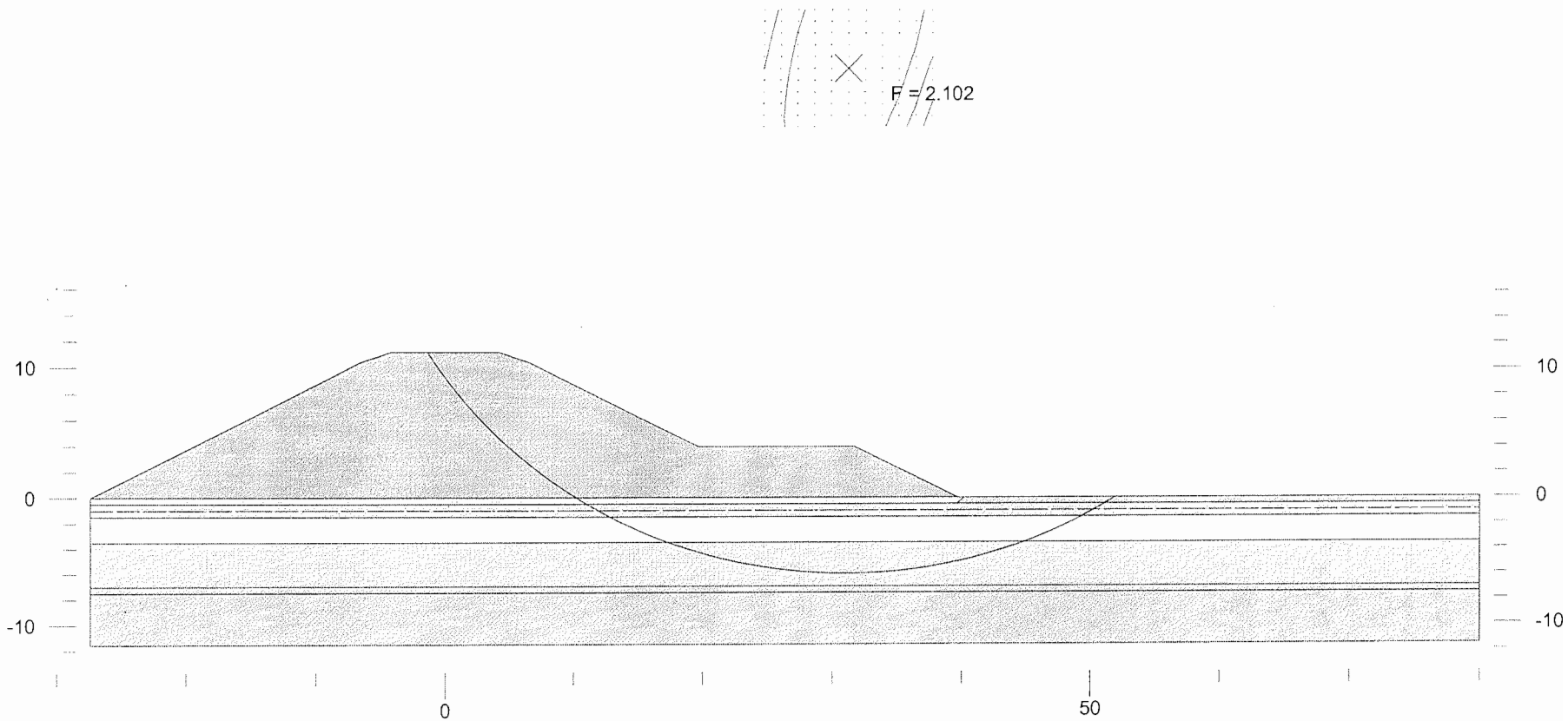

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Fig. F6

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
ROCK FILL	20	0	42	0	0
Silt/Sand	20	0	32	0	1
Silty Clay 1	19	30	0	0	2
Silty Clay 2	19	24	0	0	3
Silty Clay 3	20	42	0	0	4
BEDROCK	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
E-N Ramp Embankment (Km20+740 ~ Km20+800)
Short Term Analysis - Rock Fill - Berm 15x4m

