



# Terraprobe

*Consulting Geotechnical & Environmental Engineering  
Construction Materials Inspection & Testing*

**FOUNDATION INVESTIGATION REPORT  
DEEP CUTS & HIGH FILLS  
HIGHWAY 406 TWINNING  
PORT ROBINSION ROAD TO EAST MAIN STREET  
AGREEMENT No. 2008-E-0016, W.P. 280-99-00  
GEOCRES No. 30M3-263  
VOLUME I**

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## TABLE OF CONTENTS Volume I

### Part 1

1	INTRODUCTION.....	1
2	SITE DESCRIPTION & PHYSIOGRAPHY.....	2
3	SITE INVESTIGATION AND FIELD TESTING .....	2
4	LABORATORY TESTING .....	7
5	DESCRIPTION OF SUBSURFACE CONDITIONS .....	7
5.1	Site 1 – Ramp East Main Street E – N.....	7
5.1.1	Topsoil.....	7
5.1.2	Silty Clay .....	7
5.1.3	Clayey Silt.....	8
5.1.4	Silty Clay Till.....	9
5.1.5	Silt Till.....	9
5.1.6	Water Levels.....	10
5.2	Site 2 – Woodlawn I/C Southeast Quadrant .....	10
5.2.1	Topsoil.....	11
5.2.2	Fill – Sand and Gravel.....	11
5.2.3	Fill – Silty Clay .....	11
5.2.4	Silty Clay .....	12
5.2.5	Silt .....	13
5.2.6	Silty Clay to Clayey Silt Till .....	13
5.2.7	Silty Sand Till.....	14
5.2.8	Sand and Gravel Till.....	14
5.2.9	Bedrock (Salina Formation) .....	14
5.2.10	Water Levels.....	15
5.3	Site 3 – Woodlawn I/C Southwest Quadrant .....	16
5.3.1	Topsoil.....	16
5.3.2	Fill – Silty Clay .....	16
5.3.3	Silty Clay .....	17
5.3.4	Clayey Silt to Silty Clay Till .....	18
5.3.5	Sand.....	18
5.3.6	Silty Sand to Sand and Silt Till .....	19
5.3.7	Bedrock (Salina Formation) .....	19
5.3.8	Water Levels.....	20
5.4	Site 4 – Highway 406 NBL & SBL .....	20
5.4.1	Topsoil.....	21
5.4.2	Fill – Sandy Gravel to Gravelly Sand.....	21
5.4.3	Fill – Silty Sand to Sand and Silt .....	21
5.4.4	Fill – Silty Clay .....	21
5.4.5	Silty Clay.....	22



5.4.6	Silt .....	23
5.4.7	Clayey Silt .....	24
5.4.8	Silty Clay to Clayey Silt Till .....	24
5.4.9	Sand .....	25
5.4.10	Sandy Silt to Silty Sand Till .....	25
5.4.11	Sandy Gravel to Sand and Gravel Till .....	26
5.4.12	Bedrock (Salina Formation) .....	26
5.4.13	Water Levels .....	27
5.5	Miscellaneous .....	29

## **Appendices**

### ***Site 1***

Appendix A1 – Record of Borehole Sheets

Appendix B1 – Laboratory Test Results

Appendix C1 – Drawings titled “Borehole Locations and Soil Strata”

### ***Site 2***

Appendix A2 – Record of Borehole Sheets

Appendix B2 – Laboratory Test Results

Appendix C2 – Drawings titled “Borehole Locations and Soil Strata”

### ***Site 3***

Appendix A3 – Record of Borehole Sheets

Appendix B3 – Laboratory Test Results

Appendix C3 – Drawings titled “Borehole Locations and Soil Strata”

### ***Site 4***

Appendix A4 – Record of Borehole Sheets

Appendix B4 – Laboratory Test Results

Appendix C4 – Drawings titled “Borehole Locations and Soil Strata”



**FOUNDATION INVESTIGATION REPORT**  
**DEEP CUTS & HIGH FILLS**  
**HIGHWAY 406 TWINNING**  
**ONTARIO**  
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**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from foundation investigations conducted at the deep cut and high fill areas on the alignment of the proposed four lanes of Highway 406 and associated ramps. The project area extends from East Main Street, City of Welland to about 1.0 km north of Port Robinson Road, City of Thorold, Ontario.

The purpose of this investigation was to explore the subsurface conditions at the identified sections and based on the data obtained, to provide borehole location plans, records of boreholes, stratigraphic profiles and cross-sections, laboratory test results and a description of the subsurface conditions. Models of the subsurface conditions were developed from the data obtained.

Terraprobe conducted the investigation as a sub-consultant to Giffels Associates Ltd./IBI Group, under the Ministry of Transportation Ontario (MTO) Agreement Number 2008-E-0016.

For reporting purposes the investigated sections are identified as follows:

- **Site 1:** Cut section, Ramp East Main Street E-N, Sta. 10+000 to 10+340 approximately.
- **Site 2:** Fill section, Woodlawn Interchange southeast quadrant consisting of Ramp 406S – Woodlawn E/W (Sta. 10+000 to Sta. 10+434 approximately) and Ramp Woodlawn W – 406N (Sta. 10+000 to Sta. 10+296 approximately).
- **Site 3:** Fill section, Woodlawn Interchange southwest quadrant consisting of Ramp Woodlawn E/W – 406S (Sta. 10+000 to Sta. 10+473 approximately).
- **Site 4:** Fill section, Highway 406 north bound and south bound main lanes, Sta. 11+950 to Sta. 13+220 approximately.

High fills are also required where Port Robinson Road will cross above the proposed four lanes of Highway 406. The subsurface data for this section will be provided in a separate report.





## 2 SITE DESCRIPTION & PHYSIOGRAPHY

The south limit of the project is Sta. 10+000 located at the existing Highway 406 terminus at East Main Street in the City of Welland. The north limit is about Sta. 6+400 approximately 1.0 km north of Port Robinson Road in the City of Thorold. This approximately 6.5 km long route traverses across generally flat terrain and crosses Woodlawn Road, Merritt Road and Port Robinson Road. There is an at grade railway intersection (Trillium Railway) about 265 m south of Woodlawn Road. The alignment also crosses the Welland River and Old Welland Canal.

The site is located between the Niagara Escarpment and Lake Erie in the physiographic region of Southern Ontario referred to as the Haldimand Clay Plain. The Haldimand Clay Plain is best described as falling into a series of parallel belts with the highest ground adjacent to the Escarpment. Generally this region is flat and poorly drained although it includes several distinctive landforms such as dunes, cobble, clay and sand beaches, limestone pavements and back-shore wetland basins<sup>1</sup>.

The Niagara Region is underlain by a sequence of very gently south-dipping dolostones, limestones, shales and sandstones overlying Precambrian basement rock. The key elements in the bedrock geology of the region are the multiple layers of softer sedimentary limestones, shale, sandstone and dolostone.

The bedrock units within the project limits consist of the Salina Formation and Guelph Formation of Upper Silurian Age<sup>2</sup>. The Salina Formation consists essentially of easily weathered, grey, very finely crystalline, laminated argillaceous dolostone with grey, calcareous shale partings and gypsum veins and lenses of varying thicknesses. The Guelph Formation consists essentially of unweathered, grey, laminated argillaceous dolostone.

## 3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing at the four sites are outlined below:

**Site 1:** *Ramp East Main Street E-N* – Five boreholes drilled and sampled to depths ranging from 8.1 m to 17.3 m during the period January 15, 2010 and January 21, 2010. The approximate borehole locations are shown on the attached Borehole Locations and Soil Strata drawing in Appendix C1

**Site 2:** *Woodlawn Interchange southeast quadrant* – Fourteen boreholes drilled and sampled to depths ranging from 6.6 m to 33.0 m during the period November 02, 2009 and January 18, 2010. The approximate borehole locations are shown on the attached Borehole Locations and Soil Strata drawing in Appendix C2.

**Site 3:** *Woodlawn Interchange southwest quadrant* – Eleven boreholes drilled and sampled to depths ranging from 11.2 m to 32.1 m during the period November 04, 2009 and January 08, 2010.

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<sup>1</sup> Chapman and Putnam, "The Physiography of South Ontario", 3<sup>rd</sup> Edition, 1984.

<sup>2</sup> Ontario Division of Mines, "Quaternary Geology Of The Welland Area", Preliminary Map P.796, 1972.



The approximate borehole locations are shown on the attached Borehole Locations and Soil Strata drawing in Appendix C3.

**Site 4:** *Highway 406 north bound and south bound main lanes* – Fifty two boreholes drilled and sampled to depths ranging from 5.5 m to 35.0 m during the period November 02, 2009 and April 29, 2010. The approximate borehole locations are shown on the attached Borehole Locations and Soil Strata drawing in Appendix C4.

The borehole locations were marked in the field by surveyors from Callon Dietz Inc. who also provided Terraprobe with their coordinates and geodetic elevations. Access to some borehole locations was difficult due to locally steep slopes, existing structures and watercourses. These boreholes were therefore relocated to be as close as feasible to the staked out location while allowing safe operation of the drill rig. Utility clearances were obtained by Terraprobe prior to drilling.

Samples of the overburden soils were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT), as specified in ASTM Method D1586. In the cohesive (clayey) deposits the undrained shear strength of the soil was measured in-situ by means of field vane tests using an MTO type field vane. Relatively undisturbed soil samples were also collected with thin-walled Shelby Tube samplers. Boreholes drilled for proposed bridges in the high fill areas were also advanced into bedrock by NQ size diamond coring techniques.

In addition to the testing outlined above, Dynamic Cone Penetration Tests (DCPT) were conducted. This test consists of continuously driving into undisturbed ground a 50 mm diameter cone (60° vertex angle) attached to a drill rod, with a driving energy of 475 J per blow (63.5 kg hammer dropping freely a vertical distance of 0.76 m). The number of blows for each 300 mm of penetration is recorded and this provides an indication of the relative changes in the soil density/consistency with depth.

Ground water conditions in the open boreholes were observed throughout the drilling operations and standpipe piezometers consisting of 19 mm diameter PVC pipe with a slotted screen enclosed in sand were installed in selected boreholes to permit longer term ground water level monitoring. The remaining boreholes were abandoned in accordance with MOE Regulation 903 by sealing/grouting with a clay slurry mixture after drilling was complete.



The locations and completion details of the piezometers are shown in Tables 3.1, 3.2, 3.3 and 3.4.

**Table 3.1 – Piezometer Installation Details (Site 1 Ramp East Main Street E-N)**

Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
EMN 10+125 Lt	17.0/165.6	Piezometer with 1.5 m slotted screen installed with filter sand to 15.2 m, bentonite seal from 15.2 m to 14.9 m, silty clay cuttings from 14.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
EMN 10+125 Rt	17.2/165.3	Piezometer with 1.5 m slotted screen installed with filter sand to 15.2 m, bentonite seal from 15.2 m to 14.6 m, silty clay cuttings from 14.6 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
EMN 10+175 CL	13.4/169.0	Piezometer with 1.5 m slotted screen installed with filter sand to 11.2 m, bentonite seal from 11.2 m to 10.6 m, silty clay cuttings from 10.6 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
EMN 10+225 Lt	8.2/174.2	Piezometer with 1.5 m slotted screen installed with filter sand to 6.4 m, bentonite seal from 6.4 m to 5.8 m, silty clay cuttings from 5.8 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
EMN 10+225 Rt	7.2/175.5	Piezometer with 1.5 m slotted screen installed with filter sand to 5.5 m, bentonite seal from 5.5 m to 4.9 m, silty clay cuttings from 4.9 m to 0.6 m and bentonite seal from 0.6 m to ground surface.

**Table 3.2 – Piezometer Installation Details (Site 2 Woodlawn I/C Southeast Quadrant)**

Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
S-EW 10+025Rt	18.8/164.8	Piezometer with 3.0 m slotted screen installed with filter sand to 15.1 m, bentonite seal from 15.1 m to 14.5 m, silty clay cuttings from 14.5 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
S-EW 10+050CL	12.2/171.2	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 8.2 m, silty clay cuttings from 8.2 m to 0.5 m and bentonite seal from 0.5 m to ground surface.
TSEW2	24.2/159.1	Hole sealed with bentonite from 25.0 m to 24.4 m, piezometer with 1.5 m slotted screen installed with filter sand to 21.6 m and bentonite seal from 21.6 m to ground surface.
TSEW4	22.9/160.6	Hole sealed to 23.2 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 20.4 m and bentonite seal from 20.4 m to ground surface.
S-EW 10+110CL	12.2/170.2	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
S-EW 10+185Rt	12.2/170.5	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 8.2 m, silty clay cuttings from 8.2 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
W-N 10+200Lt	9.1/172.4	Piezometer with 3.0 m slotted screen installed with filter sand to 5.5 m, bentonite seal from 5.5 m to 5.2 m, silty clay cuttings from 5.2 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
W-N 10+275Rt	13.7/168.2	Piezometer with 3.0 m slotted screen installed with filter sand to 10.0 m, bentonite seal from 10.0 m to 9.4 m, silty clay cuttings from 9.4 m to 0.3 m and bentonite seal from 0.3 m to ground surface.



**Table 3.3 – Piezometer Installation Details (Site 3 Woodlawn I/C Southwest Quadrant)**

Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
WE-S 10+200Lt	9.1/172.5	Piezometer with 1.5 m slotted screen installed with filter sand to 7.0 m, bentonite seal from 7.0 m to 6.1 m, silty clay cuttings from 6.1 m to 0.9 m and bentonite seal from 0.9 m to ground surface.
TEW4	28.3/154.3	Hole sealed to 28.3 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 26.2 m and bentonite seal from 26.2 m to ground surface.
TEW1	15.2/167.3	Hole sealed to 15.2 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 12.8 m and bentonite seal from 12.8 m to ground surface.
WE-S 10+345CL	12.6/170.2	Piezometer with 1.5 m slotted screen installed with filter sand to 10.7 m, bentonite seal from 10.7 m to 10.1 m, silty clay cuttings from 10.1 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
WE-S 10+360Lt	19.8/163.6	Piezometer with 3.0 m slotted screen installed with filter sand to 16.2 m, bentonite seal from 16.2 m to 15.5 m, silty clay cuttings from 15.5 m to 0.6 m and bentonite seal from 0.6 m to ground surface.

**Table 3.4 – Piezometer Installation Details (Site 4 Highway 406 NBL & SBL)**

Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
NBL 12+075CL	4.9/179.7	Piezometer with 1.5 m slotted screen installed with filter sand to 2.7 m, bentonite seal from 2.7 m to 2.1 m, silty clay cuttings from 2.1 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
NBL 12+225CL	10.7/174.2	Piezometer with 1.5 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
NBL 12+375Lt	11.1/172.2	Piezometer with 3.0 m slotted screen installed with filter sand to 7.2 m, bentonite seal from 7.2 m to 6.6 m, silty clay cuttings from 6.6 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
TN2	25.9/158.3	Hole sealed to 25.9 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 23.5 m, bentonite seal from 23.5 m to 1.5 m, sand from 1.5 m to 0.3 m and a flush mounted casing installation from 0.15 m to ground surface.
TN3	19.8/164.3	Hole sealed to 19.8 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 17.7 m, bentonite seal from 17.7 m to 0.3 m, and a flush mounted casing installation from 0.15 m to ground surface.
NBL 12+440Rt	12.2/170.8	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
NBL 12+525Lt	15.2/167.6	Piezometer with 1.5 m slotted screen installed with filter sand to 13.4 m, bentonite seal from 13.4 m to 13.1 m, silty clay cuttings from 13.1 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
NBL 12+525Rt	12.2/169.8	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
NBL 12+645Lt	12.2/171.1	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
NBL 12+645Rt	12.2/168.8	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.



Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
NBL 12+695Lt	12.2/170.7	Piezometer with 3.0 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
WN2	25.9/155.3	Hole sealed to 25.9 m with bentonite, piezometer with 1.8 m slotted screen installed with filter sand to 24.1 m, bentonite seal from 24.1 m to ground surface.
WN3	22.6/159.5	Hole sealed to 22.6 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 20.7 m, bentonite seal from 20.7 m to ground surface with a flush mounted casing installation.
NBL 12+750Rt	12.6/170.2	Piezometer with 3.0 m slotted screen installed with filter sand to 9.0 m, bentonite seal from 9.0 m to 8.4 m, silty clay cuttings from 8.4 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
NBL 12+835Rt	10.7/172.2	Piezometer with 1.5 m slotted screen installed with filter sand to 8.5 m, bentonite seal from 8.5 m to 7.9 m, silty clay cuttings from 7.9 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
NBL 12+985Rt	4.6/177.7	Piezometer with 1.5 m slotted screen installed with filter sand to 2.4 m, bentonite seal from 2.4 m to 1.8 m, silty clay cuttings from 1.8 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
SBL 12+185Lt	7.9/175.3	Piezometer with 1.5 m slotted screen installed with filter sand to 5.8 m, bentonite seal from 5.8 m to 5.2 m, silty clay cuttings from 5.2 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
SBL 12+360CL	12.2/170.7	Piezometer with 3.0 m slotted screen installed with filter sand to 9.0 m, bentonite seal from 9.0 m to 8.4 m, silty clay cuttings from 8.4 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
TS1	28.0/154.6	Hole sealed to 28.0 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 25.0 m and bentonite seal from 25.0 m to ground surface.
TS4	28.3/154.1	Hole sealed to 28.4 m with bentonite, piezometer with 3.0 m slotted screen installed with filter sand to 24.7 m and bentonite seal from 24.7 m to ground surface.
SBL 12+410CL	12.2/170.3	Piezometer with 1.5 m slotted screen installed with filter sand to 10.3 m, bentonite seal from 10.3 m to 10.0 m, drill cuttings from 10.0 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
SBL 12+525CL	15.2/166.6	Piezometer with 1.5 m slotted screen installed with filter sand to 13.4 m, bentonite seal from 13.4 m to 12.8 m, silty clay cuttings from 12.8 m to 0.6 m and bentonite seal from 0.6 m to ground surface.
SBL 12+600Rt	12.2/169.9	Piezometer with 1.5 m slotted screen installed with filter sand to 10.4 m, bentonite seal from 10.4 m to 10.1 m, silty clay cuttings from 10.1 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
SBL 12+685CL	10.7/172.0	Piezometer with 3.0 m slotted screen installed with filter sand to 7.0 m, bentonite seal from 7.0 m to 6.4 m, silty clay cuttings from 6.4 m to 0.3 m, bentonite seal from 0.3 m to 0.2 m and a flush mounted casing installation from 0.2 m to ground surface.
WS1	22.9/159.8	Hole sealed to 22.9 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 20.4 m, bentonite seal from 20.4 m to ground surface.
WS4	24.4/158.3	Hole sealed to 24.4 m with bentonite, piezometer with 1.5 m slotted screen installed with filter sand to 21.9 m, bentonite seal from 21.9 m to ground surface.
SBL 12+750CL	10.5/172.4	Piezometer with 3.0 m slotted screen installed with filter sand to 6.9 m, bentonite seal from 6.9 m to 6.6 m, silty clay cuttings from 6.6 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
SBL 12+900CL	5.3/177.4	Piezometer with 1.5 m slotted screen installed with filter sand to 3.2 m, bentonite seal from 3.2 m to 2.9 m, silty clay cuttings from 2.9 m to 0.3 m and bentonite seal from 0.3 m to ground surface.



The drilling, sampling and in-situ testing operations were observed on a full time basis by members of Terraprobe's technical staff who logged the boreholes and processed the recovered soil and rock samples for transport to Terraprobe's Brampton laboratory for further examination and testing.

#### **4 LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and natural moisture content determination. Select samples were also subjected to a laboratory testing programme consisting of gradation analysis and Atterberg Limits tests, consolidation tests, unit weight, unconfined compression tests and undrained shear strength testing with a laboratory vane. The results of this testing program are shown on the Record of Borehole sheets in Appendix A1 – A4 and the figures in Appendix B1 – B4.

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

##### **5.1 Site 1 – Ramp East Main Street E – N**

Reference is made to the Record of Borehole sheets in Appendix A1. Details of the encountered soil stratigraphy are presented in these appendices and on the “Borehole Locations and Soil Strata” drawings in Appendix C1. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general, the site is underlain by overburden soils consisting of topsoil, native deposits of firm to hard silty clay, very stiff clayey silt, stiff to very stiff silty clay till and compact silt till.

##### **5.1.1 Topsoil**

Topsoil ranging from 60 mm to 130 mm in thickness was encountered at this site. Topsoil thickness may vary between and beyond the boreholes.

##### **5.1.2 Silty Clay**

A silty clay deposit was encountered across the site and Boreholes EMN 10+225Lt and EMN 10+225Rt were terminated in this deposit at depths of 8.5 (Elev. 173.9 m) and 8.1 m (Elev. 174.6 m) respectively. This deposit was fully penetrated in the remaining boreholes where it was found to extend to depths ranging from 7.1 m (Elev. 175.4 m) to 8.6 m (Elev. 173.8 m) below ground surface.

The grain size distribution plots of tested samples of the silty clay are presented in Figures B1-1 to B1-3 inclusive. These results show a grain size distribution consisting of 0-3% gravel, 1-4% sand, 40-70% silt and 28-59% clay size particles.



Samples were also subjected to Atterberg Limits tests and the results are illustrated on the plasticity charts, Figures B1-4 to B1-6. The index values from these tests are summarized below:

Liquid Limit:	26-50%
Plastic Limit:	14-25%
Plasticity Index:	11-24%
Natural Moisture Content:	8-34%

These values indicate that the silty clay has a generally low to intermediate plasticity.

Standard Penetration tests in this stratum gave 'N' values that ranged from 4 to 52 blows for 0.3 m penetration. Field vane tests gave in-situ undrained shear strengths ranging from 56 kPa to in excess of 120 kPa. Laboratory vane tests on relatively undisturbed Shelby tube samples gave undrained shear strengths ranging from 89 kPa to 173 kPa. These values indicate that the consistency of the silty clay is generally firm to hard. The variation of undrained shear strength with elevation is depicted in Figure B1-12. There are no discernable trends of undrained shear strength with depth. The moisture content of samples of the silty clay range from 8% to 34% by weight and the unit weight of selected samples ranged from 20.0 to 22.3 kN/m<sup>3</sup>.

### **5.1.3 Clayey Silt**

A native clayey silt deposit was encountered at this site in Borehole EMN 10+125 Rt. The deposit is approximately 1.5 m thick and extends to a depth of 8.6 m (Elev. 173.9 m) below ground surface.

The grain size distribution plot of a tested sample of the clayey silt is presented in Figure B1-7. The result shows a grain size distribution consisting of 0% gravel, 0% sand, 82% silt and 18% clay size particles.

One sample was also subjected to an Atterberg Limits test and the result is illustrated on the plasticity chart, Figure B1-8. The index values from this test are summarized below:

Liquid Limit:	26%
Plastic Limit:	19%
Plasticity Index:	8%
Natural Moisture Content:	23%

These results are typical for low plasticity clayey silt soils.

An SPT 'N' value of 27 blows for 0.3 m penetration was obtained from a Standard Penetration test conducted in this deposit and a field vane test gave an in-situ undrained shear strength in excess of 120 kPa. Based on these results the deposit is considered to have a very stiff consistency. The moisture content of a sample from this deposit is 23% by weight.



#### 5.1.4 Silty Clay Till

A native silty clay till deposit was encountered at this site in some of the boreholes. This deposit was not encountered in Boreholes EMN 10+225 Lt and EMN 10+225Rt. In Borehole EMN 10+125 Lt this silty clay till extends to a depth of 16.2 m (Elev. 166.4 m) below ground surface. The remaining boreholes were terminated in this deposit at depths of 13.7 m (Elev. 168.7 m) and 17.3 m (Elev. 165.2 m) below ground surface.

The grain size distribution plots of tested samples from this unit are depicted in Figure B1-9. These results show a grain size distribution consisting of 1-7% gravel, 11-21% sand, 53-64% silt and 20-24% clay size particles. Till soils will also contain random cobble and boulder inclusions.

Samples were also subjected to Atterberg Limits tests and the results are plotted on the plasticity chart, Figure B1-10. The index values from these tests are summarized below:

Liquid Limit:	23-29%
Plastic Limit:	13-16%
Plasticity Index:	9-12%
Natural Moisture Content:	12-31%

These values are typical of clayey soils of low plasticity.

Standard Penetration tests in this stratum yielded 'N' values ranging from 11 to 29 blows per 0.3 m penetration. Field vane tests were also conducted in this deposit and the results indicate an undrained shear strength ranging from 88 kPa to in excess of 120 kPa. Laboratory vane tests on relatively undisturbed Shelby tube samples gave undrained shear strengths ranging from 76 kPa to in excess of 120 kPa. Based on these results, the silty clay till is considered to have a stiff to very stiff consistency. The moisture content of samples from this deposit varies from 12% to 31% by weight and the unit weight of selected samples ranged from 20.2 to 21.1 kN/m<sup>3</sup>.

#### 5.1.5 Silt Till

A deposit of silt till was encountered in Borehole EMN 10+125 Lt. This unit extends to a borehole termination depth of 17.3 m (Elev. 165.3 m) and possibly beyond.

The grain size distribution plot of a tested sample from this stratum is depicted in Figures B1-11. These results show a grain size distribution consisting of 0% gravel, 16% sand, 78% silt and 6% clay size particles.

A Standard Penetration test in this deposit yielded an 'N' value of 13 blows per 0.3 m penetration. Based on this result, the unit is considered to have a compact relative density. The moisture content of a sample from this stratum is 21% by weight.





### 5.1.6 Water Levels

Standpipe piezometers were installed in selected boreholes. The water level readings measured on separate visits made after the completion of drilling are presented in Table 5.1.1.

**Table 5.1.1 – Water Level Measurements**

Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
EMN 10+125 Lt	Jan. 27, 2010	12.0	170.6
	Feb. 08, 2010	11.8	170.8
	Feb. 19, 2010	11.9	170.7
EMN 10+125 Rt	Jan. 19, 2010	16.8	165.7
	Jan. 27, 2010	16.1	166.4
	Feb. 08, 2010	12.2	170.3
	Feb. 19, 2010	10.1	172.4
	Apr. 16, 2010	9.3	173.2
	May. 04, 2010	9.4	173.1
	May. 06, 2010	9.4	173.1
EMN 10+175 CL	Jan. 27, 2010	13.5	168.9
	Feb. 08, 2010	13.2	169.2
	Feb. 19, 2010	12.8	169.6
	Apr. 16, 2010	8.0	174.4
	May. 04, 2010	7.6	174.8
	May. 06, 2010	7.5	174.9
	May. 18, 2010	7.7	174.7
EMN 10+225 Lt	Jan. 27, 2010	dry	-
	Feb. 08, 2010	dry	-
	Feb. 19, 2010	dry	-
EMN 10+225 Rt	Jan. 27, 2010	7.2	175.5
	Feb. 08, 2010	6.4	176.3
	Feb. 19, 2010	5.9	176.8
	Apr. 16, 2010	4.3	178.4
	May. 04, 2010	4.1	178.6
	May. 06, 2010	4.4	178.3
	May. 18, 2010	4.0	178.7

The ground water table was estimated based on the recorded water levels in the standpipe piezometers and our review of moisture contents of the retrieved samples. This interpretation indicates a phreatic surface that generally follows the ground surface topography. The water level exists at Elev.  $\pm 173.1$  m at Sta. 10+125 and it rises to Elev.  $\pm 178.7$  m at Sta. 10+225.

All ground water observations at this site are short term and the levels are expected to fluctuate seasonally and after severe weather events.

### 5.2 Site 2 – Woodlawn I/C Southeast Quadrant

Reference is made to the Record of Borehole sheets in Appendix A2. Details of the encountered soil and rock stratigraphy are presented in these appendices and on the “Borehole Locations and Soil Strata” drawings in Appendix C2. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general, the site is underlain by topsoil, fill material (loose to dense sand and gravel and sand, firm to hard silty clay) and native overburden deposits of stiff to hard silty clay, compact to dense



silt, very stiff to hard silty clay to clayey silt till, dense to very dense silty sand till and compact to very dense sand and gravel till. These soils are underlain by bedrock consisting primarily of dolostone and shale of the Salina formation.

### **5.2.1 Topsoil**

Topsoil ranging from 30 mm to 250 mm thick was encountered at this site. Topsoil thickness may vary between and beyond the boreholes.

### **5.2.2 Fill – Sand and Gravel**

Fill material ranging from sand and gravel to sand some gravel was encountered in Boreholes TSEW1, TSEW2, TSEW3 and W-N 10+275Rt. This fill material extends to depths ranging from 0.7 m (Elev.  $\pm 182.8$  m) to 1.1 m (Elev.  $\pm 180.8$  m) below ground surface.

Samples of this fill material were subjected to grain size distribution tests and the results are illustrated in Figure B2-1. These results show a grain size distribution consisting of 10-43% gravel, 30-76% sand, 13-25% silt and 3-15% clay size particles.

Standard Penetration tests in this granular fill gave 'N' values that ranged from 6 to 32 blows per 0.3 m penetration. Based on these results the fill is considered to have a loose to dense relative density. The moisture content of samples of this fill ranged from 1% to 29% by weight.

### **5.2.3 Fill – Silty Clay**

Silty clay fill material was encountered at this site extending to depths ranging from 0.7 m (Elev. 182.7 m) to 4.4 m (Elev. 179.2 m) below ground surface.

Samples of the silty clay fill were subjected to grain size distribution tests and the results are presented in Figure B2-2. These results show grain size distributions consisting of 0-9% gravel, 0-14% sand, 38-59% silt and 30-56% clay size particles.

Samples of the fill were also subjected to Atterberg Limits tests and the results are presented in Figure B2-3. The index values from these tests are summarized below:

Liquid Limit:	26-54%
Plastic Limit:	14-25%
Plasticity Index:	12-29%
Natural Moisture Content:	9-20%

These values are characteristic of clayey soils of low to high plasticity.

Standard Penetration tests in the silty clay fill gave 'N' values that ranged from 4 to 93 blows for 0.3 m penetration. Based on these results the fill is considered to have a firm to hard consistency. The moisture content of samples of this fill ranged from 8% to 28% by weight.



#### 5.2.4 Silty Clay

A major silty clay deposit was encountered across the site. This deposit was fully penetrated in some of the boreholes where it was found to extend to depths ranging from 12.4 m (Elev. 169.5 m) to 16.2 m (Elev. 167.4 m) below ground surface. The remaining boreholes were terminated within this deposit at depths ranging from 6.6 m (Elev. 176.0 m) to 14.0 m (Elev. 168.4 m) below ground surface.

The grain size distribution plots of tested samples of the silty clay are presented in Figures B2-4 to B2-12 inclusive. These results show a grain size distribution consisting of 0-4% gravel, 0-13% sand, 37-81% silt and 17-61% clay size particles.

Samples were also subjected to Atterberg Limits tests and the results are illustrated on the plasticity charts, Figures B2-13 to B2-21 inclusive. The index values from these tests are summarized below:

Liquid Limit:	24-58%
Plastic Limit:	14-25%
Plasticity Index:	7-33%
Natural Moisture Content:	16-23%

These values indicate that the silty clay has a generally low to intermediate plasticity with occasional zones of high plasticity.

Standard Penetration tests in this stratum gave 'N' values that ranged from 1 to 42 blows for 0.3 m penetration. Field vane tests gave in-situ undrained shear strengths ranging from 35 kPa to in excess of 100 kPa and laboratory vane tests on relatively undisturbed Shelby tube samples gave undrained shear strengths ranging from 56 kPa to 113 kPa. The variation of undrained shear strength with elevation is depicted in Figure B2-29. These values indicate that the consistency of the silty clay is generally stiff to hard. There are no discernable trends of undrained shear strength with depth. Moisture content of samples of the silty clay range from 6% to 24% by weight and the unit weight of selected samples ranged from 20.4 to 20.8 kN/m<sup>3</sup>

The Atterberg Limits tests results are also plotted against elevation, Figure B2-30. These results illustrate that the natural moisture contents are generally at or below the plastic limit above Elev. 177 m. Below Elev. 177 m there is a trend of increasing moisture content and the natural moisture content is between plastic limit and liquid limit.

Consolidation tests were also performed on Shelby tube samples retrieved from Boreholes S-EW 10+050CL, TSEW3, and W-N 10+275Rt and the results are presented in Figures B2-31 to B2-39 inclusive. Preconsolidation pressures were estimated from the e-log p curves. Due to the rounded nature of the curves the preconsolidation pressures were also assessed based on the 'Work' – method proposed by Becker et al. (1987).



The details of the test results are summarized below.

Borehole/Sample No.	Sample Depth/Elevation (m)	$P_c$ (kPa)	$C_c$	$C_r$	$e_o$
S-EW 10+050CL TW9	9.1/174.3	310 – 400	0.221	0.027	0.63
TSEW 3 TW13	12.2/171.1	230 – 300	0.208	0.037	0.62
W-N 10+275Rt. TW9	9.1/172.8	280 – 400	0.197	0.035	0.58

Where:  $P_c$  = Preconsolidation pressure  
 $C_c$  = Compression index  
 $C_r$  = Recompression index  
 $e_o$  = Initial void ratio

### 5.2.5 Silt

Boreholes W-N 10+125CL, W-N 10+200Lt, W-N 10+200Rt and W-N 10+275Rt encountered a silt deposit. The stratum is approximately 0.8 m to 1.1 m thick and extends to depths ranging from 2.9 m (Elev. 178.6 m) to 4.0 m (Elev. 177.9 m) below ground surface. Based on visual and tactile examinations of the retrieved samples, the unit is essentially a cohesionless silt with frequent cohesive silty clay seams and partings.

The grain size distribution plot of a tested sample of the silt deposit is presented in Figure B2-22. These results show a grain size distribution consisting of 0% gravel, 1% sand, 88% silt and 11% clay size particles.

The deposit is considered to have a compact to dense relative density based on SPT 'N' values that ranged from 22 to 32 blows for 0.3 m penetration. The moisture content of samples from this deposit ranged from 16% to 19% by weight.

### 5.2.6 Silty Clay to Clayey Silt Till

Layers of silty clay to clayey silt till were encountered across the site extending to depths ranging from 26.9 m (Elev. 156.6 m) to 28.0 m (Elev. 155.5 m). Boreholes S-EW 10+025Rt and W-N 10+275Rt were terminated in this unit at depths of 14.2 m (Elev. ±167.7 m) and 18.8 m (Elev. ±164.8 m) respectively.

The grain size distribution plots of tested samples from these till deposits are depicted in Figures B2-23 and B2-24. These results show a grain size distribution consisting of 3-28% gravel, 2-34% sand, 32-63% silt and 13-33% clay size particles. Till soils will also contain random cobble and boulder inclusions.

Samples were also subjected to Atterberg Limits tests and the results are presented in the plasticity charts, Figures B2-25 and B2-26. The index values from these tests are summarized below:

Liquid Limit: 18-31%  
Plastic Limit: 11-16%  
Plasticity Index: 5-16%  
Natural Moisture Content: 7-26%

These values are characteristic of clayey soils of low plasticity.



Standard Penetration tests in these deposits yielded 'N' values ranging from 15 to more than 100 blows per 0.3 m penetration. Field vane tests were also attempted in these deposits and the results (no-turn on vane) indicate undrained shear strengths more than 100 kPa. Based on these results the silty clay to clayey silt till is considered to have a very stiff to hard consistency. The moisture content of samples from these deposits varies from 1% to 26% by weight.

#### 5.2.7 Silty Sand Till

A silty sand till deposit was encountered at this site. This deposit extends to depths ranging from 24.0 m (Elev. 159.5 m) to 25.4 m (Elev. 157.9 m) below ground surface.

The results of grain size distribution tests conducted on samples obtained from this deposit are illustrated in Figure B2-27. These results show grain size distributions consisting of 15-35% gravel, 31-45% sand, 28-32% silt and 6-9% clay size particles. Till soils will also contain random cobble and boulder inclusions.

Standard Penetration tests in this deposit gave 'N' values that generally ranged from 30 to more than 100 blows per 0.3 m penetration indicating a dense to very dense relative density. The moisture content of samples from this deposit ranged from 4% to 17% by weight.

#### 5.2.8 Sand and Gravel Till

A deposit of sand and gravel till was encountered at this site overlying the bedrock surface. Occasional cobbles were also encountered in this deposit. This stratum extends to depths ranging from 29.5 m to 29.7 m below ground surface or to elevations of 153.6 m to 154.0 m.

Samples from this deposit were subjected to grain size distribution tests and the results are illustrated in Figure B2-28. These results show a grain size distribution consisting of 34-42 % gravel, 37-44 % sand, 14-22 % silt and 7 % clay size particles. Till soils will also contain random cobble and boulder inclusions.

Standard Penetration tests in this deposit gave 'N' values that ranged from 18 to more than 100 blows per 0.3 m penetration. Based on these results the deposit is considered to have a compact to very dense relative density. The moisture content of samples from this stratum ranged from 2% to 16% by weight.

#### 5.2.9 Bedrock (Salina Formation)

The overburden soils described above are underlain by the Salina Formation. Bedrock was proved by coring at the abutment locations of the proposed bridge structure on the Ramp 406S – Woodlawn E/W alignment. Table 5.2.1 summarizes the bedrock depth and the elevations to the top of bedrock.

**Table 5.2.1 – Depth to Bedrock**

Location	BH Number	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
South Abutment	TSEW1	29.7	153.8
	TSEW2	29.6	153.7
North Abutment	TSEW3	29.7	153.6
	TSEW4	29.5	154.0



The bedrock is described as unweathered dolostone and shale and its colour is generally grey. It is thinly laminated with white unweathered gypsum and calcite veins. Total core recovery in the bedrock ranged from 59% to 100%. The RQD values ranged widely from 0% to 84% but generally most of the RQD values were below 50%. Rubble and highly fractured zones were observed in the rock cores which contributed to the relatively low RQD values. The core data reveals that there is generally no trend of improving rock quality with depth. Based on these results the rock quality is considered to be very poor to poor with occasional zones of fair to good quality rock.

### 5.2.10 Water Levels

A standpipe piezometer was installed in selected boreholes. The water level readings measured on separate visits made after the completion of drilling are presented in Table 5.2.2.

**Table 5.2.2 – Water Level Measurements**

Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
S-EW 10+025Rt	December 08, 2009	17.7	165.9
	December 15, 2009	16.1	167.5
	January 04, 2010	5.0	178.6
	January 11, 2010	3.9	179.7
	January 19, 2010	4.0	179.6
S-EW 10+050CL	December 08, 2009	2.4	181.0
	December 15, 2009	2.4	181.0
	January 04, 2010	2.4	181.0
	January 11, 2010	2.4	181.0
TSEW2	January 11, 2010	8.5	174.8
	January 19, 2010	8.6	174.7
	January 27, 2010	8.8	174.5
	February 08, 2010	8.8	174.5
TSEW4*	-	-	-
S-EW 10+110CL	November 09, 2009	2.7	179.7
	November 20, 2009	1.1	181.3
	November 30, 2009	1.6	180.8
	December 08, 2009	1.3	181.1
	January 04, 2010	1.3	181.1
S-EW 10+185Rt	November 09, 2009	9.5	173.2
	November 20, 2009	3.2	179.5
	November 30, 2009	2.8	179.9
	December 08, 2009	2.5	180.2
	January 04, 2010	2.2	180.5
	January 19, 2010	2.2	180.5
W-N 10+200Lt	November 09, 2009	7.0	174.5
	November 20, 2009	1.9	179.6
	November 30, 2009	1.4	180.1
	January 04, 2010	1.3	180.2
W-N 10+275Rt	November 09, 2009	10.8	171.1
	November 19, 2009	2.8	179.1
	November 30, 2009	2.7	179.2
	December 08, 2009	2.5	179.4
	January 04, 2010	2.5	179.4

\* Piezometer destroyed after installation.

The ground water table was estimated based on the recorded water levels in the standpipe piezometers and our review of moisture contents of the retrieved samples. This interpretation indicates a ground water table that is estimated to range between Elev. ±179.5 m and



Elev.  $\pm 181.0$  m. Perched water can also be expected to occur where permeable layers of sand and gravel are underlain by more impermeable silty clay soils.

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

### **5.3 Site 3 – Woodlawn I/C Southwest Quadrant**

Reference is made to the Record of Borehole sheets in Appendix A3. Details of the encountered soil and rock stratigraphy are presented in these appendices and on the “Borehole Locations and Soil Strata” drawings in Appendix C3. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general, the site is underlain by topsoil, firm to very stiff silty clay fill and native overburden deposits of firm to hard silty clay, very stiff to hard clayey silt to silty clay till, dense to very dense sand, and compact to very dense silty sand to sand and silt till. These soils are underlain by bedrock consisting primarily of dolostone and shale of the Salina formation.

#### **5.3.1 Topsoil**

Topsoil ranging from 50 mm to 300 mm in thickness was encountered across the site. Topsoil thickness may vary between and beyond the boreholes.

#### **5.3.2 Fill – Silty Clay**

Silty clay fill material was encountered at this site extending to depths ranging from 0.7 m to 2.9 m below ground surface or to elevations ranging from 182.9 m to 180.3 m.

Samples of the silty clay fill were subjected to grain size analysis and the results are presented in Figure B3-1. These results show a grain size distribution consisting of 0-1% gravel, 2-5% sand, 33-63% silt and 34-64% clay size particles.

Samples of the fill material were also subjected to Atterberg Limits tests and the results are presented in Figure B3-2. The index values from these tests are summarized below:

Liquid Limit:	42-62%
Plastic Limit:	20-27%
Plasticity Index:	22-34%
Natural Moisture Content:	15-40%

These values indicate that the silty clay fill generally has an intermediate plasticity with infrequent zones of high plasticity.

Standard Penetration tests in the silty clay fill gave ‘N’ values that ranged from 6 to 65 blows for 0.3 m penetration but generally ‘N’ values ranged from 6 to 27 blows for 0.3 m penetration. Based on these results, the fill is considered to have a generally firm to very stiff consistency with



occasional hard zones. The moisture content of samples of this fill ranged from 15% to 40% by weight.

### 5.3.3 Silty Clay

A silty clay deposit was encountered across the site. This deposit was fully penetrated in Boreholes WE-S 10+360 Lt, TEW1, TEW2, TEW3 and TEW4 where it extended to depths ranging from 14.6 m (Elev. 168.0 m) to 16.1 m (Elev. 167.3 m) below ground surface. The remaining boreholes drilled along the alignment of this ramp were terminated in this deposit at depths ranging from 11.2 m to 14.6 m below ground surface or to elevations ranging from 172.7 m to 168.2 m.

The grain size distribution plots of tested samples of the silty clay are presented in Figures B3-3 to B3-8 inclusive. These results show a grain size distribution consisting of 0-6% gravel, 1-7% sand, 52-81% silt and 17-47% clay size particles.

Samples were also subjected to Atterberg Limits tests and the results are illustrated on the plasticity charts, Figures B3-9 to B3-14 inclusive. The index values from these tests are summarized below:

Liquid Limit:	24-40%
Plastic Limit:	11-20%
Plasticity Index:	6-29%
Natural Moisture Content:	11-28%

These values indicate that the silty clay has a generally low to intermediate plasticity with occasional clayey silt zones.

Standard Penetration tests in this stratum gave 'N' values that ranged from 6 to 77 blows for 0.3 m penetration. Field vane tests gave in-situ undrained shear strengths ranging from 56 kPa to in excess of 120 kPa. An unconfined compression test gave an undrained shear strength of 65 kPa and laboratory vane tests on a relatively undisturbed Shelby tube samples gave undrained shear strengths ranging from 34 to 140 kPa. The variation of undrained shear strength with elevation is depicted in Figure B3-21. These values indicate that the consistency of the silty clay is generally firm to hard. There are no discernable trends of undrained shear strength with depth. Moisture content of samples of the silty clay range from 11% to 28% by weight and the unit weight of tested samples ranged from 20.6 to 20.8 kN/m<sup>3</sup>

The Atterberg Limits tests results are also plotted against elevation, Figure B3-22. These results illustrate that the natural moisture contents are generally below the plastic limit down to Elev. 178.0 m. The moisture contents are at or slightly above the plastic limit below Elev. 178.0 m.

Consolidation tests were also performed on Shelby tube samples retrieved from Boreholes WE-S 10+295CL, WE-S 10+345CL and WE-S 10+360Lt and the results are presented in Figures B3-23 to B3-31. Preconsolidation pressures were estimated from the e-log p curves. Due to the rounded nature of the curves the preconsolidation pressures were also assessed based on the 'Work' – method proposed by Becker et al. (1987). The details of the test results are summarized in the following table.





Borehole/Sample No.	Sample Depth/Elevation (m)	P <sub>c</sub> (kPa)	C <sub>c</sub>	C <sub>r</sub>	e <sub>o</sub>
WE-S 10+295CL TW10	9.1/173.7	350	0.160	0.028	0.55
WE-S 10+345CL TW10	10.7/172.1	230 – 370	0.183	0.019	0.56
WE-S 10+360Lt. TW11	12.2/171.2	220 – 260	0.157	0.029	0.59

Where: P<sub>c</sub> = Preconsolidation pressure  
C<sub>c</sub> = Compression index  
C<sub>r</sub> = Recompression index  
e<sub>o</sub> = Initial void ratio

### 5.3.4 Clayey Silt to Silty Clay Till

Discontinuous layers of clayey silt to silty clay till were encountered in Boreholes TEW1 and TEW2. The thickness of these deposits range from 0.7 m to 4.7 m and these strata extend to depths ranging from 23.8 m (Elev. 158.9 m) to 24.2 m (Elev. 158.3 m) below ground surface. In Boreholes TEW3 and TEW4, the till deposit is undivided and extends to depths ranging from 24.7 m (Elev. 157.9 m) to 24.8 m (Elev. 157.8 m) below ground surface. Borehole WE-S10+360Lt was terminated in this deposit at a depth of 20.3 m (Elev. 163.1 m) below ground surface.

The grain size distribution plots of tested samples from these strata are presented in Figures B3-15 and B3-16. These results show a grain size distribution consisting of 4-12% gravel, 13-31% sand, 43-62% silt and 14-21% clay size particles. Till soils will also contain random cobble and boulder inclusions.

Seven samples were also subjected to Atterberg Limits tests and the results are presented in Figures B3-17 and B3-18. The index values from these tests are summarized below:

Liquid Limit: 17-23%  
Plastic Limit: 11-14%  
Plasticity Index: 5-9%  
Natural Moisture Content: 7-16%

These values are characteristic of clayey soils of low plasticity.

Standard Penetration tests in these deposits yielded 'N' values ranging from 30 to more than 100 blows per 0.3 m penetration. Field vane tests were also attempted in these deposits and the results (no-turn on vane) indicate undrained shear strengths more than 100 kPa. Based on these results, the clayey silt to silty clay till is considered to have a very stiff to hard consistency. The moisture content of samples from these deposits varies from 7% to 16% by weight.

### 5.3.5 Sand

Discontinuous layers of sand and gravel to gravelly sand were encountered in Boreholes TEW1 and TEW2. These deposits are approximately 0.8 m to 1.8 m thick and extend to depths of 23.1 m below ground surface or to elevations ranging from 159.4 m to 159.6 m.



A sample from this stratum was subjected to a grain size distribution test and the results are illustrated in Figure B3-19. These results show a grain size distribution consisting of 32 % gravel, 56 % sand, 10 % silt and 2 % clay size particles.

Standard Penetration tests in these deposits gave 'N' values that ranged from 34 to more than 100 blows per 0.3 m penetration. Based on these results, the deposits are considered to have a dense to very dense relative density. The moisture content of samples from these strata ranged from 8% to 12% by weight.

### 5.3.6 Silty Sand to Sand and Silt Till

A deposit of silty sand to sand and silt till was encountered at this site overlying the bedrock surface. This deposit extends to depths ranging from 28.7 m (Elev. 154.0 m) to 28.9 m (Elev. 153.7 m) below ground surface.

Samples from these deposits were subjected to grain size distribution tests and the results are illustrated in Figure B3-20. These results show a grain size distribution consisting of 2-26 % gravel, 38-95 % sand, 3-38 % silt and 7-8 % clay size particles. Till soils will also contain random cobble and boulder inclusions.

Standard Penetration tests in these deposits gave 'N' values that ranged from 21 to more than 100 blows per 0.3 m penetration indicating a compact to very dense relative density. The moisture content of samples from these strata ranged from 7% to 15% by weight.

### 5.3.7 Bedrock (Salina Formation)

The overburden soils described above are underlain by the Salina Formation. Bedrock was proved by coring at the abutment locations of the proposed bridge structure on this alignment. Table 5.3.1 summarizes the bedrock depth and the elevations to the top of bedrock.

**Table 5.3.1 – Depth to Bedrock**

Location	BH Number	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
South Abutment	TEW1	28.8	153.7
	TEW2	28.7	154.0
North Abutment	TEW3	28.9	153.7
	TEW4	28.7	153.9

The bedrock is described as unweathered dolostone and shale and its colour is generally grey. It is thinly laminated with white unweathered gypsum and calcite veins. Total core recovery in the bedrock ranged from 50% to 100%. The RQD values ranged widely from 0% to 78% but generally, most of the RQD values were below 50%. Rubble and highly fractured zones were observed in the rock cores, which contributed to the relatively low RQD values. The core data also reveals that there is no trend of improving rock quality with depth. Based on these results the rock quality is considered to be very poor to poor with occasional zones of fair to good quality rock.



### 5.3.8 Water Levels

Standpipe piezometers were installed in selected boreholes. The water level readings measured on separate visits made after the completion of drilling are presented in Table 5.3.2.