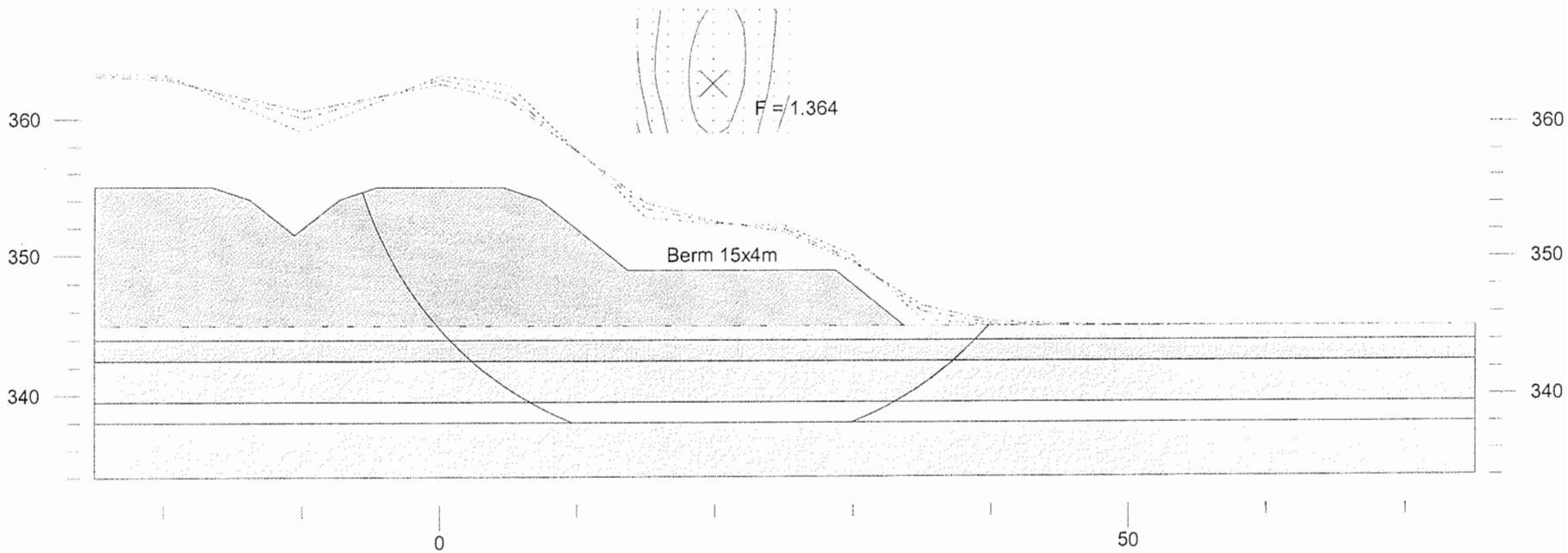

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Fig. F7

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
ROCK FILL	20	0	42	0	0
Silt/Sand	20	0	32	0	1
Silty Clay 1	19	0	28	0	1
Silty Clay 2	19	0	28	0	1
Silty Clay 3	20	0	28	0	1
BEDROCK	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
E-N Ramp Embankment(Km20+740 ~ Km20+800)
Long Term Analysis- Rock Fill - Berm 15x4m