**Table 5.3.2 – Water Level Measurements**

Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
WE-S 10+200Lt	November 09, 2009	6.8	174.8
	November 20, 2009	3.2	178.4
	November 30, 2009	2.7	178.9
	December 07, 2009	2.6	179.0
	December 15, 2009	2.6	179.0
TEW4	January 11, 2010	10.2	172.4
	January 19, 2010	10.6	172.0
	January 27, 2010	10.5	172.1
	February 08, 2010	10.6	172.0
TEW1	January 19, 2010	3.2	179.3
	January 27, 2010	2.4	180.1
	February 08, 2010	2.4	180.1
WE-S 10+345CL	November 19, 2009	4.0	178.8
	November 30, 2009	3.4	179.4
	December 07, 2009	3.1	179.7
	December 15, 2009	3.0	179.8
	January 11, 2010	2.6	180.2
	January 27, 2010	2.7	180.1
WE-S 10+360Lt	November 20, 2009	6.3	177.1
	November 30, 2009	7.7	175.7
	December 15, 2009	5.9	177.5
	January 04, 2010	5.7	177.7
	January 11, 2010	5.5	177.9

The ground water table was estimated based on the recorded water levels in the standpipe piezometers, our review of moisture contents of the retrieved samples and the change in colour of the soil matrix from brown to grey. This interpretation indicates an estimated ground water table of Elev.  $\pm 179.5$  m at Sta. 10+200, increasing southward to about Elev.  $\pm 180.5$  m from Sta. 10+250 to Sta. 10+360. The ground water table is estimated to be at Elev.  $\pm 181.0$  m at Sta. 10+425.

All ground water observations at this site are short term and the levels are expected to fluctuate seasonally and after severe weather events.

### 5.4 Site 4 – Highway 406 NBL & SBL

Reference is made to the Record of Borehole sheets in Appendix A4. Details of the encountered soil and stratigraphy are presented in these appendices and on the “Borehole Locations and Soil Strata” drawings in Appendix C4. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general, the site is underlain by topsoil and about 25.9 m to 30.6 m of overburden soils consisting of fill material (compact to very dense sandy gravel to gravelly sand, loose to compact silty sand to sand and silt and soft to hard silty clay) and native deposits of firm to hard silty clay, loose to very dense silt, very stiff to hard clayey silt, stiff to hard silty clay to clayey silt till, dense



to very dense sand, compact to very dense silty sand to sandy silt till and compact to very dense sandy gravel to sand and gravel till. These soils are underlain by bedrock of the Salina Formation.

#### **5.4.1 Topsoil**

Topsoil ranging from 25 mm to 380 mm in thickness was encountered at this site. Topsoil thickness may vary between and beyond the boreholes.

#### **5.4.2 Fill – Sandy Gravel to Gravelly Sand**

Some of the boreholes were extended through the gravel shoulders of roadways where they encountered granular fill material ranging in composition from sandy gravel to gravelly sand. This fill extends to depths ranging from 0.4 m to 0.8 m below ground surface or to elevations ranging from 184.9 m to 180.6 m.

The grain size distribution plots of tested samples of this granular fill are depicted in Figure B4-1. These results show a grain size distribution consisting of 30-72% gravel, 17-51% sand and 7-16% silt and 2-4% clay size particles.

Standard Penetration tests in the granular fill gave 'N' values that ranged from 11 to 53 blows for 0.3 m penetration. Based on these results the fill is considered to have a compact to very dense relative density. The moisture content of samples of the fill ranged from 2% to 6% by weight.

#### **5.4.3 Fill – Silty Sand to Sand and Silt**

Fill material consisting of silty sand to sand and silt was encountered in Boreholes TN1, NBL 12+645Rt and SBL 12+650CL extending to depths ranging from 0.2 m to 1.4 m below ground surface or to elevations ranging from 183.0 m to 180.8 m.

The grain size distribution plots of tested samples of these fill are presented in Figure B4-2. These results show a grain size distribution consisting of 13-17% gravel, 57-65% sand and 18-22% silt and 8% clay size particles.

The blow counts from Standard Penetration tests conducted in this fill material ranged from 5 to 16 blows for 0.3 m penetration. Based on these results the fill is considered to have a loose to compact relative density. The moisture content of samples of this fill ranged from 5% to 19% by weight.

#### **5.4.4 Fill – Silty Clay**

Silty clay fill material was encountered at this site extending to depths ranging from 0.7 m (Elev. 183.9 m) to 3.7 m (Elev. 178.8 m) below ground surface.

The grain size distribution plots of tested samples of this fill are illustrated in Figures B4-3 to B4-5 inclusive. These results show a grain size distribution consisting of 0-15% gravel, 1-18% sand, 35-67% silt and 22-63% clay size particles.



Samples of the fill were also subjected to Atterberg Limits tests and the results are presented in Figures B4-6 and B4-7. The index values from these tests are summarized below:

Liquid Limit:	24-59%
Plastic Limit:	14-27%
Plasticity Index:	10-32%
Natural Moisture Content:	15-39%

These values are characteristic of clayey soils of low to high plasticity.

Standard Penetration tests in the silty clay fill gave 'N' values ranging from 2 to 91 blows for 0.3 m penetration. Based on these results the fill is considered to have a soft to hard consistency. The moisture content of samples of the silty clay fill generally ranged from 6% to 33% by weight and moisture contents of 37% to 44% (by weight) were recorded from samples retrieved from organic rich zones in the fill.

#### **5.4.5 Silty Clay**

All of the boreholes encountered a native silty clay deposit. This deposit was fully penetrated in some of the boreholes where it was found to extend to depths ranging from 13.2 m to 15.7 m below ground surface or to elevations ranging from 169.5 m to 166.9 m. Boreholes were also terminated in this deposit at depths ranging from 14.6 m to 5.5 m or to elevations ranging from 178.8 m to 168.5 m.

The grain size distribution plots of tested samples of the silty clay are presented in Figures B4-8 to B4-38 inclusive. These results show a grain size distribution consisting of 0-17% gravel, 0-11% sand, 36-87% silt and 12-63% clay size particles. One tested sample from borehole TN3 at approximately 5.5 m depth (Elev. 178.6 m) contained 41% sand and was described as sandy.

Samples were also subjected to Atterberg Limits tests and the results are illustrated on the plasticity charts, Figures B4-39 to B4-68 inclusive. The index values from these tests are summarized below:

Liquid Limit:	23-52%
Plastic Limit:	10-24%
Plasticity Index:	5-29%
Natural Moisture Content:	12-33%

These values indicate that the silty clay has a generally low to intermediate plasticity with occasional zones of high plasticity and infrequent clayey silt zones.

Standard Penetration tests in this stratum gave 'N' values that ranged from 1 to 61 blows for 0.3 m penetration and field vane tests gave in-situ undrained shear strengths ranging from 32 kPa to in excess of 100 kPa. Unconfined compression tests gave undrained shear strengths ranging from 36 kPa to 93 kPa and laboratory vane tests on relatively undisturbed Shelby tube samples gave undrained shear strengths ranging from 49 kPa to in excess of 100 kPa. The variation of undrained shear strength with elevation is depicted in Figures B4-88 and B4-89. These values indicate that



the consistency of the silty clay is generally stiff to hard with infrequent firm zones. There are no discernable trends of undrained shear strength with depth. The moisture content of samples from this stratum ranged from 10% to 33% by weight and the unit weight of tested samples ranged between 20.4 and 21.1 kN/m<sup>3</sup>.

The Atterberg Limits tests results are also plotted against elevation, Figures B4-90 and B4-91. These results illustrate that the natural moisture contents are generally at or below the plastic limit above Elev. 178.0 m. Below Elev. 178.0 the moisture content increases and is generally between the plastic and liquid limit up to Elev. 169.0 m. Below Elev. 169.0 m the natural moisture content decreases and is generally at or below the plastic limit.

Consolidation tests were also performed on Shelby tube samples retrieved from Boreholes NBL 12+375Lt, NBL 12+440Rt, NBL 12+695Lt, NBL 12+750Rt, SBL 12+360CL, SBL 12+410CL, SBL 12+685CL, and SBL 12+750CL and the results are presented in Figures B4-92 to B4-115 inclusive. Preconsolidation pressures were estimated from the e-log p curves. Due to the rounded nature of the curves the preconsolidation pressures were also assessed based on the 'Work' – method proposed by Becker et al. (1987). The details of the test results are summarized below.

Borehole/Sample No.	Sample Depth/Elevation (m)	P <sub>c</sub> (kPa)	C <sub>c</sub>	C <sub>r</sub>	e <sub>o</sub>
NBL 12+375Lt. TW9	9.1/174.2	310	0.204	0.036	0.60
NBL 12+440Rt. TW10	10.7/172.3	370 – 480	0.193	0.025	0.59
NBL 12+695Lt. TW11	12.2/170.7	320 – 450	0.224	0.028	0.60
NBL 12+750Rt. TW9	9.1/173.7	320 – 340	0.194	0.026	0.57
SBL 12+360CL TW10	10.7/172.2	340 – 500	0.201	0.030	0.57
SBL 12+410CL TW9	9.1/173.4	300 – 350	0.205	0.031	0.60
SBL 12+685CL TW10	10.7/172.0	370 – 550	0.233	0.027	0.59
SBL 12+750CL TW10	9.9/173.0	370 – 380	0.171	0.020	0.50

Where: P<sub>c</sub> = Preconsolidation pressure  
C<sub>c</sub> = Compression index  
C<sub>r</sub> = Recompression index  
e<sub>o</sub> = Initial void ratio

#### 5.4.6 Silt

A discontinuous silt deposit was encountered at this site. The deposit is approximately 0.5 m to 1.9 m thick and extends to depths ranging from 2.1 m (Elev. ±180.7 m) to 5.9 m (Elev. ±176.8 m) below ground surface. Based on visual and tactile examinations of the retrieved samples, the unit is essentially a cohesionless silt with frequent cohesive silty clay seams and partings.

The grain size distribution plots of tested samples of the silt are presented in Figures B4-69 and B4-70. These results show a grain size distribution consisting of 0-1% gravel, 0-2% sand, 75-87% silt and 12-22% clay size particles.

The deposit is considered to have a loose to very dense relative density based on SPT 'N' values that ranged from 9 to 64 blows for 0.3 m penetration. The moisture content of samples from this deposit ranged from 16% to 23% by weight.



#### **5.4.7 Clayey Silt**

A clayey silt deposit was encountered at this site in Boreholes NBL 12+835Lt and NBL 12+835Rt. The deposit is approximately 1.5 m to 1.6 m thick and extends to depths of 5.6 m (Elev.  $\pm 175.6$  m) and 7.1 m (Elev.  $\pm 175.8$  m) below ground surface.

The grain size distribution plot of a tested sample of the clayey silt is presented in Figure B4-71. These results show a grain size distribution consisting of 0% gravel, 0% sand, 87% silt and 13% clay size particles.

A sample of the clayey silt was also subjected to Atterberg Limits tests and the results are presented in Figures B4-72. The index values from these tests are summarized below:

Liquid Limit:	23%
Plastic Limit:	17%
Plasticity Index:	6%
Natural Moisture Content:	21%

These values indicate that a low plasticity clayey silt.

Standard Penetration tests in this stratum gave 'N' values ranging from 15 to 34 blows for 0.3 m penetration. Field vane tests were also attempted in these deposits and the results (no-turn on vane) indicate undrained shear strengths more than 100 kPa. Based on these results the clayey silt is considered to have a very stiff to hard consistency. The moisture content of samples from this stratum ranged from 19% to 21% by weight.

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

Discontinuous layers of silty clay to clayey silt till were encountered at this site. An upper silty clay to clayey silt till unit was encountered directly underlying the native silty clay deposit. This unit was fully penetrated in the deep boreholes drilled at the proposed Trillium Overhead and Woodlawn Overhead structures where it was found to extend to depths ranging from 16.2 m to 21.6 m below ground surface or to elevations of 165.4 m to 161.7 m. Boreholes NBL 12+525Lt, NBL 12+595Rt, SBL 12+485Lt, SBL 12+485Rt and SBL 12+525CL were terminated within the upper silty clay to clayey silt till stratum at depths ranging from 14.2 m (Elev. 167.4 m) to 17.0 m (Elev. 164.8 m) below ground surface. Some of the deep boreholes drilled for the Trillium Overhead and Woodlawn Overhead structures encountered lower deposits of silty clay to clayey silt till that extends to depths ranging from 22.3 m (Elev. 160.8 m) to 28.4 m (Elev. 155.1 m) below ground surface.

The grain size distribution plots of samples of the silty clay to clayey silt till deposits are presented in Figures B4-73 to B4-77 inclusive. These results show a grain size distribution consisting of 0-20% gravel, 3-39% sand, 35-76% silt and 12-42% clay size particles. Till soils can also be expected to contain random cobble and boulder inclusions.



Samples of the silty clay to clayey silt till were also subjected to Atterberg Limits tests and the results are presented in Figures B4-78 to B4-82 inclusive. The index values from these tests are summarized below:

Liquid Limit:	15-32%
Plastic Limit:	11-16%
Plasticity Index:	4-16%
Natural Moisture Content:	7-29%

These values indicate low plasticity silty clay and clayey silt soils.

Standard Penetration tests in the silty clay to clayey silt till yielded 'N' values ranging from 10 to more than 100 blows for 0.3 m penetration. Field vane tests gave in-situ undrained shear strengths ranging from 88 kPa to in excess of 100 kPa. These values indicate that the consistency of the silty clay to clayey silt till is generally very stiff to hard with occasional stiff zones. Moisture contents of samples of the silty clay to clayey silt till range from 2% to 29% by weight.

#### **5.4.9 Sand**

Discontinuous layers of sand and gravel to gravelly sand were encountered at this site in Boreholes TS1, TS2, and TS3. These deposits are approximately 0.8 m to 2.4 m thick and extend to depths ranging from 24.8 m (Elev. 157.8 m) to 26.2 m (Elev. 157.1 m) below ground surface.

Two samples from these strata were subjected to a grain size distribution tests and the results are illustrated in Figure B4-83. These results show a grain size distribution consisting of 31-32 % gravel, 56-57 % sand and 12 % silt and clay size particles.

Standard Penetration tests in these deposits gave 'N' values that ranged from 40 to more than 100 blows per 0.3 m penetration. Based on these results the deposits are considered to have a dense to very dense relative density. The moisture content of samples from these strata ranged from 5% to 14% by weight.

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

Till deposits ranging in composition from sandy silt to sand some silt were encountered in the deep boreholes drilled for the Trillium Overhead and Woodlawn Road Overhead structures. These deposits extend to depths ranging from 23.9 m to 30.6 m below ground surface or to elevations ranging from 160.3 m to 153.0 m.

The results of grain size distribution tests conducted on samples obtained from these till deposits are illustrated in Figures B4-84 to B4-86 inclusive. These results show grain size distributions of 2-27% gravel, 10-72% sand, 15-72% silt and 4-17% clay size particles. Till soils will also contain random cobble and boulder inclusions.

Standard Penetration tests in these deposits gave 'N' values that ranged from 28 to more than 100 blows per 0.3 m penetration indicating a compact to very dense relative density. The moisture content of samples from these strata ranged from 4% to 28% by weight.





#### 5.4.11 Sandy Gravel to Sand and Gravel Till

Till deposits consisting of sandy gravel to sand and gravel were encountered in the deep boreholes drilled for the Trillium Overhead structures. These deposits were found to extend to depths ranging from 28.4 m and 30.5 m below the ground surface or to elevations ranging from 154.5 m to 153.7 m.

Grain size distribution tests were performed on representative samples from these deposits and the results are illustrated in Figure B4-87. These results show grain size distributions of 31-51% gravel, 26-41% sand, 14-29% silt and 5-7% clay size particles. Till soils will also contain random cobble and boulder inclusions.

The blow counts from Standard Penetration tests conducted in these deposits ranged from 23 to more than 100 blows for 0.3 m penetration indicating a compact to very dense relative density. The moisture content of samples from these strata ranged from 1% to 10% by weight.

#### 5.4.12 Bedrock (Salina Formation)

The overburden soils described above are underlain by the Salina Formation. Bedrock was proved by coring at the abutment locations of the proposed bridge structures on the NBL and SBL alignments. Table 5.4.1 summarizes the bedrock depth and the elevations to the top of bedrock.

**Table 5.4.1 – Depth to Bedrock**

Bridge	Location	BH Number	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
Trillium NBL	South Abutment	TN1	30.5	153.0
		TN2	30.5	153.7
	North Abutment	TN3	29.6	154.5
		TN4	30.6	153.4
Trillium SBL	South Abutment	TS1	28.4	154.2
		TS2	29.4	153.9
	North Abutment	TS3	28.7	153.8
		TS4	28.4	154.0
Woodlawn NBL	South Abutment	WN1	27.4	155.7
		WN2	25.9	155.7
	North Abutment	WN3	26.4	155.7
		WN4	26.0	156.5
Woodlawn SBL	South Abutment	WS1	27.5	155.2
		WS2	27.3	155.8
	North Abutment	WS3	25.9	157.1
		WS4	26.3	156.4

The bedrock is described as unweathered interbedded dolostone and shale and its colour is generally grey. It is thinly laminated with white unweathered gypsum and calcite veins and coarse grained calcitic vugs. Total core recovery in the bedrock generally ranged from 20% to 100% and a recorded TCR of 0% was obtained in the first run of Borehole TN2.

The RQD values ranged widely from 0% to 78% but generally most of the RQD values were below 50%. An RQD of 0% was obtained from the first run in Boreholes TN2, TN4, TS3, WN3, and WS1. Rubble and highly fractured zones were observed in the rock cores, which contributed to the relatively low RQD values. The core data also reveals that there is no trend of improving rock



quality with depth. Based on these results the rock quality is considered to be very poor to poor with occasional zones of fair to good quality rock.

#### 5.4.13 Water Levels

A standpipe piezometer was installed in selected boreholes. The water level readings measured on separate visits made after the completion of drilling are presented in Table 5.4.2.

**Table 5.4.2 – Water Level Measurements**

Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
NBL 12+075CL	November 20, 2009	4.2	180.4
	December 08, 2009	1.2	183.4
	January 04, 2010	1.5	183.1
	January 19, 2010	1.8	182.8
NBL 12+225CL	December 08, 2009	2.0	182.9
	April 16, 2010	2.0	182.9
	April 29, 2010	2.1	182.8
NBL 12+375Lt	November 19, 2009	5.8	177.5
	November 30, 2009	3.2	180.1
	December 07, 2009	1.3	182.0
	December 15, 2009	1.8	181.5
	January 19, 2010	1.7	181.6
TN2	April 16, 2010	2.6	181.6
	April 29, 2010	1.6	182.6
	May 04, 2010	6.2	178.0
	May 06, 2010	6.2	178.0
TN3	April 16, 2010	3.9	180.2
	April 29, 2010	4.7	179.4
	May 04, 2010	8.7	175.4
	May 06, 2010	9.4	174.7
	May 18, 2010	3.8	180.3
NBL 12+440Rt	November 09, 2009	8.2	174.8
	November 19, 2009	2.1	180.9
	November 30, 2009	1.9	181.1
	December 08, 2009	1.9	181.1
NBL 12+525Lt	November 30, 2009	9.4	173.4
	December 07, 2009	6.2	176.6
	December 15, 2009	4.7	178.1
	January 04, 2010	3.4	179.4
	January 11, 2010	3.3	179.5
	January 19, 2010	3.3	179.5
NBL 12+525Rt	November 09, 2009	10.8	171.2
	November 19, 2009	4.6	177.4
	November 30, 2009	2.4	179.6
	December 08, 2009	2.0	180.0
	January 04, 2010	2.0	180.0
NBL 12+645Lt	November 09, 2009	10.3	173.0
	November 19, 2009	3.9	179.4
	November 30, 2009	5.9	177.4
	December 08, 2009	3.0	180.3
	December 15, 2009	3.0	180.3
NBL 12+645Rt	November 30, 2009	2.2	178.8
	December 08, 2009	2.0	179.0
	January 04, 2010	1.5	179.5
	January 11, 2010	1.8	179.2
	January 19, 2010	1.9	179.1



Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
NBL 12+695Lt	November 30, 2009	9.3	173.6
	December 15, 2009	3.4	179.5
	January 04, 2010	3.2	179.7
	January 11, 2010	3.3	179.6
	January 19, 2010	3.4	179.5
WN2	January 04, 2010	5.2	176.4
	January 11, 2010	4.2	177.4
	January 19, 2010	5.2	176.4
	January 27, 2010	5.2	176.4
WN3	April 16, 2010	7.7	174.4
	April 29, 2010	3.9	178.2
	May 04, 2010	5.2	176.9
	May 06, 2010	4.8	177.3
NBL 12+750Rt	December 15, 2009	5.1	177.7
	January 04, 2010	2.7	180.1
	January 11, 2010	2.7	180.1
	January 19, 2010	2.8	180.0
NBL 12+835Rt	November 09, 2009	6.7	176.2
	November 19, 2009	2.7	180.2
	November 30, 2009	2.5	180.4
	December 08, 2009	2.3	180.6
	December 15, 2009	2.3	180.6
NBL 12+985Rt	November 19, 2009	3.1	179.2
	November 30, 2009	2.9	179.4
	December 08, 2009	2.5	179.8
	December 15, 2009	1.9	180.4
	January 04, 2010	1.9	180.4
SBL 12+185Lt*	November 30, 2009	0.1	183.1
	-	-	-
SBL 12+360CL	November 19, 2009	5.0	177.9
	November 30, 2009	2.6	180.3
	December 07, 2009	2.4	180.5
	December 15, 2009	2.3	180.6
	January 04, 2010	2.1	180.8
	January 11, 2010	2.1	180.8
TS1	January 19, 2010	10.6	172.0
	January 27, 2010	10.4	172.2
	February 08, 2010	10.5	172.1
TS4	January 11, 2010	9.4	173.0
	January 19, 2010	9.9	172.5
	January 27, 2010	10.2	172.2
	February 08, 2010	10.4	172.0
SBL 12+410CL	November 30, 2009	1.7	180.8
	December 07, 2009	1.4	181.1
	December 15, 2009	1.3	181.2
SBL 12+525CL	November 19, 2009	4.5	177.3
	November 30, 2009	5.4	176.4
	December 07, 2009	4.5	177.3
	December 15, 2009	4.2	177.6
	January 04, 2010	4.1	177.7
SBL 12+600Rt	November 19, 2009	6.4	175.7
	November 30, 2009	8.3	173.8
	December 08, 2009	2.7	179.4
	January 04, 2010	1.4	180.7
	January 11, 2010	1.8	180.3
	January 19, 2010	1.6	180.5
SBL 12+685CL*	-	-	-
WS1	January 27, 2010	6.8	175.9
	February 08, 2010	6.8	175.9



Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
WS4	February 08, 2010	4.7	178.0
	April 16, 2010	2.1	180.6
	April 29, 2010	5.1	177.6
	May 04, 2010	5.7	177.0
	May 06, 2010	4.1	178.6
	May 18, 2010	5.9	176.8
SBL 12+750CL	November 19, 2009	4.6	178.3
	November 30, 2009	7.8	175.1
	December 08, 2009	4.1	178.8
	December 15, 2009	3.2	179.7
	January 04, 2010	2.7	180.2
	January 11, 2010	2.7	180.2
	January 19, 2010	2.6	180.3
SBL 12+900CL	November 19, 2009	2.5	180.2
	November 30, 2009	2.3	180.4
	December 08, 2009	2.0	180.7
	December 15, 2009	1.5	181.2
	January 04, 2010	1.7	181.0
	January 11, 2010	1.9	180.8
	January 19, 2010	1.7	181.0

\* Piezometer destroyed after installation.

The ground water table was estimated based on the recorded water levels in the standpipe piezometers and our review of moisture contents of the retrieved samples. This interpretation indicates a ground water table that is estimated to range between Elev.  $\pm 179.5$  m and Elev.  $\pm 181.0$  m. Perched water can also be expected to occur where permeable layers of sand and gravel and sand and silts are underlain by more impermeable silty clay soils.

All ground water observations at this site are short term and the levels are expected to fluctuate seasonally and after severe weather events.

## 5.5 Miscellaneous

The drilling, sampling and in-situ testing operations were conducted with track and truck mounted drill rigs owned and operated by Groundworks Drilling Limited of Toronto, Ontario, DBW Drilling Limited of Ajax, Ontario and Determination Drilling & Soil Investigations of Hamilton, Ontario. The boreholes were advanced using both solid stem and hollow-stem auger drilling techniques and casing and washboring methods. NQ size rock cores of the bedrock were obtained using diamond drilling techniques.

Messrs. Phil Khuu, B.A.T., Marc Paoliello, E.I.T., Alexander Winkelmann, E.I.T. and Lucas Yu, E.I.T. observed and recorded the field work. The laboratory testing was performed at Terraprobe's Brampton laboratory and the Mississauga laboratory of Golder Associates. The report was written by Rehman Abdul, P.Eng. and reviewed by Michael Tanos, P.Eng.



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Senior Geotechnical Engineer



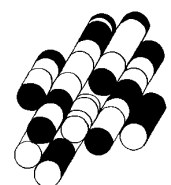
*Michael Tanos*

Report Reviewed by:  
Michael Tanos, P.Eng.,  
Review Principal



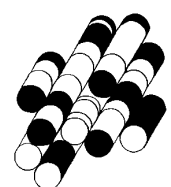
# SITE 1

**TERRAPROBE INC.**



# A1

**TERRAPROBE INC.**



RECORD OF BOREHOLE No EMN 10+125Lt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4761648.7 E:327547.1 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.18.10 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
182.6 0.1	Ground Surface 60mm TOPSOIL						20 40 60 80 100						GR SA SI CL
	soft to firm, trace rootlets	1	SS	4		182							
	SILTY CLAY trace sand, stiff to hard, brown, damp to moist	2	SS	50									
		3	SS	51		181							0 1 55 44
		4	SS	47		180							
		5	SS	29		179							
		6	SS	22		178							0 2 61 37
		7	SS	23		176							
		8	SS	13		175							0 1 62 37
174.0 8.6	SILTY CLAY some sand, trace gravel, stiff to very stiff, brown, damp to moist  (GLACIAL TILL)	9	TW	PH		174						20.6	sampler wet
		10	SS	18		172							4 17 55 24
		11	SS	15		170							
		12	SS	13		169							7 19 52 22
						168							

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT GDT 06/21/10



RECORD OF BOREHOLE No EMN 10+125Lt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4761648.7 E:327547.1 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.18.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)						
						20	40	60	80	100		10	20	30			
166.4	SILT some sand, trace clay, compact, brown, wet (GLACIAL TILL)		13	SS	25												
166.2																	
165.3			14	SS	13												0 16 78 6
17.3	End of Borehole																
	Water level at 6.1m (not stabilized) and hole open to full depth on completion.																
	No sample recovery at SS7, SS8, and SS11. Sampler redriven and disturbed sample collected.																
	Unable to push vane beyond 10.1m.																
	Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.																
	Water Level Readings: Date Depth(m) Elevation(m) Jan.27.10 12.0 170.6 Feb.08.10 11.8 170.8 Feb.19.10 11.9 170.7																

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT.GDT 06/21/10

RECORD OF BOREHOLE No EMN 10+125Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4761674.9 E:327575.3 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.15.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
182.5	Ground Surface													
182.4 0.1	60mm TOPSOIL													
	stiff		1	SS	9		182							
	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp to moist		2	SS	38		181						1 4 63 32	
			3	SS	42		180							
			4	SS	35		179						0 2 56 42	
			5	SS	32		178						0 2 61 37	
			6	SS	24		177							
			7	SS	16		176							
175.4 7.1	CLAYEY SILT very stiff, brown, damp to moist		8	SS	27		175						0 0 81 19	
173.9 8.6	SILTY CLAY some sand, trace gravel, stiff to very stiff, brown, damp to moist (GLACIAL TILL)		9	SS	20		174							
			10	SS	29		173						2 21 57 20	
			11	TW	PH		172						21.1	
			12	SS	11		171							
							170							
							169						5 18 57 20	
							168							

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT GDT 06/21/10

RECORD OF BOREHOLE No EMN 10+125Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4761674.9 E:327575.3 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.15.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
								20 40 60 80 100							
			13	SS	19		167								
							166								
165.2 17.3	End of Borehole		14	SS	28									1 11 63 25	
<p>Borehole was dry (not stabilized) and hole open to full depth on completion.</p> <p>No sample recovery at SS13. Sampler redriven and disturbed sample collected.</p> <p>Unable to push vane to 7.5m, 10.1m and 11.6m.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings: Date      Depth(m)      Elevation(m) Jan.19.10      16.8      165.7 Jan.27.10      16.1      166.4 Feb.08.10      12.2      170.3 Feb.19.10      10.1      172.4 Apr.16.10      9.3      173.2 May.04.10      9.4      173.1 May.06.10      9.4      173.1</p>															

ONTARIO MOT 1-09-4739 EAST MAIN.GPJ ONTARIO.MOT.GDT 00/27/10

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT GDT 06/21/10

RECORD OF BOREHOLE No EMN 10+175CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4761703.9 E:327562.8 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.19.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.4	Ground Surface							20 40 60 80 100						
182.3 0.1	90mm TOPSOIL							20 40 60 80 100						
	firm		1	SS	7		182							
	SILTY CLAY trace sand, stiff to hard, brown, damp to moist		2	SS	19		181							
			3	SS	46		180							
			4	SS	40		179							
			5	SS	37		178							
			6	SS	23		177							
			7	SS	19		176							
			8	SS	11		175							
173.8 8.6	SILTY CLAY some sand, trace gravel, very stiff, brown, damp to moist  (GLACIAL TILL)		9	TW	PH		174							
			10	SS	18		173							
			11	AS			172							
168.7 13.7	End of Borehole						171							
	Borehole was dry (not stabilized) and hole open to full depth on completion.						170							
							169							

Continued Next Page

+ 3, x 3. Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT GDT 06/21/10

## 2 OF 2

METRIC

ONTARIO MOT 1-09-4135 EAST MAIN.GPJ ONTARIO MOT.GDT 06/21/10

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 <sub>p</sub>	W	W <sub>L</sub>
	No sample recovery at SS7 and SS10. Sampler redriven and disturbed sample collected.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date      Depth(m)      Elevation(m) Jan.27.10      13.5      168.9 Feb.08.10      13.2      169.2 Feb.19.10      12.8      169.6 Apr.16.10      8.0      174.4 May.04.10      7.6      174.8 May.06.10      7.5      174.9 May.18.10      7.7      174.7																			

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT GDT 06/21/10

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No EMN 10+225Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4761755.2 E:327550.3 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.21.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub>	W	W <sub>L</sub>		GR   SA   SI   CL			
182.4	Ground Surface							20   40   60   80   100									
182.3	120mm TOPSOIL							20   40   60   80   100									
0.1																	
	trace rootlets, firm		1	SS	7		182						50		0	1   38   61	
			2	SS	34		181								0	2   55   43	
	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp to moist		3	SS	48		180										
			4	SS	39		179								1	2   58   39	
			5	SS	40		178										
			6	SS	34		177										
			7	SS	22		176								3	1   55   41	
			8	TW	PH		175			>>X				20.0			
173.9	End of Borehole						174			>>							
8.5	Borehole was dry (not stabilized) and hole open to full depth on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date      Depth(m)      Elevation(m) Jan.27.10      dry      - Feb.08.10      dry      - Feb.19.10      dry      -																

ONTARIO MOT 1-09-4135 EAST MAIN GPJ, ONTARIO MOT, GDT, 06/21/10

RECORD OF BOREHOLE No EMN 10+225Rt

1 OF 1

METRIC

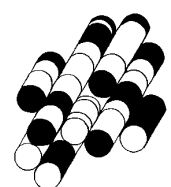
W.P. 280-99-00 LOCATION Coords: N:4761752.4 E:327566.5 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 01.20.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)																								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																															
								20 40 60 80 100																															
								20 40 60 80 100																															
182.7	Ground Surface																																						
182.6	130mm TOPSOIL																																						
0.1	stiff		1	SS	9		182																																
	SILTY CLAY trace sand, hard, brown, moist		2	SS	48		181								0 2 50 48																								
			3	SS	52		180								0 2 57 41																								
			4	SS	43		179																																
			5	SS	39		178																																
			6	SS	36		177																																
			7	SS	33		176								0 2 54 44																								
	stiff		8	TW	PH		175							22.3																									
174.6	End of Borehole																																						
8.1	<p>Borehole was dry (not stabilized) and hole open to full depth on completion.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table><tr><th>Date</th><th>Depth(m)</th><th>Elevation(m)</th></tr><tr><td>Jan.27.10</td><td>7.2</td><td>175.5</td></tr><tr><td>Feb.08.10</td><td>6.4</td><td>176.3</td></tr><tr><td>Feb.19.10</td><td>5.9</td><td>176.8</td></tr><tr><td>Apr.16.10</td><td>4.3</td><td>178.4</td></tr><tr><td>May.04.10</td><td>4.1</td><td>178.6</td></tr><tr><td>May.06.10</td><td>4.4</td><td>178.3</td></tr><tr><td>May.18.10</td><td>4.0</td><td>178.7</td></tr></table>															Date	Depth(m)	Elevation(m)	Jan.27.10	7.2	175.5	Feb.08.10	6.4	176.3	Feb.19.10	5.9	176.8	Apr.16.10	4.3	178.4	May.04.10	4.1	178.6	May.06.10	4.4	178.3	May.18.10	4.0	178.7
Date	Depth(m)	Elevation(m)																																					
Jan.27.10	7.2	175.5																																					
Feb.08.10	6.4	176.3																																					
Feb.19.10	5.9	176.8																																					
Apr.16.10	4.3	178.4																																					
May.04.10	4.1	178.6																																					
May.06.10	4.4	178.3																																					
May.18.10	4.0	178.7																																					

ONTARIO MOT 1-09-4135 EAST MAIN GPJ ONTARIO MOT GDT 06/21/10

# B1

**TERRAPROBE INC.**

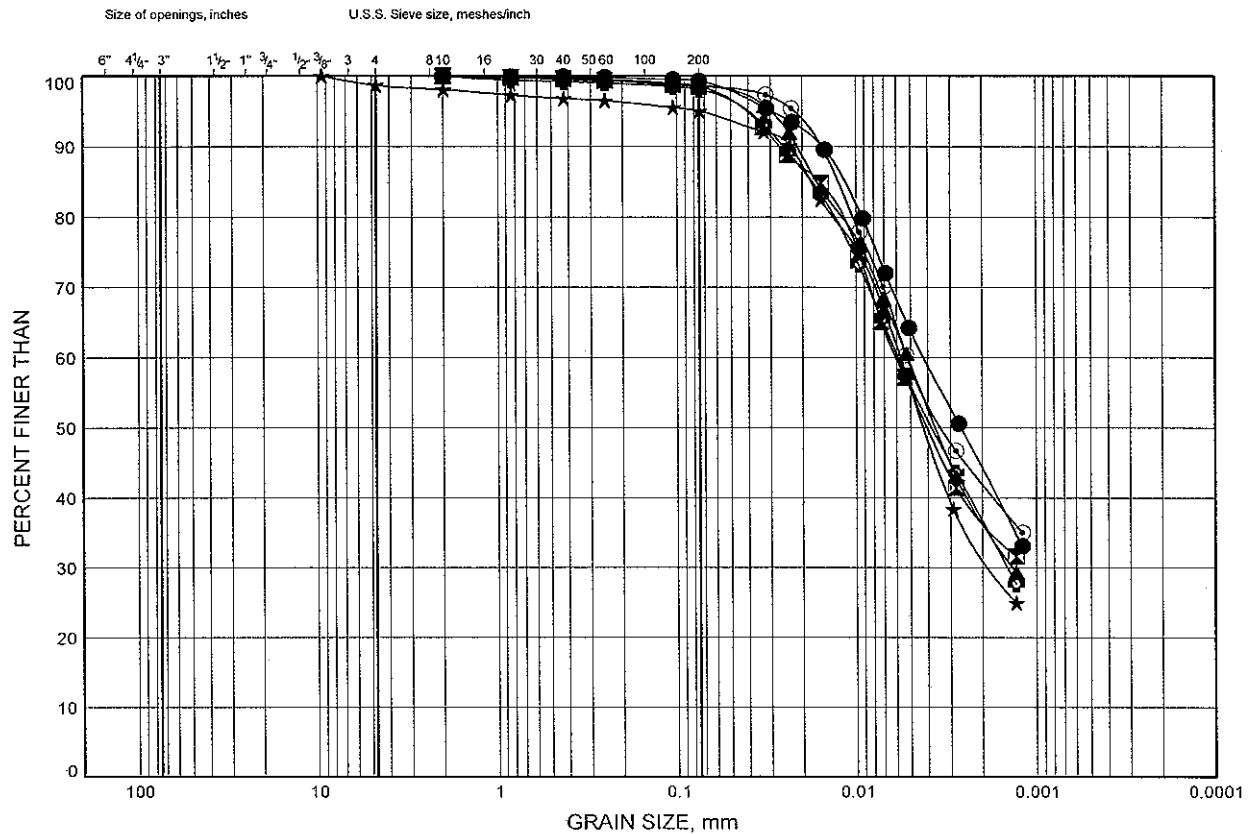




# GRAIN SIZE DISTRIBUTION

FIGURE B1-1

## SILTY CLAY

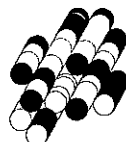


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	EMN 10+125Lt	1.7	180.9
⊠	EMN 10+125Lt	4.7	177.9
▲	EMN 10+125Lt	7.8	174.8
★	EMN 10+125Rt	1.0	181.5
⊙	EMN 10+125Rt	3.2	179.3
⊛	EMN 10+125Rt	4.7	177.8

Date June 2010  
Project 1-09-4135

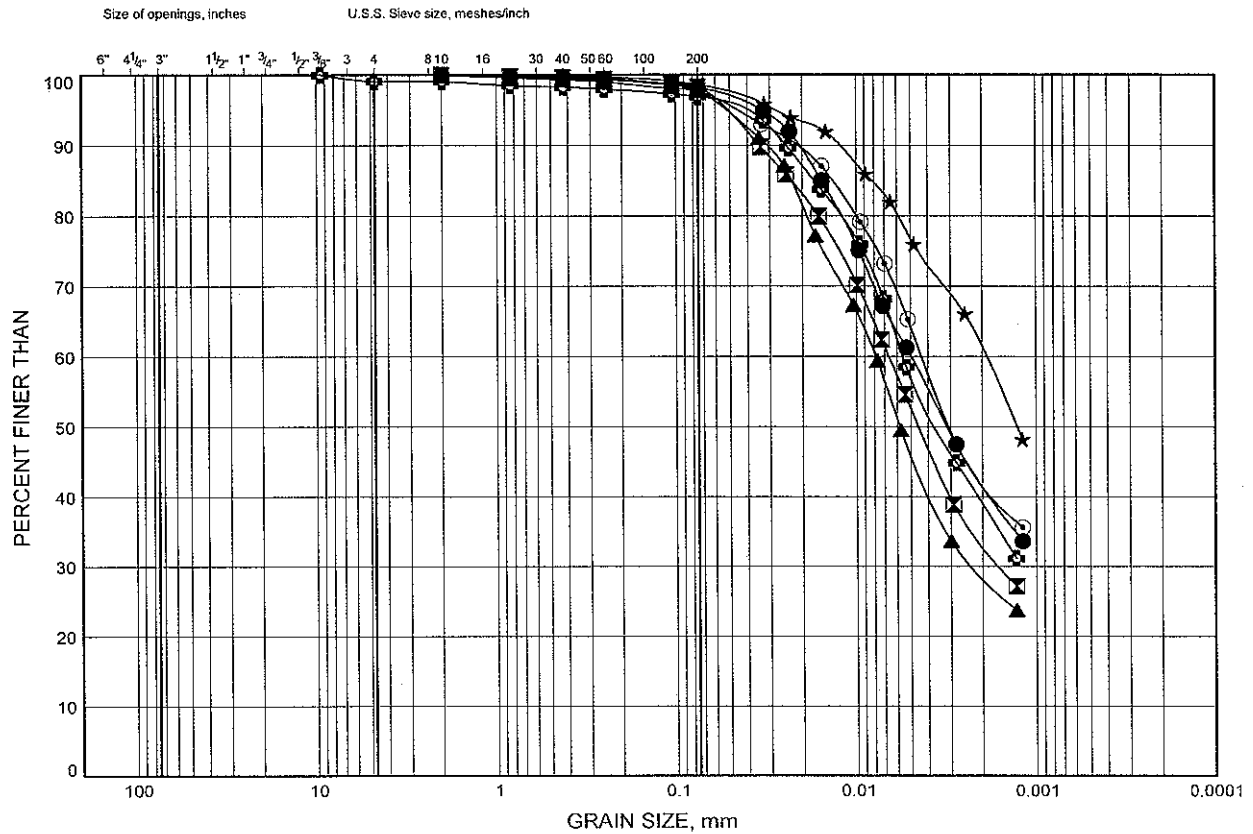


Prep'd DB  
Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B1-2

## SILTY CLAY



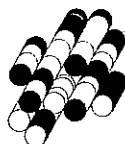
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	EMN 10+175CL	2.5	179.9
⊠	EMN 10+175CL	6.3	176.1
▲	EMN 10+175CL	7.8	174.6
★	EMN 10+225Lt	0.3	182.1
⊙	EMN 10+225Lt	1.7	180.7
⊕	EMN 10+225Lt	3.2	179.2

Date June 2010

Project 1-09-4135



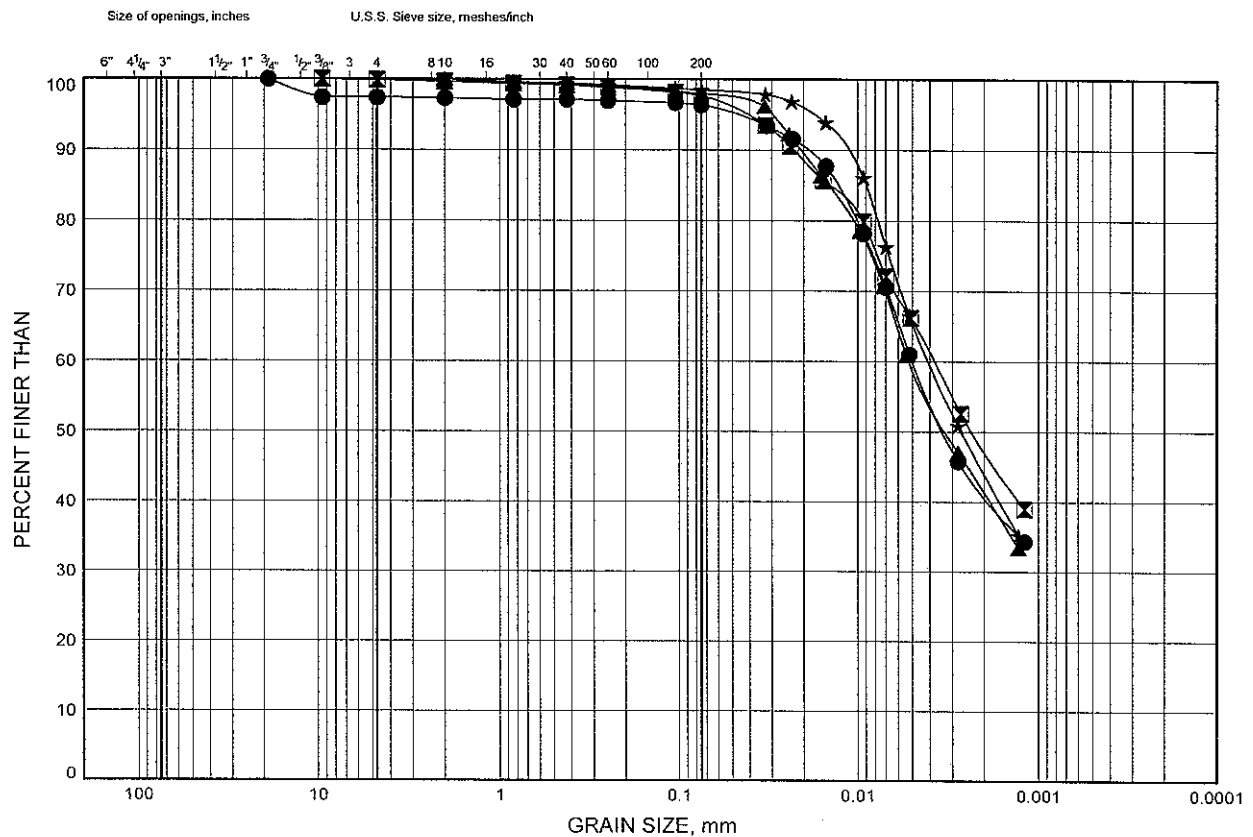
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B1-3

## SILTY CLAY



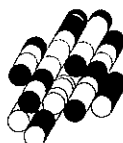
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	EMN 10+225Lt	6.3	176.1
⊠	EMN 10+225Rt	1.7	181.0
▲	EMN 10+225Rt	3.2	179.5
★	EMN 10+225Rt	6.3	176.4

Date June 2010

Project 1-09-4135



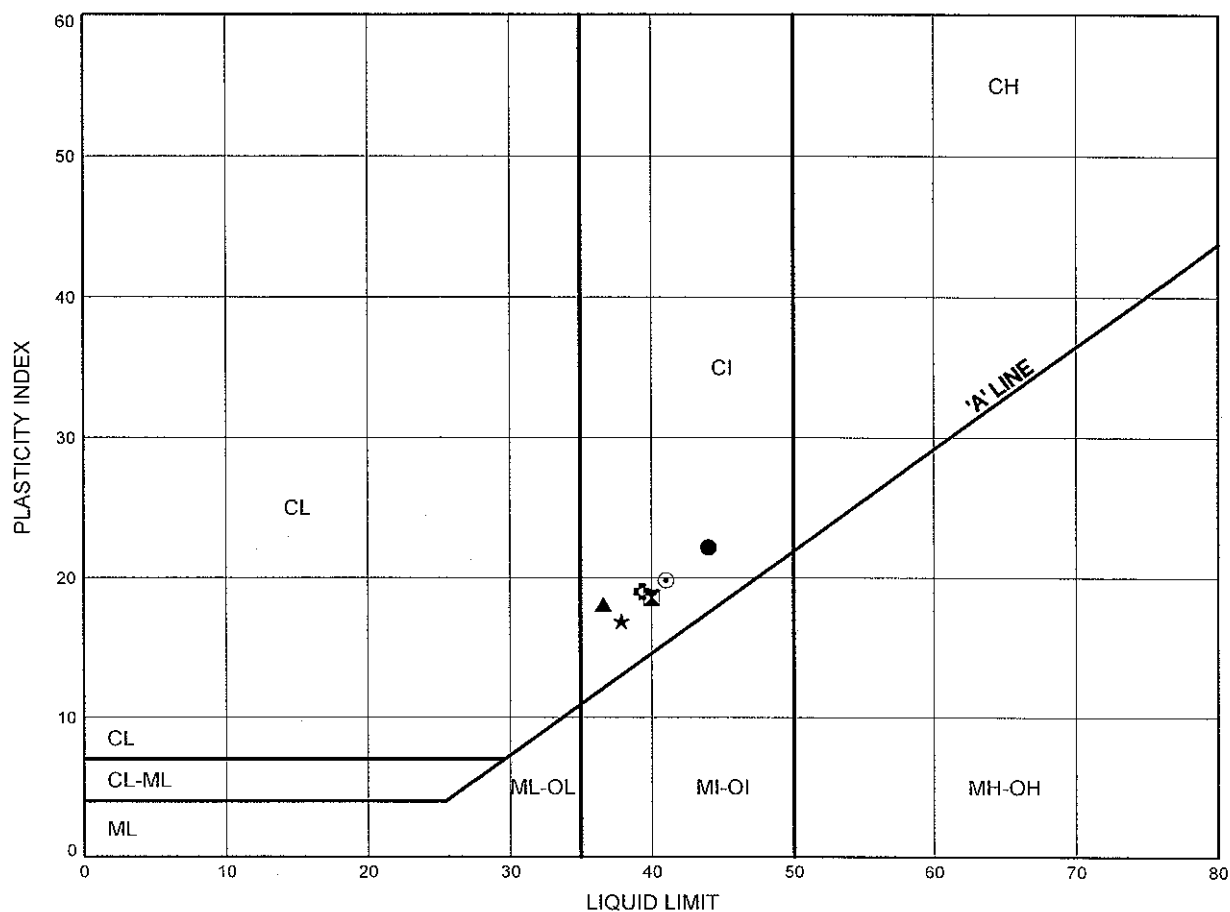
Prep'd DB

Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

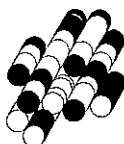
FIGURE B1-4

## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+125Lt	1.7	180.9
⊠	EMN 10+125Lt	4.7	177.9
▲	EMN 10+125Lt	7.8	174.8
★	EMN 10+125Rt	1.0	181.5
⊙	EMN 10+125Rt	3.2	179.3
⊛	EMN 10+125Rt	4.7	177.8

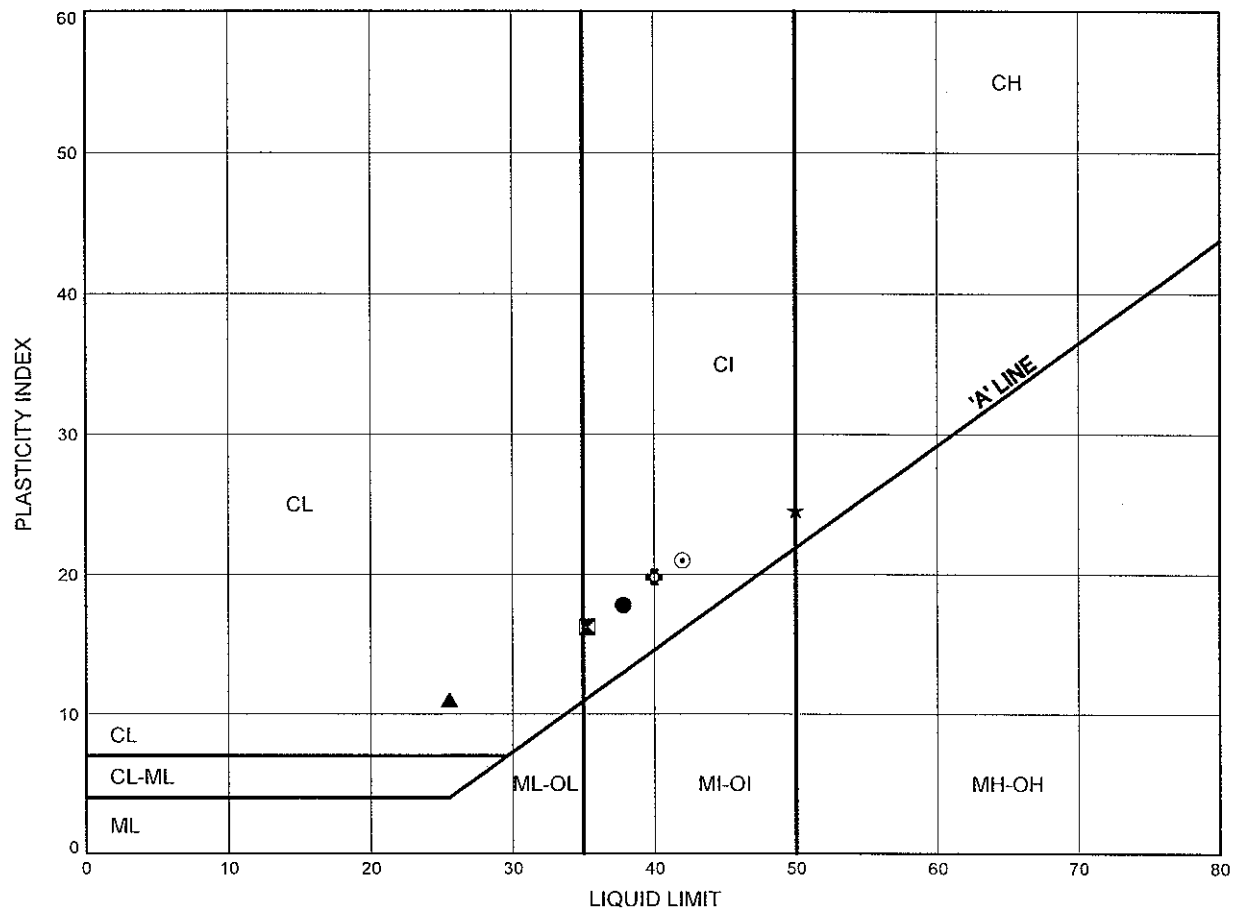
Date June 2010  
Project 1-09-4135



Prep'd DB  
Chkd HW

## FIGURE B1-5

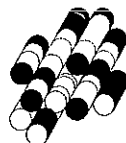
SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+175CL	2.5	179.9
☒	EMN 10+175CL	6.3	176.1
▲	EMN 10+175CL	7.8	174.6
★	EMN 10+225Lt	0.3	182.1
⊙	EMN 10+225Lt	1.7	180.7
⊕	EMN 10+225Lt	3.2	179.2

Date June 2010

Project 1-09-4135



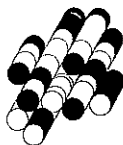
Prep'd ..... DB .....

Chkd. .... HW .....

## FIGURE B1-6

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+225Lt	6.3	176.1
⊠	EMN 10+225Rt	1.7	181.0
▲	EMN 10+225Rt	3.2	179.5
★	EMN 10+225Rt	6.3	176.4

Date June 2010  
Project 1-09-4135

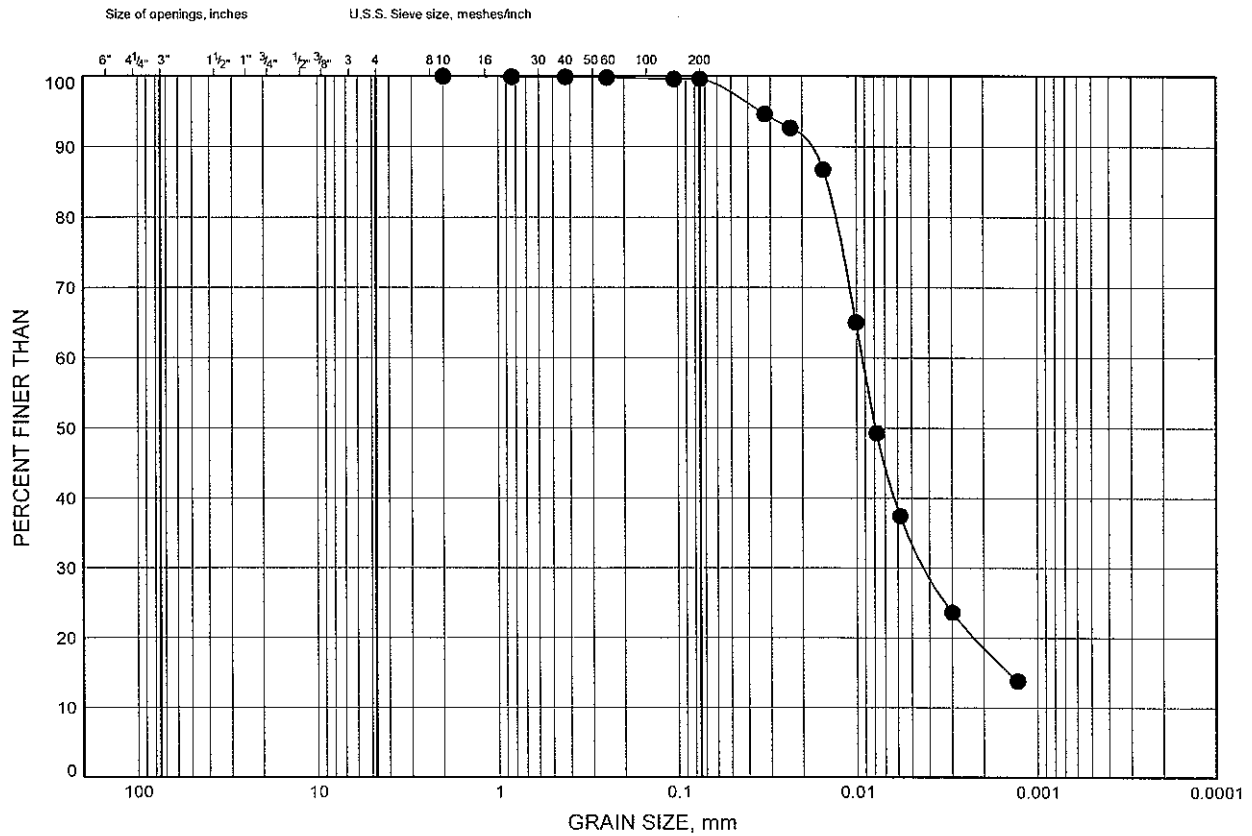


Prep'd ..... DB  
Chkd. .... HW

# GRAIN SIZE DISTRIBUTION

FIGURE B1-7

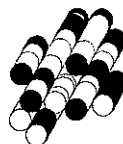
## CLAYEY SILT



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+125Rt	7.8	174.7

Date June 2010  
Project 1-09-4135

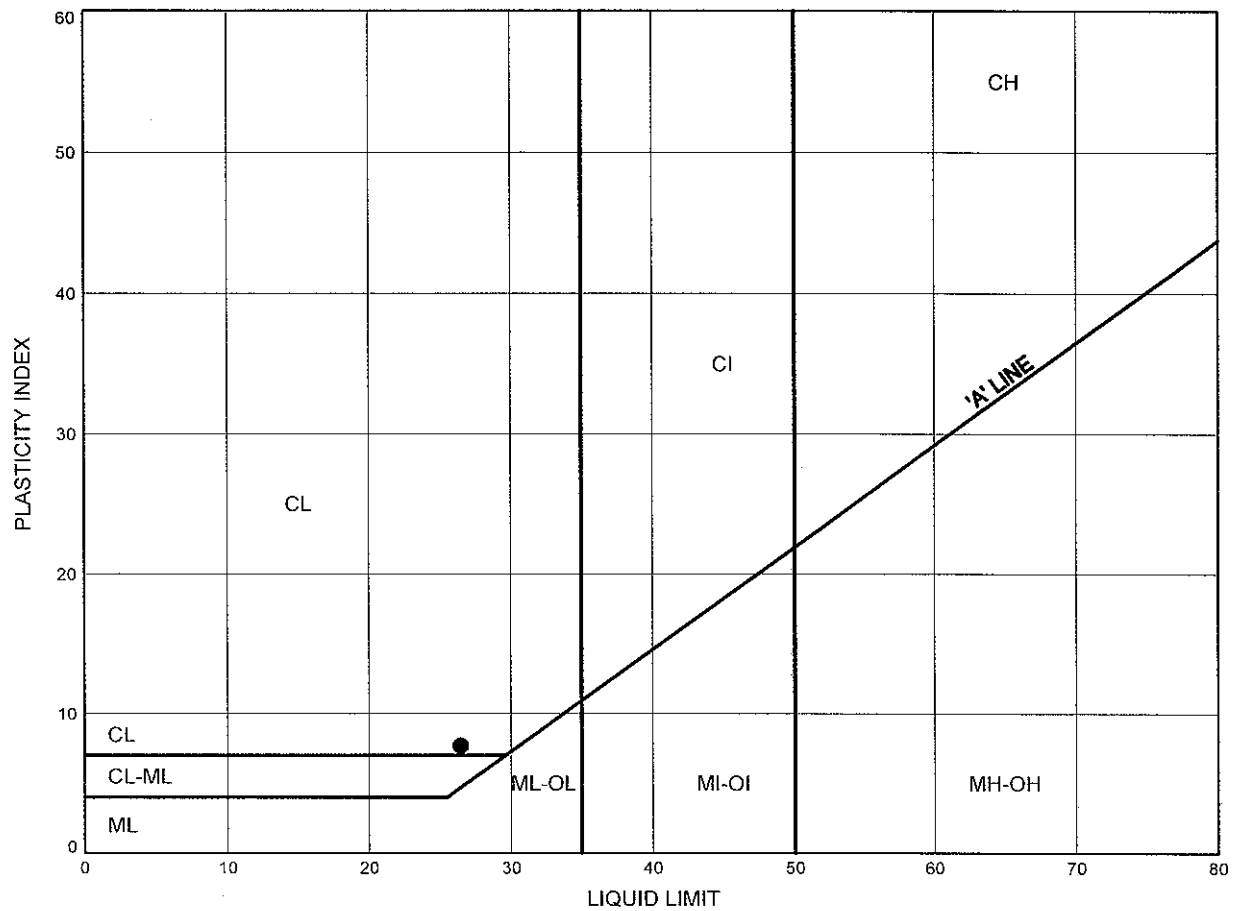


Prep'd DB  
Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

FIGURE B1-8

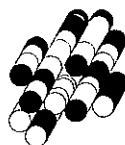
## CLAYEY SILT



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+125Rt	7.8	174.7

Date June 2010

Project 1-09-4135



Prep'd DB

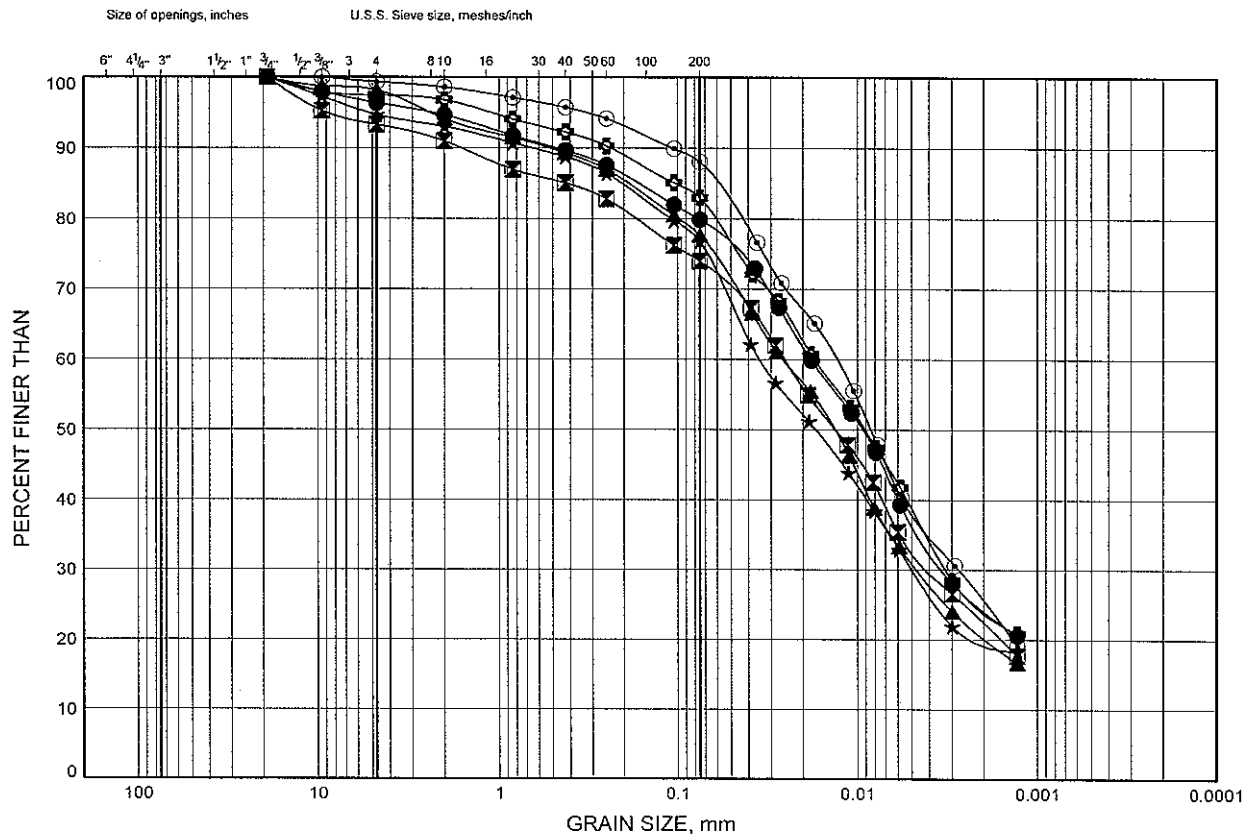
Chkd. HW



# GRAIN SIZE DISTRIBUTION

FIGURE B1-9

## SILTY CLAY TILL



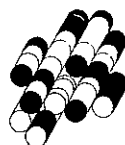
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	EMN 10+125Lt	10.9	171.7
⊠	EMN 10+125Lt	13.9	168.7
▲	EMN 10+125Rt	10.9	171.6
★	EMN 10+125Rt	13.9	168.6
⊙	EMN 10+125Rt	17.0	165.5
⊕	EMN 10+175CL	10.9	171.5

Date June 2010

Project 1-09-4135



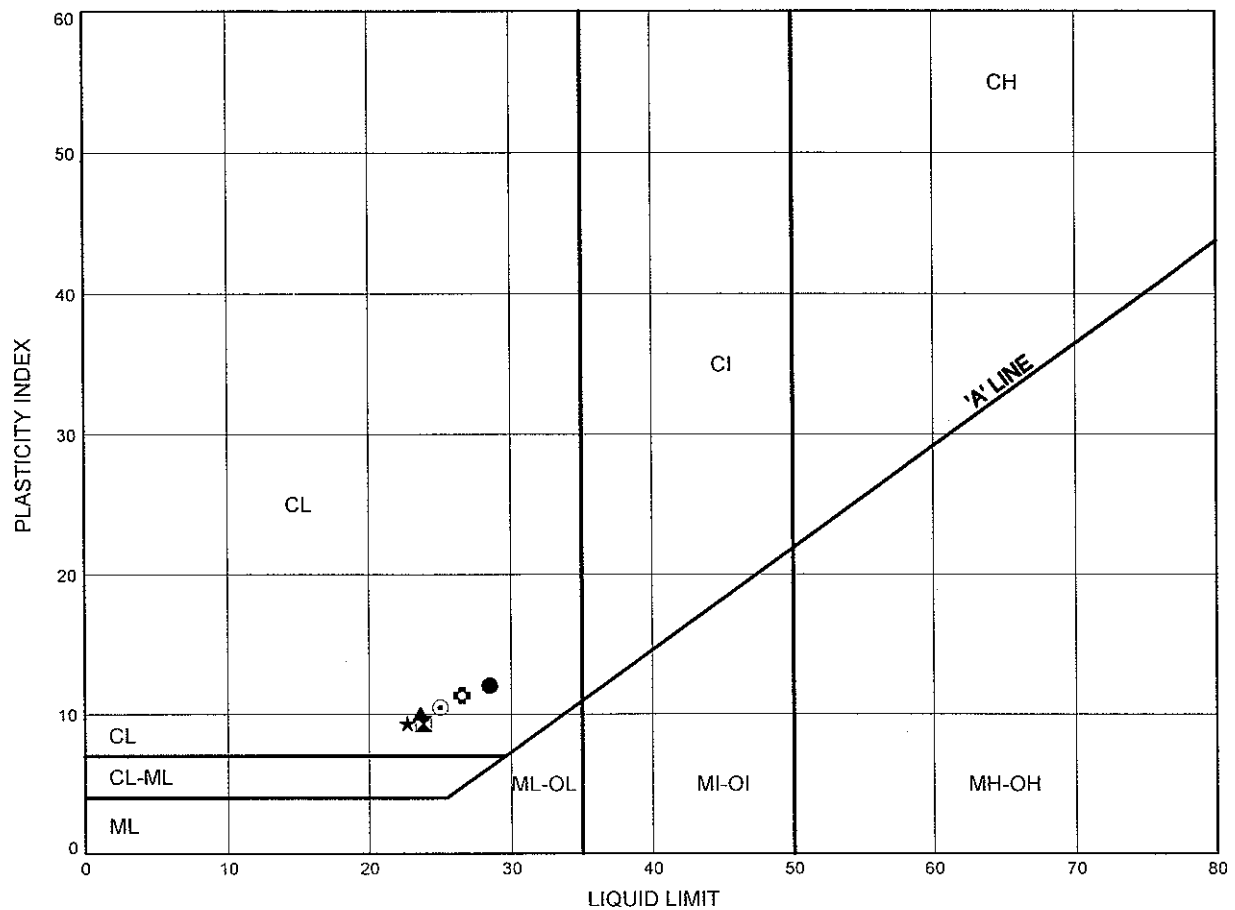
Prep'd DB

Chkd. HW

# 

FIGURE B1-10

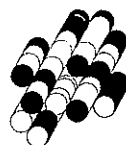
### SILTY CLAY TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+125Lt	10.9	171.7
⊠	EMN 10+125Lt	13.9	168.7
▲	EMN 10+125Rt	10.9	171.6
★	EMN 10+125Rt	13.9	168.6
⊙	EMN 10+125Rt	17.0	165.5
⊛	EMN 10+175CL	10.9	171.5

Date June 2010

Project 1-09-4135



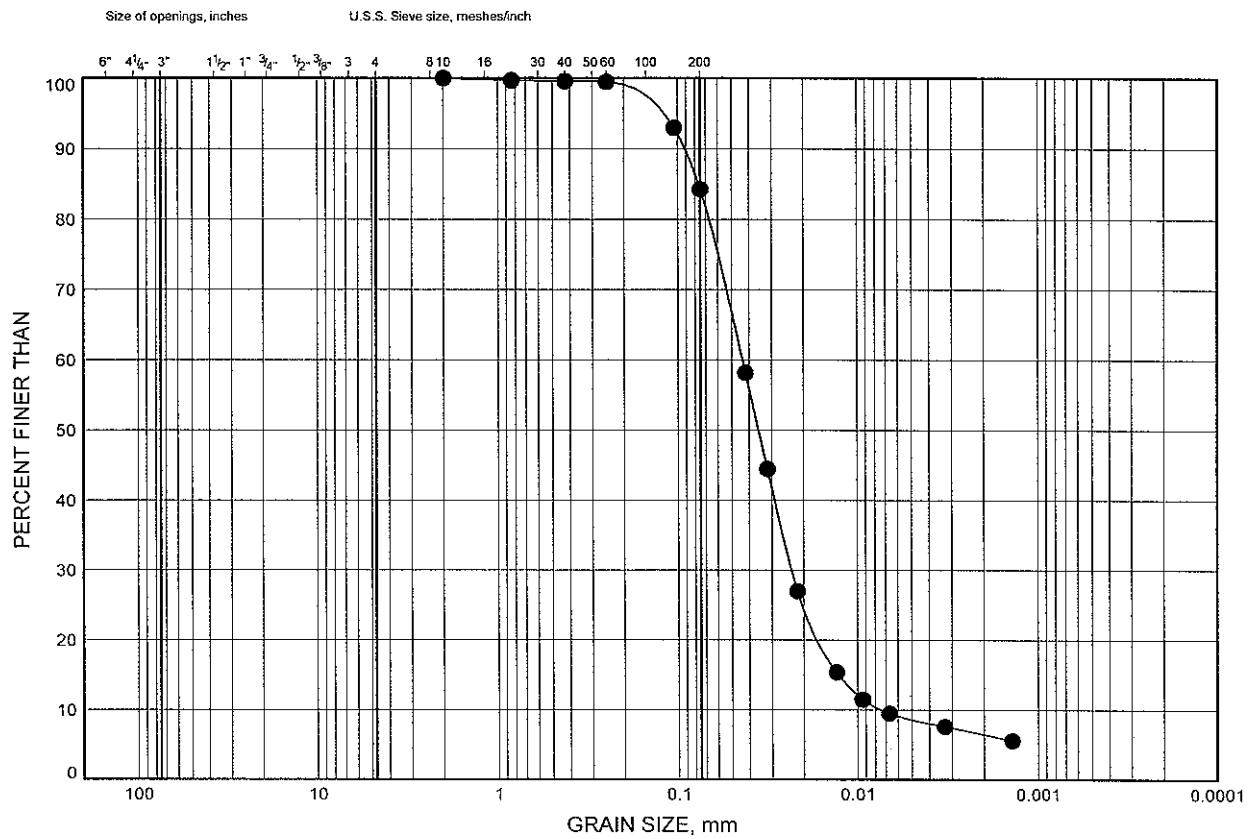
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B1-11

## SILT TILL

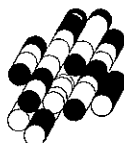


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	EMN 10+125Lt	17.0	165.6

Date June 2010

Project 1-09-4135



Prep'd DB

Chkd. HW

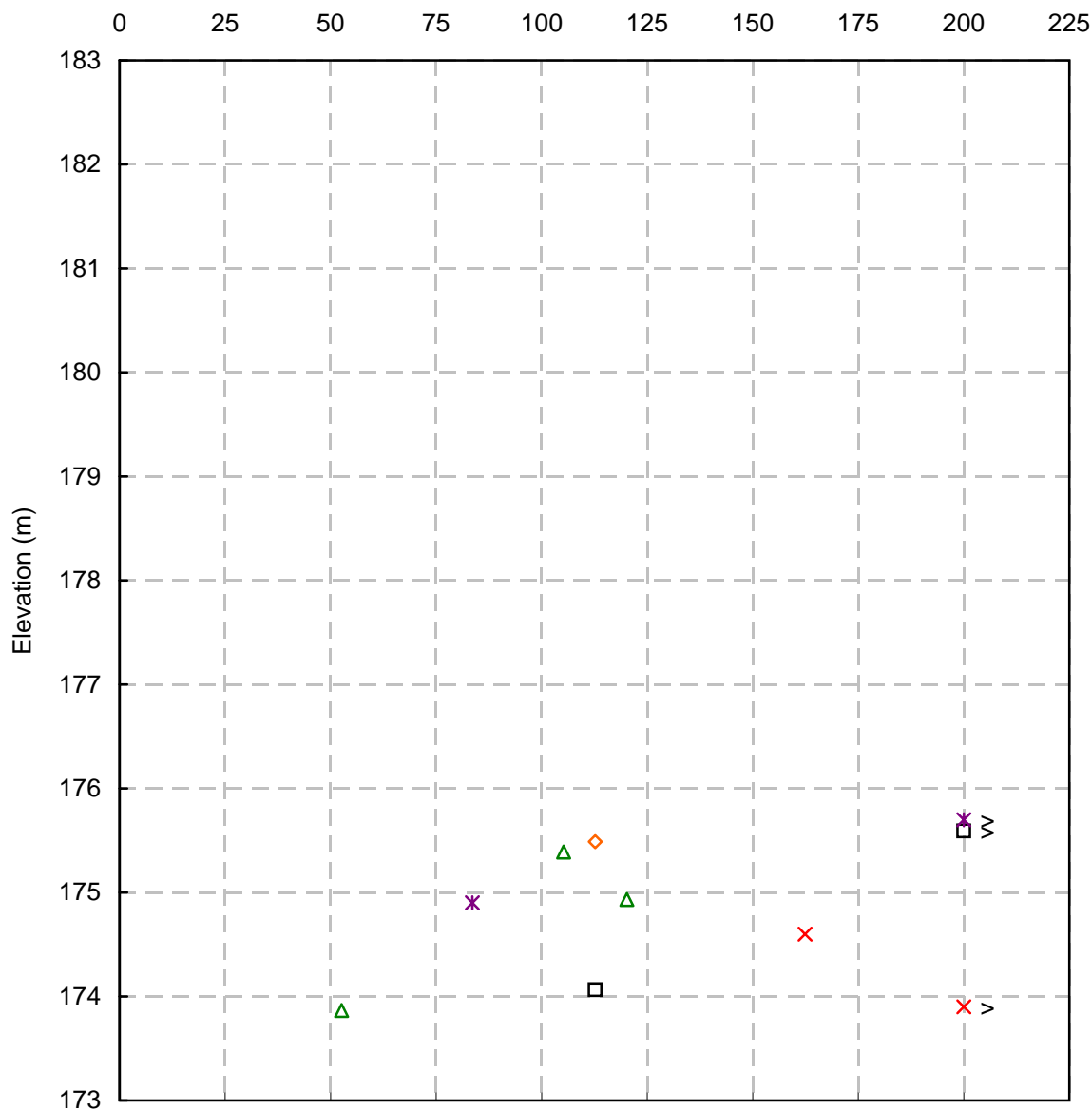
# CORRECTED UNDRAINED SHEAR STRENGTH

FIGURE B1-12

HWY 406 TWINNING - EAST MAIN ST

Silty Clay

Corrected Cu (kPa)



□ EMN 10+125 LT    ◇ EMN 10+125 RT    △ EMN 10+175 CL    × EMN 10+225 LT    × EMN 10+225 RT

## Field Shear Vane Correction

## Applied Correction Factors

Morris & Williams (1994)

0.82 (Elev.>176m)

0.94 (Elev.<176m)

( $\mu = 1.18 \text{ EXP}(-0.08 \text{ Ip}) + 0.57$ )

Project No. : 1-09-4135

Date : September, 2010



**Terraprobe Inc.**

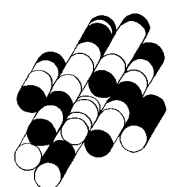
Prepared By : HW

Checked By : RA

C:\Documents and Settings\Hongliu\My Documents\Project 2009\1-09-4135 - HWY 406 Foundations\Deep Cut\East Main St\1-09-4135 Soil Parameter Estimation-EMN-SI.C1.xls

# C1

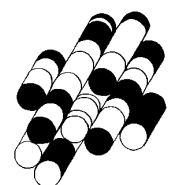
**TERRAPROBE INC.**





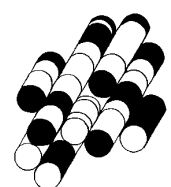
# SITE 2

**TERRAPROBE INC.**



# A2

**TERRAPROBE INC.**





RECORD OF BOREHOLE No S-EW 10+025Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763892.5 E:327500.9 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 12.03.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
183.6 0.1	Ground Surface 70mm TOPSOIL		1	SS	13		183							
	FILL - Silty Clay, trace to some sand, trace organics, occasional gravel inclusions, occasional concrete debris, stiff to hard, brown, damp to moist		2	SS	93		182							0 11 59 30
			3	SS	50		181							
			4	SS	15		180							
			5	SS	12		179							
			6	SS	14		178							
179.2 4.4	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		7	SS	25		177							0 2 67 31
			8	SS	17		176							
			9	SS	21		175							
			10	SS	11		174							0 2 68 30
			11	SS	15		173							
			12	TW	PH		172							
			13	SS	28		171							
							170							0 2 66 32
							169							

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10

RECORD OF BOREHOLE No S-EW 10+025Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763892.5 E:327500.9 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 12.03.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	WATER CONTENT (%)
167.4 16.2	CLAYEY SILT TO SILTY CLAY sandy, some gravel, hard, brown, damp  (GLACIAL TILL)		14	SS	26		168											
							167											
					15		SS	81	166									
164.8 18.8	End of Borehole		16	SS	125		165											
	Unable to push vane beyond 15.7m.  Borehole was dry (not stabilized) and hole open to full depth on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.  Water Level Readings: Date      Depth(m)      Elevation(m) Dec.08.09    17.7      165.9 Dec.15.09    16.1      167.5 Jan.04.10    5.0      178.6 Jan.11.10    3.9      179.7 Jan.19.10    4.0      179.6																	

ONTARIO MOT 1-08-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10

# RECORD OF BOREHOLE No S-EW 10+050CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763920.4 E:327494.1 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.24.09 - 11.25.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
183.4	Ground Surface							20 40 60 80 100						
183.3	120mm TOPSOIL							20 40 60 80 100						
0.1	FILL - Silty Clay, trace sand, trace gravel, trace organics, very stiff, brown, moist		1	SS	29		183	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
182.7														
0.7	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, damp to moist		2	SS	30		182							
			3	SS	31		181							
			4	SS	30		180							
			5	SS	20		179							0 1 69 30
			6	SS	18		178							Nov.24 Nov.25
			7	SS	20		177							0 2 65 33
			8	SS	15		176							
			9	TW	PH		175							
			10	SS	13		174						20.4	0 3 70 27
			11	SS	15		173							
							172							1 4 68 27
							171							
							170							
169.8	End of Borehole													
13.6	Water level at 7.6m (not stabilized) and hole open to full depth on completion.  Consolidation test performed on TW9.													

ONTARIO MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No S-EW 10+050CL

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763920.4 E:327494.1 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.24.09 - 11.25.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa																							
						20	40	60	80	100																					
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Dec.08.09</td> <td>2.4</td> <td>181.0</td> </tr> <tr> <td>Dec.15.09</td> <td>2.4</td> <td>181.0</td> </tr> <tr> <td>Jan.04.10</td> <td>2.4</td> <td>181.0</td> </tr> <tr> <td>Jan.11.10</td> <td>2.4</td> <td>181.0</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Dec.08.09	2.4	181.0	Dec.15.09	2.4	181.0	Jan.04.10	2.4	181.0	Jan.11.10	2.4	181.0															
Date	Depth(m)	Elevation(m)																													
Dec.08.09	2.4	181.0																													
Dec.15.09	2.4	181.0																													
Jan.04.10	2.4	181.0																													
Jan.11.10	2.4	181.0																													

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10

# RECORD OF BOREHOLE No TSEW1

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763922.8 E:327487.0 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 01.08.10 - 01.18.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
183.5	Ground Surface							20 40 60 80 100	10 20 30						
0.0	30mm TOPSOIL		1	SS	32		183							30 30 25 15	
182.8	FILL - Sand and Gravel, silty, some clay, dense, moist to wet														
0.7	SILTY CLAY trace sand, trace gravel, stiff to hard, brown, damp to moist		2	SS	16		182							0 3 40 57	
			3	SS	27		181								
			4	SS	40		180								
			5	SS	34		179								
			6	SS	34		178							0 2 66 32	
			7	SS	42		177								
			8	SS	23		176								
			9	SS	24		175							1 3 70 26	
			10	SS	21		174								
			11	SS	16		173							2 3 66 29	
			12	TW	PH		172								
			13	SS	13		171							1 2 70 27	
			14	SS	13		170								
168.8							169								
14.7															

ONTARIO MOT 1-09-4135 S-EW RAMP GP1 ONTARIO MOT GDT 06/29/10

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No TSEW1										3 OF 3		METRIC						
W.P. 280-99-00		LOCATION		Coords: N:4763922.8 E:327487.0				ORIGINATED BY AW										
DIST HWY 406		BOREHOLE TYPE		Hollow Stem Augers / Casing and Washboring / NQ Rock Coring				COMPILED BY DB										
DATUM Geodetic		DATE		01.06.10 - 01.18.10				CHECKED BY RA										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)						
							20	40	60	80	100							
							20	40	60	80	100							
												10	20	30				
150.8	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ		153										RUN#1 TCR=89% SCR=75% RQD=54%	
			2	RUN	NQ		152											RUN#2 TCR=93% SCR=81% RQD=52%
							151											
32.7	End of Borehole																	
	Borehole sealed with bentonite slurry to ground surface.  No sample recovery at SS16 and SS17. Sampler redriven and disturbed sample collected.  Resistance to augering at 19.8m and 23.8m.  Unable to push vane beyond 6.6m and 15.7m and 26.4m.																	

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10

RECORD OF BOREHOLE No TSEW2

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763936.1 E:327490.9 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.05.10 - 01.07.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × LAB VANE						
183.3	Ground Surface						20 40 60 80 100	20 40 60 80 100	10 20 30					GR SA SI CL	
0.0															
182.6	FILL - Sand, some gravel, some silt, compact, brown, wet		1	SS	25									10 76 (14)	
0.7															
	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, moist		2	SS	26									0 1 43 56	
			3	SS	40										
			4	SS	31									0 2 37 61	
			5	SS	26										
			6	SS	24										
			7	SS	22										
			8	SS	25										
	dark brown		9	SS	20									0 2 68 30	
			10	TW	PH									commence casing and washboring	
			11	SS	12									1 3 66 30	
														Jan.05	
														Jan.06	
			12	SS	22										
			13	SS	23										
	reddish brown														
			14	SS	13										
168.6															
14.7															

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10



## METRIC

[illegible]

ONTARIO MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

## METRIC

[illegible]

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No TSEW3

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763960.8 E:327478.6 ORIGINATED BY LY  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.08.09 - 12.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
183.3	Ground Surface						20	40	60	80	100	10	20	30	GR SA SI CL	
0.0	FILL - Sand and Gravel, trace silt, loose, grey, dry		1	SS	6											
182.6																
0.7	FILL - Silty Clay, some sand, some gravel, firm, grey, damp to moist		2	SS	5											
182.0																
1.3	SILTY CLAY trace sand, trace gravel, stiff to very stiff, brown, moist		3	SS	18											
			4	SS	18											
			5	SS	24									45	0 2 46 52	
			6	SS	24											
			7	SS	12										1 4 61 34	
			8	SS	10											
			9	SS	14											
			10	SS	16											
			11	SS	9										0 4 64 32	
			12	SS	9										4 5 67 24	
			13	TW	PH										20.8 2 2 75 21	
			14	SS	12										3 3 70 24	
168.6																
14.7																

Continued Next Page

+ 3, X 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10

# RECORD OF BOREHOLE No TSEW3

2 OF 3

METRIC


W.P. 280-99-00 LOCATION Coords: N:4763960.8 E:327478.6 ORIGINATED BY LY  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.08.09 - 12.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							20 40 60 80 100	20 40 60 80 100						
			</											

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No TSEW3										3 OF 3	METRIC						
W.P. 280-99-00		LOCATION		Coords: N:4763960.8 E:327478.6				ORIGINATED BY LY									
DIST _____ HWY 406		BOREHOLE TYPE		Hollow Stem Augers / Casing and Washboring / NQ Rock Coring				COMPILED BY DB									
DATUM Geodetic		DATE		12.08.09 - 12.10.09				CHECKED BY RA									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20	40	60	80	100						
							○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE					WATER CONTENT (%)					
							20	40	60	80	100	10	20	30			
	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ		153										RUN#1 TCR=59% SCR=54% RQD=13%
			2	RUN	NQ		152										RUN#2 TCR=79% SCR=58% RQD=46%
150.5							151										
32.8	End of Borehole  Consolidation test performed on TW 13.  Borehole sealed with bentonite slurry to ground surface.  Unable to push vane beyond 10.5m and 16.6m.																

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10

RECORD OF BOREHOLE No TSEW4

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763951.2 E:327473.9 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.02.09 - 12.07.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
183.5	Ground Surface													
0.0														
	FILL - Silty Clay, some sand, trace gravel, trace organics, stiff to very stiff, dark brown / brown, moist		1	SS	11		183							
			2	SS	18		182							3 11 48 38
	firm		3	SS	6		181							
181.4														
2.1	SILTY CLAY trace sand, trace gravel, stiff to very stiff, brown, damp to moist		4	SS	14		180							0 1 54 45
			5	SS	18		179							
	some sand		6	SS	19		178							
			7	SS	18		177							1 13 55 31
			8	SS	13		176							
			9	SS	11		175							
			10	SS	7		174							2 3 70 25
			11	SS	3		173							
			12	SS	8		172							
			13	SS	9		171							0 6 63 31
			14	TW	PH		170							
168.8							169							1 2 70 27
14.7														

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10

## METRIC

○ 3% STRAIN AT FAILURE

## METRIC

[illegible]

+ 3, x 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No S-EW 10+110CL 1 OF 2 METRIC

W.P. 280-99-00 LOCATION Coords: N:4763976.0 E:327471.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
							20 40 60 80 100						
							20 40 60 80 100						
182.4	Ground Surface												
0.0	250mm TOPSOIL												
182.2													
0.3	FILL - Silty Clay, trace sand, trace gravel, trace organics, firm, brown, moist		1	SS	4								
181.7													
0.7	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, damp to moist		2	SS	13								
			3	SS	18								
			4	SS	18								
			5	SS	21								
			6	SS	12								
			7	SS	12								
			8	SS	10								
			9	TW	PH								
			10	TW	PH								
			11	TW	PH								
168.4	End of Borehole												
14.0													

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 05/29/10

Continued Next Page

+ 3 . x 3: Numbers refer to  
Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No S-EW 10+110CL

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763976.0 E:327471.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)																										
						20	40	60	80	100	20	40	60	80	100	10	20	30																					
	<p>Borehole was open and dry (not stabilized) upon completion of drilling.</p> <p>No sample recovery at TW9 and TW10. Split spoon sampler driven and disturbed sample collected.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.09.09</td> <td>2.7</td> <td>179.7</td> </tr> <tr> <td>Nov.20.09</td> <td>1.1</td> <td>181.3</td> </tr> <tr> <td>Nov.30.09</td> <td>1.6</td> <td>180.8</td> </tr> <tr> <td>Dec.08.09</td> <td>1.3</td> <td>181.1</td> </tr> <tr> <td>Jan.04.10</td> <td>1.3</td> <td>181.1</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.09.09	2.7	179.7	Nov.20.09	1.1	181.3	Nov.30.09	1.6	180.8	Dec.08.09	1.3	181.1	Jan.04.10	1.3	181.1																				
Date	Depth(m)	Elevation(m)																																					
Nov.09.09	2.7	179.7																																					
Nov.20.09	1.1	181.3																																					
Nov.30.09	1.6	180.8																																					
Dec.08.09	1.3	181.1																																					
Jan.04.10	1.3	181.1																																					

ONTARIO MOT 1-09-4135 S-EW RAMP GPJ ONTARIO MOT GDT 06/29/10

RECORD OF BOREHOLE No S-EW 10+185Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764050.9 E:327459.8 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.03.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub>	W	W <sub>L</sub>		
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
182.4	Ground Surface						20 40 60 80 100							GR SA SI CL
182.3	100mm TOPSOIL													
0.1	SILTY CLAY trace sand, stiff to very stiff, brown, moist		1	SS	8		182							
			2	SS	22		181						46	0 0 50 50
			3	SS	21		180							
			4	SS	17		179							
			5	SS	21		178							
			6	SS	17		177							
			7	SS	14		176							
			8	SS	13		175							
			9	SS	12		174							
			10	SS	7		173							
			11	AS	-		172							
169.3	End of Borehole						171							
13.1	Borehole was dry (not stabilized) and hole open to full depth on completion.						170							

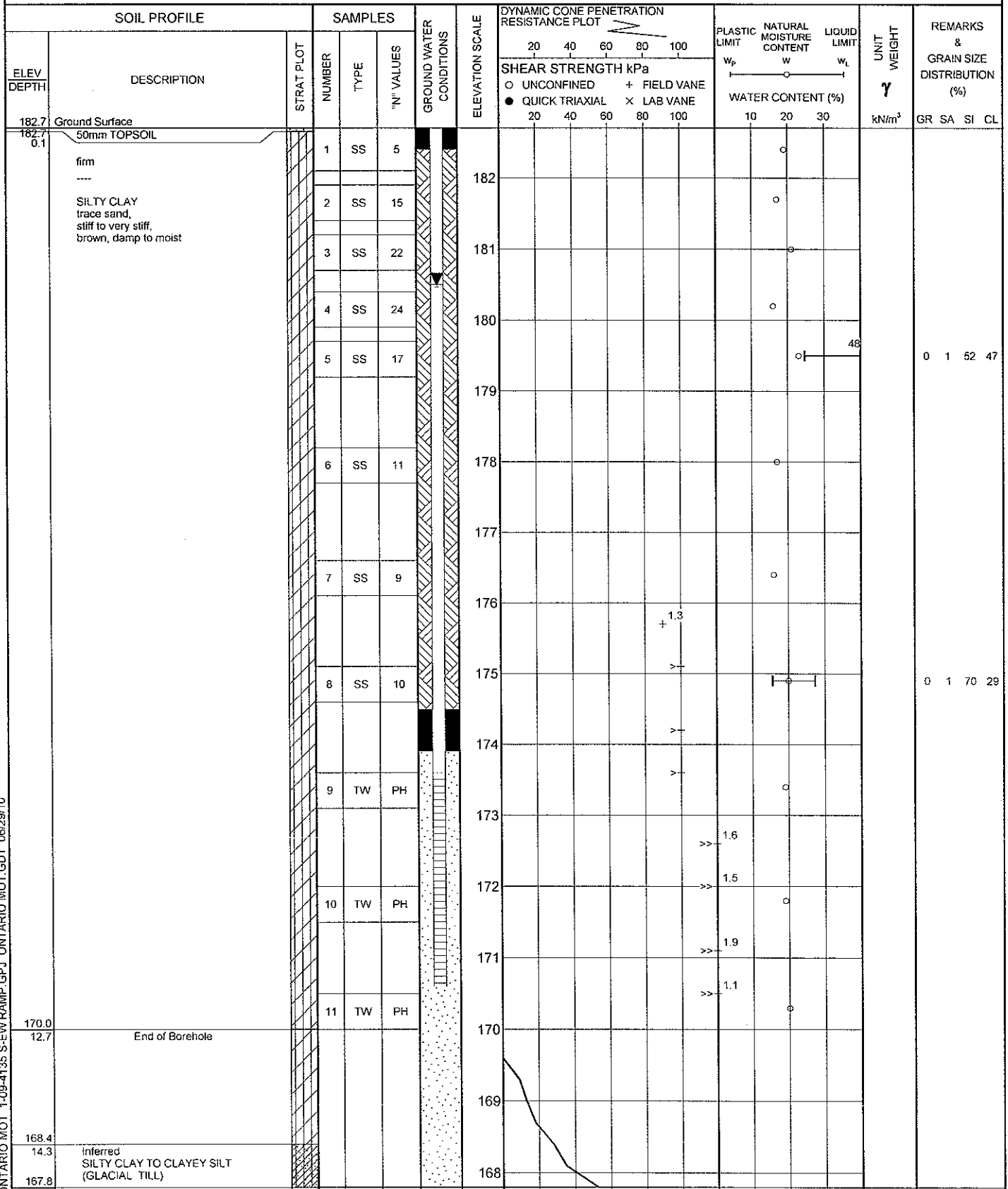
ONTARIO MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10

# RECORD OF BOREHOLE No S-EW 10+185Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764049.9 E:327468.0 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers, D.C.P.T. COMPILED BY DB  
DATUM Geodetic DATE 11.03.09 CHECKED BY RA



ONTARIO MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO MOT.GDT 06/29/10



RECORD OF BOREHOLE No S-EW 10+260CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764122.3 E:327485.4 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.03.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100					
182.6	Ground Surface															
182.5 0.1	90mm TOPSOIL															
	firm		1	SS	5											
			2	SS	16											
	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, moist		3	SS	27											0 3 68 29
			4	SS	30											
			5	SS	35											
			6	SS	13											1 2 70 27
176.0	End of Borehole		7	SS	12											
6.6	Borehole was dry (not stabilized) and hole open to full depth on completion.															

ONTARIO.MOT 1-09-4135 S-EW RAMP.GPJ ONTARIO.MOT.GDT 06/29/10

# RECORD OF BOREHOLE No W-N 10+125CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764184.2 E:327474.8 ORIGINATED BY MP  
 DIST HWY 405 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.03.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)	
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×						LAB VANE	
181.3	Ground Surface						20	40	60	80	100								
181.2	150mm TOPSOIL																		
0.2	FILL - Silty Clay, trace organics, firm, brown, damp to moist		1	SS	7											54	0 0 44 56		
180.6																			
0.7	SILTY CLAY trace sand, very stiff, brown, moist		2	SS	20														
			3	SS	20														
179.2																			
2.1	SILT frequent silty clay seams and partings, compact, brown, moist to wet		4	SS	23														
178.4																			
2.9	SILTY CLAY trace sand, stiff, brown, damp to moist		5	SS	14												0 2 69 29		
			6	SS	14														
			7	SS	8												0 2 70 28		

ONTARIO MOT 1-09-4135 W-N RAMP.GPJ ONTARIO MOT.GDT 07/02/10

## METRIC

CHECKED BY RA

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No W-N 10+200 Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764129.9 E:327434.3 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.02.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
181.5	Ground Surface							20 40 60 80 100						
181.4	100mm TOPSOIL		1	SS	4			20 40 60 80 100						
0.1	FILL - Silty Clay, trace sand, trace organics, soft to firm, dark brown, moist													
180.8			2	SS	15									
0.7	SILTY CLAY trace sand, very stiff, brown, damp		3	SS	17									
179.4			4	SS	25									
2.1	SILT frequent silty clay seams and partings, compact, brown, moist													
178.6			5	SS	30									
2.9	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		6	SS	12									
			7	SS	3									
			8	SS	3									
			9	SS	4									
			10	AS	-									
169.9	End of Borehole													
11.6	Borehole was dry (not stabilized) and hole open to full depth on completion.													

ONTARIO MOT 1-09-4135 W-N RAMP.GPJ ONTARIO MOT.GDT 07/02/10

RECORD OF BOREHOLE No W-N 10+275 Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764158.5 E:327375.1 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.06.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
181.9	Ground Surface																
181.8 0.1	100mm TOPSOIL																
	FILL - Sand and Gravel, some silt, trace clay, occasional silty clay lump, loose to compact, grey, damp to moist		1	SS	18		181										43 41 13 3
180.8 1.1			2	SS	8												
	SILTY CLAY trace sand, trace gravel, firm to very stiff, brown, damp		3	SS	17		180										
			4	SS	15												
179.0 2.9			5	SS	22		179										1 1 66 32
	SILT frequent silty clay seams and partings, compact, brown, moist to wet																
177.9 4.0			6	SS	6		178										
	SILTY CLAY trace sand, firm to stiff, brown, damp to moist																
			7	SS	9		177										0 7 61 32
			8	SS	7		176										
			9	TW	PH		175										
			10	SS	15		174										0 2 70 28
							173										
							172										
							171										0 2 81 17
							170										
169.5 12.4			11	SS	25		169										
	SILTY CLAY TO CLAYEY SILT sandy, trace gravel, very stiff, brown, damp to moist  (GLACIAL TILL)																
167.7 14.2			12	SS	16		168										3 25 56 16
	End of Borehole																
	Borehole was dry (not stabilized) and hole open to full depth on completion.																