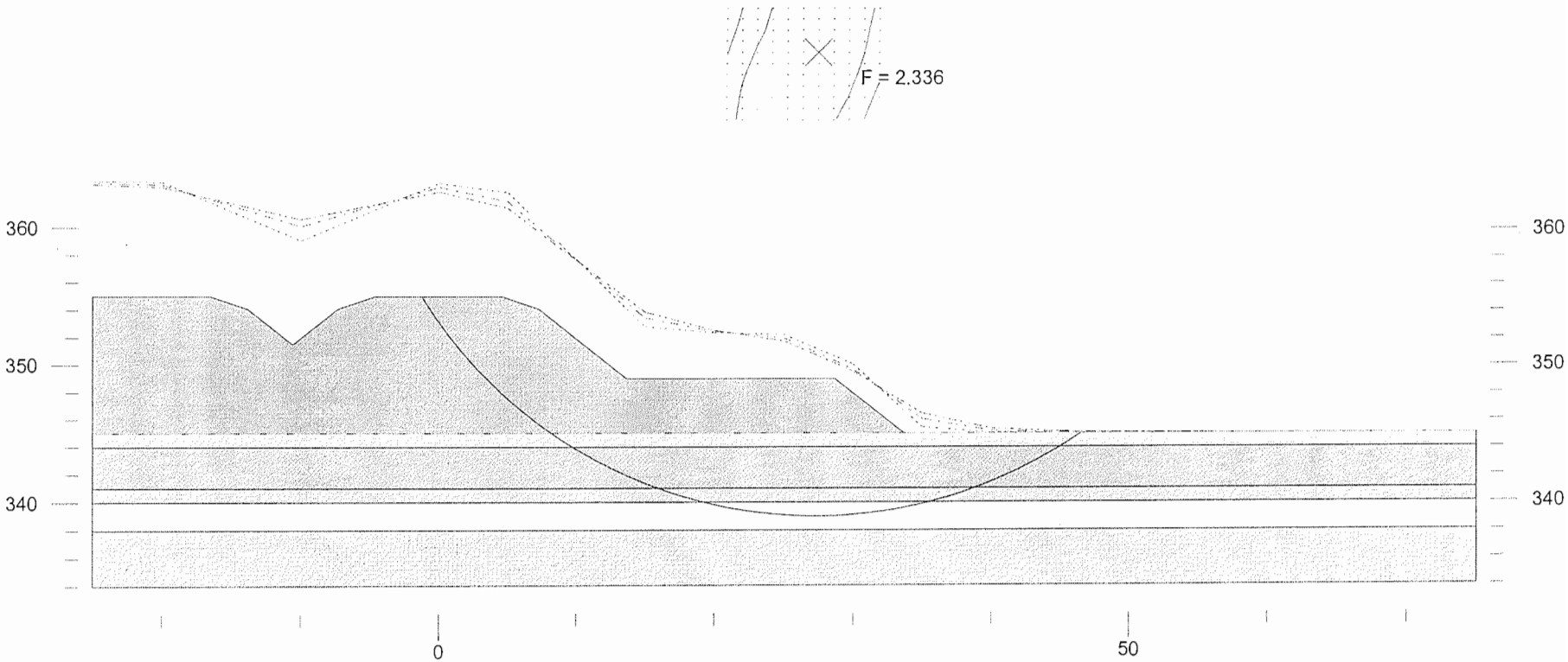

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Fig. F8

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
Rock Fill	20	0	42	0	0
Fill/Rock	22	0	30	0	1
Sand/Silt	20	0	32	0	1
Silty Clay 1	18	35	0	0	2
BEDROCK	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
N-E Ramp Embankment (Km20+700 ~ Km20+760) - South Slope
Short Term Analysis - Rock Fill- Berm 15m Width at Elevation 353

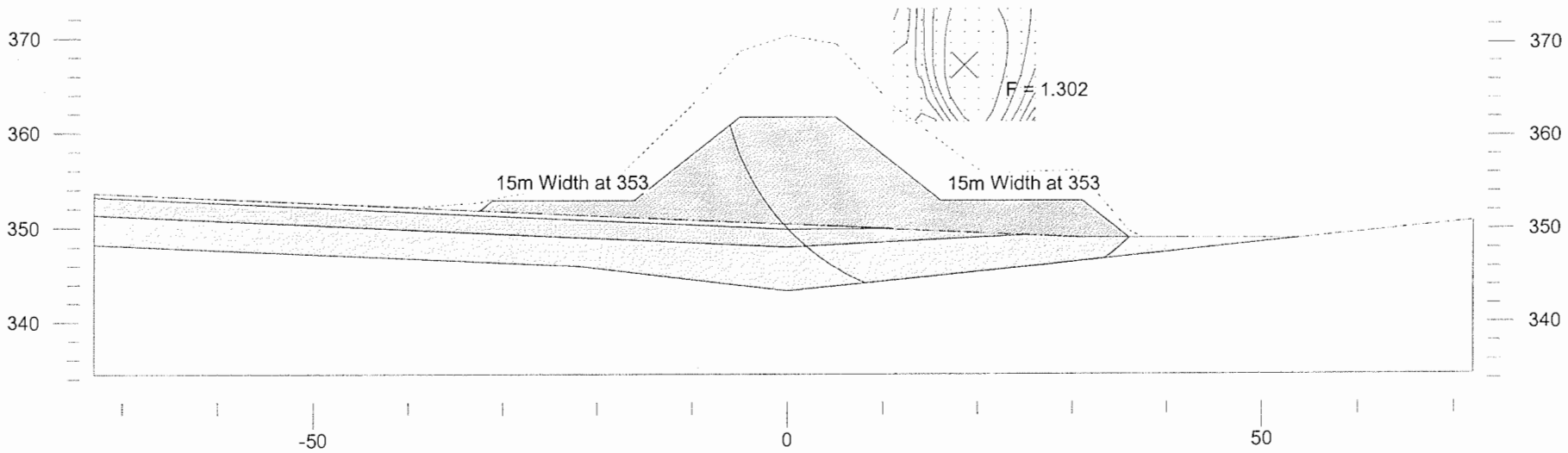

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Fig. F9

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
Rock Fill	20	0	42	0	0
Fill/Rock	22	0	30	0	1
Sand/Silt	20	0	32	0	1
Silty Clay 1	18	35	0	0	2
BEDROCK	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
December 2004
N-E Ramp Embankment (Km20+700 ~ Km20+760) - North Slope
Short Term Analysis - Rock Fill- Berm 15m Width at Elevation 353

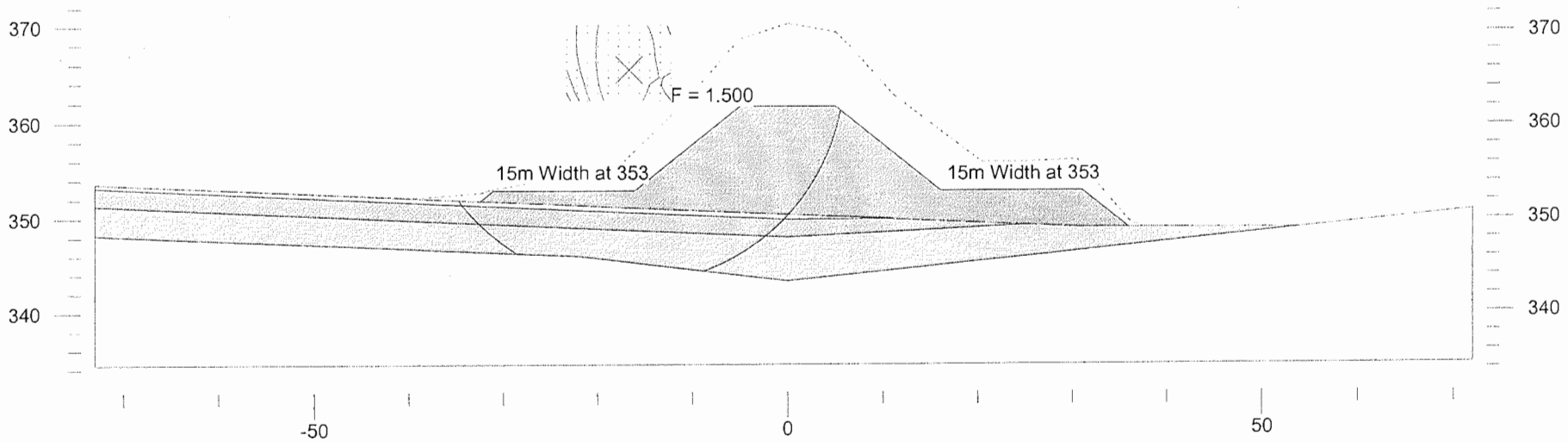

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Fig. F10

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
SSM First Stage	22	0	30	0	1
Sand/Silt	20	0	32	0	1
Clay	18	35	0	.2	2
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
January 2004
Muskoka Road Embankment (Km9+875 ~ Km9+960)-SSM Fill
Short Term Analysis - First Stage of Construction upto 366