Continued Next Page

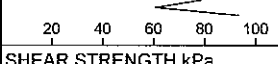
+ 3, x 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 W-N RAMP.GPJ ONTARIO MOT GDT 07/02/10

**RECORD OF BOREHOLE No W-N 10+275 Rt 2 OF 2 METRIC**

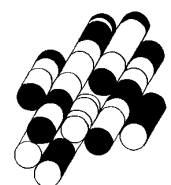
W.P. 280-99-00 LOCATION Coords: N:4764158.5 E:327375.1 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.06.09 CHECKED BY RA

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES						W <sub>p</sub>	W			W <sub>L</sub>																
	Consolidation test performed on TW 9.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.  Water Level Readings: <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.09.09</td> <td>10.8</td> <td>171.1</td> </tr> <tr> <td>Nov.19.09</td> <td>2.8</td> <td>179.1</td> </tr> <tr> <td>Nov.30.09</td> <td>2.7</td> <td>179.2</td> </tr> <tr> <td>Dec.08.09</td> <td>2.5</td> <td>179.4</td> </tr> <tr> <td>Jan.04.10</td> <td>2.5</td> <td>179.4</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.09.09	10.8	171.1	Nov.19.09	2.8	179.1	Nov.30.09	2.7	179.2	Dec.08.09	2.5	179.4	Jan.04.10	2.5	179.4														
Date	Depth(m)	Elevation(m)																															
Nov.09.09	10.8	171.1																															
Nov.19.09	2.8	179.1																															
Nov.30.09	2.7	179.2																															
Dec.08.09	2.5	179.4																															
Jan.04.10	2.5	179.4																															

ONTARIO MOT 1-09-4135 W-N RAMP GPJ ONTARIO MOT GDT 07/02/10

# B2

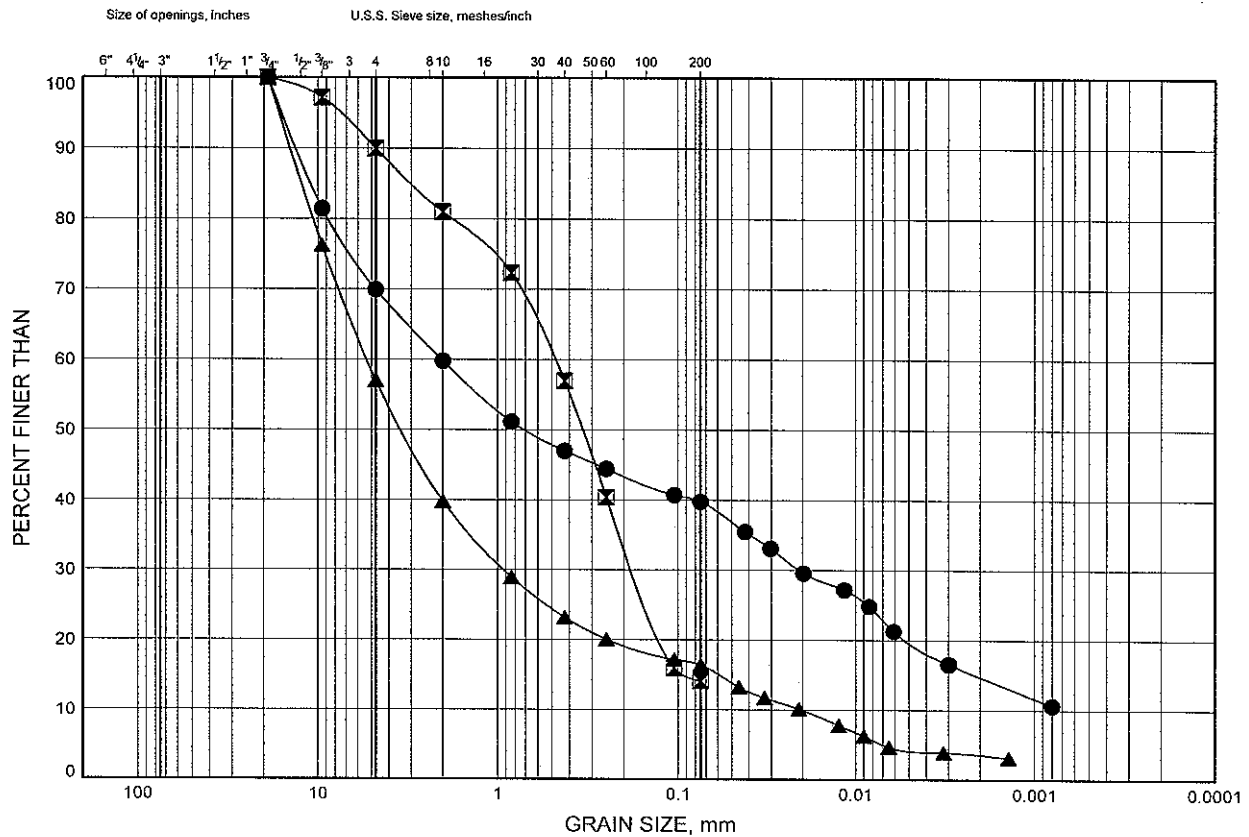
**TERRAPROBE INC.**



# GRAIN SIZE DISTRIBUTION

FIGURE B2-1

## FILL - Sand and Gravel



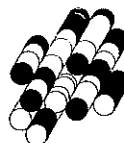
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	TSEW1	0.3	183.2
⊠	TSEW2	0.3	183.0
▲	W-N 10+275 Rt	0.3	181.6

Date July 2010

Project 1-09-4135



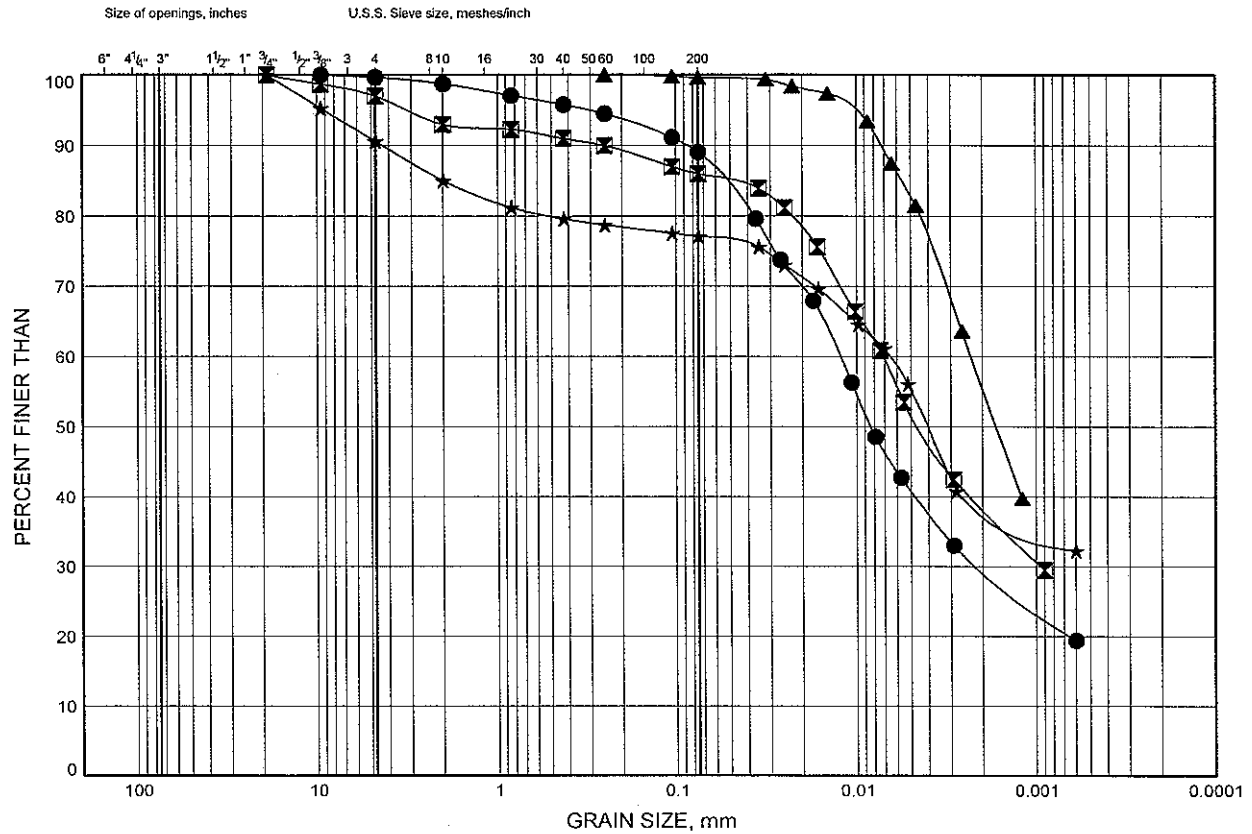
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-2

## FILL - Silty Clay



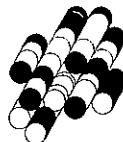
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	S-EW 10+025Rt	1.7	181.9
⊠	TSEW4	1.0	182.5
▲	W-N 10+125CL	0.3	181.0
★	W-N 10+200 Lt	0.3	181.2

Date July 2010

Project 1-09-4135



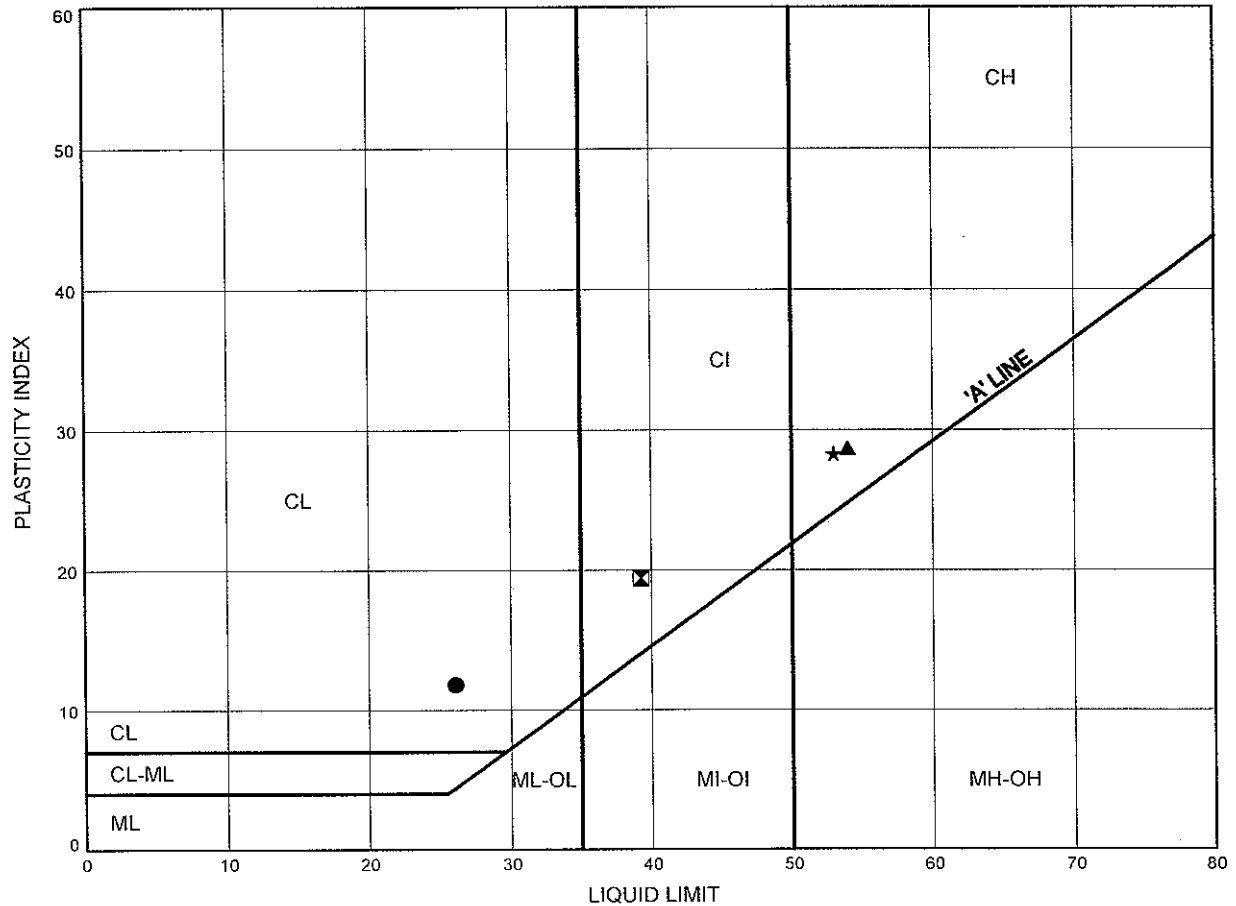
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

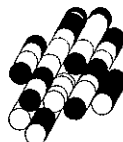
FIGURE B2-3

## FILL - Silty Clay



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+025Rt	1.7	181.9
⊠	TSEW4	1.0	182.5
▲	W-N 10+125CL	0.3	181.0
★	W-N 10+200 Lt	0.3	181.2

Date July 2010  
Project 1-09-4135

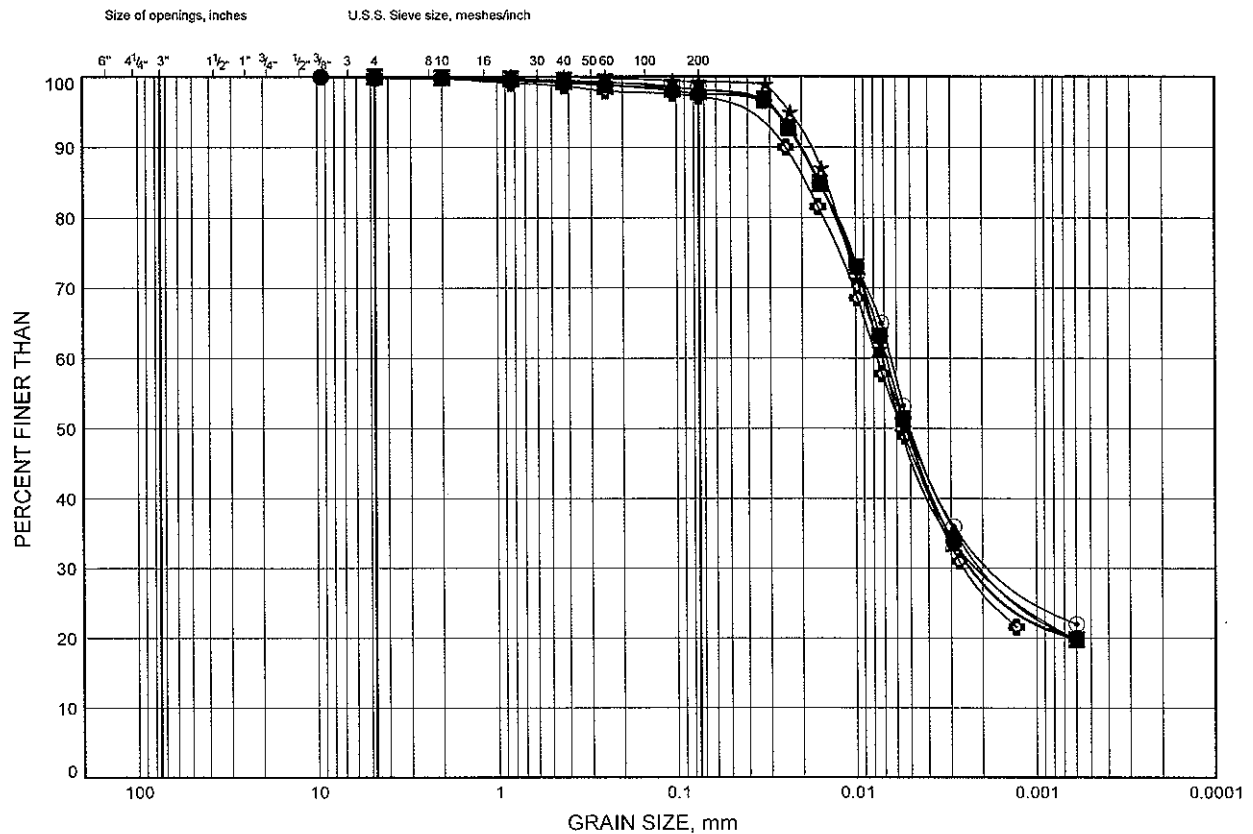


Prep'd DB  
Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-4

## SILTY CLAY



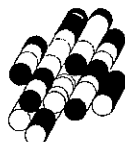
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	S-EW 10+025Rt	6.3	177.3
⊠	S-EW 10+025Rt	9.3	174.3
▲	S-EW 10+025Rt	13.9	169.7
★	S-EW 10+050CL	3.2	180.2
⊙	S-EW 10+050CL	6.3	177.1
⊛	S-EW 10+050CL	9.3	174.1

Date July 2010

Project 1-09-4135



Prep'd DB

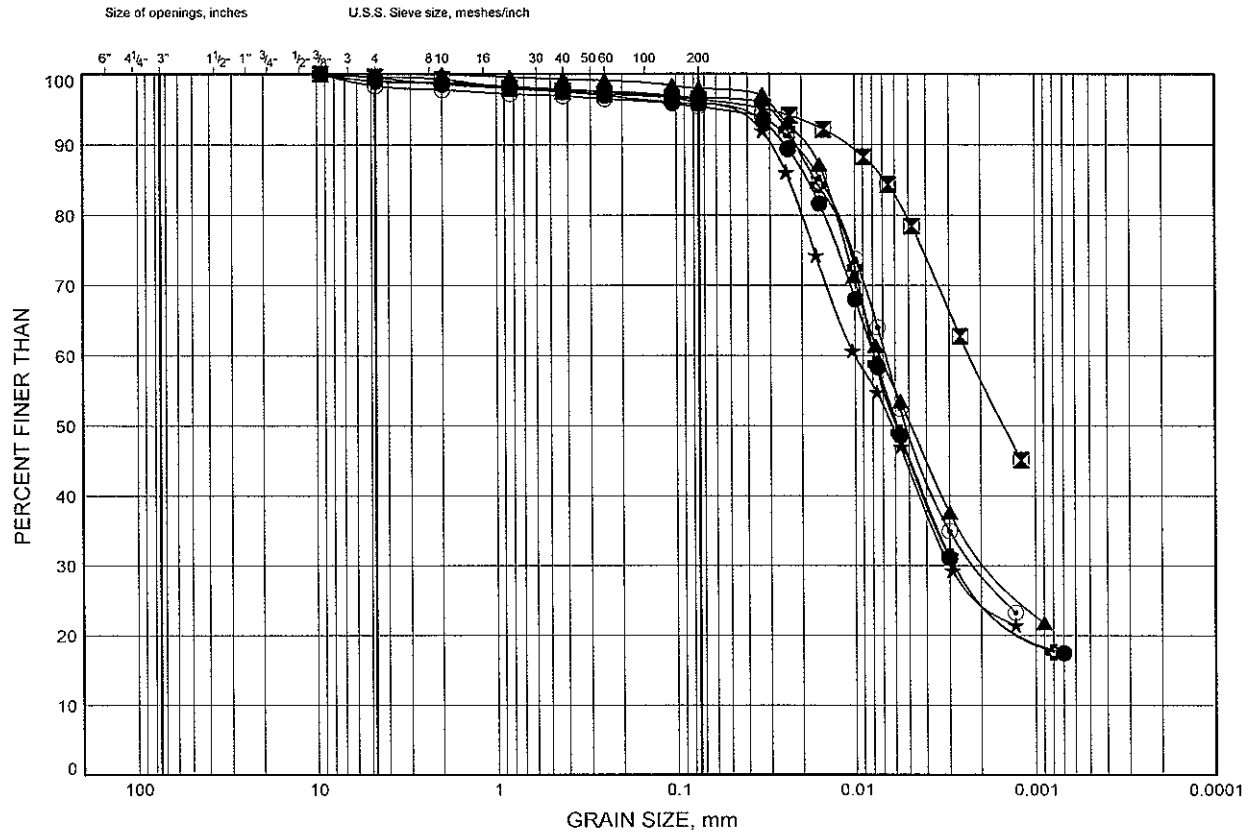
Chkd. MP



# GRAIN SIZE DISTRIBUTION

FIGURE B2-5

## SILTY CLAY



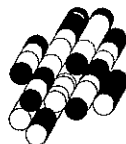
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	S-EW 10+050CL	10.9	172.5
⊠	TSEW1	1.7	181.8
▲	TSEW1	4.0	179.5
★	TSEW1	6.3	177.2
⊙	TSEW1	9.3	174.2
⊛	TSEW1	12.4	171.1

Date July 2010

Project 1-09-4135



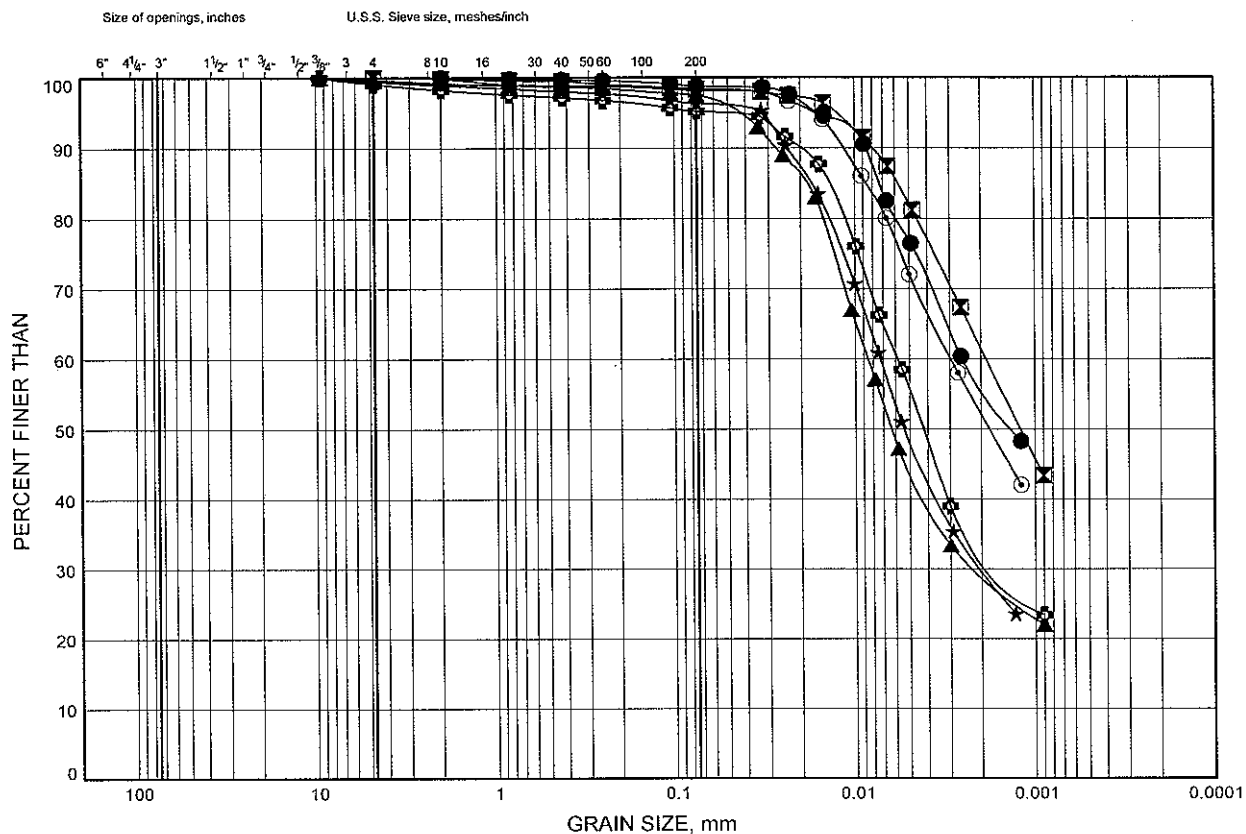
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-6

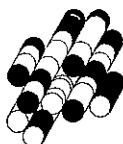
## SILTY CLAY



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TSEW2	1.0	182.3
⊠	TSEW2	2.5	180.8
▲	TSEW2	5.5	177.8
★	TSEW2	9.3	174.0
⊙	TSEW3	3.2	180.1
⊕	TSEW3	4.7	178.6

Date July 2010  
Project 1-09-4135

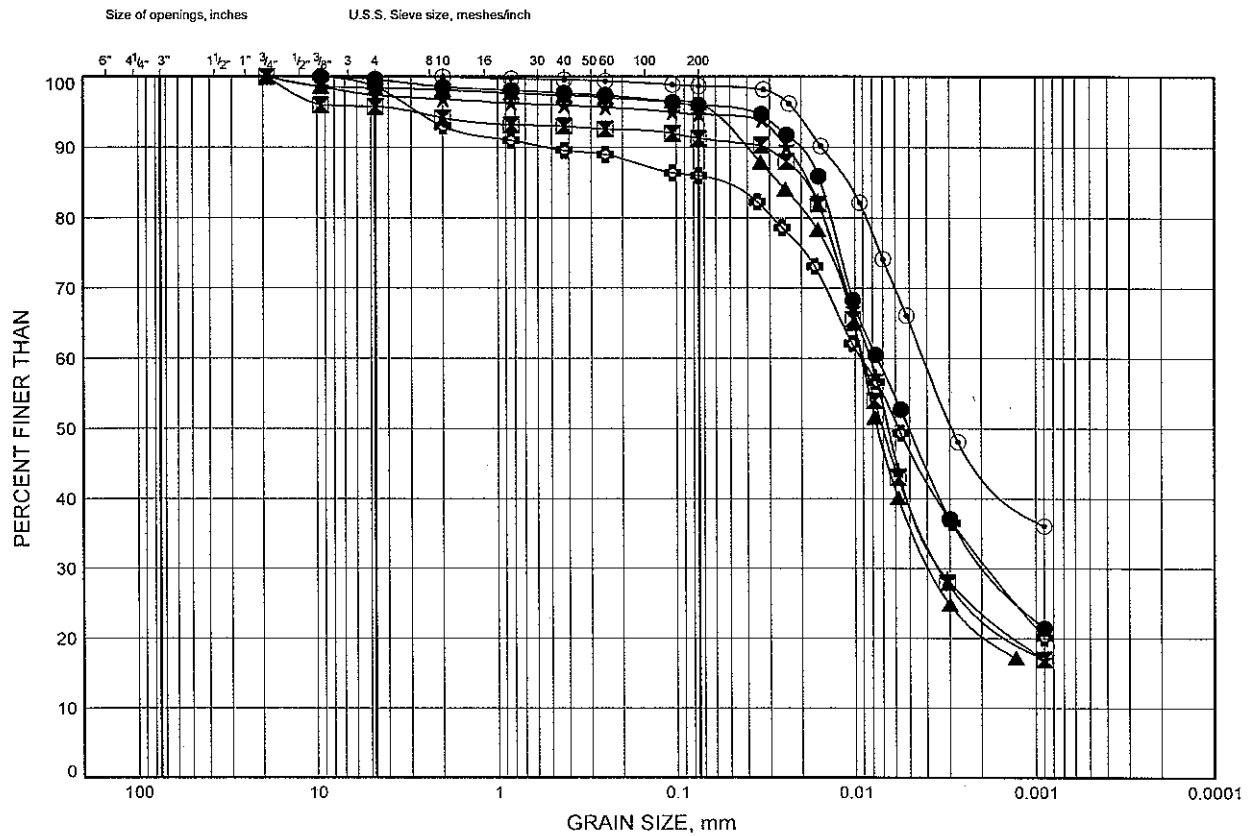


Prep'd DB  
Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-7

## SILTY CLAY

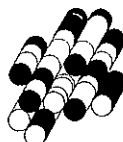


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
--------	----------	-----------	---------------

●	TSEW3	9.3	174.0
⊠	TSEW3	10.9	172.4
▲	TSEW3	12.4	170.9
★	TSEW3	13.9	169.4
⊙	TSEW4	2.5	181.0
⊛	TSEW4	4.7	178.8

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Project 1-09-4135

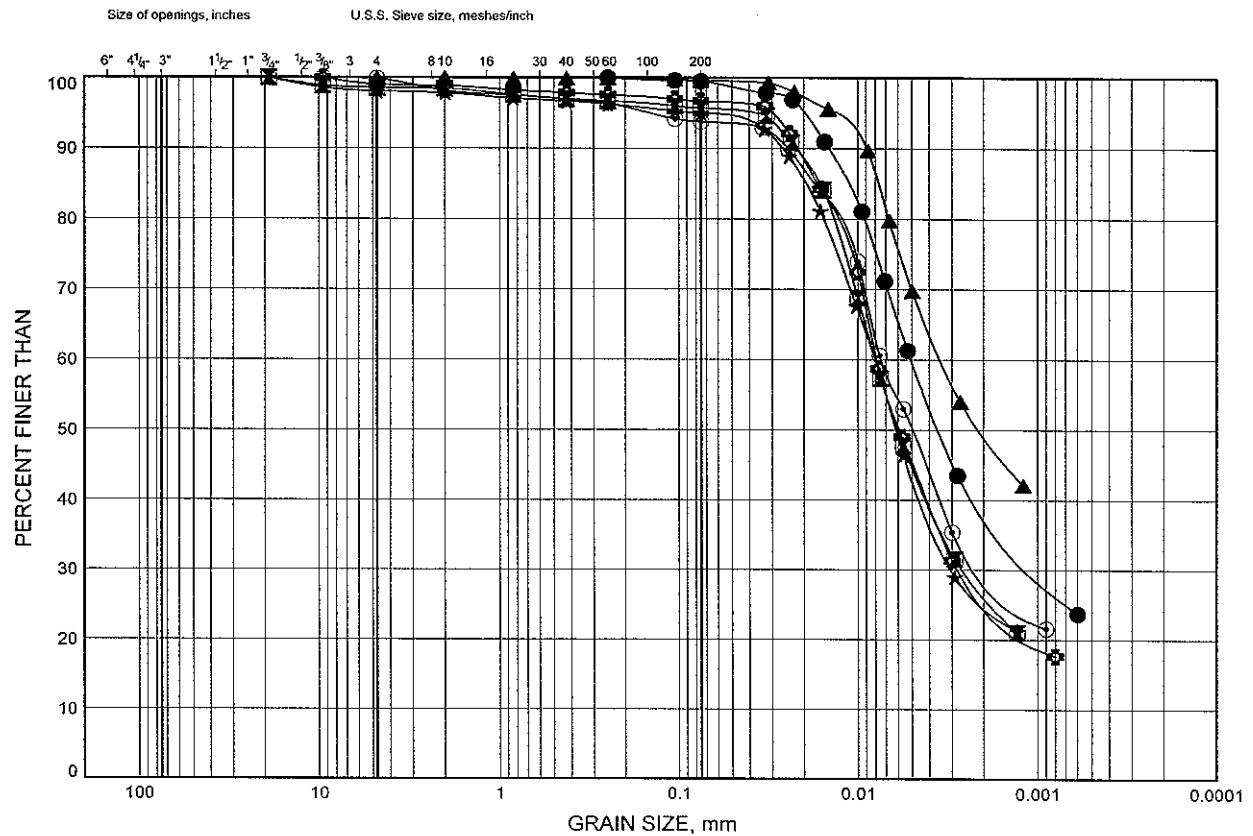


Prep'd DB  
Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-8

## SILTY CLAY



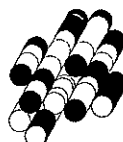
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	S-EW 10+110CL	1.7	180.7
⊠	S-EW 10+110CL	12.4	170.0
▲	S-EW 10+185Lt	1.0	181.4
★	TSEW4	7.8	175.7
⊙	TSEW4	9.3	174.2
⊛	TSEW4	12.4	171.1

Date July 2010

Project 1-09-4135



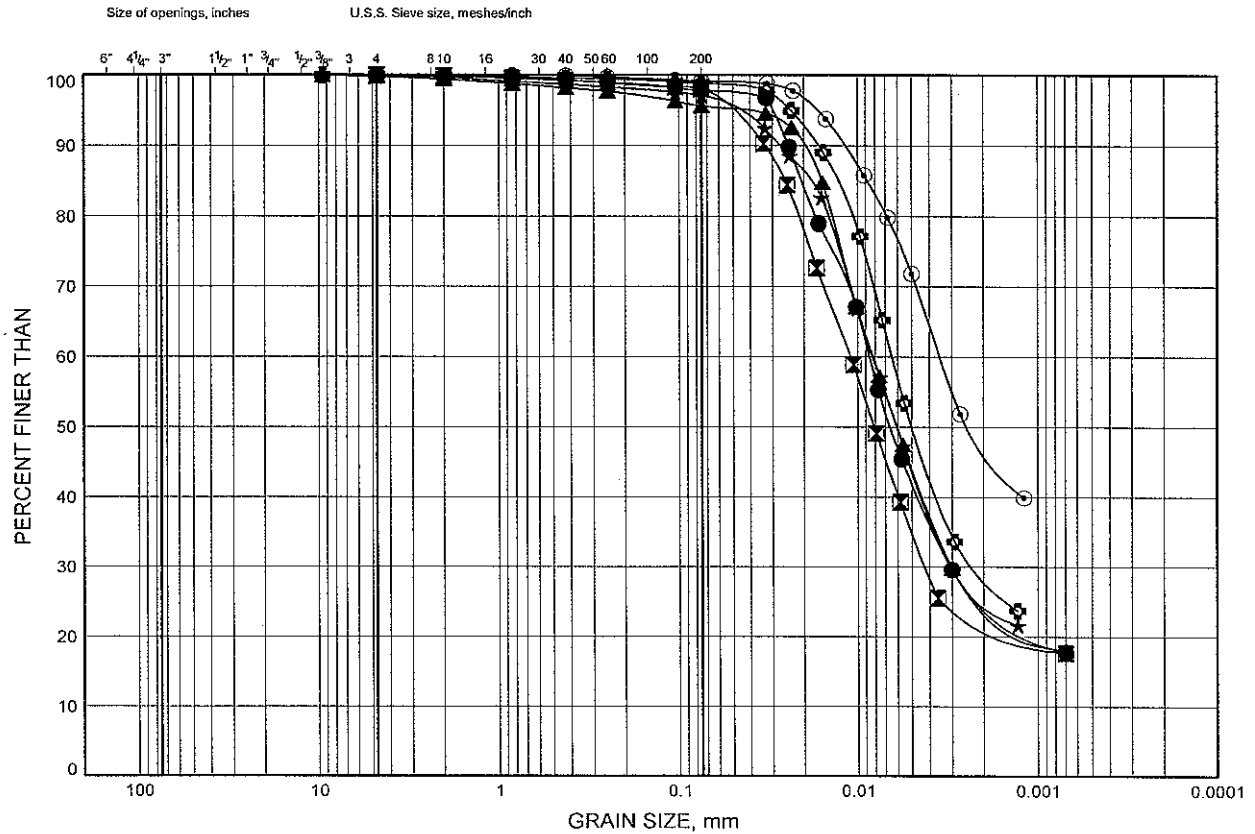
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-9

## SILTY CLAY



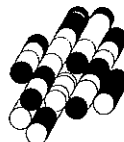
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	S-EW 10+185Lt	2.5	179.9
⊠	S-EW 10+185Lt	4.7	177.7
▲	S-EW 10+185Lt	7.8	174.6
★	S-EW 10+185Lt	10.9	171.5
⊙	S-EW 10+185Rt	3.2	179.5
⊛	S-EW 10+185Rt	7.8	174.9

Date July 2010

Project 1-09-4135



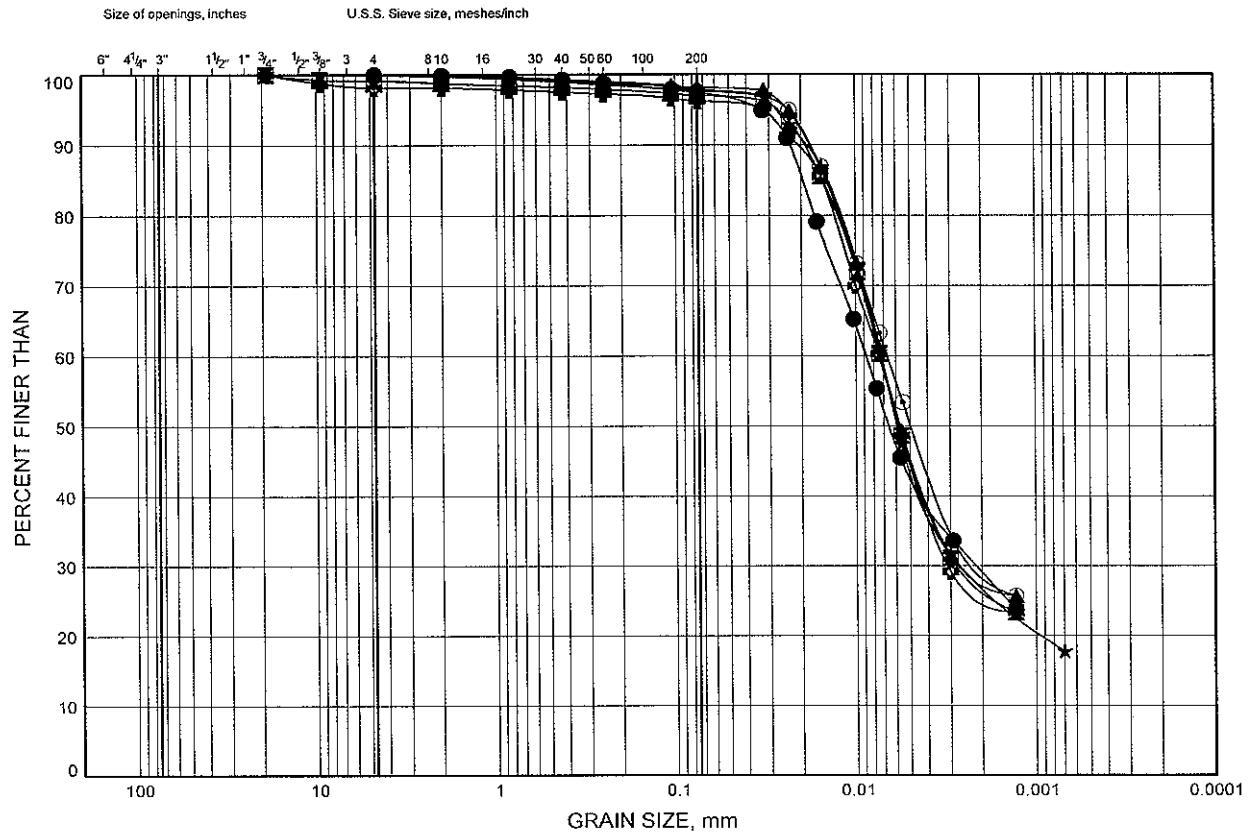
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-10

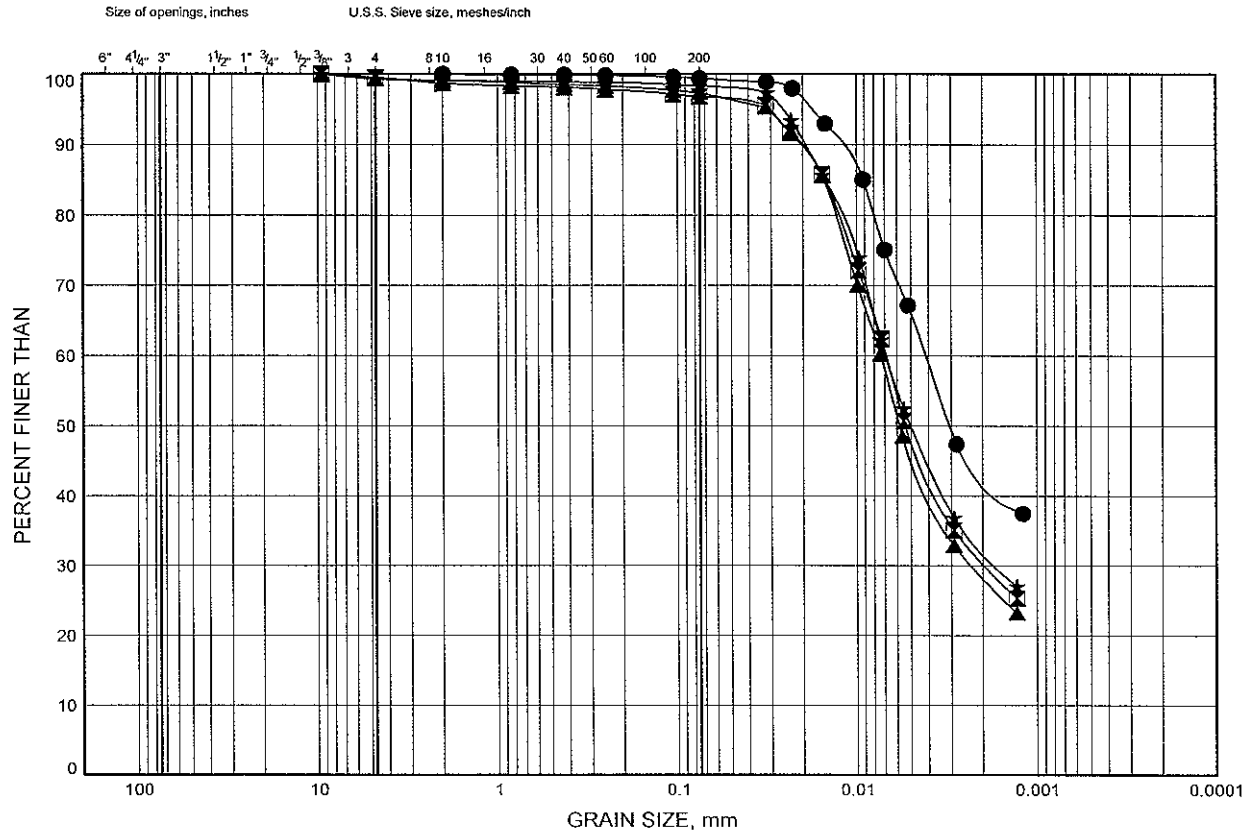
## SILTY CLAY



# GRAIN SIZE DISTRIBUTION

FIGURE B2-11

## SILTY CLAY

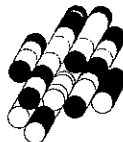


SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	W-N 10+200 Rt	1.7	179.8
⊠	W-N 10+200 Rt	3.2	178.3
▲	W-N 10+200 Rt	7.8	173.7
★	W-N 10+275 Rt	2.5	179.4

Date July 2010

Project 1-09-4135



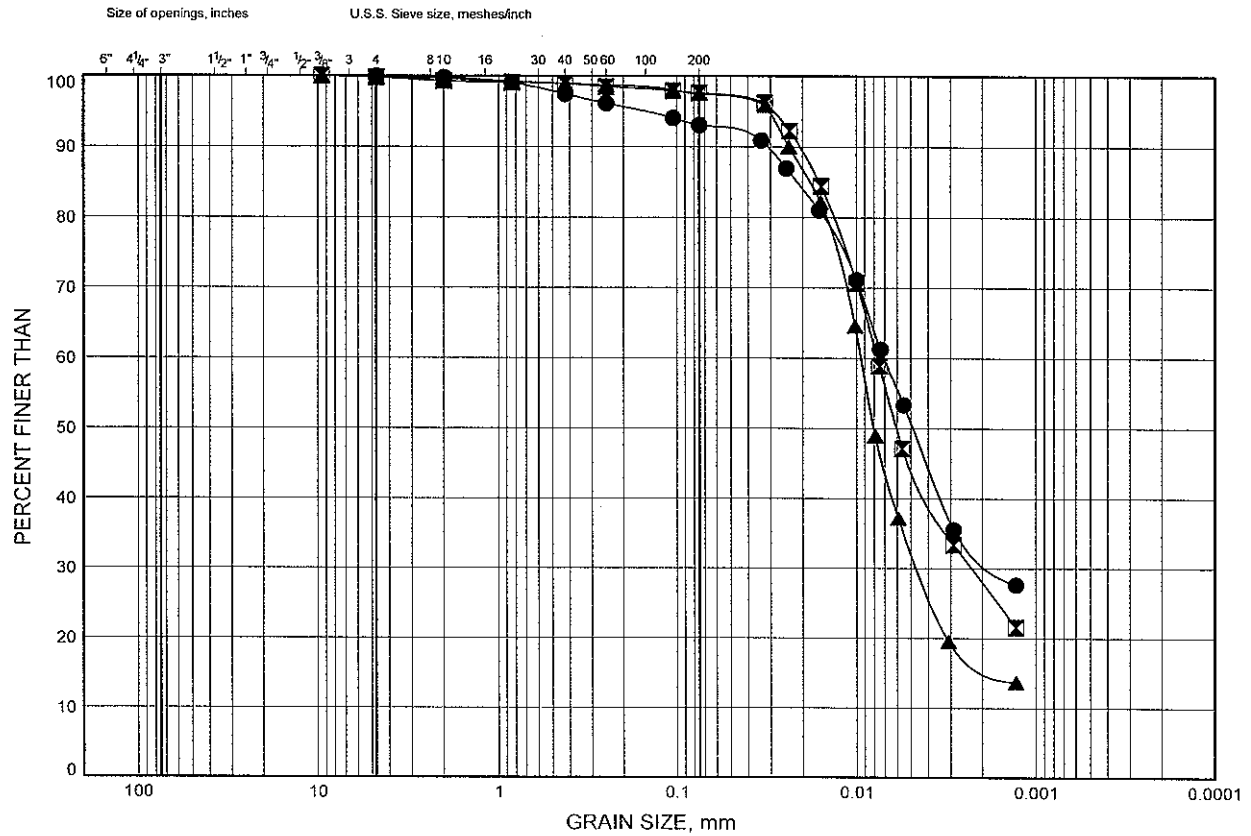
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-12

## SILTY CLAY



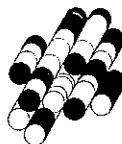
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	W-N 10+275 Rt	4.7	177.2
⊠	W-N 10+275 Rt	7.8	174.1
▲	W-N 10+275 Rt	10.9	171.0

Date July 2010

Project 1-09-4135



Prep'd DB

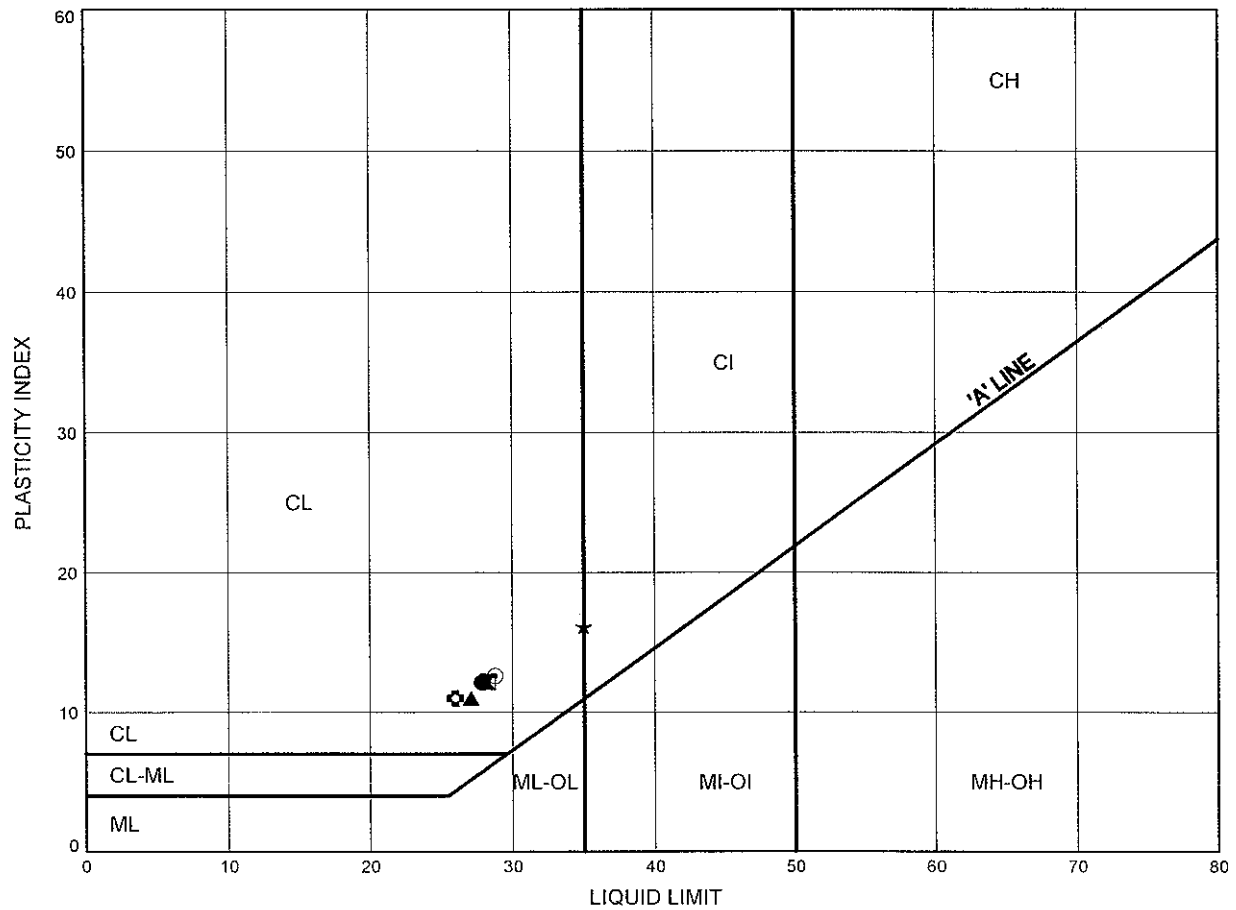
Chkd. MP



# ATTERBERG LIMITS TEST RESULTS

FIGURE B2-13

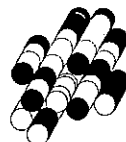
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+025Rt	6.3	177.3
⊠	S-EW 10+025Rt	9.3	174.3
▲	S-EW 10+025Rt	13.9	169.7
★	S-EW 10+050CL	3.2	180.2
⊙	S-EW 10+050CL	6.3	177.1
⊛	S-EW 10+050CL	9.3	174.1

Date July 2010

Project 1-09-4135



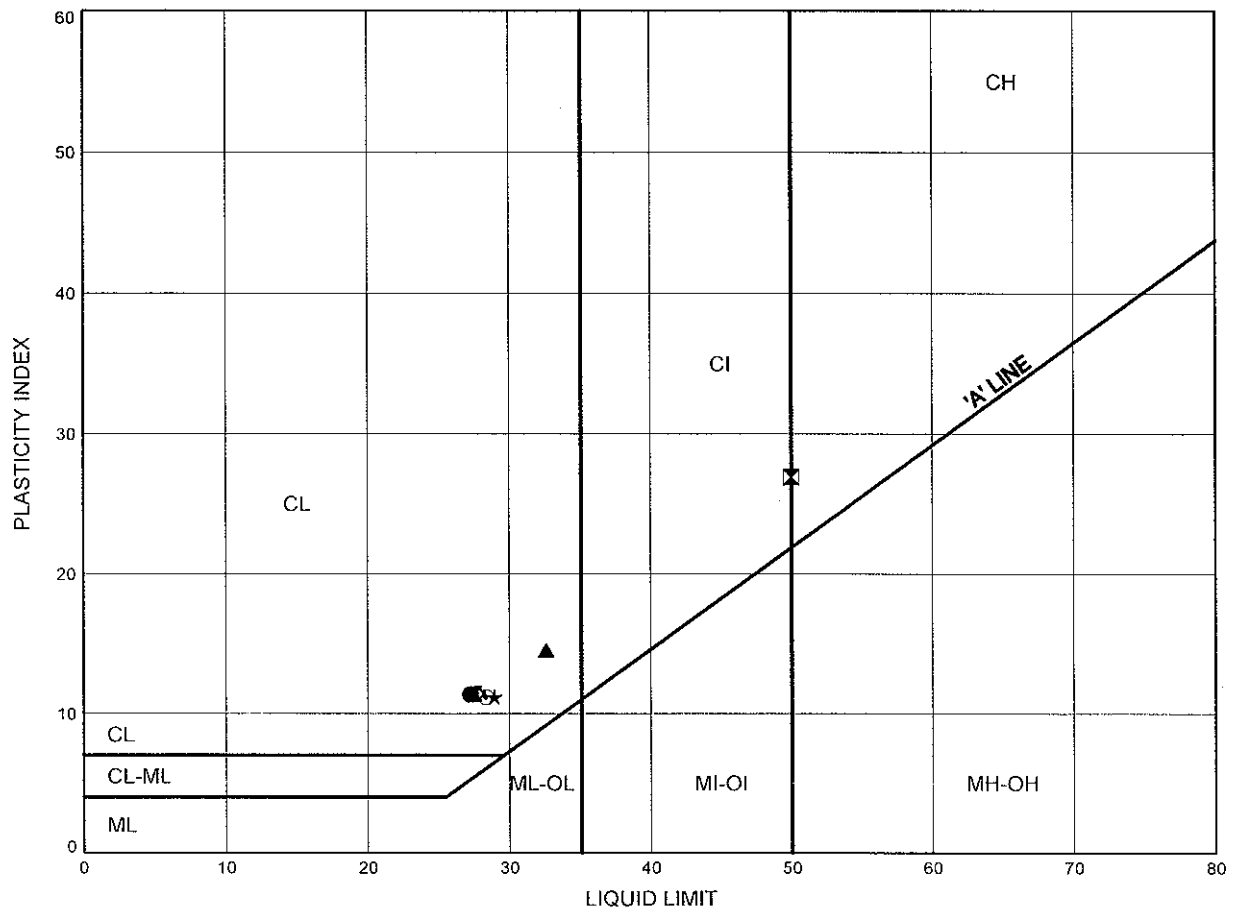
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

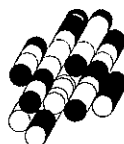
FIGURE B2-14

## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+050CL	10.9	172.5
⊠	TSEW1	1.7	181.8
▲	TSEW1	4.0	179.5
★	TSEW1	6.3	177.2
⊙	TSEW1	9.3	174.2
⊛	TSEW1	12.4	171.1

Date July 2010  
Project 1-09-4135

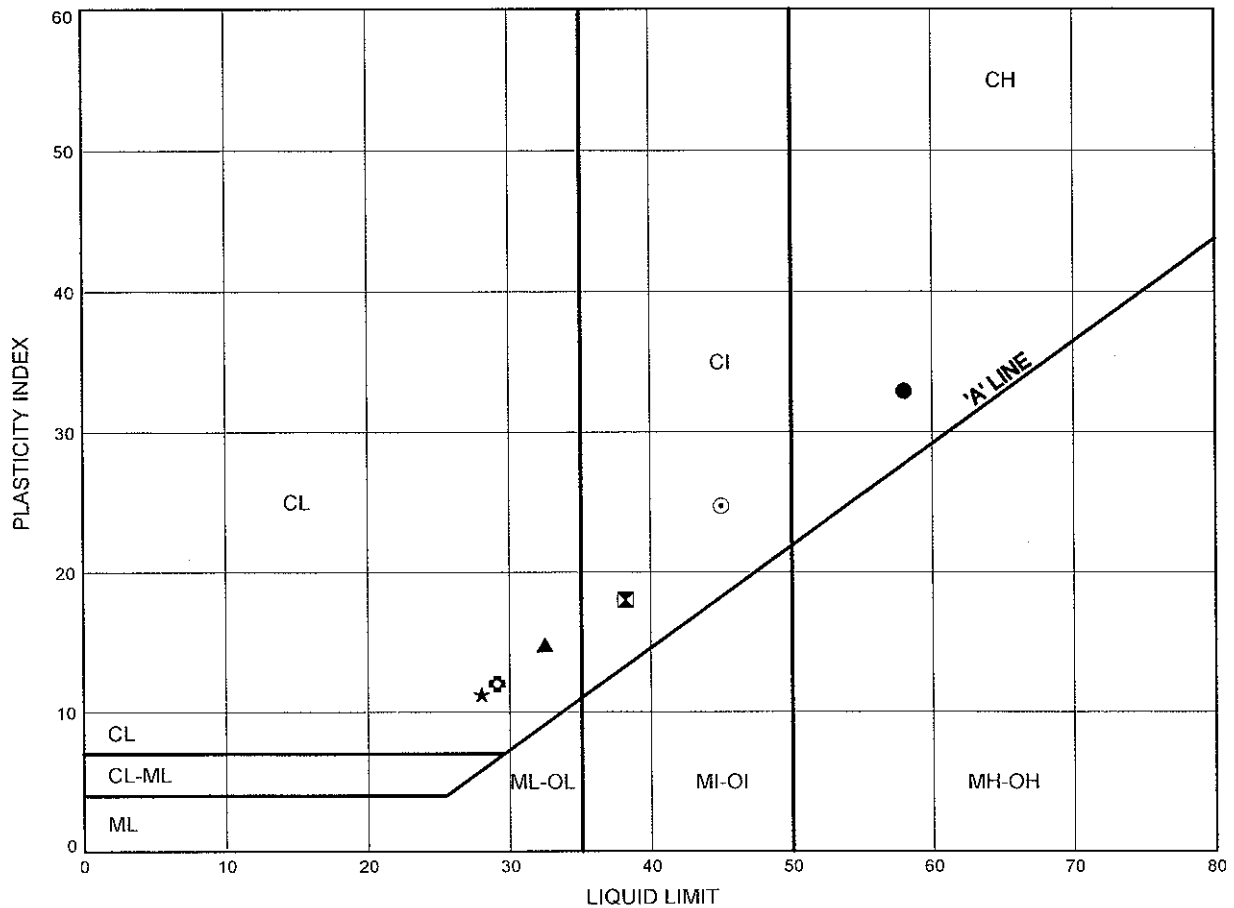


Prep'd DB  
Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

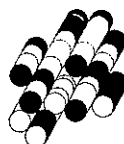
FIGURE B2-15

## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TSEW2	1.0	182.3
⊠	TSEW2	2.5	180.8
▲	TSEW2	5.5	177.8
★	TSEW2	9.3	174.0
⊙	TSEW3	3.2	180.1
⊛	TSEW3	4.7	178.6

Date July 2010  
Project 1-09-4135

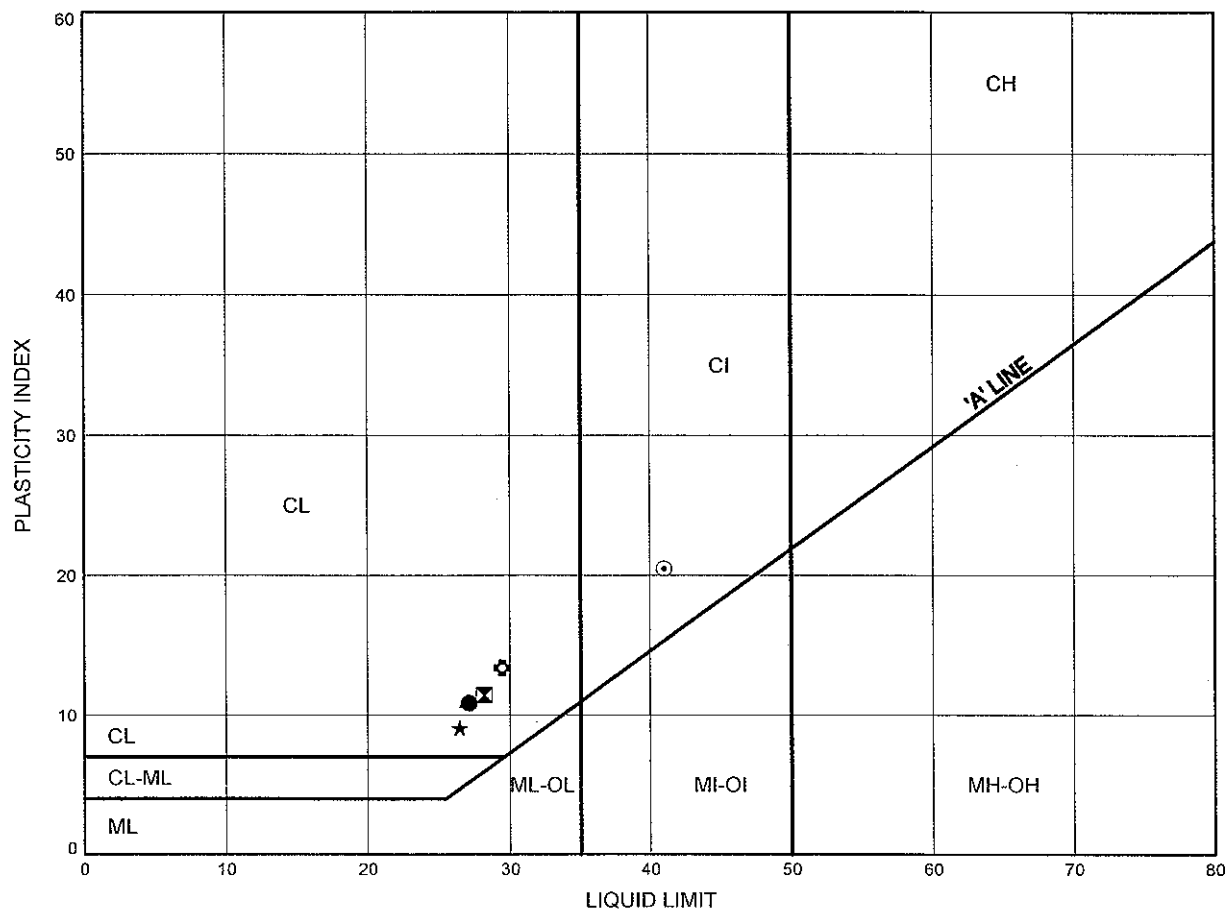


Prep'd DB  
Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B2-16

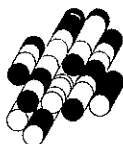
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TSEW3	9.3	174.0
⊠	TSEW3	10.9	172.4
▲	TSEW3	12.4	170.9
★	TSEW3	13.9	169.4
⊙	TSEW4	2.5	181.0
⊛	TSEW4	4.7	178.8

Date July 2010

Project 1-09-4135



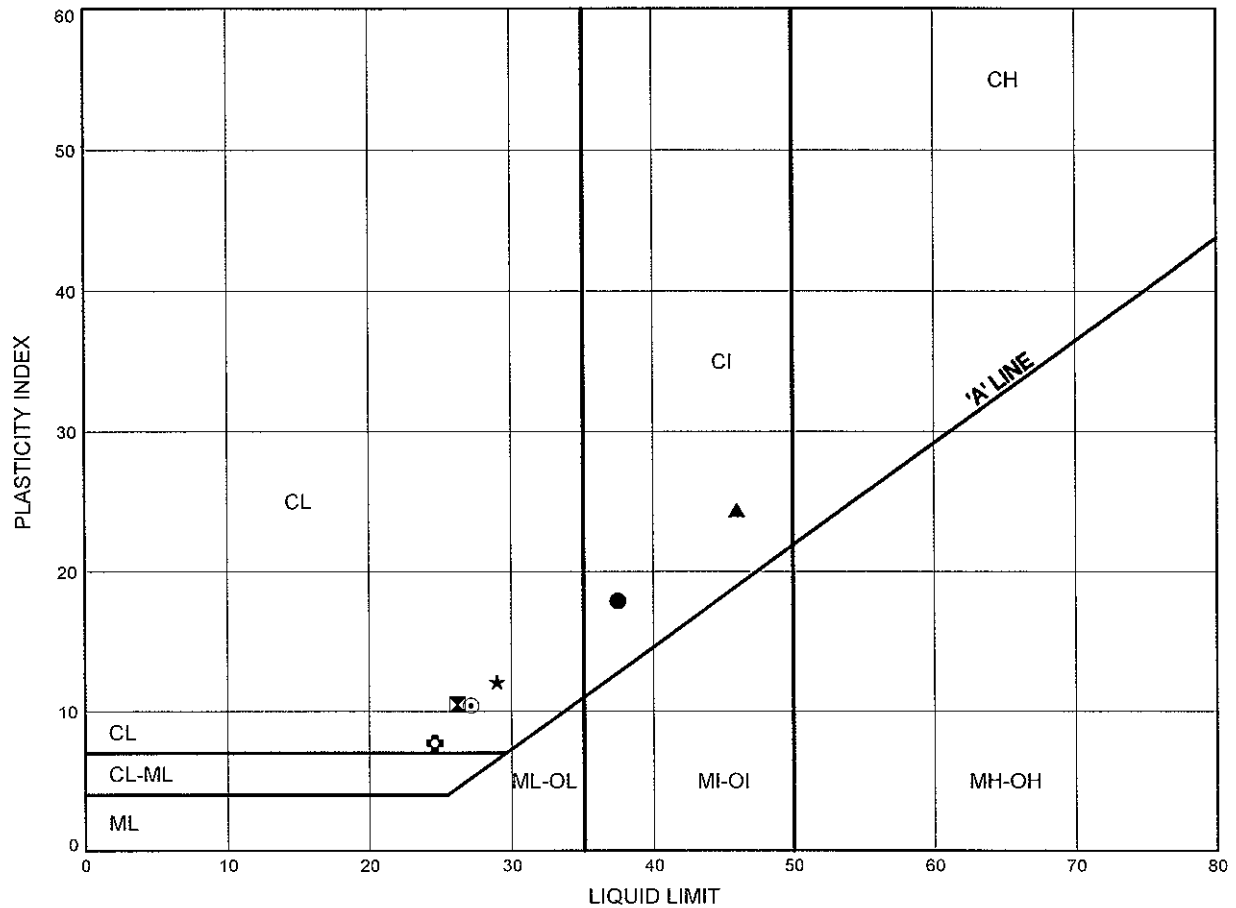
Prep'd DB

Chkd. MP

# 

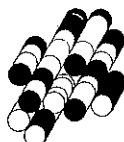
FIGURE B2-17

### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+110CL	1.7	180.7
⊠	S-EW 10+110CL	12.4	170.0
▲	S-EW 10+185Lt	1.0	181.4
★	TSEW4	7.8	175.7
⊙	TSEW4	9.3	174.2
⊕	TSEW4	12.4	171.1

Date July 2010  
Project 1-09-4135

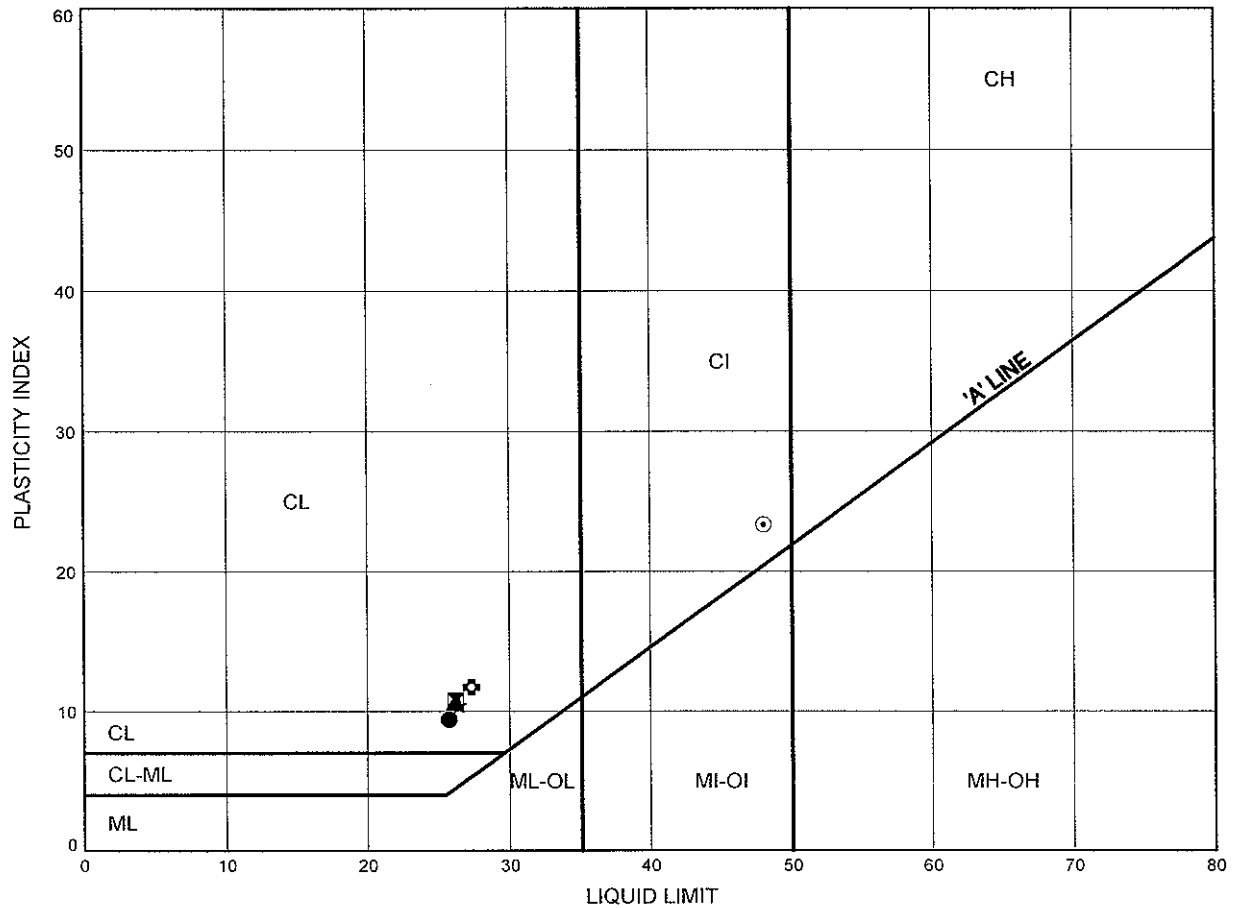


Prep'd DB  
Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B2-18

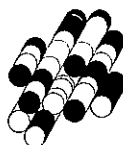
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+185Lt	2.5	179.9
⊠	S-EW 10+185Lt	4.7	177.7
▲	S-EW 10+185Lt	7.8	174.6
★	S-EW 10+185Lt	10.9	171.5
⊙	S-EW 10+185Rt	3.2	179.5
⊛	S-EW 10+185Rt	7.8	174.9

Date July 2010

Project 1-09-4135



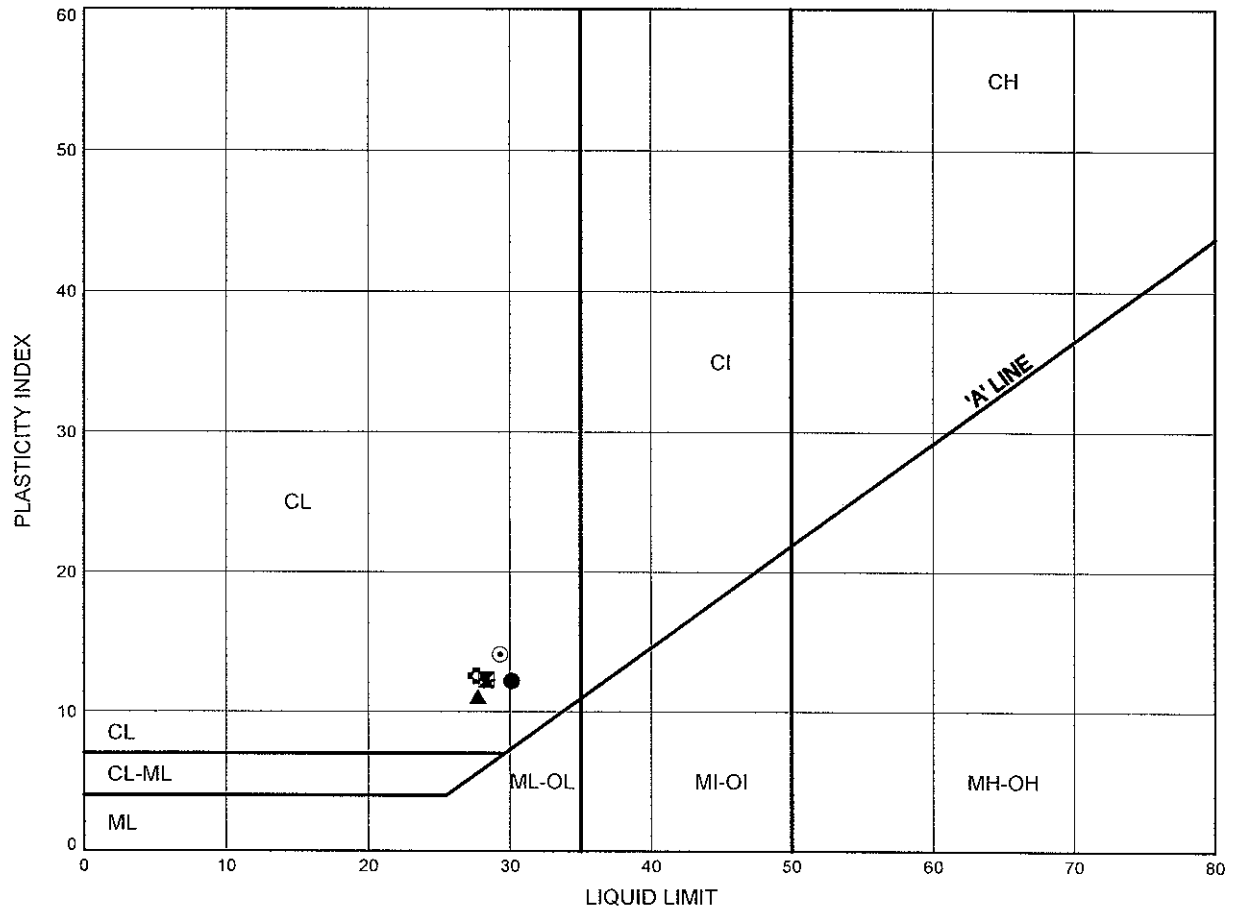
Prep'd DB

Chkd. MP

# 

FIGURE B2-19

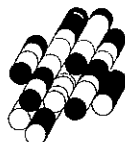
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+260CL	1.7	180.9
⊠	S-EW 10+260CL	4.7	177.9
▲	W-N 10+125CL	3.2	178.1
★	W-N 10+125CL	6.3	175.0
⊙	W-N 10+200 Lt	6.3	175.2
⊛	W-N 10+200 Lt	9.3	172.2

Date July 2010

Project 1-09-4135



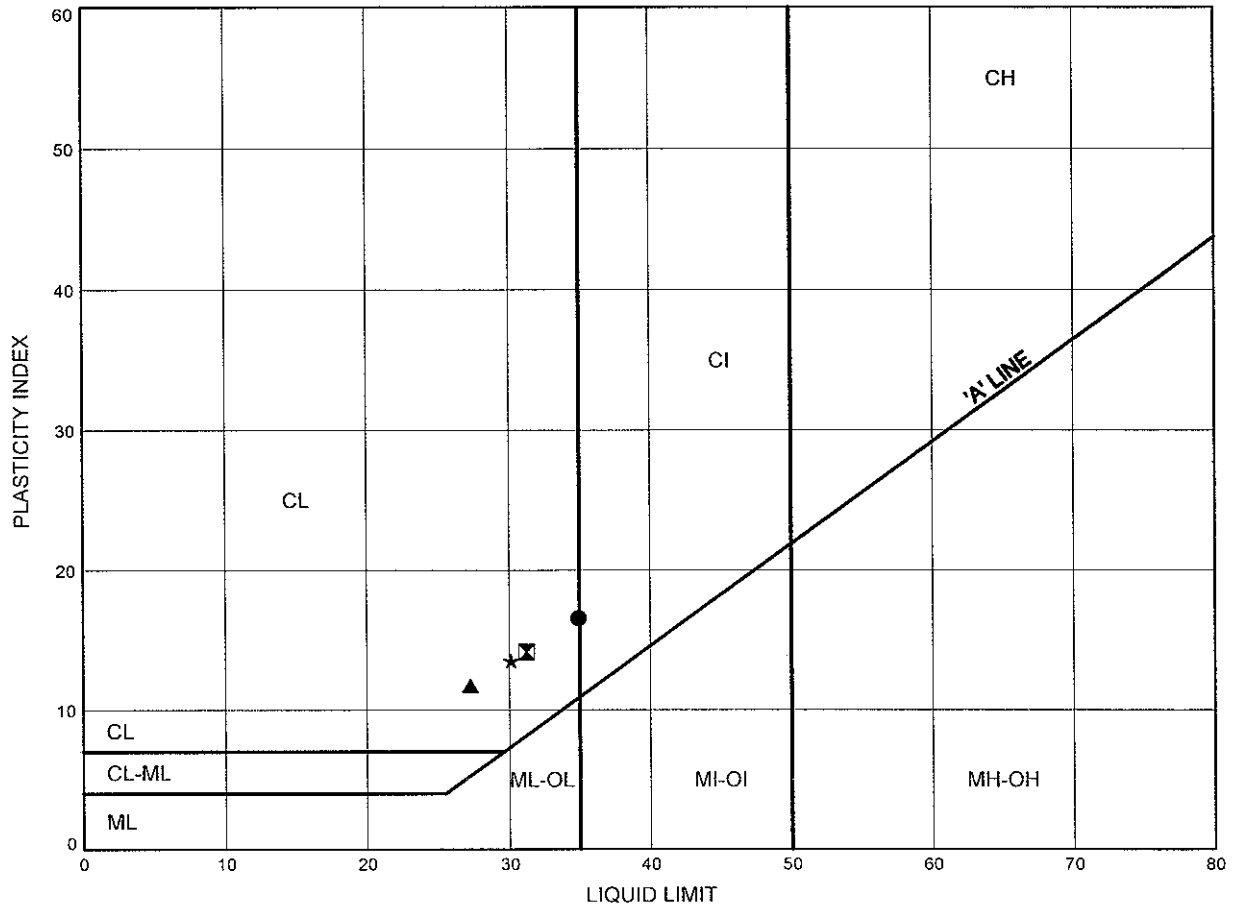
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

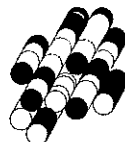
FIGURE B2-20

## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	W-N 10+200 Rt	1.7	179.8
⊠	W-N 10+200 Rt	3.2	178.3
▲	W-N 10+200 Rt	7.8	173.7
★	W-N 10+275 Rt	2.5	179.4

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Project 1-09-4135



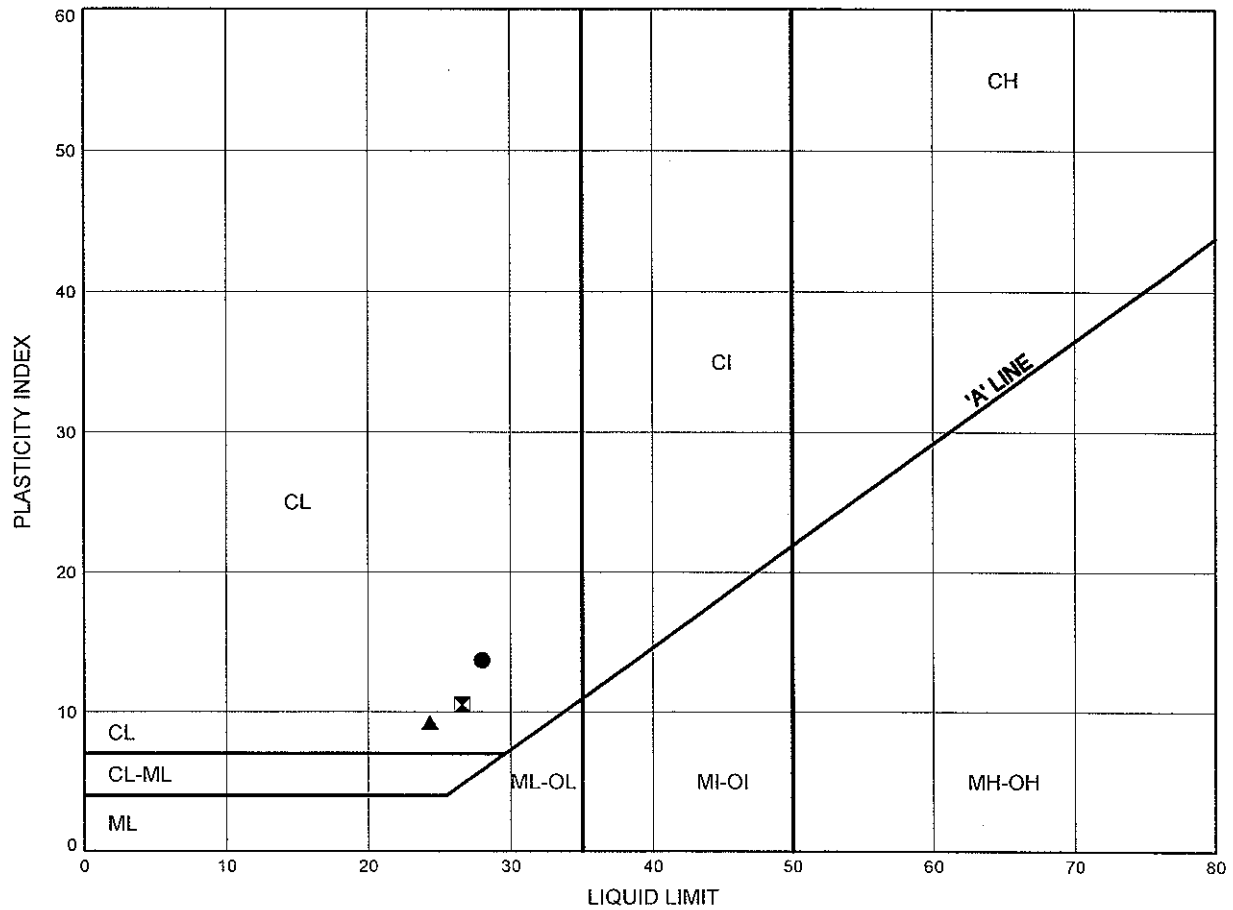
Prep'd DB  
Chkd. MP



# ATTERBERG LIMITS TEST RESULTS

FIGURE B2-21

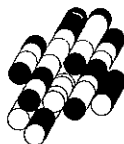
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	W-N 10+275 Rt	4.7	177.2
⊠	W-N 10+275 Rt	7.8	174.1
▲	W-N 10+275 Rt	10.9	171.0

Date July 2010

Project 1-09-4135



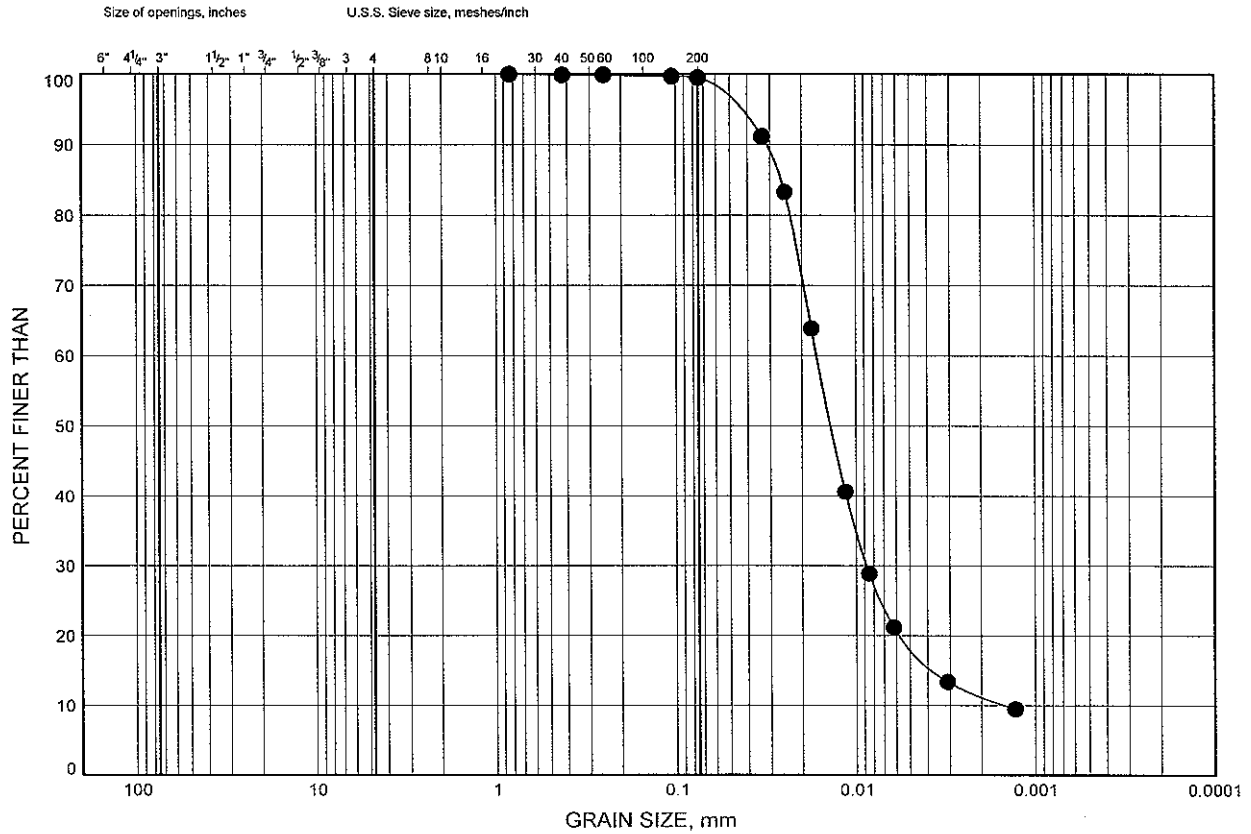
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-22

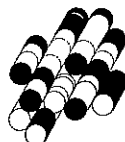
## SILT



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	W-N 10+200 Lt	2.5	179.0

Date July 2010  
Project 1-09-4135

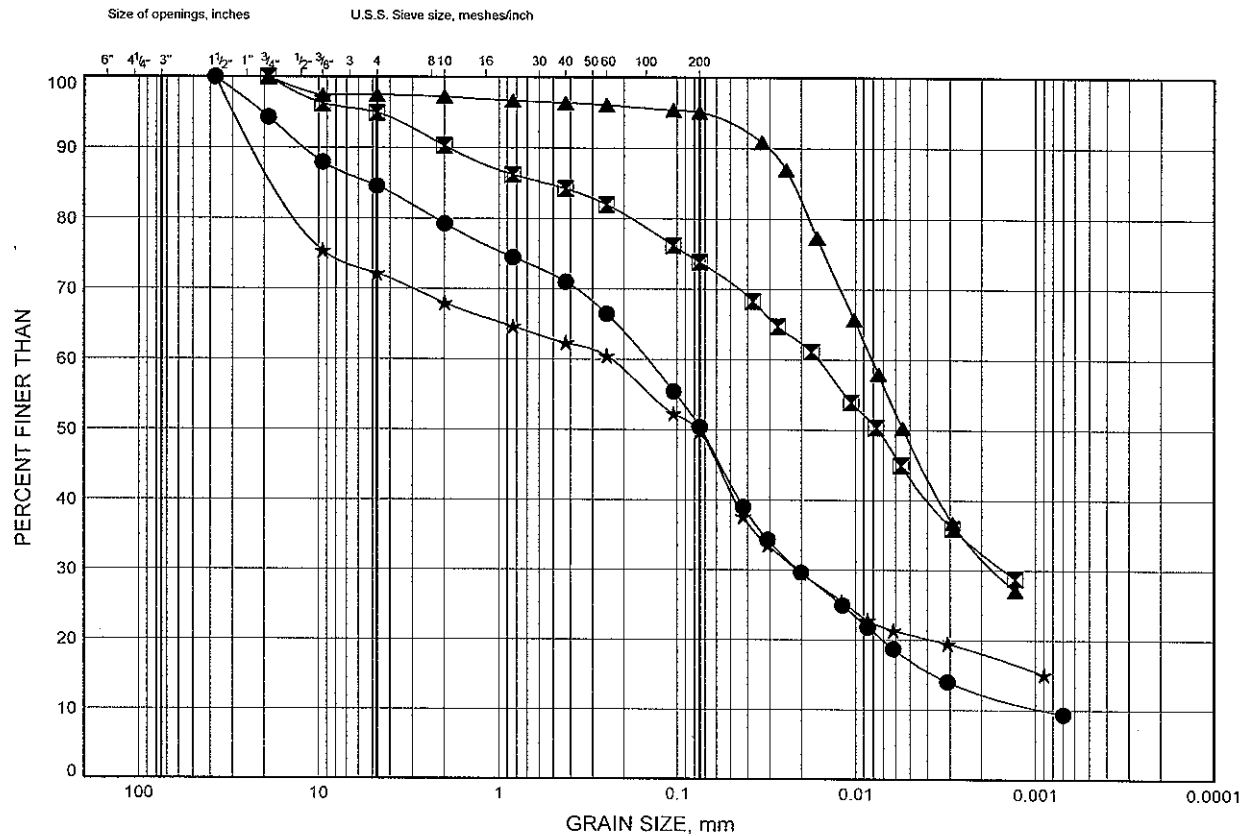


Prep'd DB  
Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-23

## SILTY CLAY TO CLAYEY SILT TILL



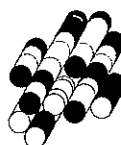
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	S-EW 10+025Rt	17.0	166.6
⊠	TSEW1	26.1	157.4
▲	TSEW2	26.1	157.2
★	TSEW3	26.1	157.2

Date July 2010

Project 1-09-4135



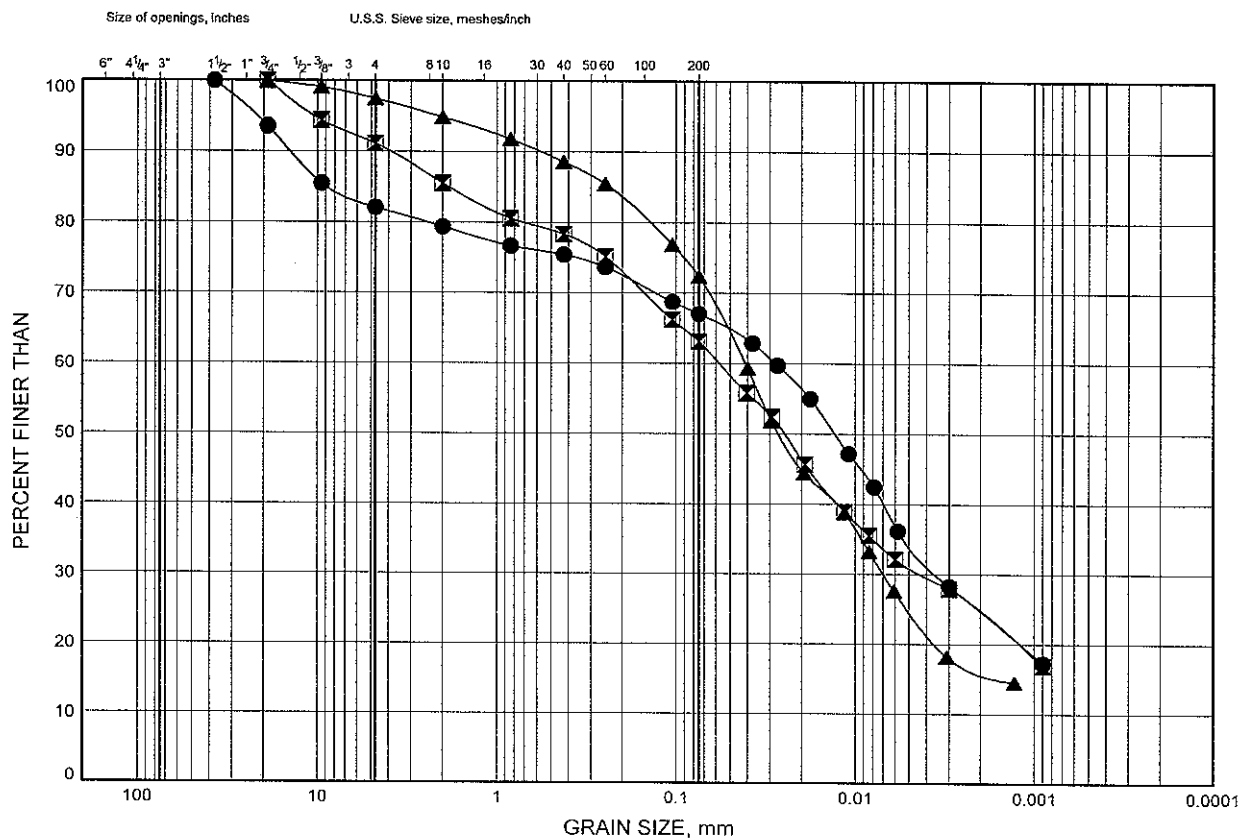
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-24

## SILTY CLAY TO CLAYEY SILT TILL



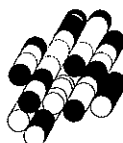
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	TSEW4	18.5	165.0
⊠	TSEW4	26.1	157.4
▲	W-N 10+275 Rt	13.9	168.0

Date July 2010

Project 1-09-4135



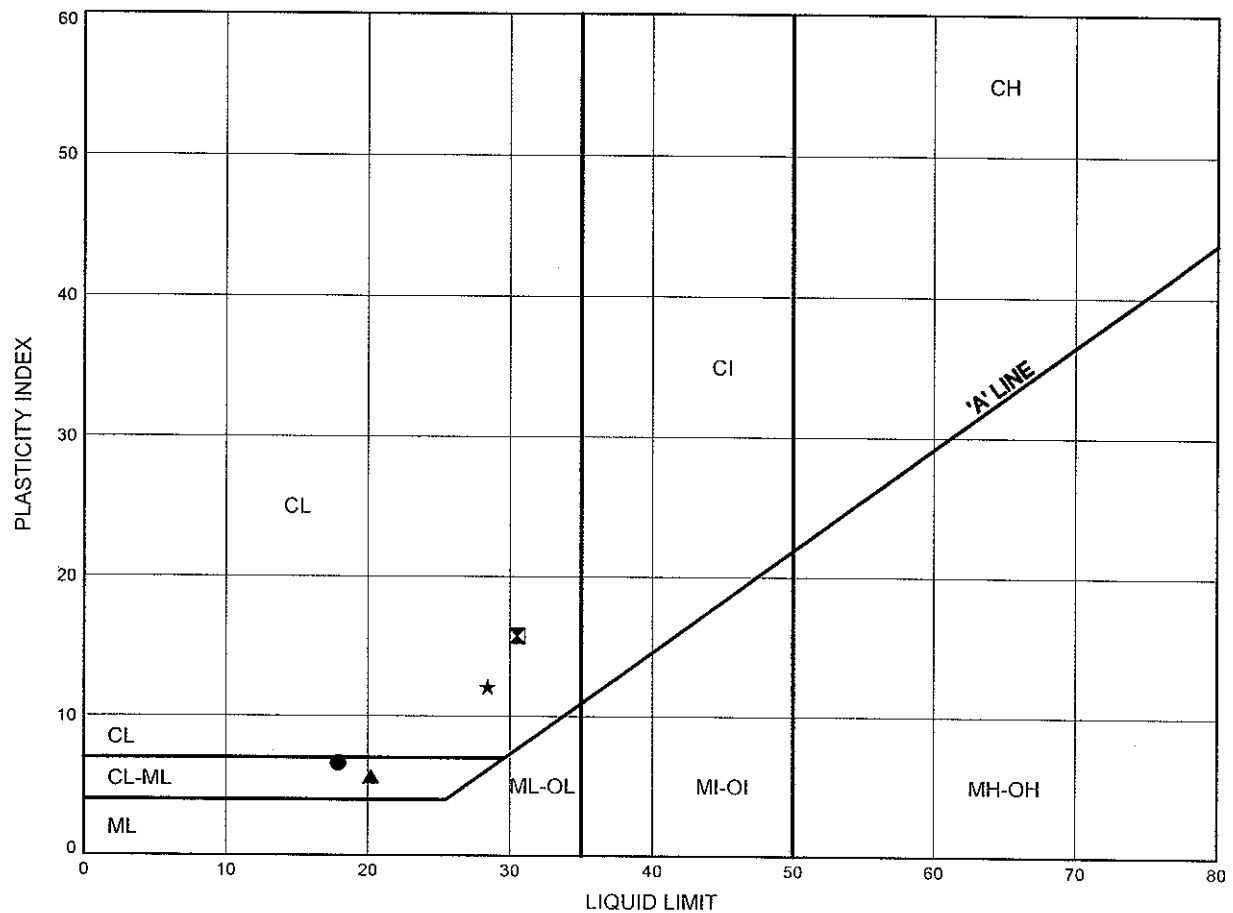
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B2-25

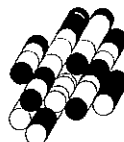
## SILTY CLAY TO CLAYEY SILT TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	S-EW 10+025Rt	17.0	166.6
⊠	TSEW1	26.1	157.4
▲	TSEW2	18.5	164.8
★	TSEW2	26.1	157.2

Date July 2010

Project 1-09-4135



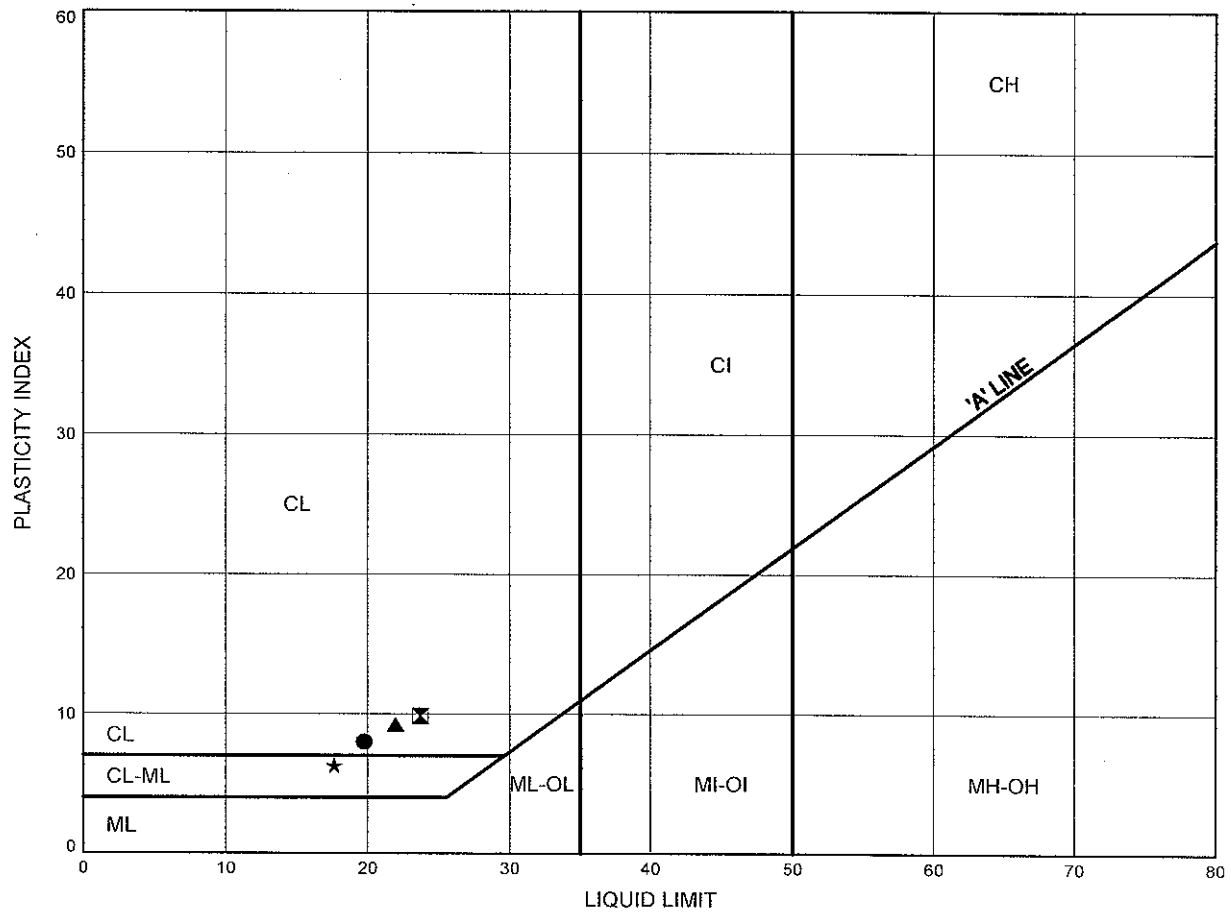
Prep'd DB

Chkd. MP

# 

FIGURE B2-26

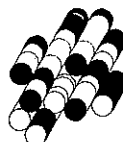
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TSEW3	26.1	157.2
⊠	TSEW4	18.5	165.0
▲	TSEW4	26.1	157.4
★	W-N 10+275 Rt	13.9	168.0