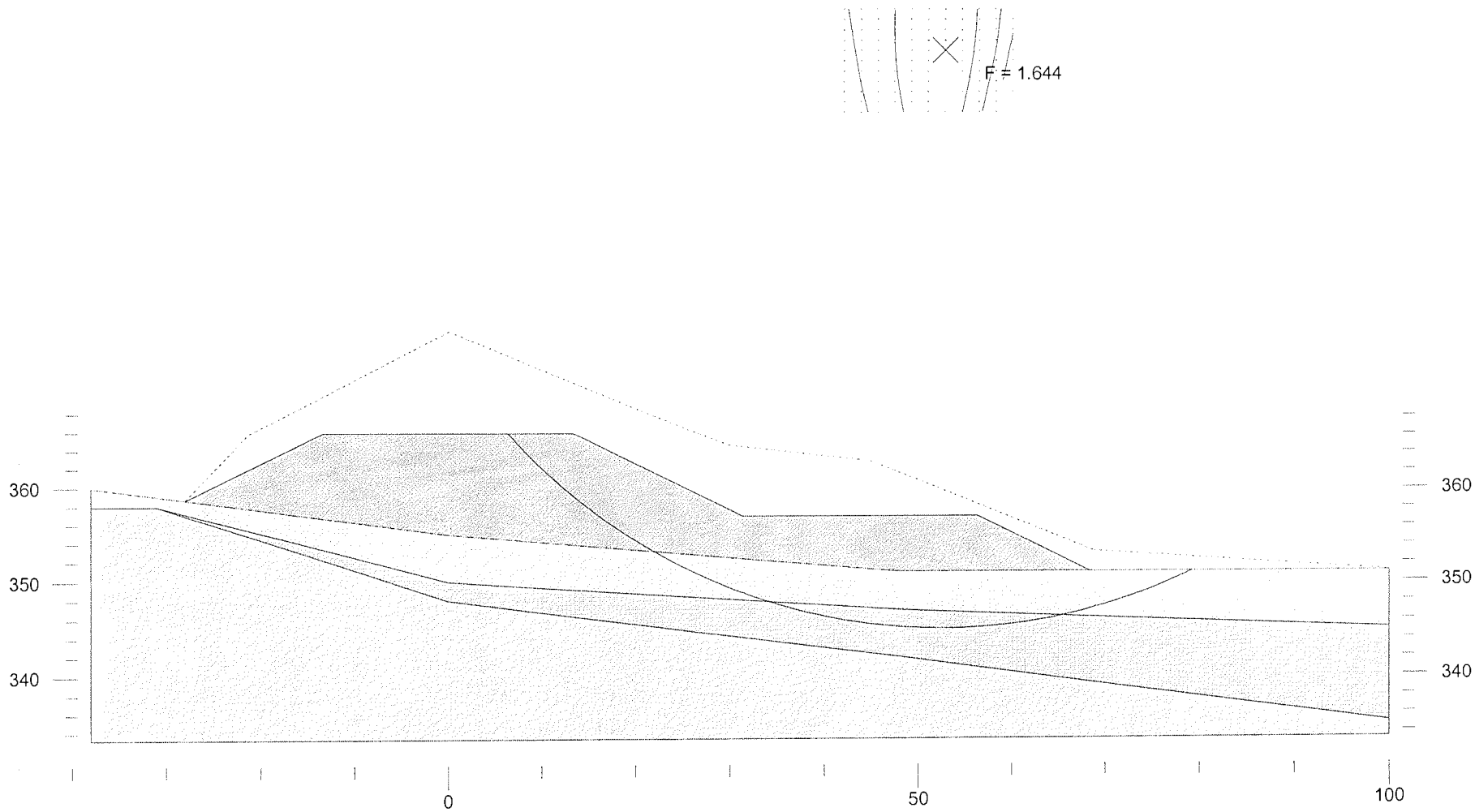

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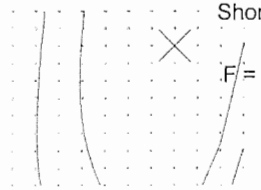
Fig. F11

	Gamma kN/m3	C kPa	Phi deg	Min c/p	Piezo Surf.
SSM Second Stage	22	0	30	0	1
SSM First Stage	22	0	30	0	1
Sand/Silt	20	0	32	0	1
Clay	18	35	0	.2	2
Bedrock	(Infinitely Strong)				

Thurber Engineering Ltd. - Toronto
19-1423-12
HWY11-BURKE'S FALLS-HWY124 I/C
January 2004
Muskoka Road Embankment (Km9+875 ~ Km9+960)-SSM Fill
Short Term Analysis - Second and last Stage of Construction



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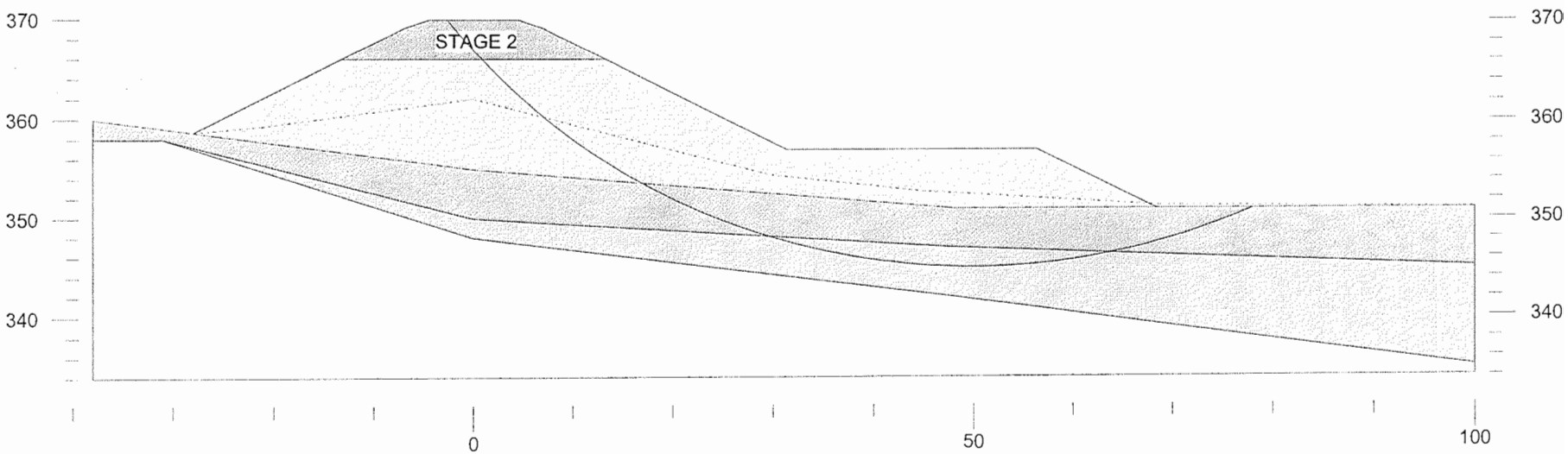