Date July 2010

Project 1-09-4135



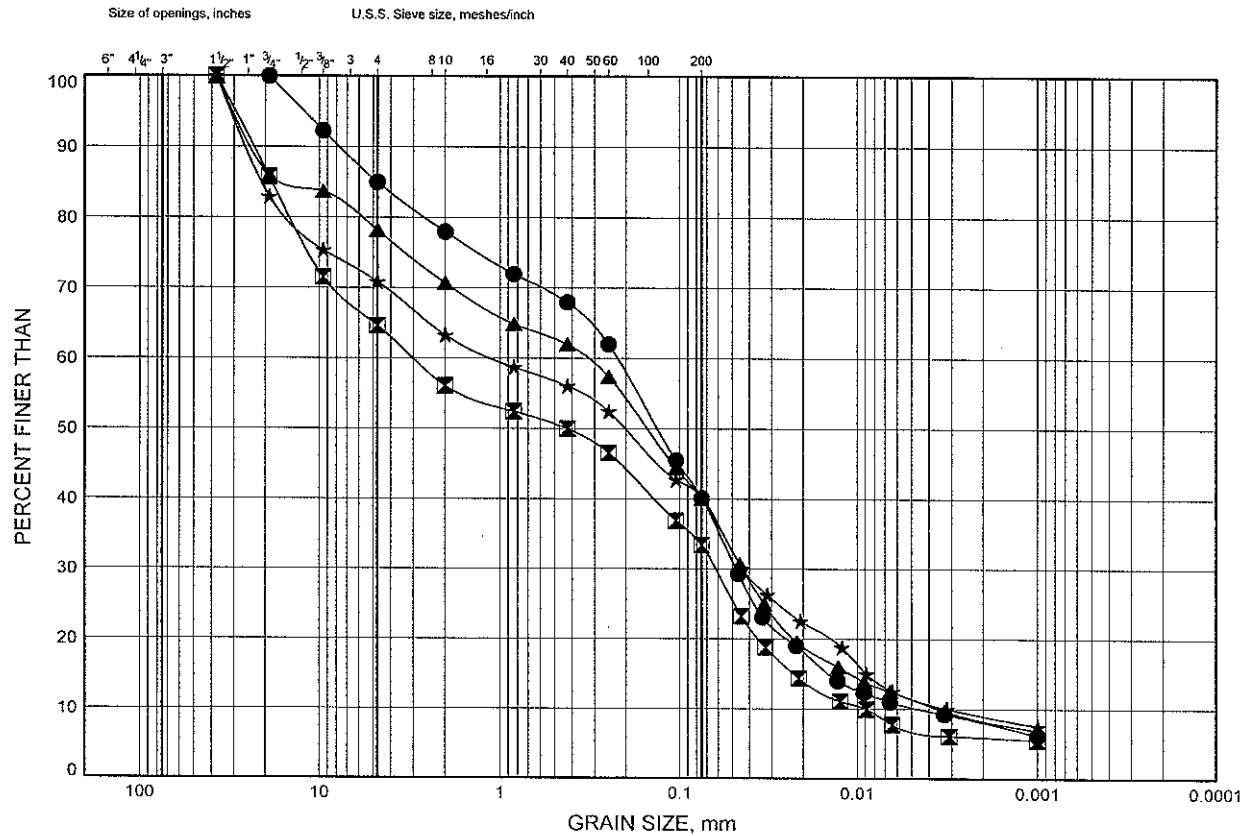
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-27

## SILTY SAND TILL

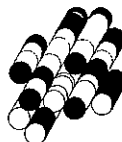


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TSEW3	20.0	163.3
⊠	TSEW3	23.1	160.2
▲	TSEW4	20.0	163.5
★	TSEW4	23.1	160.4

Date July 2010

Project 1-09-4135



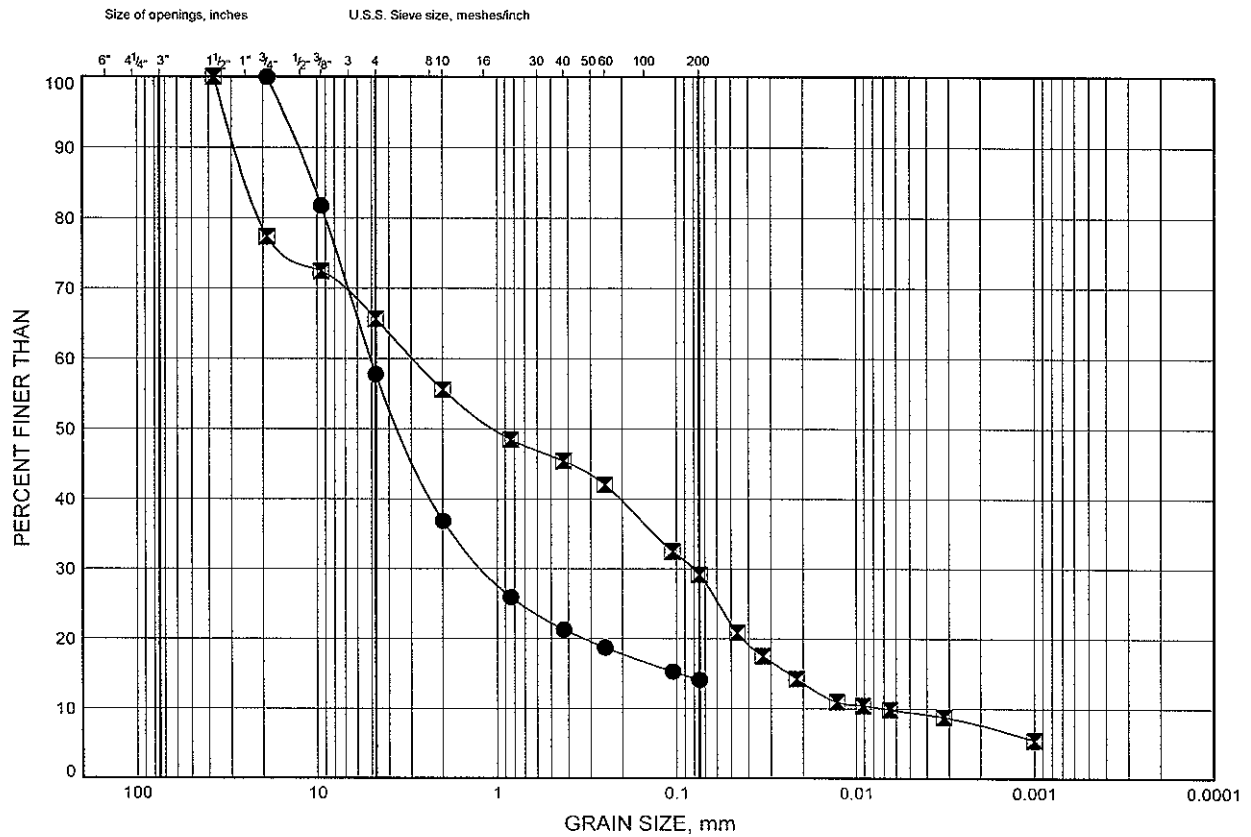
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B2-28

## SAND AND GRAVEL TILL

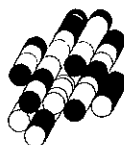


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TSEW1	29.2	154.3
✕	TSEW3	27.6	155.7

Date July 2010

Project 1-09-4135



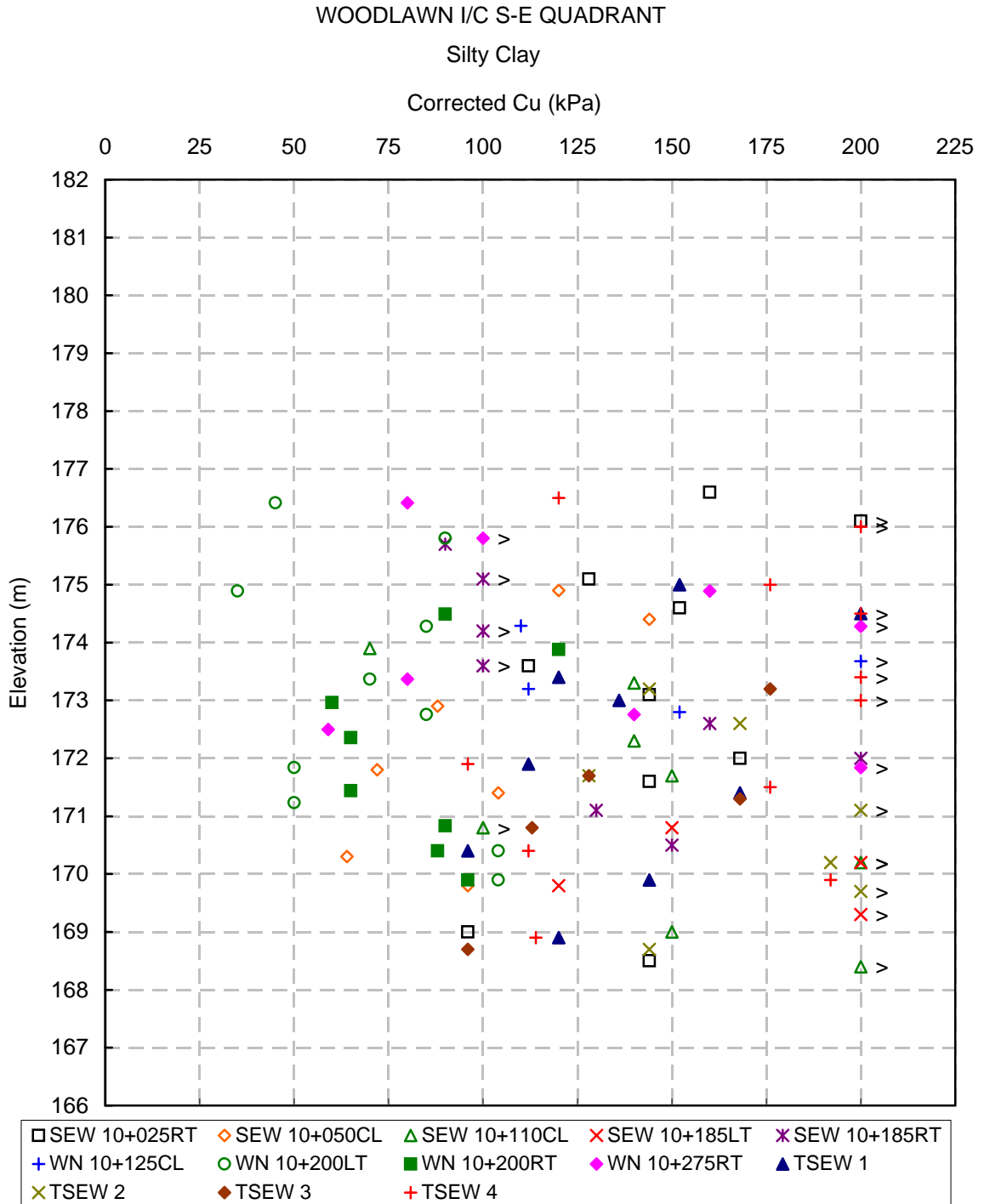
Prep'd DB

Chkd. MP



# CORRECTED UNDRAINED SHEAR STRENGTH

FIGURE B2-29



## Field Shear Vane Correction

## Applied Correction Factors

Morris & Williams (1994)

0.89 (Elev.>178m)

1.00 (Elev.<178m)

( $\mu = 1.18 \text{ EXP}(-0.08 \text{ Ip}) + 0.57$ )

Project No. : 1-09-4135

Date : September, 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA

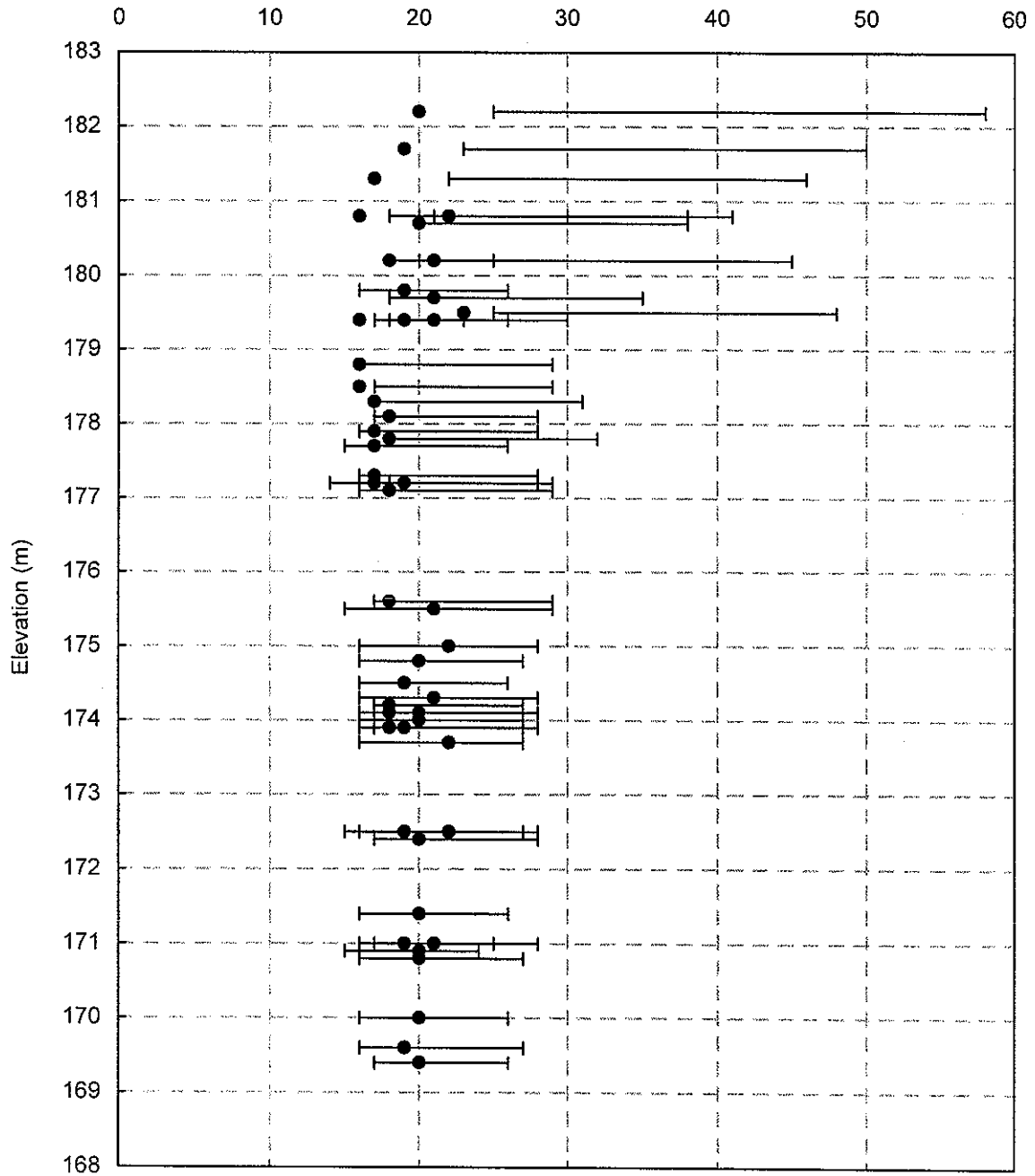
# ATTERBERG LIMITS AND WATER CONTENTS

FIGURE B2-30

## HWY 406 TWINNING - WOODLAWN I/C S-E QUADRANT

Silty Clay

Atterberg Limits & Water Contents (%)



Project No. : 1-09-4135

Date : June, 2010



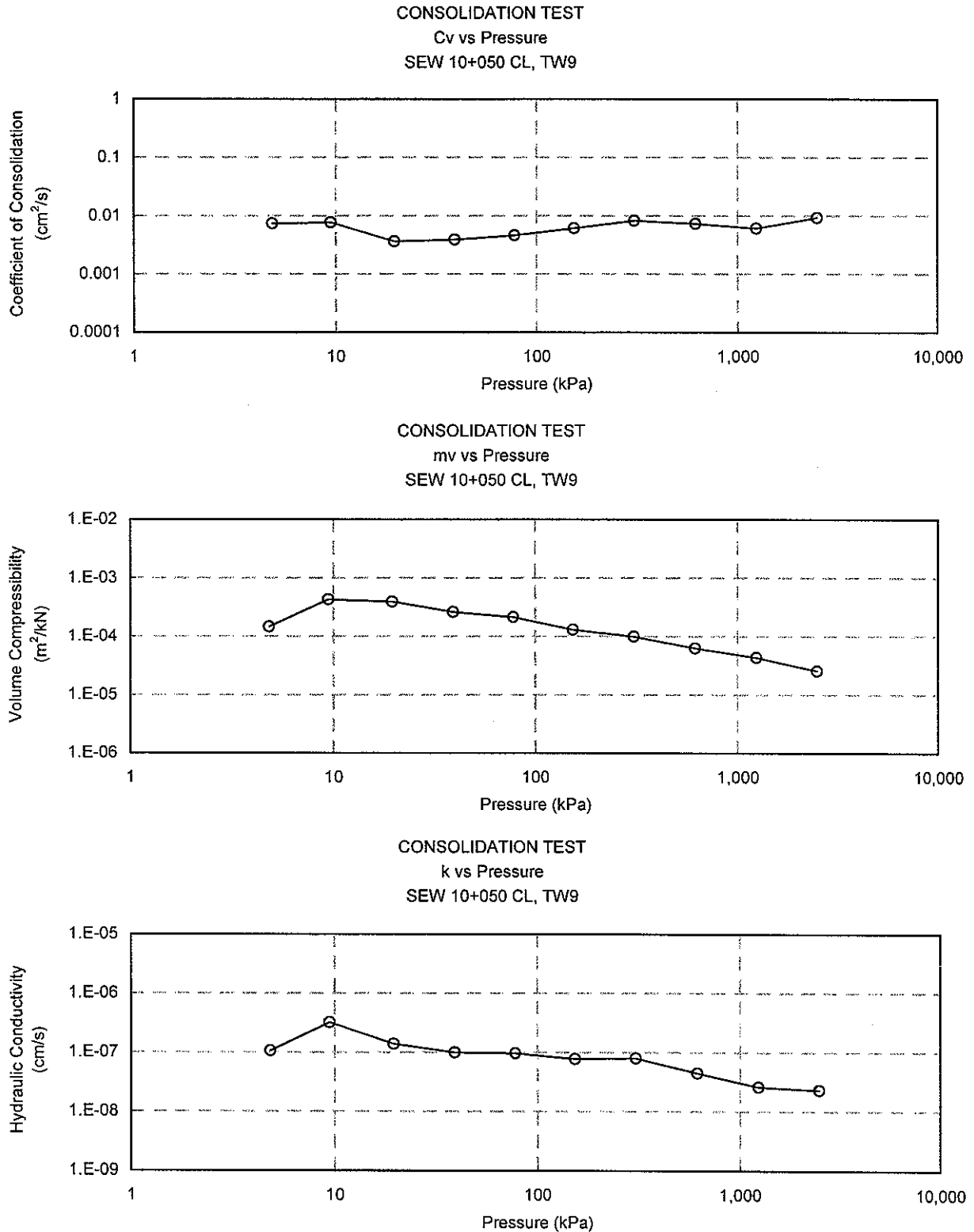
Terraprobe Inc.

Prepared By : HW

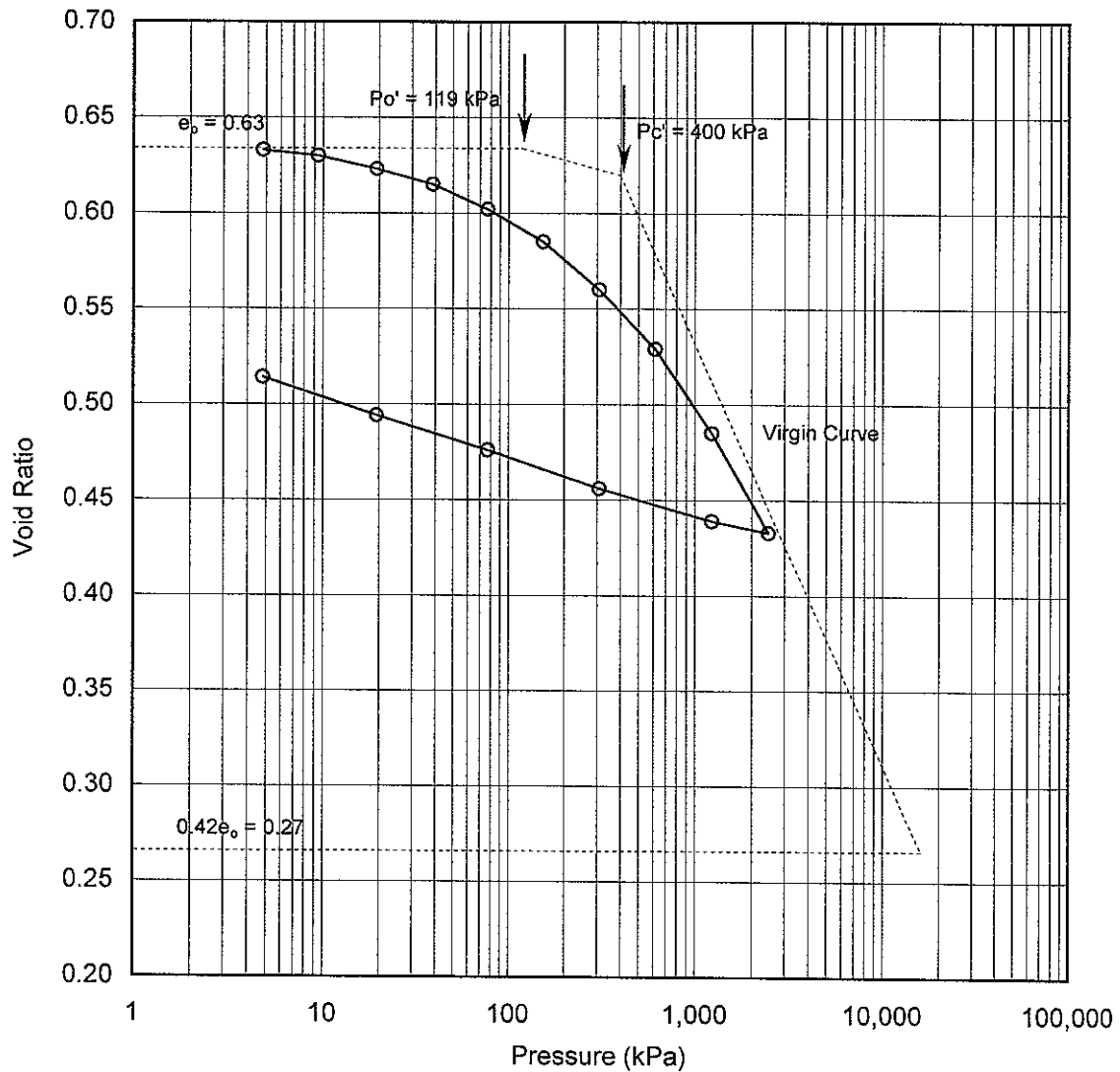
Checked By : RA

C:\Documents and Settings\Hongliu\My Documents\Project 2009\1-09-4135 - HWY 406 Foundations\High Fill\Woodlawn S-E Quadrant\SEW Ramp\1-09-4135 Consolidation Results-SEW.xls

C:\Documents and Settings\Hongjiu\My Documents\Project 2009\1-09-4135 - HWY 406 Foundations\High Fill\Woodlawn S-E Quadrant\SEW Ramp\1-09-4135 Consolidation Results-SEW.xls



CONSOLIDATION TEST  
e vs Pressure  
SEW 10+050 CL, TW9



Soil Type : Silty Clay

$e_0 =$	0.63	$\omega_L =$	27%	$P_{o'} =$	119 kPa
$\omega =$	22%	$\omega_P =$	16%	$P_{c'} =$	400 kPa
$\gamma =$	20.4 kN/m <sup>3</sup>	PI =	11%	Cc =	0.221
Gs =	2.78			Cr =	0.027

Project No. : 1-09-4135  
Date : June 2010



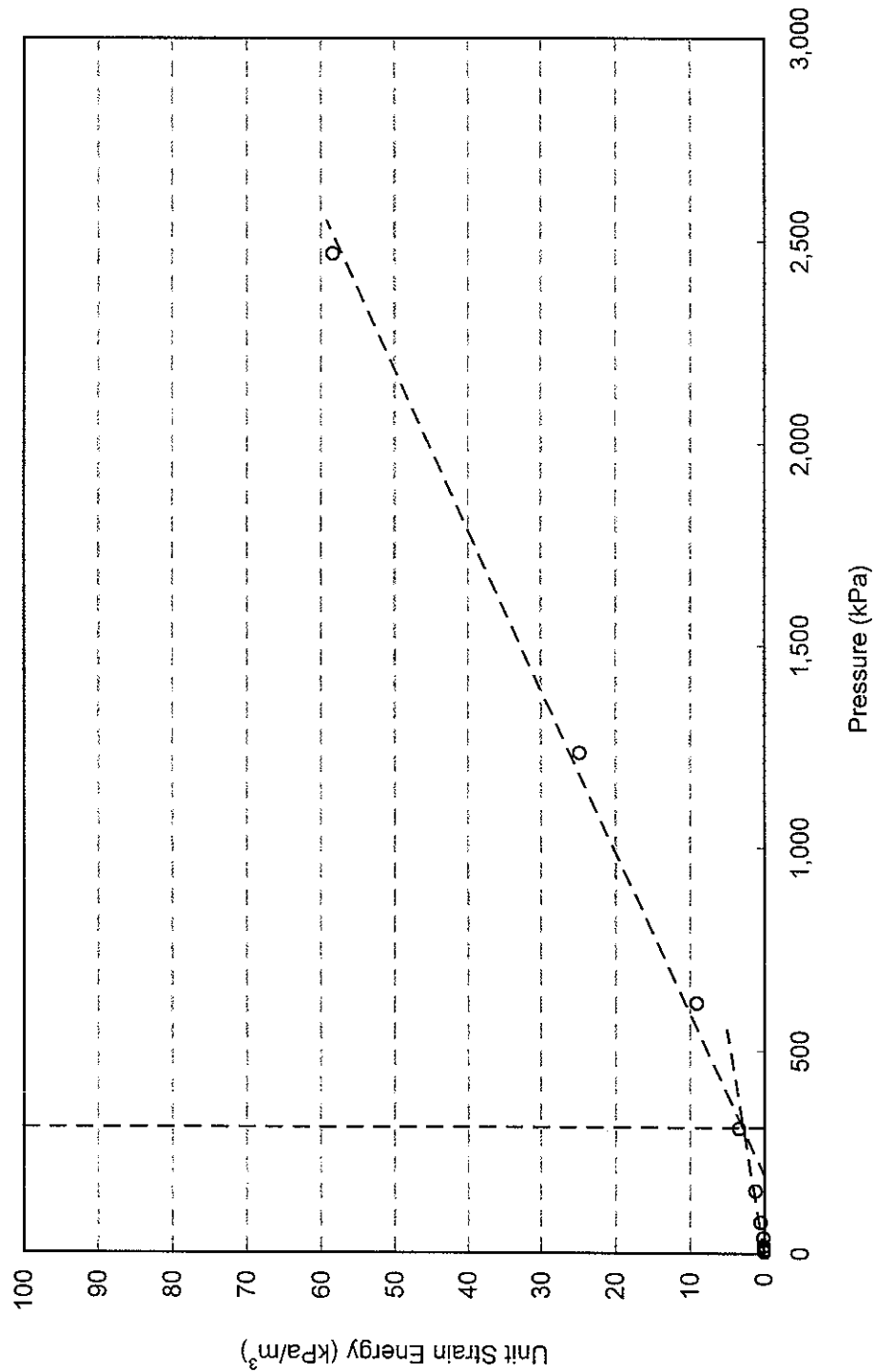
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

# HWY 406 TWINNING - WOODLAWN S-EW RAMP

FIGURE B2-33

## CONSOLIDATION TEST Unit Strain Energy vs Pressure SEW 10+050 CL, TW9



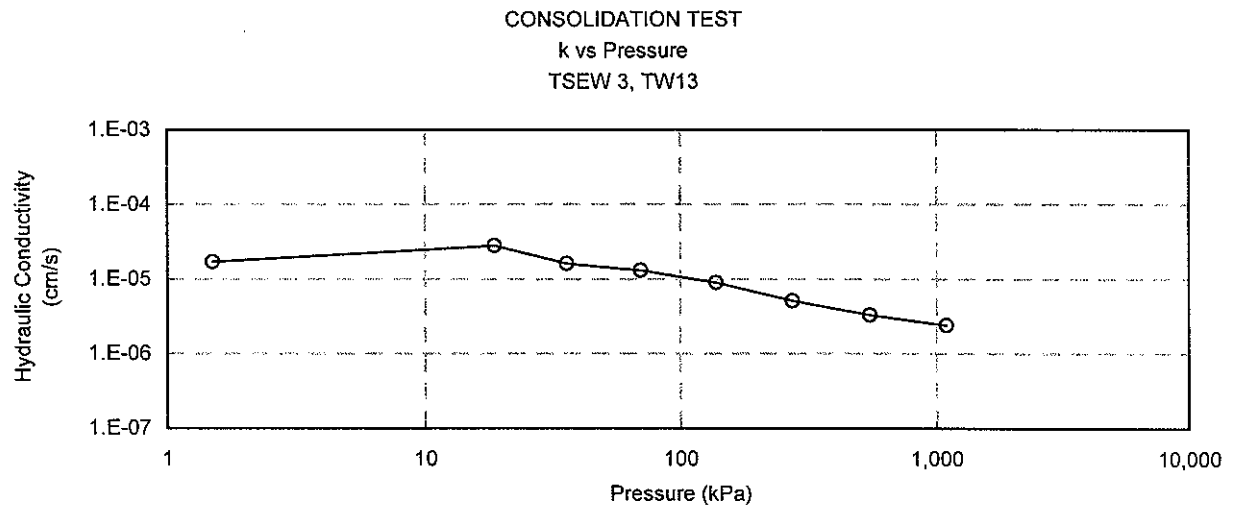
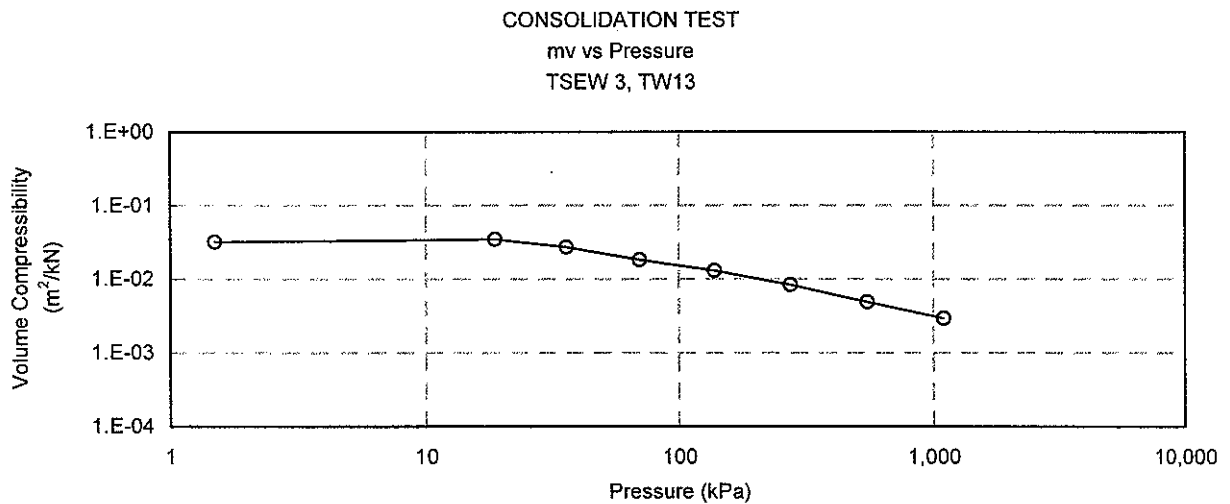
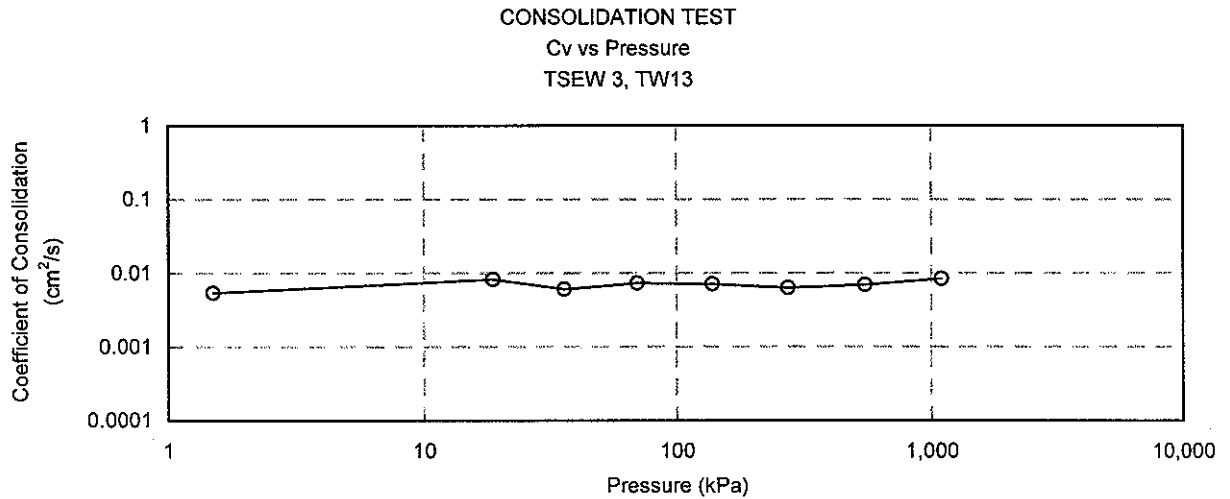
Pc = 310 kPa

Project No. : 1-09-4135  
Date : June 2010

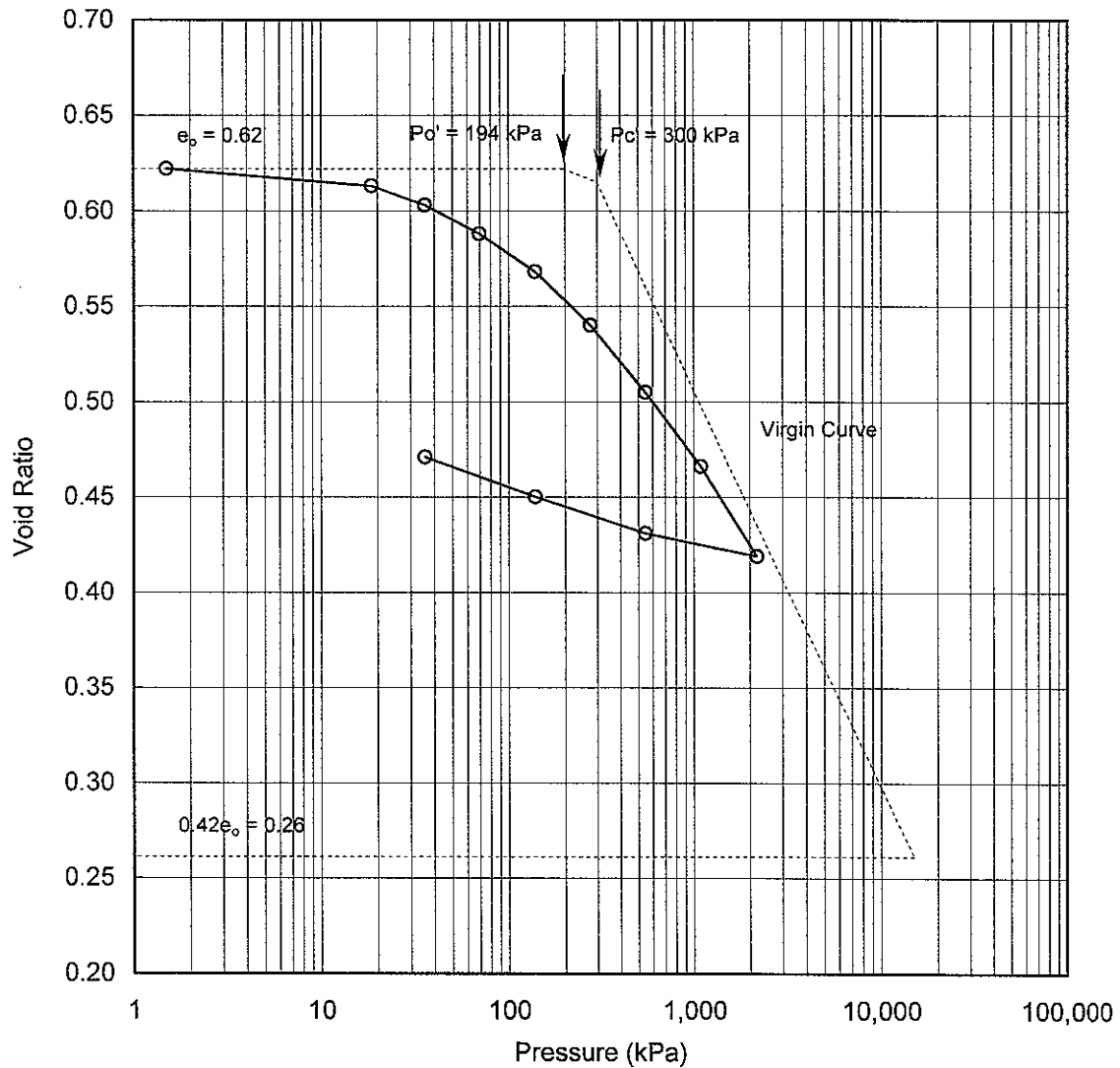


**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA



CONSOLIDATION TEST  
e vs Pressure  
TSEW 3, TW13



Soil Type : Silty Clay

$e_0 =$	0.62	$\omega_L =$	27%	$P_{o'} =$	194 kPa
$\omega =$	20%	$\omega_p =$	16%	$P_{c'} =$	300 kPa
$\gamma =$	20.8 kN/m <sup>3</sup>	PI =	10%	Cc =	0.208
Gs =	2.75			Cr =	0.037

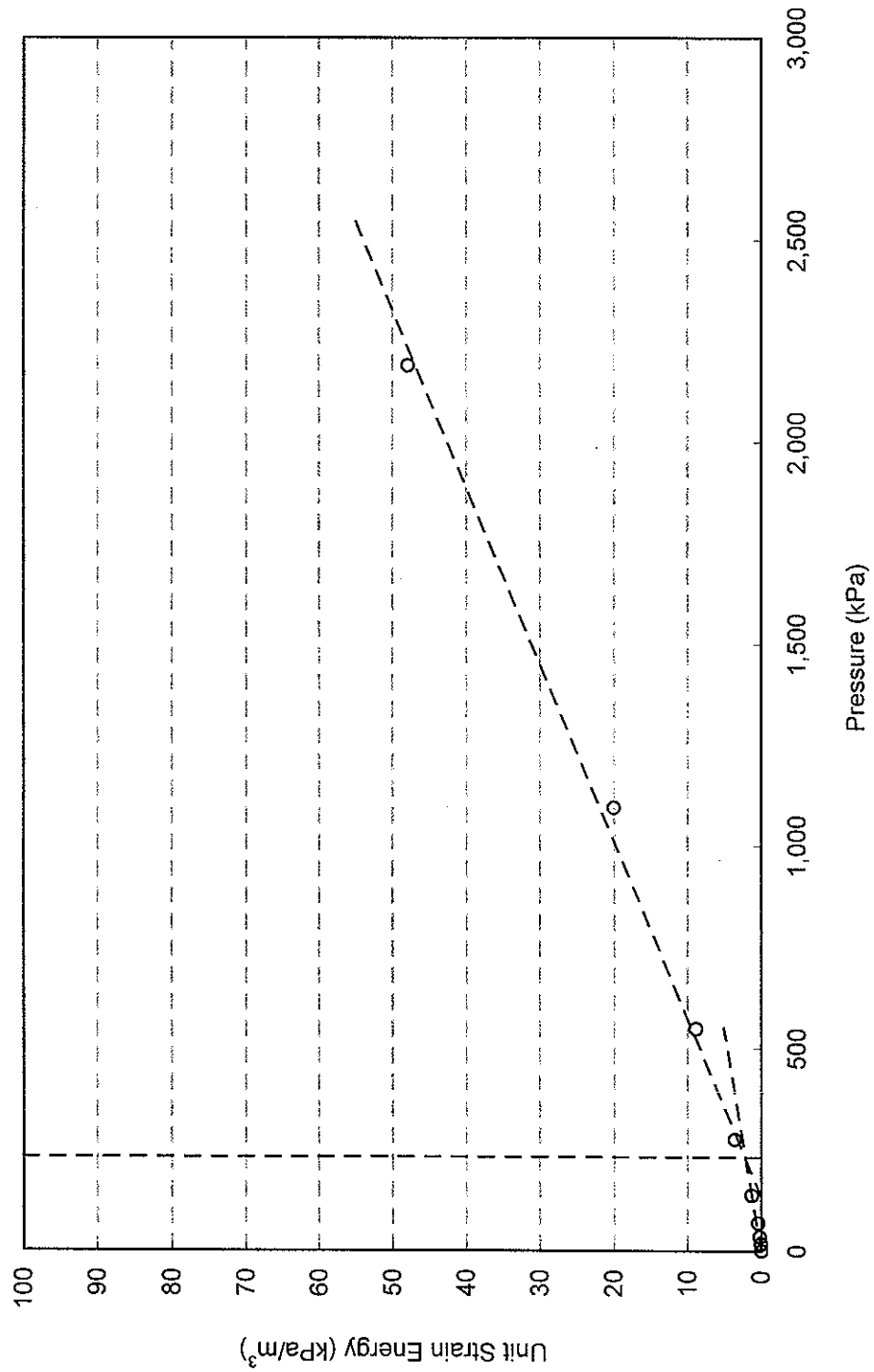
Project No. : 1-09-4135  
Date : June 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

CONSOLIDATION TEST  
Unit Strain Energy vs Pressure  
TSEW 3, TW13



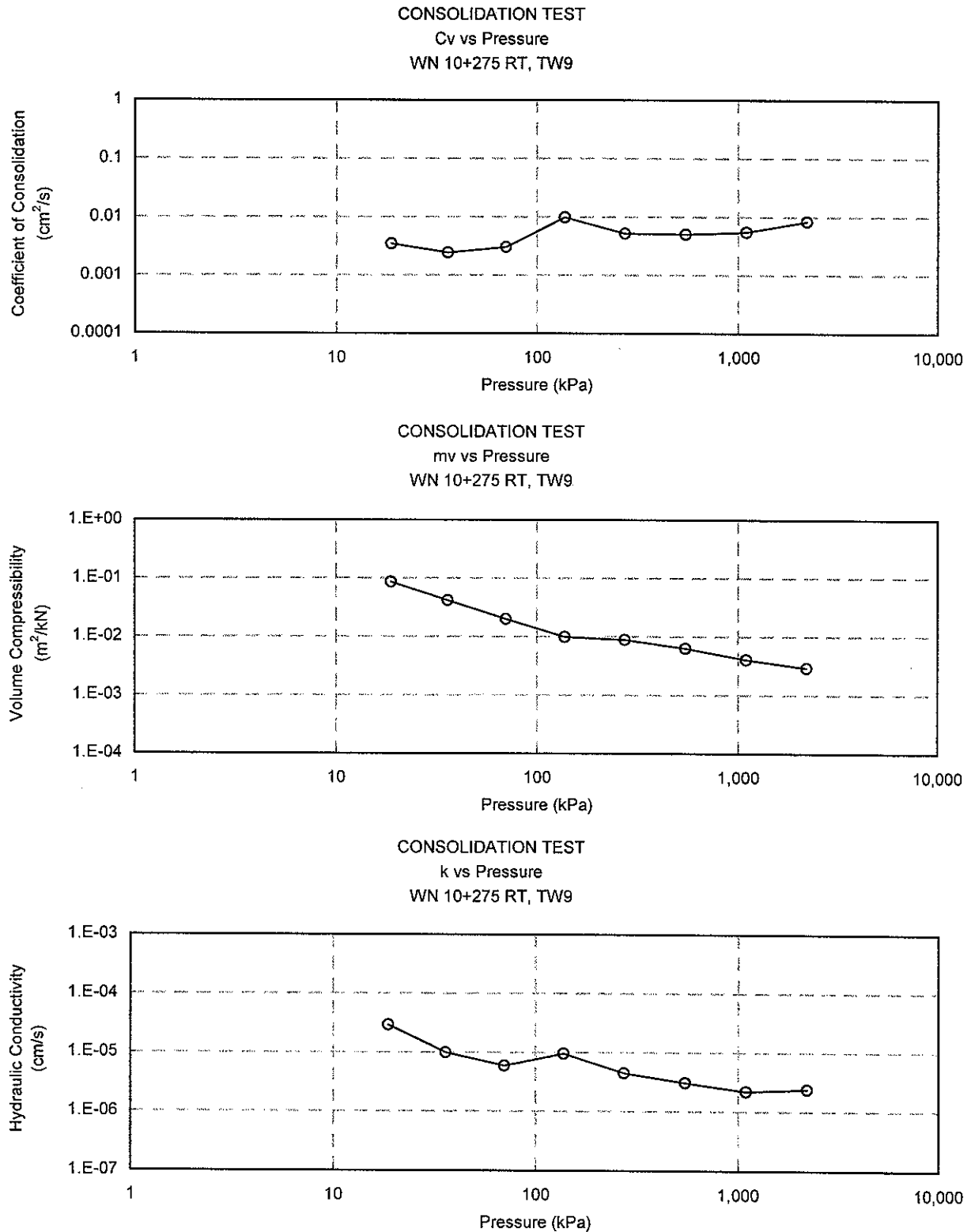
Project No. : 1-09-4135  
Date : June 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA





Project No. : 1-09-4135  
Date : July 2010



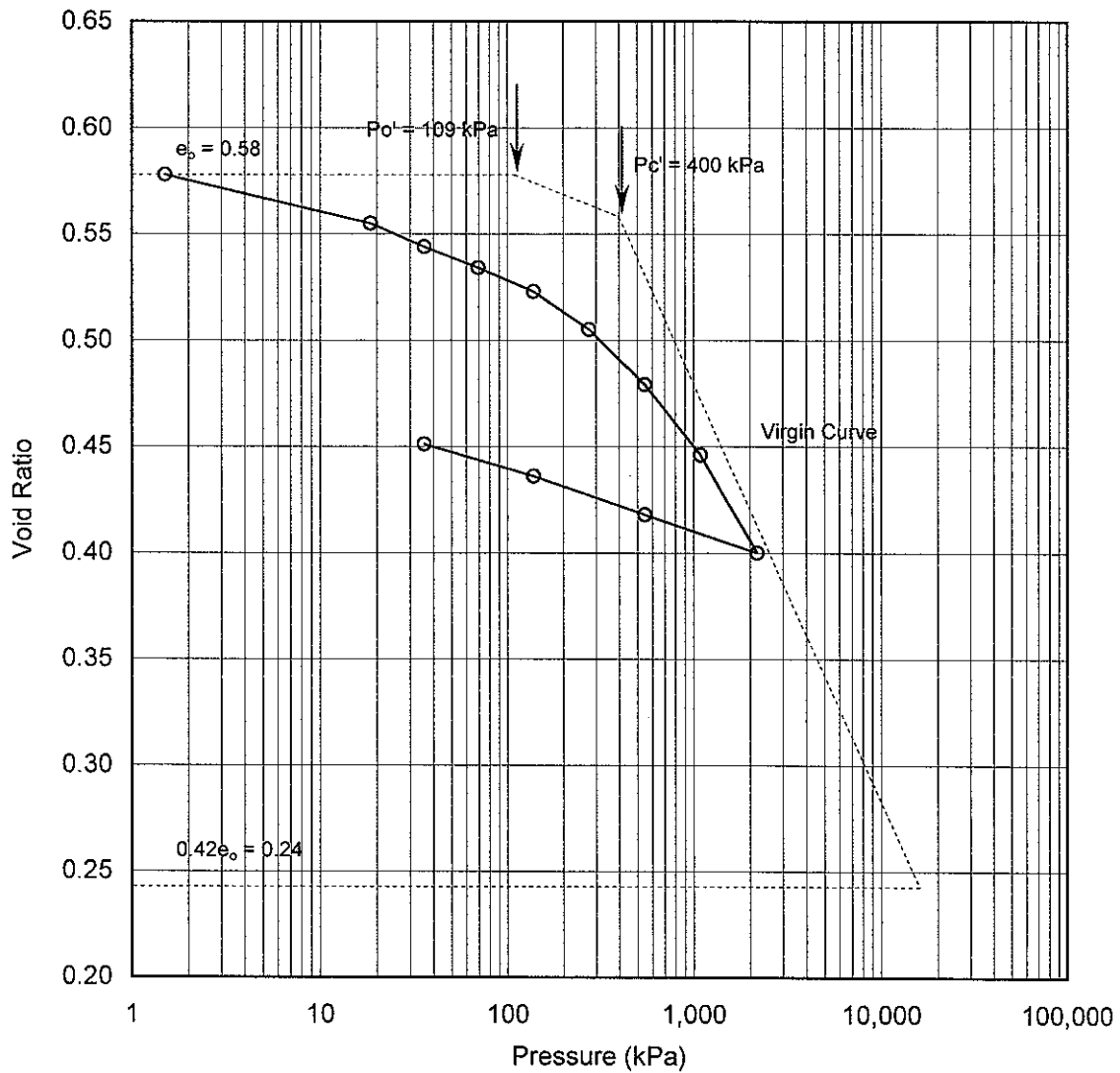
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

## CONSOLIDATION TEST

e vs Pressure

WN 10+275 RT, TW9



Soil Type : Silty Clay

$e_o =$	0.58	$\omega_L =$	29%	$P_o' =$	108 kPa
$\omega =$	21%	$\omega_P =$	18%	$P_c' =$	400 kPa
$\gamma =$	20.6 kN/m <sup>3</sup>	PI =	12%	Cc =	0.197
Gs =	2.74			Cr =	0.035

Project No. : 1-09-4135  
Date : July 2010



Terraprobe Inc.