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Fig. F12

Appendix G

Settlement Analysis

THURBER

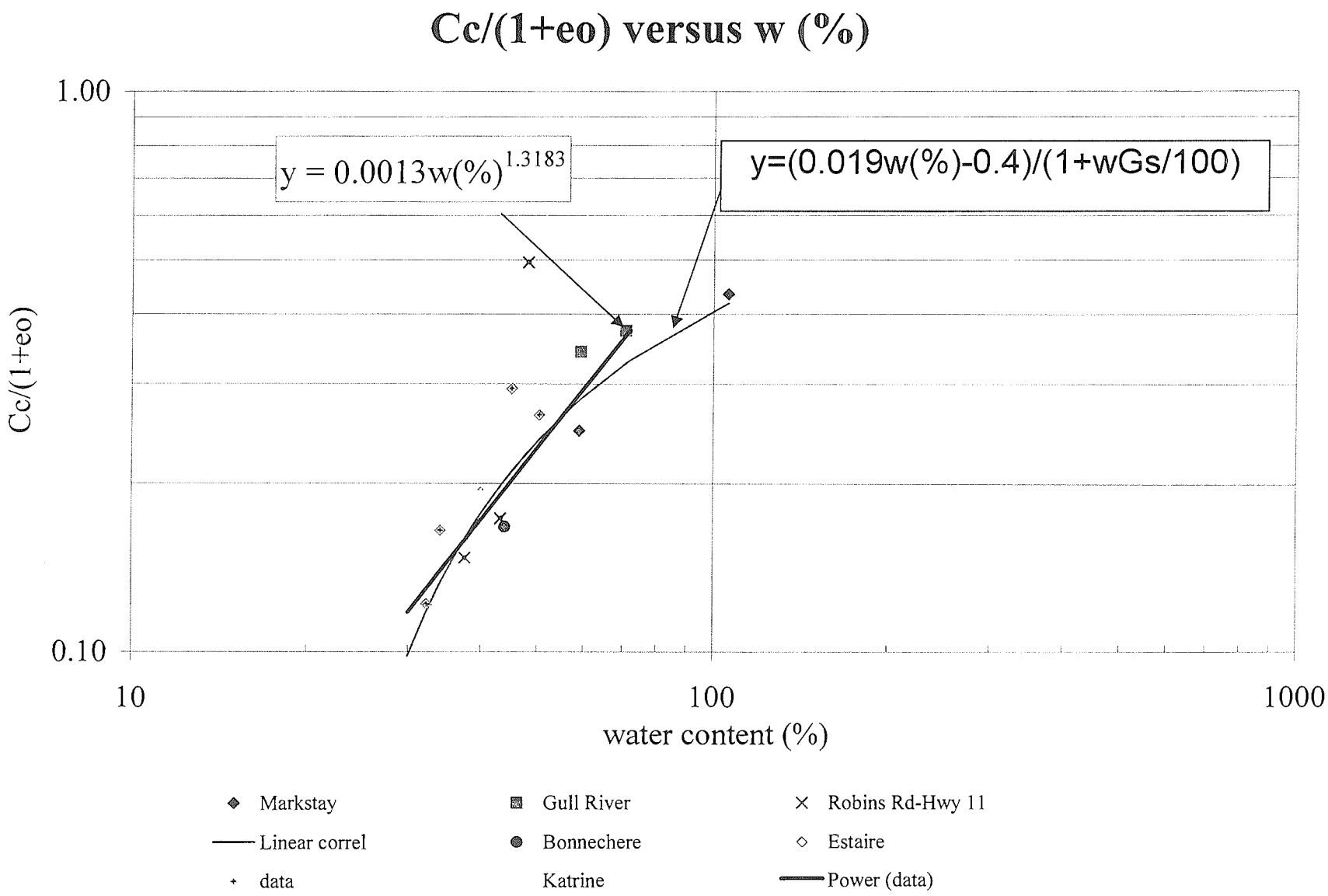

FIGURE G1

19-1423-12

HWY11 BURKE'S FALLS
HWY124 I/C

HWY 124

9+875 ~ 9+960

4 γ_w = 9.81 | γ_{soil} = 19 | γ_{fill} = 22 | Fill Height= 18.3 | q_0= 402.6 | Width= 55 | Es= 20,000 | Poisson Ratio= 0.42 | Secondary Comp. Ratio 4.75E-03