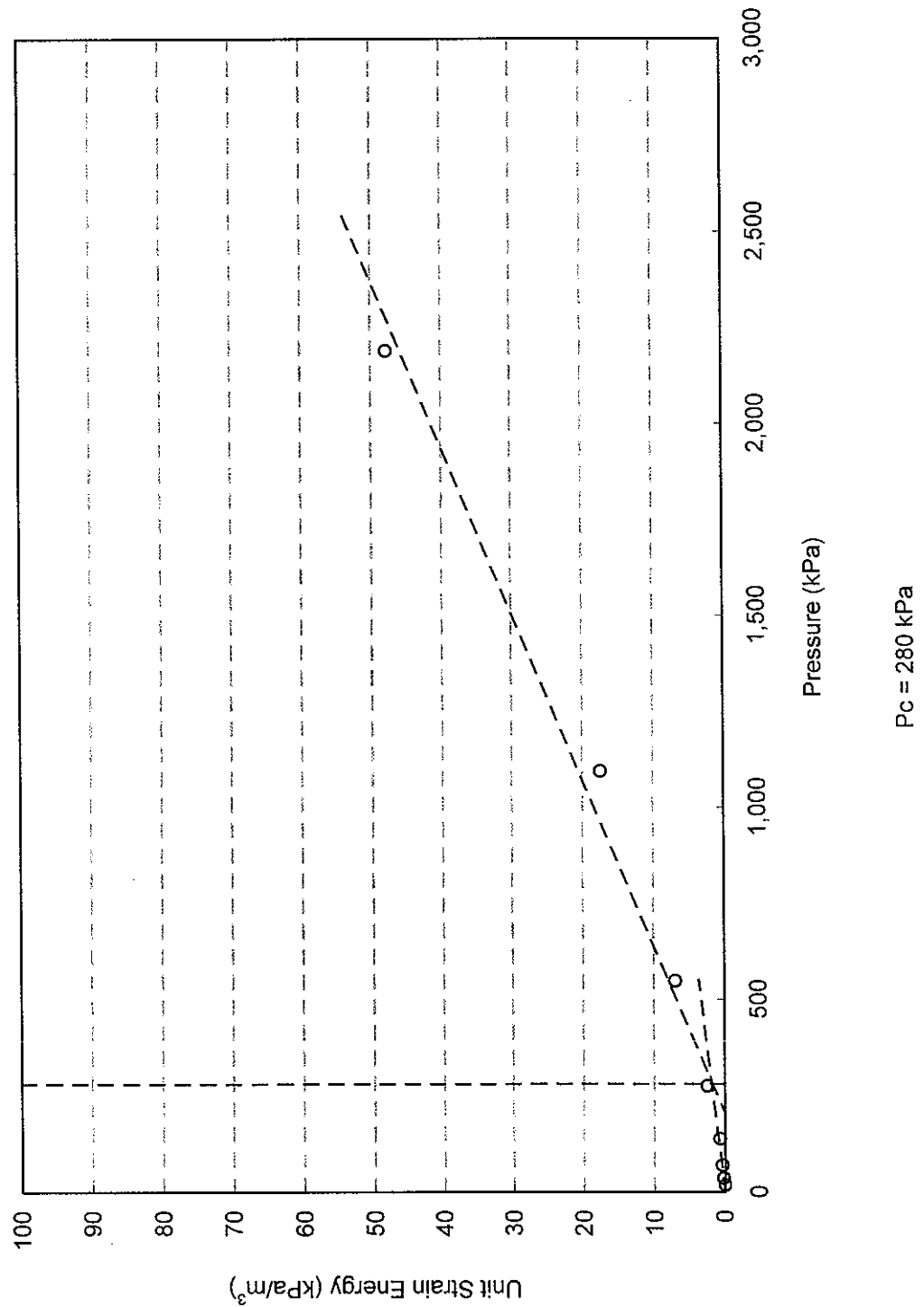
Prepared By : HW  
Checked By : RA

C:\Documents and Settings\Hong\My Documents\Project 2009\1-09-4135 - HWY 406 Foundations\High Fill\Woodlawn S-E Quadrant\WN Ramp\1-09-4135 Consolidation Results-WN.xls

# HWY 406 TWINNING - WOODLAWN W-N RAMP

FIGURE B2-39

## CONSOLIDATION TEST Unit Strain Energy vs Pressure WN 10+275 RT, TW9



Project No. : 1-09-4135  
Date : July 2010

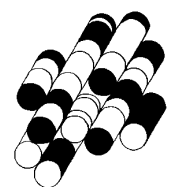


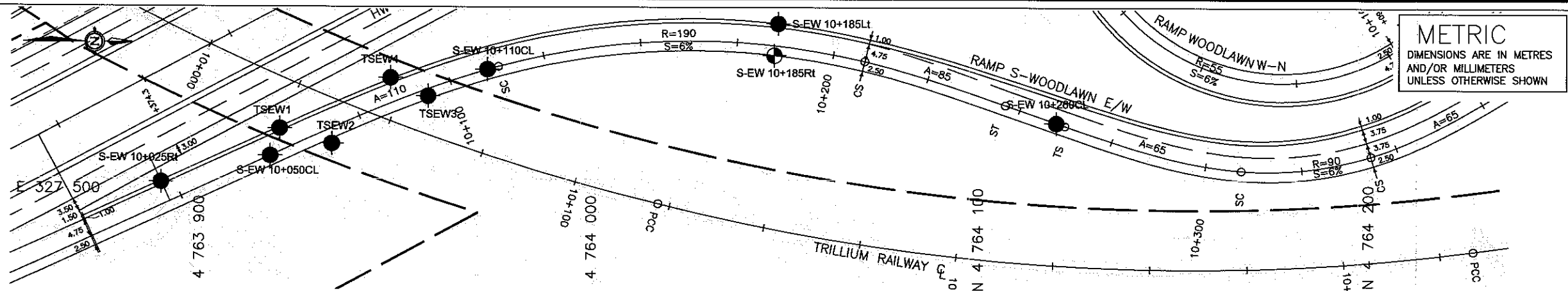
Terraprobe Inc.

Prepared By : HW  
Checked By : RA

# C2

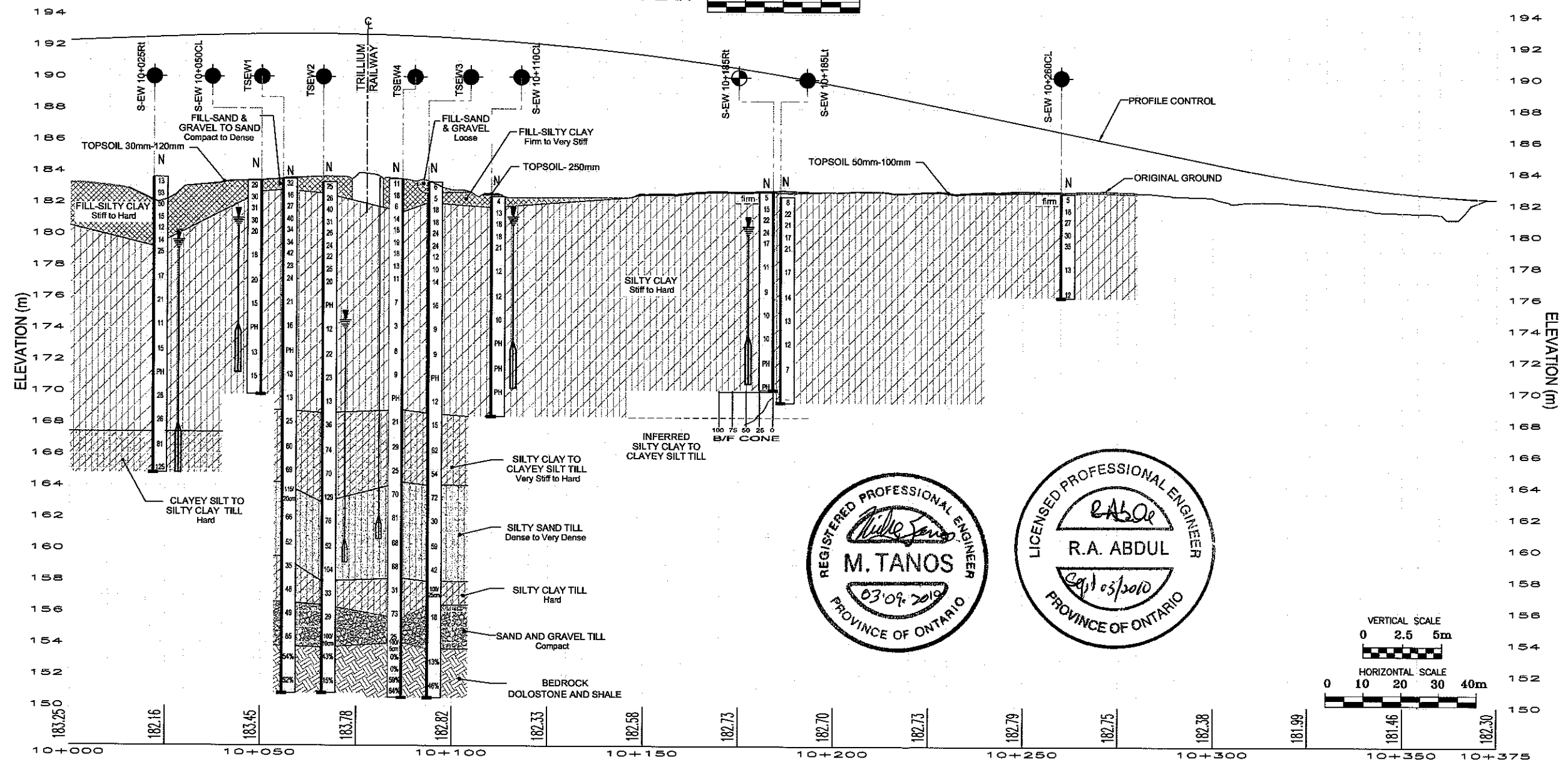
**TERRAPROBE INC.**





**METRIC**  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETERS  
 UNLESS OTHERWISE SHOWN

PLAN 0 10 20 30 40m



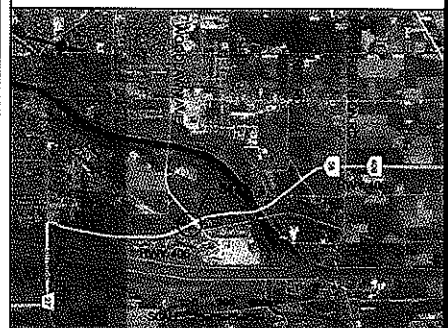
VERTICAL SCALE  
 0 2.5 5m  
 HORIZONTAL SCALE  
 0 10 20 30 40m

PROFILE RAMP 406 S-WOODLAWN E/W

CONT No  
 WP No 280-99-00

HIGHWAY 406  
 RAMP 406 S-WOODLAWN E/W  
 BOREHOLE LOCATIONS AND SOIL STRATA

Giffels Associates Limited  
 Consulting Engineers and Architects  
 An IBI Group Company



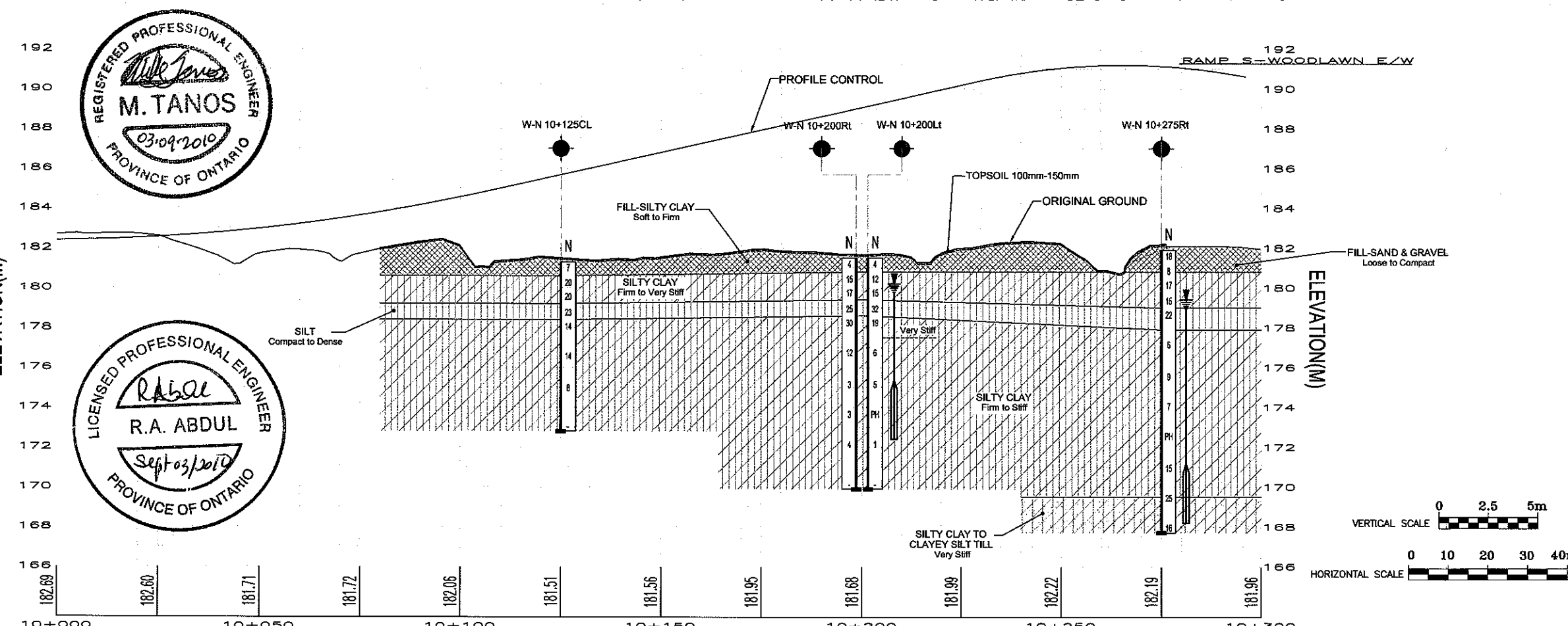
KEY PLAN

LEGEND	
●	Bore Hole
⊕	Dynamic Cone Penetration Test
⊙	Bore Hole And Cone
'N'	Blows/0.3m (Std Pen Test, 475 J/blow)
CONE	Blows/0.3m (60' Cone, 475 J/blow)
≡	WL at Time of Investigation
≡	WL in Piezometer (MAY, 2010)
⊥	Piezometer
90%	Rock Quality Designation
A/R	Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
S-EW 10+025Rt	183.6	4 763 892.5	327 500.9
S-EW 10+050CL	183.4	4 763 920.4	327 494.1
S-EW 10+110CL	182.4	4 763 976.0	327 471.7
S-EW 10+185Lt	182.4	4 764 050.9	327 459.8
S-EW 10+185Rt	182.7	4 764 049.9	327 468.0
S-EW 10+260CL	182.6	4 764 122.3	327 485.4
TSEW1	183.5	4 763 922.8	327 487.0
TSEW2	183.3	4 763 936.1	327 490.9
TSEW3	183.3	4 763 960.8	327 478.6
TSEW4	183.5	4 763 951.2	327 473.9

**NOTE**  
 The boundaries between soil strata have been established only at Bore Hole locations. Between Bore holes the boundaries are assumed from geological evidence.  
 This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

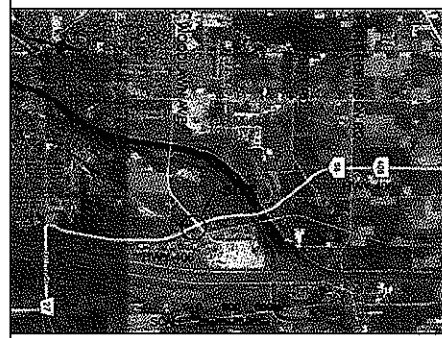
REVISIONS	DATE	BY	DESCRIPTION
DESIGN R.A.	CODE CHS002006	LOAD	DATE SEPT. 2010
DRAWN K.C.	CHK R.A.	STRUCT	GEORES 30M3-263



SHEET 1 OF
---------------



**Terraprobe**  
Consulting Geotechnical & Environmental Engineering  
Construction Materials Engineering, Inspection & Testing

[illegible]

**NOTE**

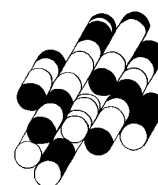
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REVISIONS				
	DATE	BY	DESCRIPTION	
DESIGN	R.A	CODE	CHB0C2006	LOAD
				DATE SEPT. 2010
DRAWN	K.C	CHK	RA	STRUCT
				GEORGES 30M3-263

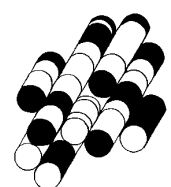
# SITE 3

**TERRAPROBE INC.**



# A3

**TERRAPROBE INC.**



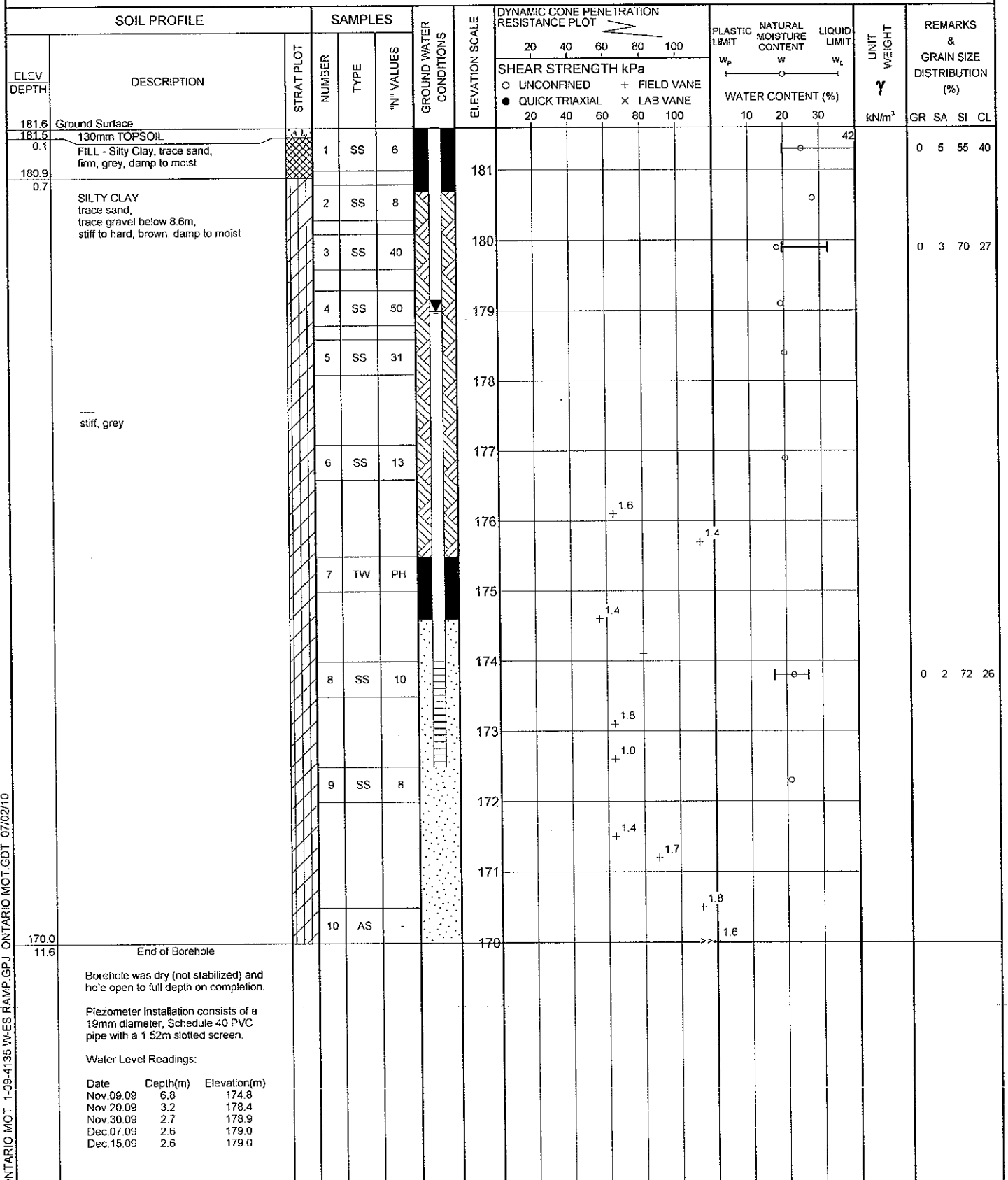


RECORD OF BOREHOLE No WE-S 10+200Lt

1 OF 1

METRIC

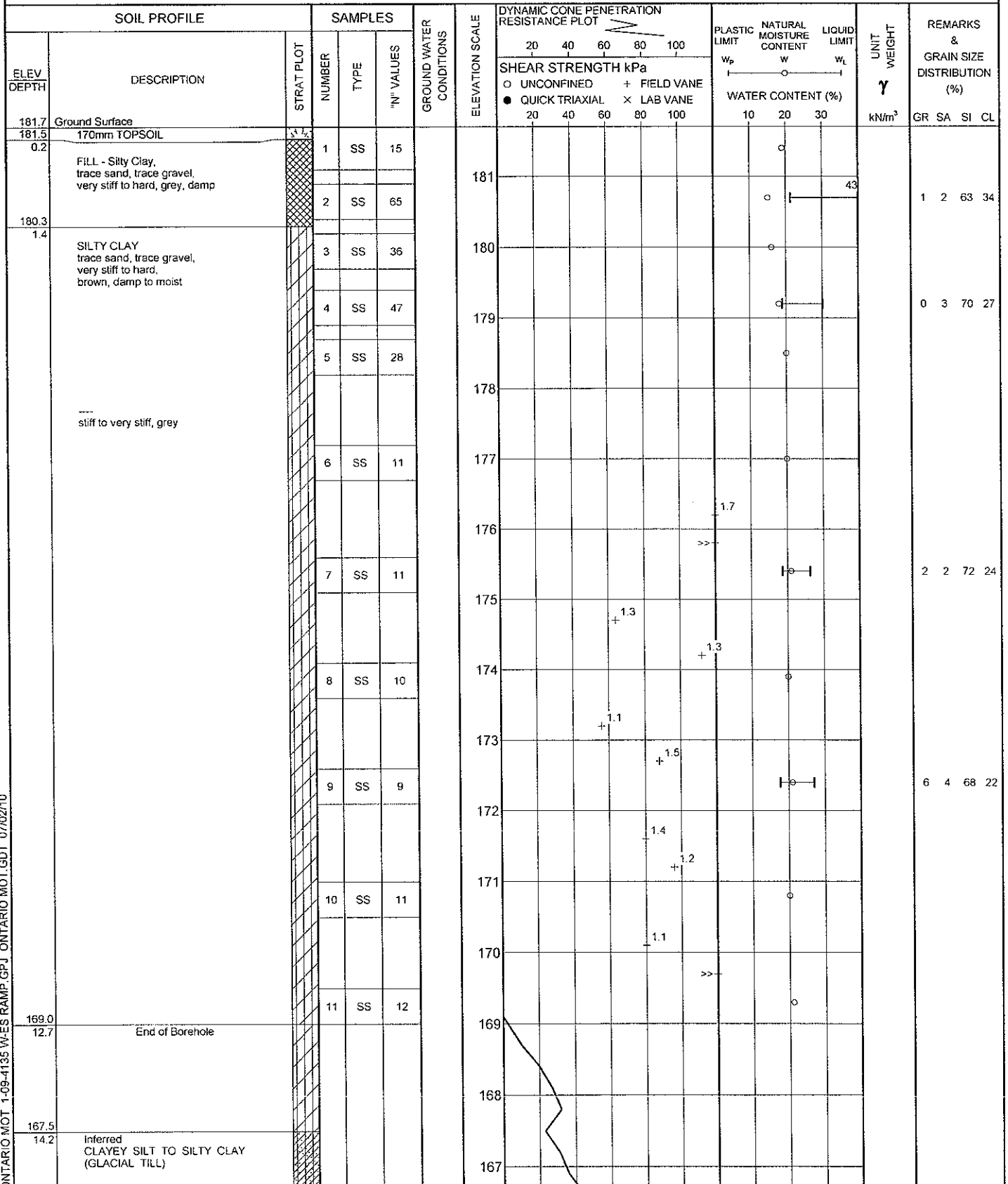
W.P. 280-99-00 LOCATION Coords: N:4763971.1 E:327388.0 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA



ONTARIO MOT 1-09-4135 W-ES RAMP GPJ ONTARIO MOT GDT 07/02/10

RECORD OF BOREHOLE No WE-S 10+200Rt 1 OF 2 METRIC

W.P. 280-99-00 LOCATION Coords: N:4763968.5 E:327379.8 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / DCPT COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA



ONTARIO MOT 1-09-4135 WE-S RAMP GPJ ONTARIO MOT.GDT 07/02/10

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## METRIC

ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT1.GPJ 07/02/10

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

1 OF 1

METRIC

LOCATION

Coords: N:4763928.5 E:327408.3

ORIGINATED BY   AW

DIST HWY 406

BOREHOLE TYPE Solid Stem Augers

COMPILED BY DB

DATUM Geodetic

DATE 11.04.09

CHECKED BY RA

+ 3, x 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No WE-S 10+295CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763889.2 E:327432.2 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
182.8 0.0	Ground Surface													
	FILL - Silty Clay, trace sand, stiff to very stiff, brown, damp to moist		1	SS	8		182							
181.4 1.4			2	SS	27									
	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp to moist		3	SS	32		181							
			4	SS	45		180							0 3 66 31
			5	SS	40									
			6	SS	67		178							
			7	SS	32									
	grey		8	SS	33		177							
			9	SS	37		175							2 4 66 28
			10	TW	PH		174						20.8	0 3 73 24
							173							
171.6 11.2	End of Borehole		11	SS	17		172							
	Borehole was dry (not stabilized) and hole open to full depth on completion.  Consolidation test performed on TW 10.													

ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

# RECORD OF BOREHOLE No TEW1

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763851.9 E:327450.6 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.23.09 - 01.08.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
182.5	Ground Surface													
0.0	230mm TOPSOIL													
182.3														
0.2	FILT. - Silty Clay, trace sand, trace organics, firm, brown, damp to moist		1	SS	7		182						62	0 3 33 64
181.8														
0.7	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, damp to moist		2	SS	27		181							
			3	SS	34									
			4	SS	54		180							0 3 70 27
			5	SS	35		179							
			6	SS	31		178							
			7	SS	18		177							1 4 65 30
			8	TW	PH		176							
			9	SS	22		175							
			10	SS	18		174							0 3 70 27
			11	SS	16		173							
			12	SS	19		172							
			13	SS	32		171							
							170							
							169							
							168							

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE





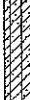
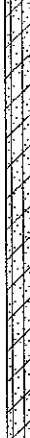

ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

# RECORD OF BOREHOLE No TEW1

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763851.9 E:327450.6 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 12.23.09 - 01.08.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE							
167.3 15.2	CLAYEY SILT TO SILTY CLAY sandy, trace to some gravel, hard, brown, damp  (GLACIAL TILL)  ----- occasional cobbles		14	SS	33									11 30 43 16		
163.3 19.2	SAND and gravel, trace to some silt, very dense, grey, wet													commence casing and washboring		
162.5 20.0																
	CLAYEY SILT sandy, trace to some gravel, hard, brown, damp (GLACIAL TILL)		17	SS	94									Dec.23 Jan.05		
161.2 21.3	SAND gravelly, trace clay, trace silt, dense to very dense, grey, wet		18	SS	70									32 56 10 2		
159.4 23.1	SILTY CLAY some gravel, trace to some sand, hard, brown, damp (GLACIAL TILL)		19	SS	34									15 40 38 7		
158.3 24.2	SAND AND SILT some gravel, trace clay, occasional cobbles, very dense, brown, moist to wet  (GLACIAL TILL)		20	SS	75									Jan.05 Jan.08		
			21	SS	99											
			22	SS	125											
153.7 28.8	BEDROCK													RUN#1 TCR=88% SCR=78% ROD=48%		
			1	RUN	NQ											

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE


ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

RECORD OF BOREHOLE No TEW1

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763851.9 E:327450.6 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.23.09 - 01.08.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		2	RUN	NQ		152  151										RUN#2 TCR=82% SCR=68% ROD=31%
150.5 32.0	End of Borehole  Borehole was open to 20.7m on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date Depth(m) Elevation(m) Jan.19.10 3.2 179.3 Jan.27.10 2.4 180.1 Feb.08.10 2.4 180.1																

ONTARIO MOT. 1-09-4135 W-ES RAMP GPJ ONTARIO MOT. GOT 07/02/10



# RECORD OF BOREHOLE No TEW2

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763860.7 E:327455.5 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 12.18.09 - 12.22.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.7	Ground Surface							20 40 60 80 100						
0.0 182.4	300mm TOPSOIL		1	SS	8									
0.3 182.0	FILL - Silty Clay, trace sand, trace organics, firm to stiff, brown, moist													
0.7	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, damp to moist		2	SS	27									
			3	SS	28									
			4	SS	28									0 1 52 47
			5	SS	42									
			6	SS	36									
			7	SS	14									
			8	SS	19									
			9	SS	17									
			10	SS	22									
			11	TW	PH									
			12	TW	PH									
			13	SS	21									4 6 66 24

Continued Next Page

+ 3, x 3. Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 W-ES RAMP GPJ ONTARIO MOT.GDT 07/02/10

RECORD OF BOREHOLE No TEW2

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763860.7 E:327455.5 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.18.09 - 12.22.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
								○ UNCONFINED	+	FIELD VANE							
								● QUICK TRIAXIAL	×	LAB VANE							
								20	40	60	80	100					
14.9	CLAYEY SILT TO SILTY CLAY sandy, trace gravel, occasional cobbles, hard, brown, damp to moist  (GLACIAL TILL)		14	SS	88		167										8 26 48 18
								166									
				15	SS	100/ 13cm		165									
	----							164									
	sand and gravel, grey, wet			16	SS	166/ 28cm		163									
	----						162										
163.1							161										
19.6	SAND and gravel, trace to some silt, very dense, grey, moist to wet		17	SS	100/ 14cm		160										
162.3								159									
20.4	CLAYEY SILT and sand, some gravel, hard, brown, damp  (GLACIAL TILL)		18	SS	127		158										
160.8								157									
21.9	SAND some gravel, very dense, grey, moist						156										
159.6								155									
23.1	SILTY CLAY trace to some sand, trace gravel, hard, brown, damp (GLACIAL TILL)		19	SS	148		154										
158.9								153									
23.8	SAND trace gravel to gravelly, trace to some silt, trace clay, occasional cobbles, compact to very dense, grey, wet  (GLACIAL TILL)		20	SS	40												2 95 (3)
				21	SS	21											
				22	SS	105											
154.0																	
28.7	BEDROCK		1	RUN	NQ												RUN#1 TCR=93% SCR=75% ROD=46%

ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## METRIC

[illegible]

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No TEW3

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords N:4763877.2 E:327436.9 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 12.07.09 - 12.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
182.6	Ground Surface													
182.5	120mm TOPSOIL													
0.1	FILL - Silty Clay, trace sand, trace organics, firm to stiff, brown, moist		1	SS	8		182							
181.9														
0.7	SILTY CLAY trace sand, occasional gravel inclusions, very stiff to hard, brown, damp to moist		2	SS	33		181							
			3	SS	26									
			4	SS	31		180							
			5	SS	25									0 2 55 43
			6	SS	33		179							
			7	SS	26		178							0 3 65 32
			8	SS	31		177							
			9	SS	33		176							
			10	SS	38		175							3 3 66 28
			11	SS	32		174							
			12	SS	23		173							
			13	TW	PH		172							0 3 69 28
			14	SS	22		171							
							170							
							169							
							168							

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 WES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

RECORD OF BOREHOLE No TEW3

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763877.2 E:327436.9 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.07.09 - 12.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
166.8 15.8	CLAYEY SILT TO SILTY CLAY some sand to sandy, trace gravel, hard, brown, damp to moist  (GLACIAL TILL)		15	SS	26		167							4 13 62 21
							166							
			16	SS	61		165							
							164							
			17	SS	42		163							
							162							
	SILTY SAND some gravel to gravelly, trace clay, compact to dense, brown, damp to moist  (GLACIAL TILL)						161							5 30 46 19 Dec.07 Dec.08
			18	SS	38		160							
							159							
			19	SS	31		158							
							157							
			20	SS	38		156							
157.9 24.7	SILTY SAND some gravel to gravelly, trace clay, compact to dense, brown, damp to moist  (GLACIAL TILL)		21	SS	100/ 13cm		155							25 38 29 8 Dec.08 Dec.09
							154							
			22	SS	29		153							
	frequent cobbles													RUN#1 TCR=52% SCR=40% RQD=0%
			23	SS	38									
153.7 28.9	BEDROCK		1	RUN	NQ									RUN#2 TCR=95% SCR=83% RQD=49%

ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No TEW4

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763885.4 E:327439.2 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.10.09 - 12.15.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
182.6	Ground Surface													
182.5	110mm TOPSOIL													
0.1	FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	9									
181.9							182							
0.7	SILTY CLAY trace sand, occasional gravel inclusions, very stiff to hard, brown, damp to moist		2	SS	47									0 2 58 40
			3	SS	55		181							
			4	SS	49		180							
			5	SS	55									
			6	SS	42		179							
			7	SS	41		178							0 3 67 30
			8	SS	30		177							
			9	SS	30		176							
			10	SS	24		175							
			11	SS	24		174							
							173							0 7 69 24
														Dec.10
														Dec.11
			12	SS	12		172							
							171							
			13	SS	19		170							
							169							
			14	TW	PH		168							
168.0														
14.6														

Continued Next Page

+<sup>3</sup> ×<sup>3</sup> Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 W-ES RAMP GPJ ONTARIO MOT.GDT 07/02/10

## METRIC

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



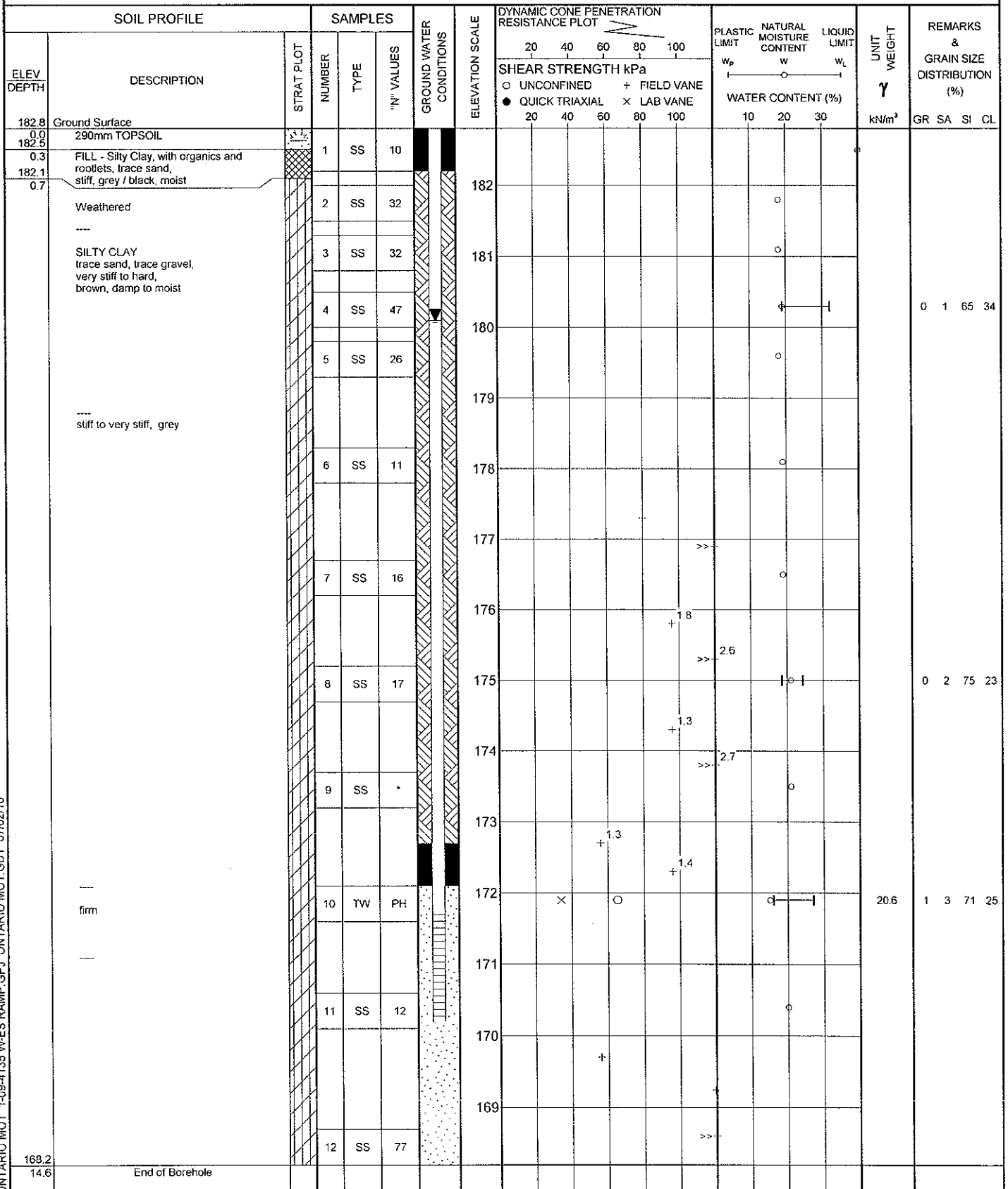


RECORD OF BOREHOLE No WE-S 10+345CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763845.9 E:327457.4 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA



ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT GDT 07/02/10

RECORD OF BOREHOLE No WE-S 10+345CL 2 OF 2 METRIC

W.P. 280-99-00 LOCATION Coords: N:4763845.9 E:327457.4 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)																					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)																								
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>																							
	<p>* TW sampling attempted at 9.1m. No recovery, split spoon sample collected.</p> <p>Consolidation test performed on TW 10.</p> <p>Borehole was dry (not stabilized) and hole open to full depth on completion.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.19.09</td> <td>4.0</td> <td>178.8</td> </tr> <tr> <td>Nov.30.09</td> <td>3.4</td> <td>179.4</td> </tr> <tr> <td>Dec.07.09</td> <td>3.1</td> <td>179.7</td> </tr> <tr> <td>Dec.15.09</td> <td>3.0</td> <td>179.8</td> </tr> <tr> <td>Jan.11.10</td> <td>2.6</td> <td>180.2</td> </tr> <tr> <td>Jan.27.10</td> <td>2.7</td> <td>180.1</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.19.09	4.0	178.8	Nov.30.09	3.4	179.4	Dec.07.09	3.1	179.7	Dec.15.09	3.0	179.8	Jan.11.10	2.6	180.2	Jan.27.10	2.7	180.1															
Date	Depth(m)	Elevation(m)																																			
Nov.19.09	4.0	178.8																																			
Nov.30.09	3.4	179.4																																			
Dec.07.09	3.1	179.7																																			
Dec.15.09	3.0	179.8																																			
Jan.11.10	2.6	180.2																																			
Jan.27.10	2.7	180.1																																			

ONTARIO MOT 1-09-4135 W-ES RAMP GPJ ONTARIO MOT GDT 07/02/10

## METRIC

ORIGINATED BY    AW

COMPILED BY DB

CHECKED BY \_\_\_\_\_ RA

ONTARIO MOT 1-09-4135 W-ES RAMP.GPJ ONTARIO MOT.GDT 07/02/10

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No WE-S 10+360Lt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763814.3 E:327476.6 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.12.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
							20 40 60 80 100								
167.3	SILTY CLAY trace sand, very stiff to hard, brown, damp to moist (continued)		13	SS	18										
16.1	CLAYEY SILT trace to some sand, trace gravel, hard, grey / brown, damp (GLACIAL TILL)		14	SS	54										
			15	SS	116									5 29 49 17	
163.1			16	SS	91										
20.3	End of Borehole  Unable to push vane below 16.1m.  Consolidation test performed on TW 11.  Borehole was dry (not stabilized) and hole open to full depth on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.  Water Level Readings:  Date      Depth(m)      Elevation(m) Nov.20.09      6.3      177.1 Nov.30.09      7.7      175.7 Dec.15.09      5.9      177.5 Jan.04.10      5.7      177.7 Jan.11.10      5.5      177.9														

# RECORD OF BOREHOLE No WE-S 10+425Lt

1 OF 1

METRIC

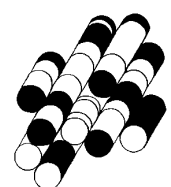
W.P. 280-99-00 LOCATION Coords: N:4763780.6 E:327503.9 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.13.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE								○				
								● QUICK TRIAXIAL × LAB VANE												
185.8	Ground Surface						20	40	60	80	100									
185.7	140mm TOPSOIL						20	40	60	80	100									
0.1	FILL - Silty Clay, trace sand, firm to stiff, grey / brown, damp to moist		1	SS	9															
	some organics, grey / black		2	SS	9															
			3	SS	7															
			4	SS	8															
182.9	Weathered		5	SS	17															
2.9	SILTY CLAY trace sand, very stiff, brown, damp to moist		6	SS	34															
	firm to stiff		7	SS	21															
			8	SS	15															
			9	SS	10															
			10	SS	10															
			11	AS	-															
172.7	End of Borehole																			
13.1	Borehole was dry (not stabilized) and hole open to full depth on completion.																			

ONTARIO MOT 1-09-4135 WES RAMP.GPJ ONTARIO MOT GDT 07/02/10

# B3

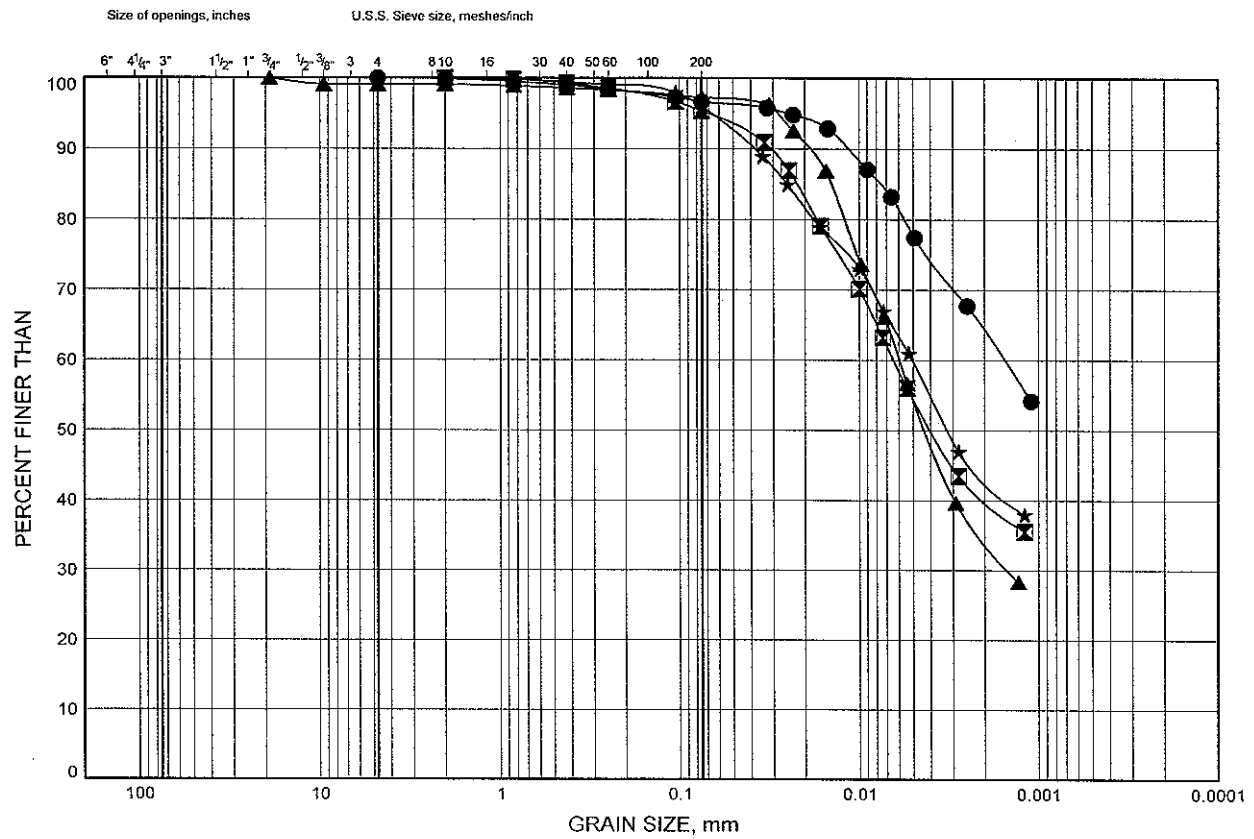
**TERRAPROBE INC.**



# GRAIN SIZE DISTRIBUTION

FIGURE B3-1

## FILL - Silty Clay

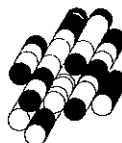


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW1	0.3	182.2
⊠	WE-S 10+200Lt	0.3	181.3
▲	WE-S 10+200Rt	1.0	180.7
★	WE-S 10+425Lt	1.0	184.8

Date July 2010

Project 1-09-4135



Prep'd DB

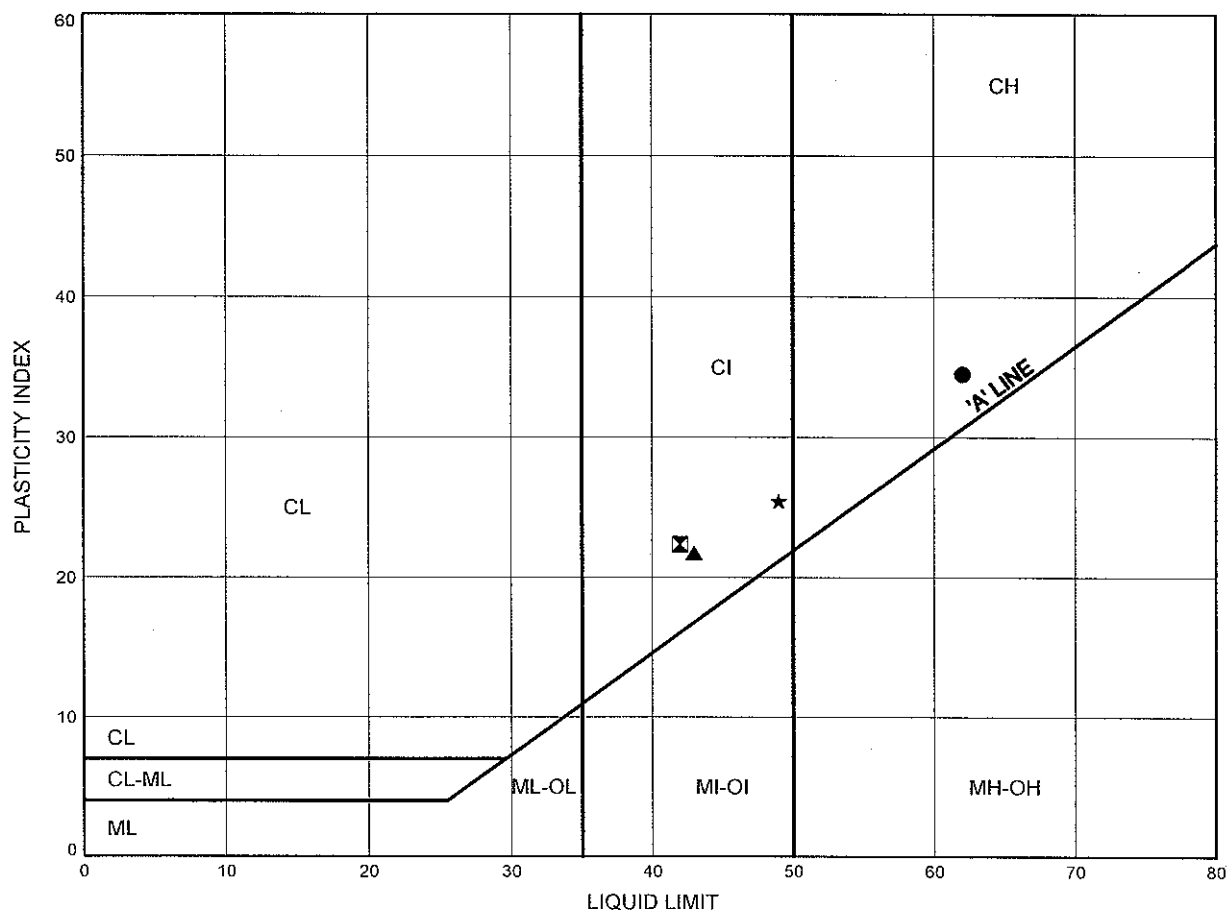
Chkd. HW



# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-2

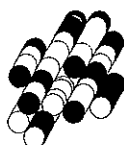
## FILL - Silty Clay



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW1	0.3	182.2
⊠	WE-S 10+200Lt	0.3	181.3
▲	WE-S 10+200Rt	1.0	180.7
★	WE-S 10+425Lt	1.0	184.8