Sublayer	Compressible Soil from Depth:	To the Depth of:	GWT Level	$Cc/1+e_0$	$Cs/1+e_0$	C_v	P_C	q_{top}	q_{bot}	q_{ave}	σ' at Top	σ' at Bottom	Effective Stress at middle Layer	Consolidation settlement (mm)	Degree of Consolidation (%)	Time Required (Two Way Drainage)	Time Required (One Way Drainage)	Elastic Settlement (mm)	Time for Secondary Settlement Calculation	secondary Settlement (mm)
1	3	4.5	0	0.136	0.0136	40	210	402.4	401.9	402.1	27.57	41.36	34.46	81	90	0.530	2.120	204	30	83
2	4.5	6		0.136	0.0136	40	210	401.9	400.9	401.4	41.36	55.14	48.2475	80						
3	6	8.5		0.168	0.0168	40	67	400.9	398.1	399.5	55.14	78.12	66.6275	355						
4	8.5	11		0.168	0.0168	40	90	398.1	393.5	395.8	78.12	101.1	89.6025	308						
5	11	13		0.168	0.0168	40	110	393.5	388.4	391.0	101.1	119.5	110.28	221						
														1045						

m'	5.00
n'	0.47
sqr(1+m2)	5.10
sqr(n2+m2)	5.02
sqr(n2+m2+1	5.12
A0	0.004
A1	0.099
A2	2.065
F1	0.033
F2	0.084
Is	0.056

FIGURE G2

HWY11 BURKE'S FALLS
HWY124 I/C

E-S RAMP

20+630 ~ 20+720

2 γ_w = 9.81 | γ_{soil} = 19 | γ_{fill} = 22 | Fill Height= 11.2 | q_0= 246.4 | Width= 34 | Es= 34,000 | Poisson Ratio= 0.42 | Secondary Comp. Ratio 4.49E-03

Sublayer	Compressible Soil from Depth:	To the Depth of:	GWT Level	$Cc/1+e_0$	$Cs/1+e_0$	C_v	P_C	q_{top}	q_{bot}	q_{ave}	σ' at Top	σ' at Bottom	Effective Stress at middle Layer	Consolidation settlement (mm)	Degree of Consolidation (%)	Time Required (Two Way Drainage)	Time Required (One Way Drainage)	Elastic Settlement (mm)	Time for Secondary Settlement Calculation	secondary Settlement (mm)
1	1.5	2	1	0.126	0.0126	40	200.00	246.3	246.2	246.3	23.6	28.19	25.89	14	90	0.160	0.641	38	30	56
2	2	3		0.126	0.0126	40	200.00	246.2	245.8	246.0	28.19	37.38	32.785	28						
3	3	3.5		0.126	0.0126	40	200.00	245.8	245.5	245.7	37.38	41.98	39.6775	14						
4	3.5	4		0.163	0.0163	40	120.00	245.5	245.1	245.3	41.98	46.57	44.2725	35						
5	4	7		0.163	0.0163	40	120.00	245.1	240.4	242.7	46.57	74.14	60.355	211						
														302						

m'	5.00
n'	0.41
sqr(1+m2)	5.10
sqr(n2+m2)	5.02
sqr(n2+m2+1	5.12
A0	0.003
A1	0.077
A2	2.374
F1	0.025
F2	0.077
Is	0.047

FIGURE G3

HWY11 BURKE'S FALLS
HWY124 I/C

E-N RAMP

20+740 ~ 20+800

2 γ_w = 9.81 | γ_{soil} = 19 | γ_{fill} = 22 | Fill Height= 10 | q_0= 220 | Width= 33 | Es= 37000 | Poisson Ratio= 0.41 | Secondary Comp. Ratio 2.03E-03

Sublayer	Compressible Soil from Depth:	To the Depth of:	GWT Level	$Cc/1+e_0$	$Cs/1+e_0$	C_v	P_C	q_{top}	q_{bot}	q_{ave}	σ' at Top	σ' at Bottom	Effective Stress at middle Layer	Consolidation settlement (mm)	Degree of Consolidation (%)	Time Required (Two Way Drainage)	Time Required (One Way Drainage)	Elastic Settlement (mm)	Time for Secondary Settlement Calculation	secondary Settlement (mm)
1	1	2.5	0	0.115	0.0115	40	150.00	220.0	219.7	219.8	9.19	22.98	16.08	51	90	0.191	0.763	33	30	27
2	2.5	3.5		0.086	0.0086	40	120.00	219.7	219.2	219.4	22.98	32.17	27.57	32						
3	3.5	4.5		0.086	0.0086	40	120.00	219.2	218.3	218.7	32.17	41.36	36.76	33						
4	4.5	5.5		0.086	0.0086	40	120.00	218.3	217.0	217.6	41.36	50.55	45.95	33						
5	5.5	7		0.031	0.0031	40	210.00	217.0	214.2	215.6	50.55	64.33	57.4375	8						
														157						

m'	5.00
n'	0.42
sqr(1+m2)	5.10
sqr(n2+m2)	5.02
sqr(n2+m2+1	5.12
A0	0.004
A1	0.081
A2	2.303
F1	0.027
F2	0.078
Is	0.051

FIGURE G4

HWY11 BURKE'S FALLS
HWY124 I/C

N-E RAMP

20+700 ~ 20+760

2 γ_w= 9.81 | γ_{soil}= 19 | γ_{fill}= 22 | Fill Height= 11.4 | q_0= 250.8 | Width= 33 | Es= 26,000 | Poisson Ratio= 0.41 | Secondary Comp. Ratio 4.02E-03

Sublayer	Compressible Soil from Depth:	To the Depth of:	GWT Level	$Cc/1+e_0$	$Cs/1+e_0$	C_v	P_C	q_{top}	q_{bot}	q_{ave}	σ' at Top	σ' at Bottom	Effective Stress at middle Layer	Consolidation settlement (mm)	Degree of Consolidation (%)	Time Required (Two Way Drainage)	Time Required (One Way Drainage)	Elastic Settlement (mm)	Time for Secondary Settlement Calculation	secondary Settlement (mm)
1	2.4	3	0	0.134	0.0134	40	175.00	250.5	250.2	250.3	22.06	27.57	24.81	23	90	0.117	0.468	55	30	46
2	3	4		0.134	0.0134	40	175.00	250.2	249.4	249.8	27.57	36.76	32.165	38						
3	4	5		0.134	0.0134	40	175.00	249.4	248.1	248.8	36.76	45.95	41.355	38						
4	5	6		0.134	0.0134	40	175.00	248.1	246.4	247.3	45.95	55.14	50.545	38						
5	6	7.1		0.134	0.0134	40	175.00	246.4	243.9	245.1	55.14	65.25	60.1945	42						
														179						

m'	5.00
n'	0.43
sqr(1+m2)	5.10
sqr(n2+m2)	5.02
sqr(n2+m2+1	5.12
A0	0.004
A1	0.083
A2	2.271
F1	0.028
F2	0.079
Is	0.052

FIGURE G5

HWY11 BURKE'S FALLS
HWY124 I/C

MAINLINE (HWY 11)

20+400 ~ 20+450

2 γ_w = 9.81 | γ_{soil} = 19 | γ_{fill} = 22 | Fill Height= 8.3 | q_0= 182.6 | Width= 87 | Es= 42,000 | Poisson Ratio= 0.4 | Secondary Comp. Ratio 0.0033

Sublayer	Compressible Soil from Depth:	To the Depth of:	GWT Level	$Cc/1+e_0$	$Cs/1+e_0$	C_v	P_C	q_{top}	q_{bot}	q_{ave}	σ' at Top	σ' at Bottom	Effective Stress at middle Layer	Consolidation settlement (mm)	Degree of Consolidation (%)	Time Required (Two Way Drainage)	Time Required (One Way Drainage)	Elastic Settlement (mm)	Time for Secondary Settlement Calculation	secondary Settlement (mm)
1	4.5	5.5	1	0.1	0.01	40	345.00	182.5	182.4	182.5	51.17	60.36	55.76	6	90	0.191	0.763	33	30	43
2	5.5	6.5		0.1	0.01	40	345.00	182.4	182.3	182.4	60.36	69.55	64.95	6						
3	6.5	7.5		0.115	0.0115	40	360.00	182.3	182.2	182.3	69.55	78.74	74.14	6						
4	7.5	8.5		0.115	0.0115	40	360.00	182.2	182.0	182.1	78.74	87.93	83.33	6						
5	8.5	10.5		0.115	0.0115	40	375.00	182.0	181.6	181.8	87.93	106.3	97.115	11						
														35						

m'	5.00
n'	0.24
sqr(1+m2)	5.10
sqr(n2+m2)	5.01
sqr(n2+m2+1	5.10
A0	0.001
A1	0.028
A2	4.058
F1	0.009
F2	0.051
Is	0.026

FIGURE G6