Date July 2010

Project 1-09-4135



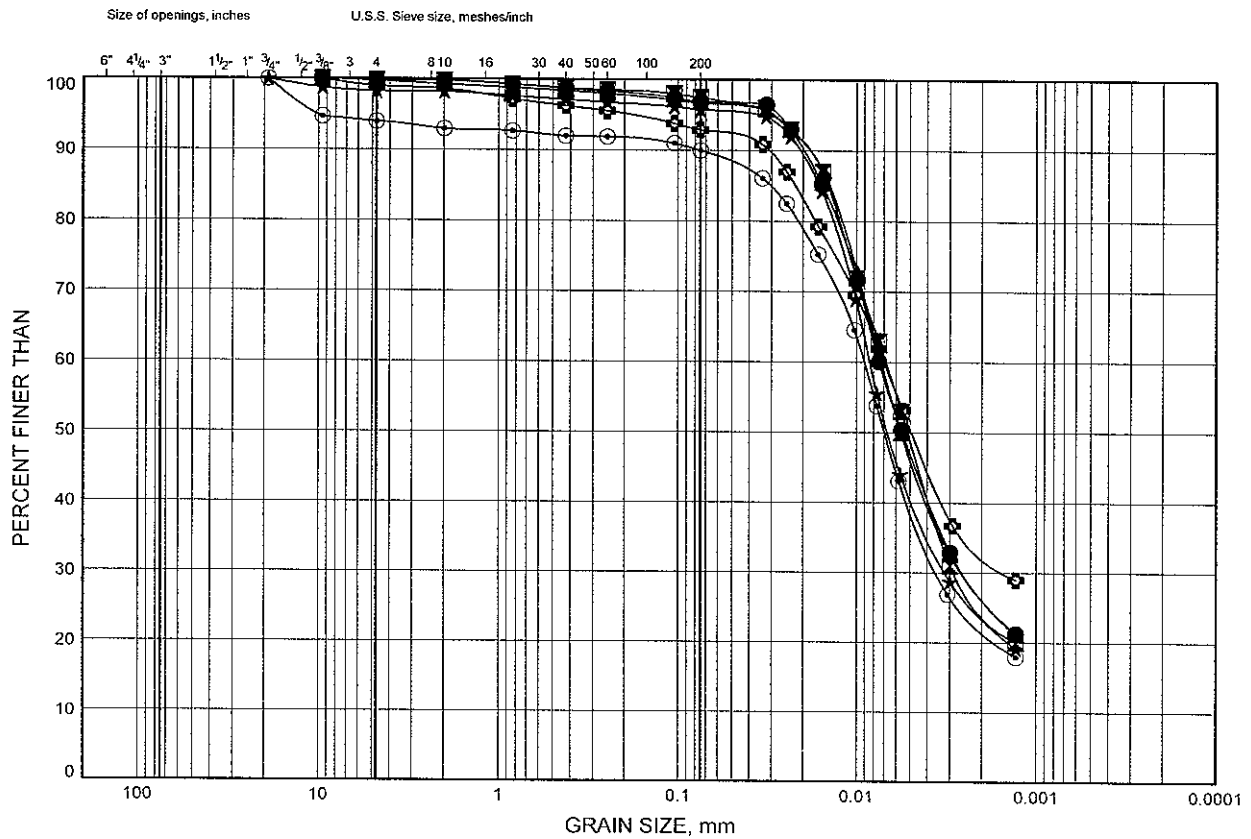
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-3

## SILTY CLAY



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

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	WE-S 10+200Lt	1.7	179.9
⊠	WE-S 10+200Lt	7.8	173.8
▲	WE-S 10+200Rt	2.5	179.2
★	WE-S 10+200Rt	6.3	175.4
⊙	WE-S 10+200Rt	9.3	172.4
⊛	WE-S 10+250CL	3.2	178.9

Date July 2010

Project 1-09-4135



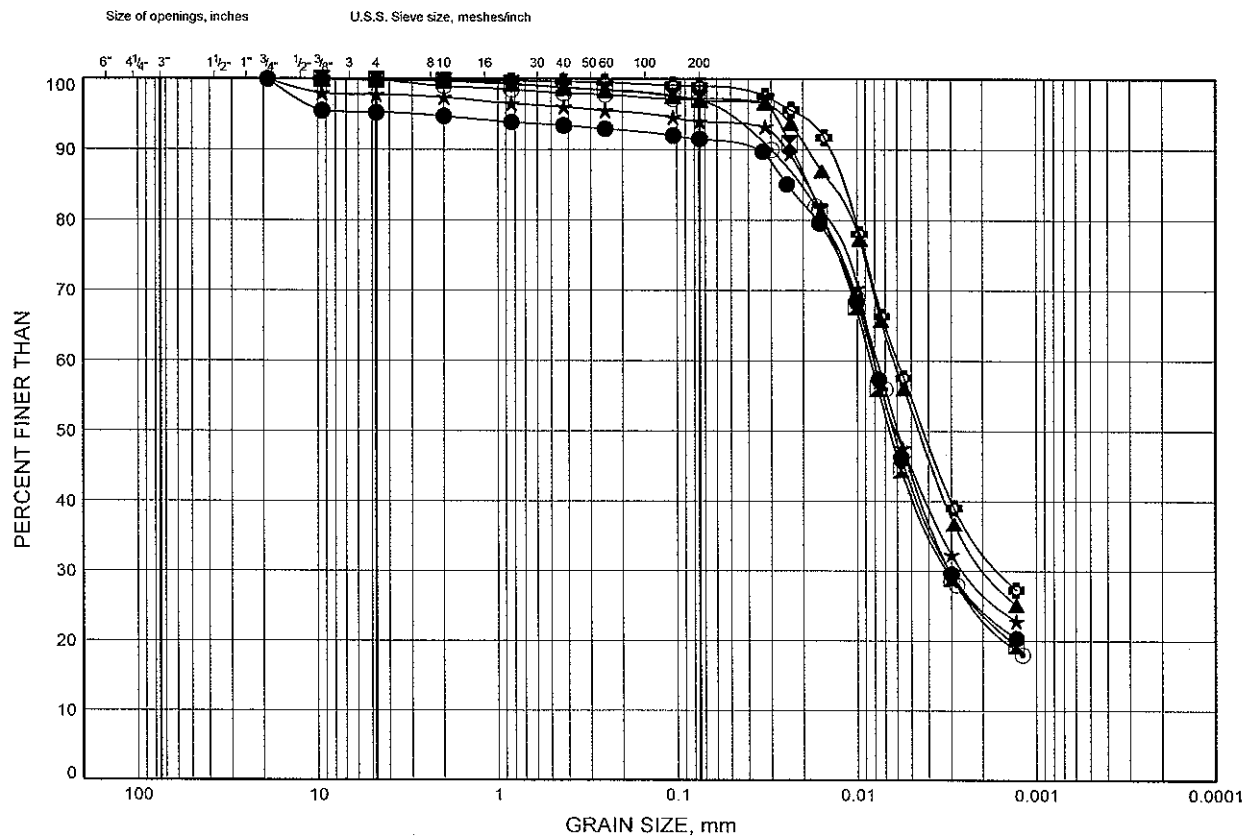
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-4

## SILTY CLAY



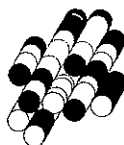
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	WE-S 10+250CL	6.3	175.8
⊠	WE-S 10+250CL	10.9	171.2
▲	WE-S 10+295CL	2.5	180.3
★	WE-S 10+295CL	7.8	175.0
⊙	WE-S 10+295CL	9.3	173.5
⊕	WE-S 10+345CL	2.5	180.3

Date July 2010

Project 1-09-4135



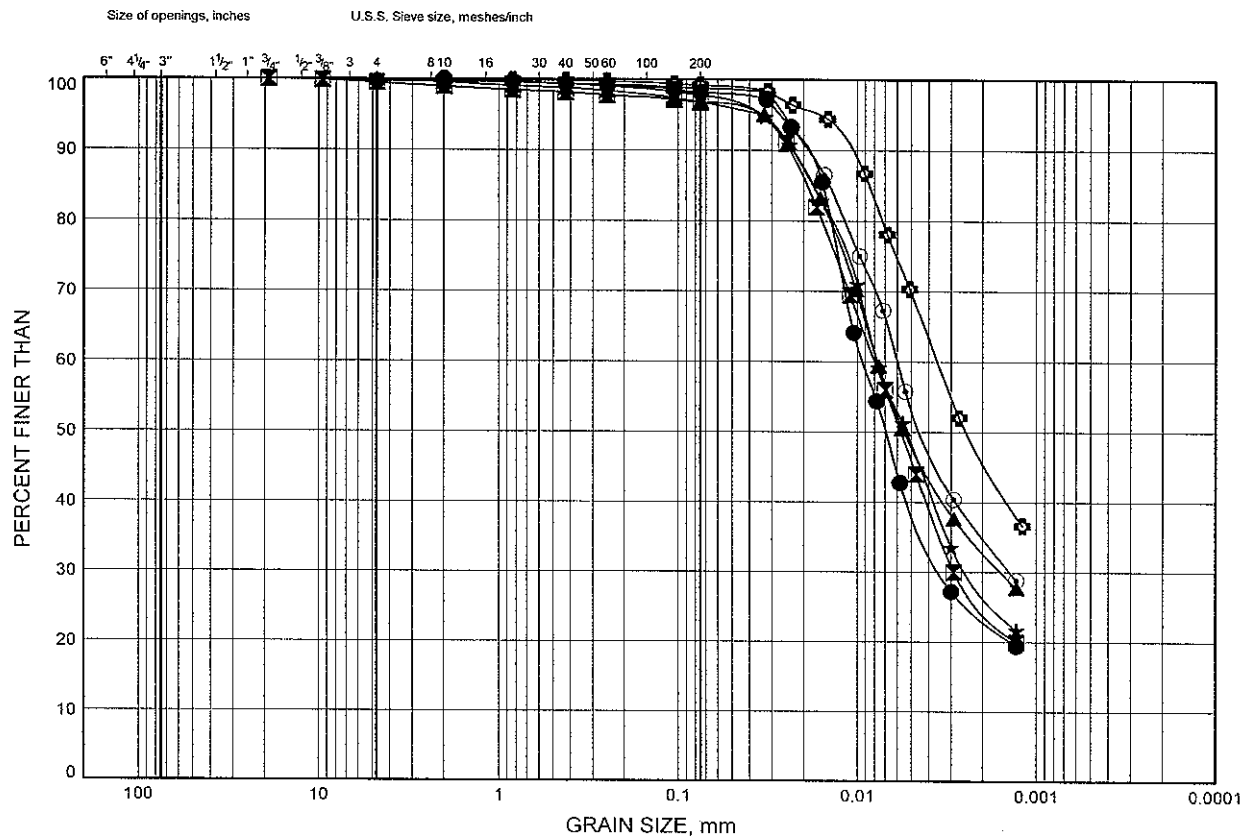
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B3-5

## SILTY CLAY



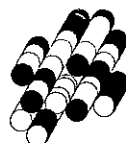
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	WE-S 10+345CL	7.8	175.0
⊠	WE-S 10+345CL	10.9	171.9
▲	WE-S 10+360Lt	3.2	180.2
★	WE-S 10+360Lt	6.3	177.1
⊙	WE-S 10+360Lt	13.9	169.5
⊛	WE-S 10+425Lt	4.7	181.1

Date July 2010

Project 1-09-4135



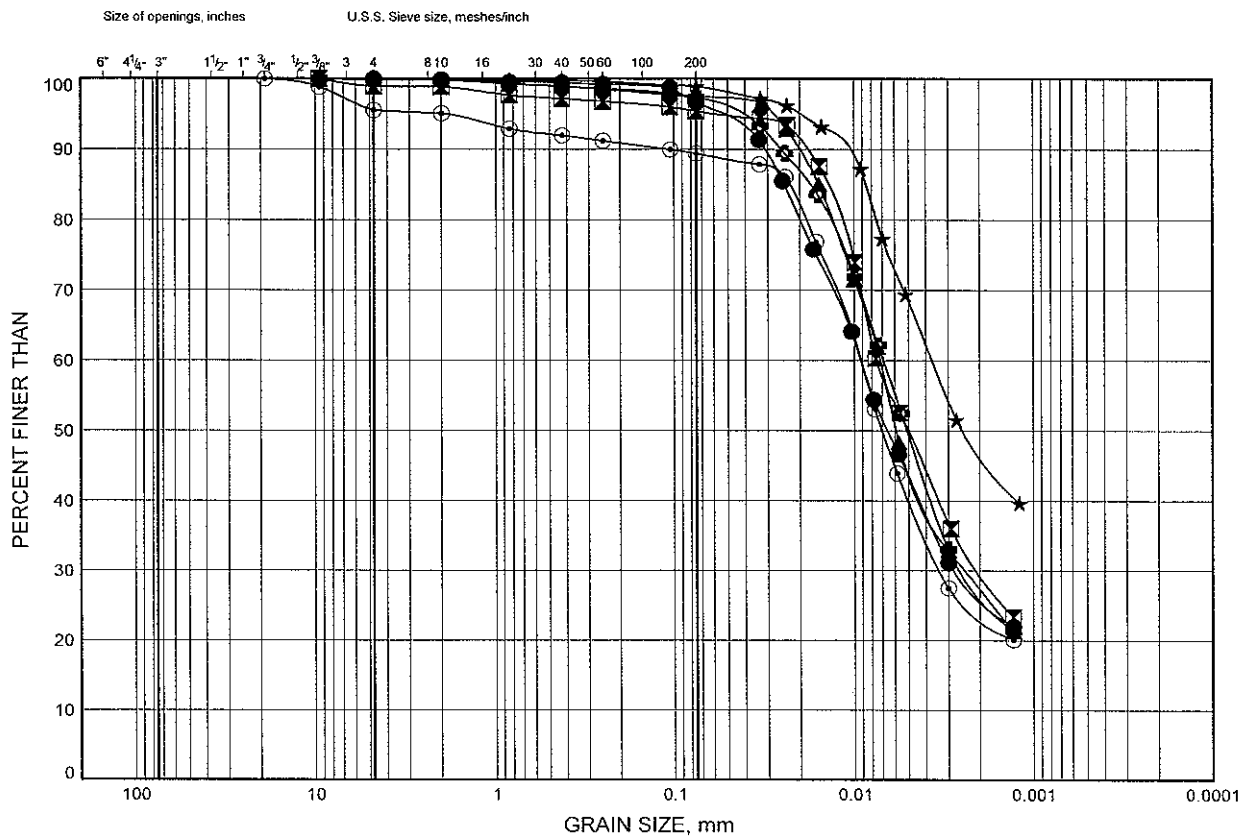
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-6

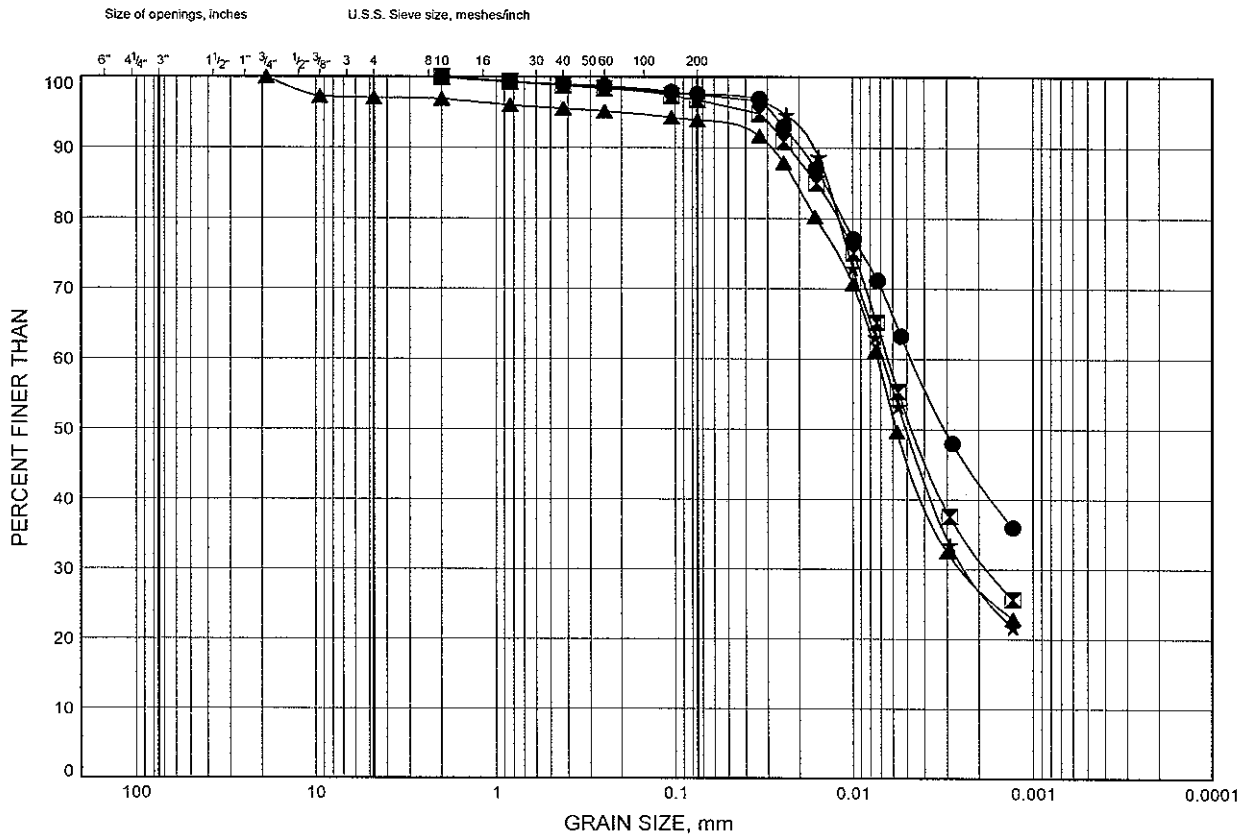
## SILTY CLAY



# GRAIN SIZE DISTRIBUTION

FIGURE B3-7

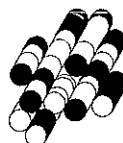
## SILTY CLAY



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW3	3.2	179.4
⊠	TEW3	4.7	177.9
▲	TEW3	7.8	174.8
★	TEW3	10.9	171.7

Date July 2010  
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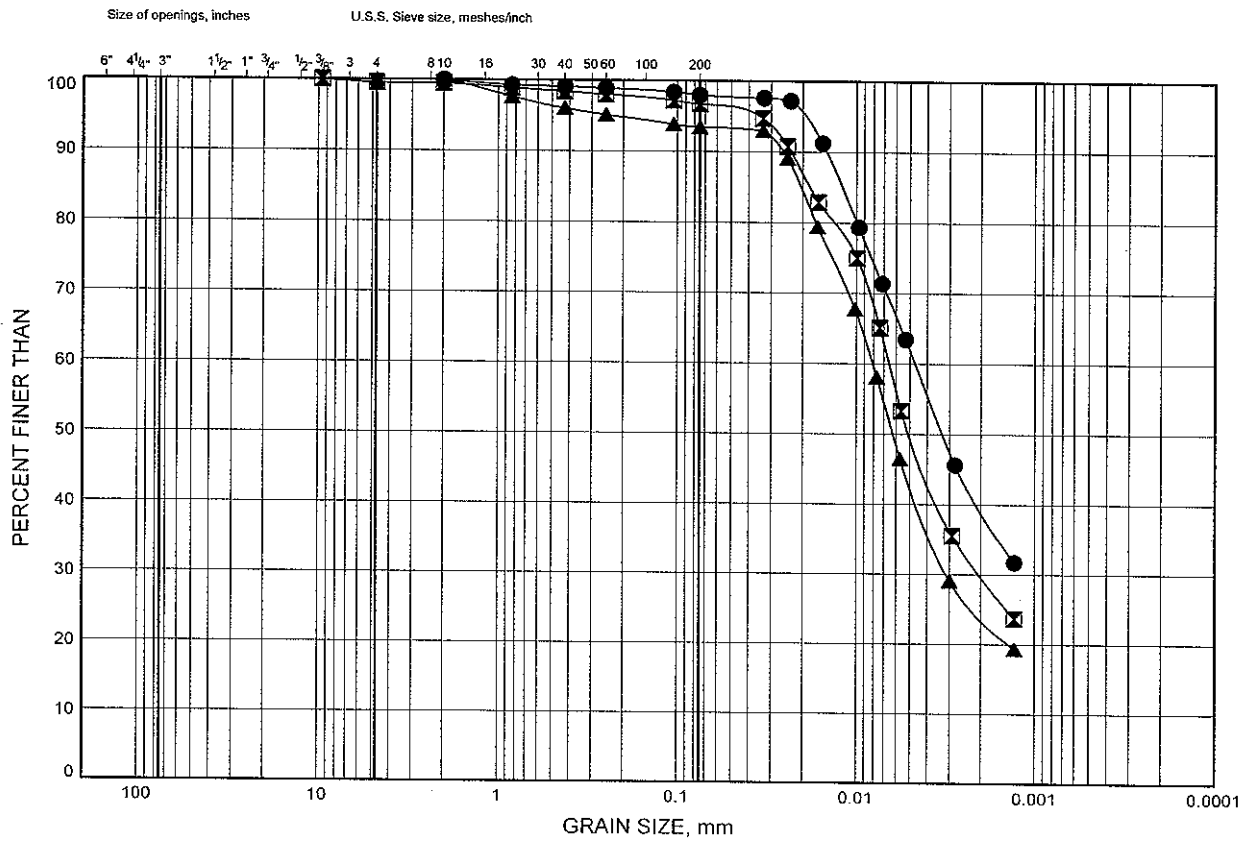


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Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-8

## SILTY CLAY

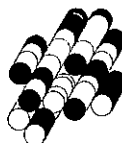


SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

● TEW4 1.0 181.6  
 ✕ TEW4 4.7 177.9  
 ▲ TEW4 9.3 173.3

Date July 2010

Project 1-09-4135



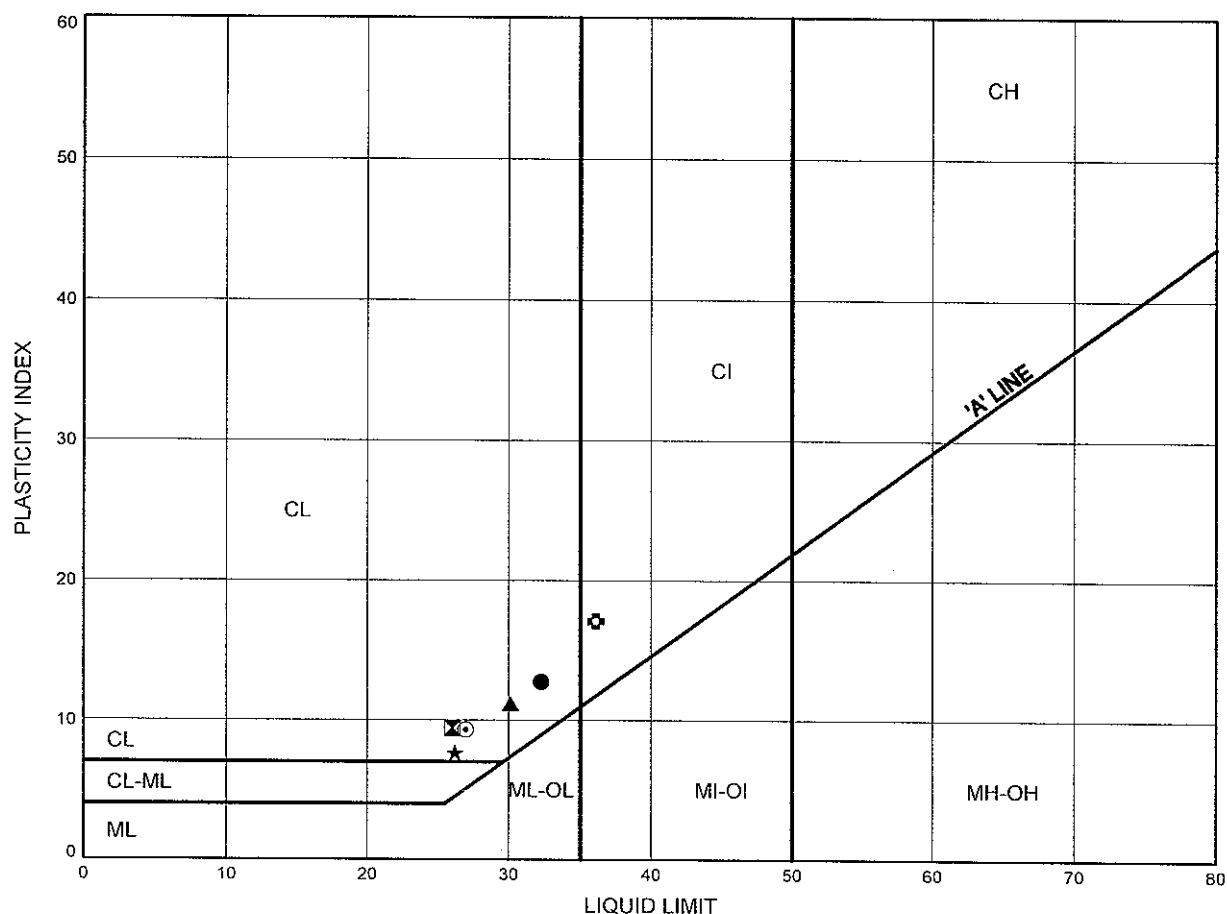
Prep'd DB

Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-9

## SILTY CLAY

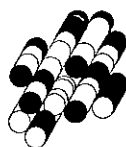


SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	WE-S 10+200Lt	1.7	179.9
⊠	WE-S 10+200Lt	7.8	173.8
▲	WE-S 10+200Rt	2.5	179.2
★	WE-S 10+200Rt	6.3	175.4
⊙	WE-S 10+200Rt	9.3	172.4
⊛	WE-S 10+250CL	3.2	178.9

Date July 2010

Project 1-09-4135



Prep'd DB

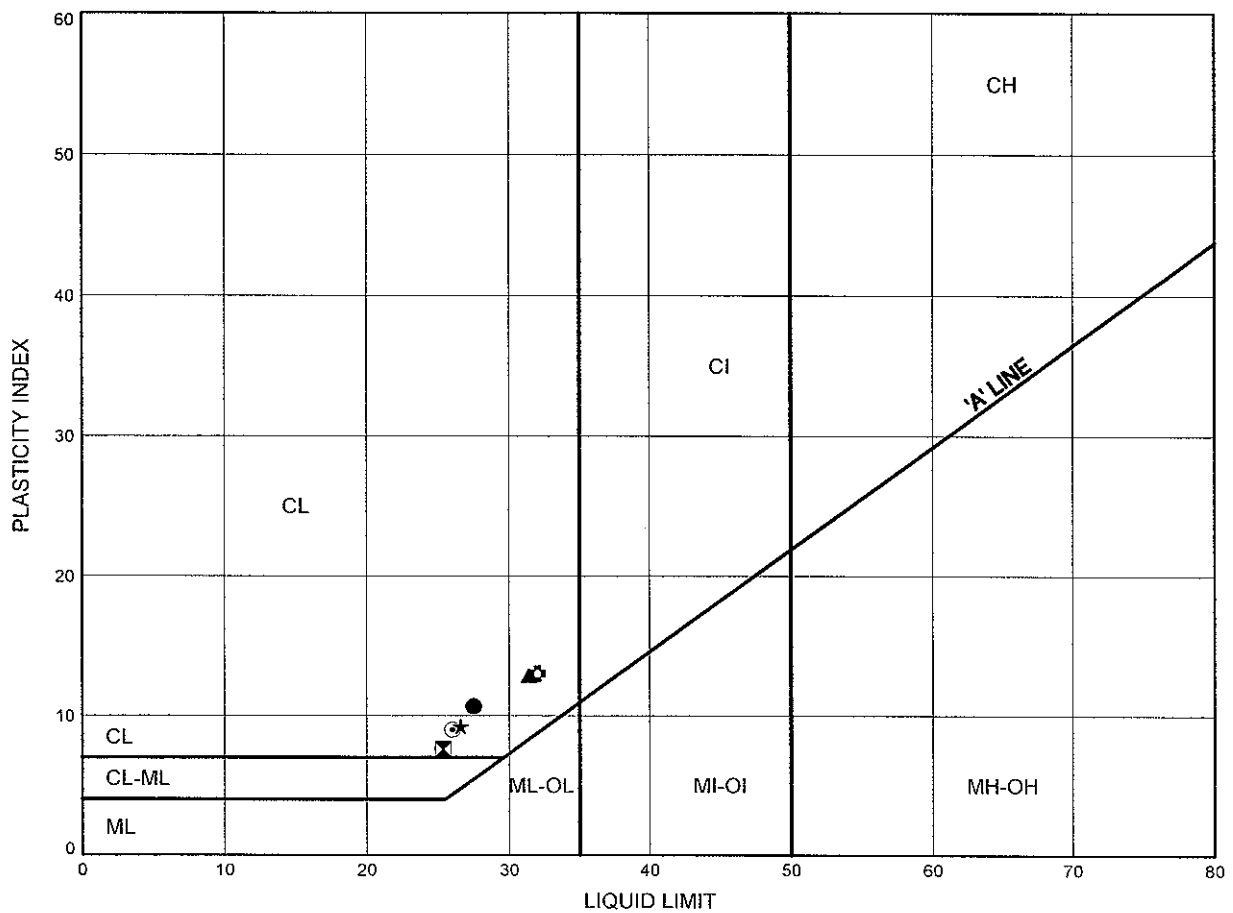
Chkd HW



# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-10

## SILTY CLAY

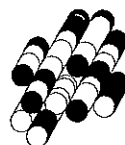


SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
--------	----------	-----------	---------------

●	WE-S 10+250CL	6.3	175.8
⊠	WE-S 10+250CL	10.9	171.2
▲	WE-S 10+295CL	2.5	180.3
★	WE-S 10+295CL	7.8	175.0
⊙	WE-S 10+295CL	9.3	173.5
⊛	WE-S 10+345CL	2.5	180.3

Date July 2010

Project 1-09-4135



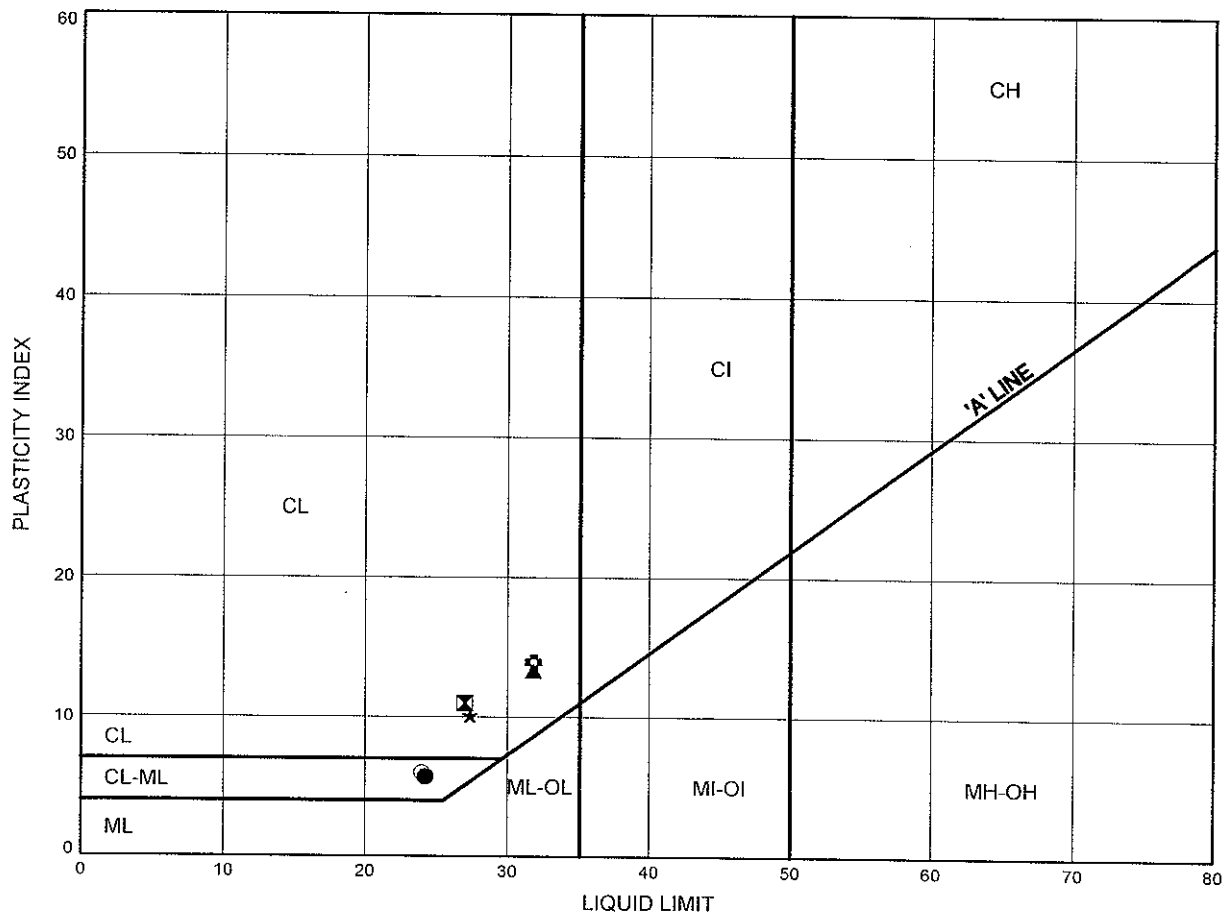
Prep'd DB

Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-11

## SILTY CLAY

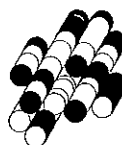


SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WE-S 10+345CL	7.8	175.0
⊠	WE-S 10+345CL	10.9	171.9
▲	WE-S 10+360Lt	3.2	180.2
★	WE-S 10+360Lt	6.3	177.1
⊙	WE-S 10+360Lt	12.4	171.0
⊛	WE-S 10+360Lt	13.9	169.5

ALTR 1-09-4135 W-ES RAMP GPJ 07/02/10

Date July 2010

Project 1-09-4135



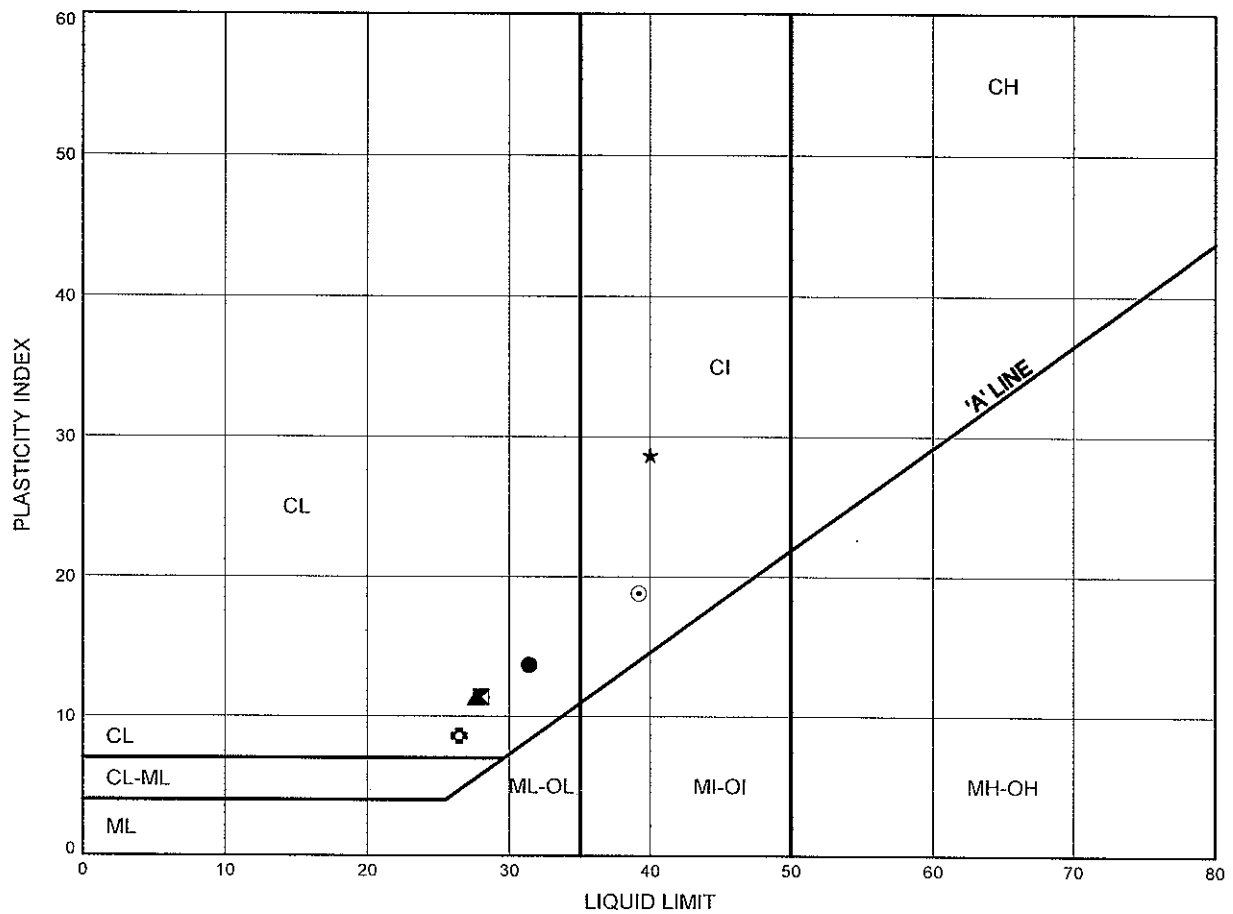
Prep'd DB

Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

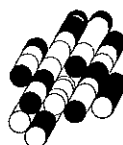
FIGURE B3-12

## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW1	2.5	180.0
⊠	TEW1	4.7	177.8
▲	TEW1	9.3	173.2
★	TEW2	2.5	180.2
⊙	WE-S 10+425Lt	4.7	181.1
⊕	WE-S 10+425Lt	10.9	174.9

Date July 2010  
Project 1-09-4135

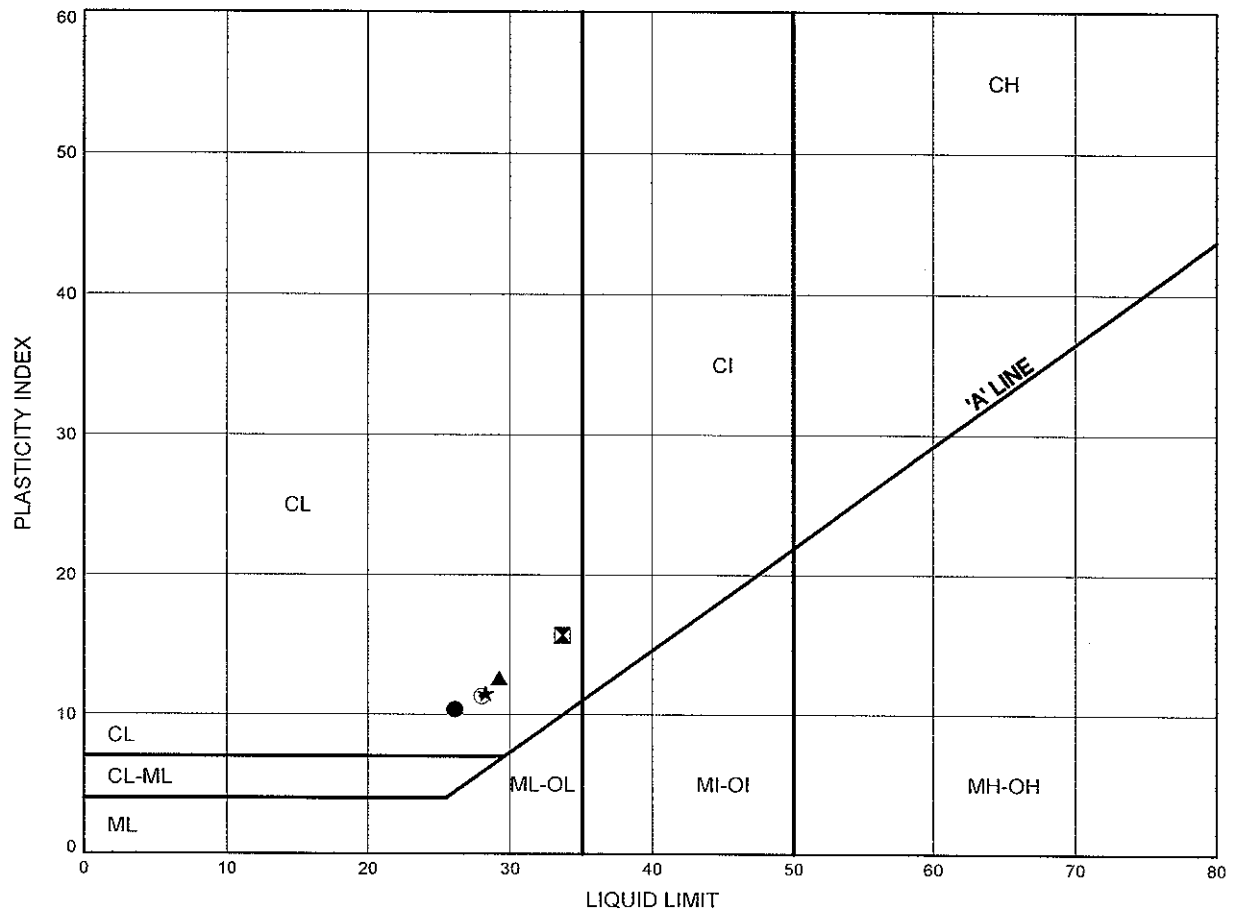


Prep'd DB  
Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-13

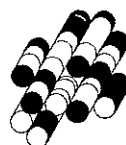
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW2	13.9	168.8
⊠	TEW3	3.2	179.4
▲	TEW3	4.7	177.9
★	TEW3	7.8	174.8
⊙	TEW3	10.9	171.7

Date July 2010

Project 1-09-4135



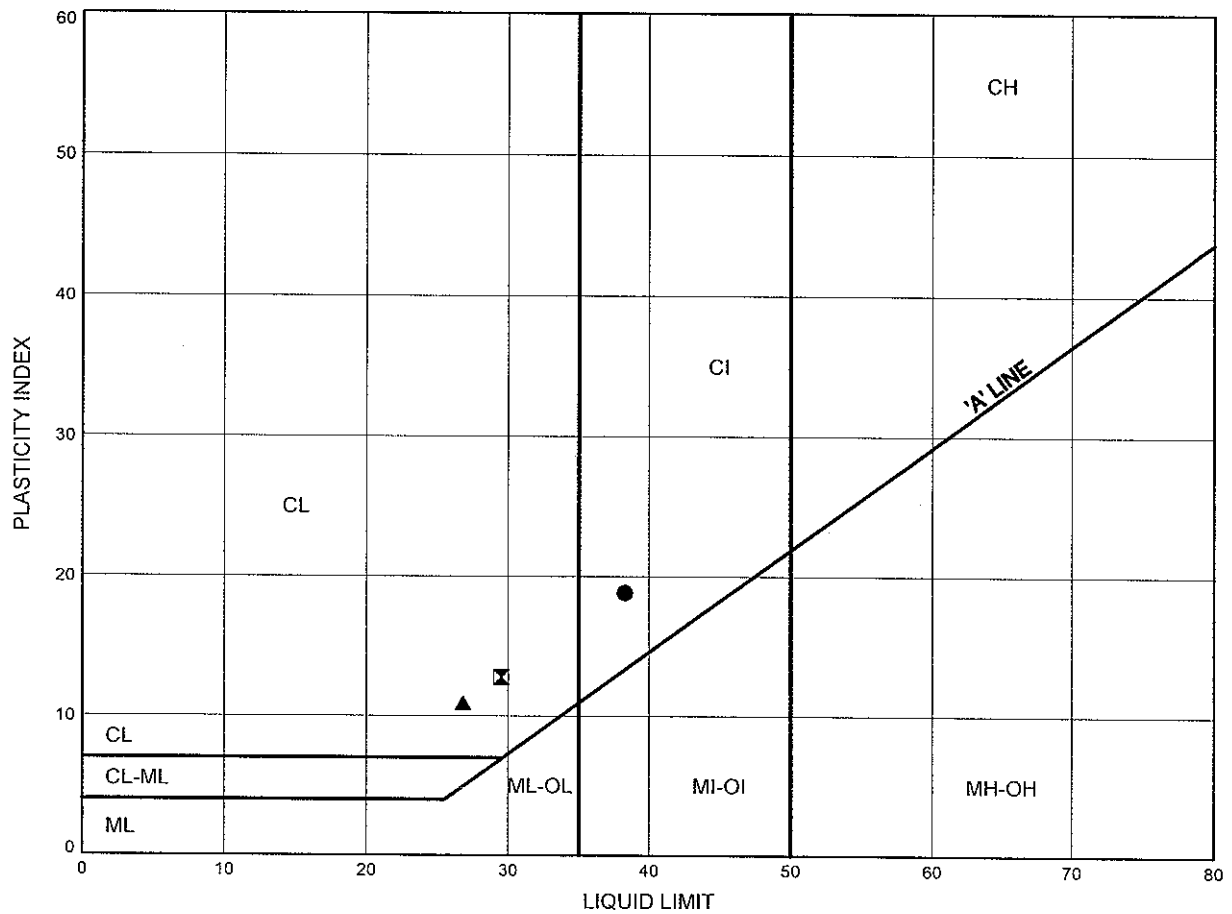
Prep'd DB

Chkd. HW

# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-14

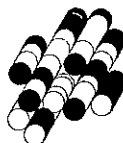
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW4	1.0	181.6
■	TEW4	4.7	177.9
▲	TEW4	9.3	173.3

Date July 2010

Project 1-09-4135



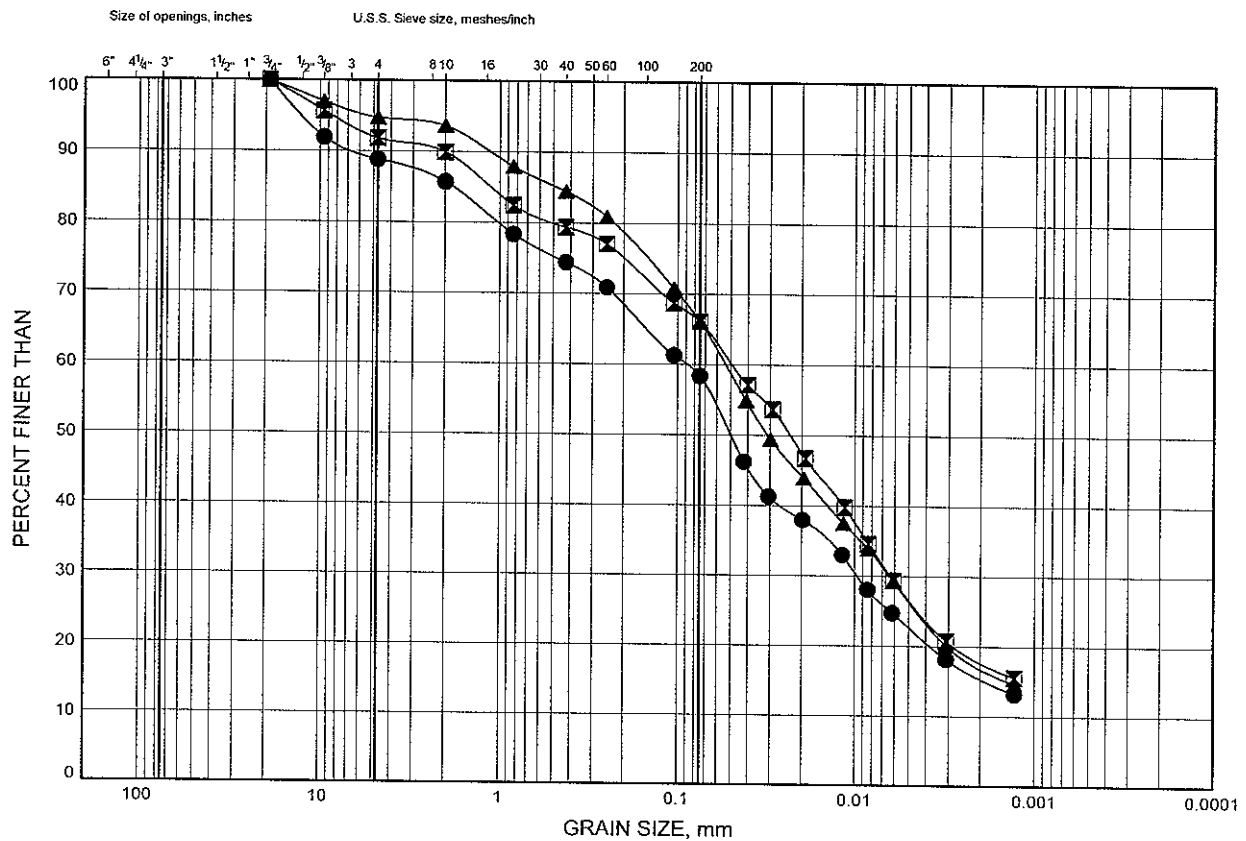
Prep'd DB

Chkd HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-15

## CLAYEY SILT TO SILTY CLAY TILL



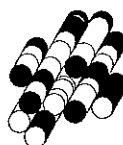
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	TEW1	17.0	165.5
×	TEW2	15.4	167.3
▲	WE-S 10+360Lt	18.5	164.9

Date July 2010

Project 1-09-4135



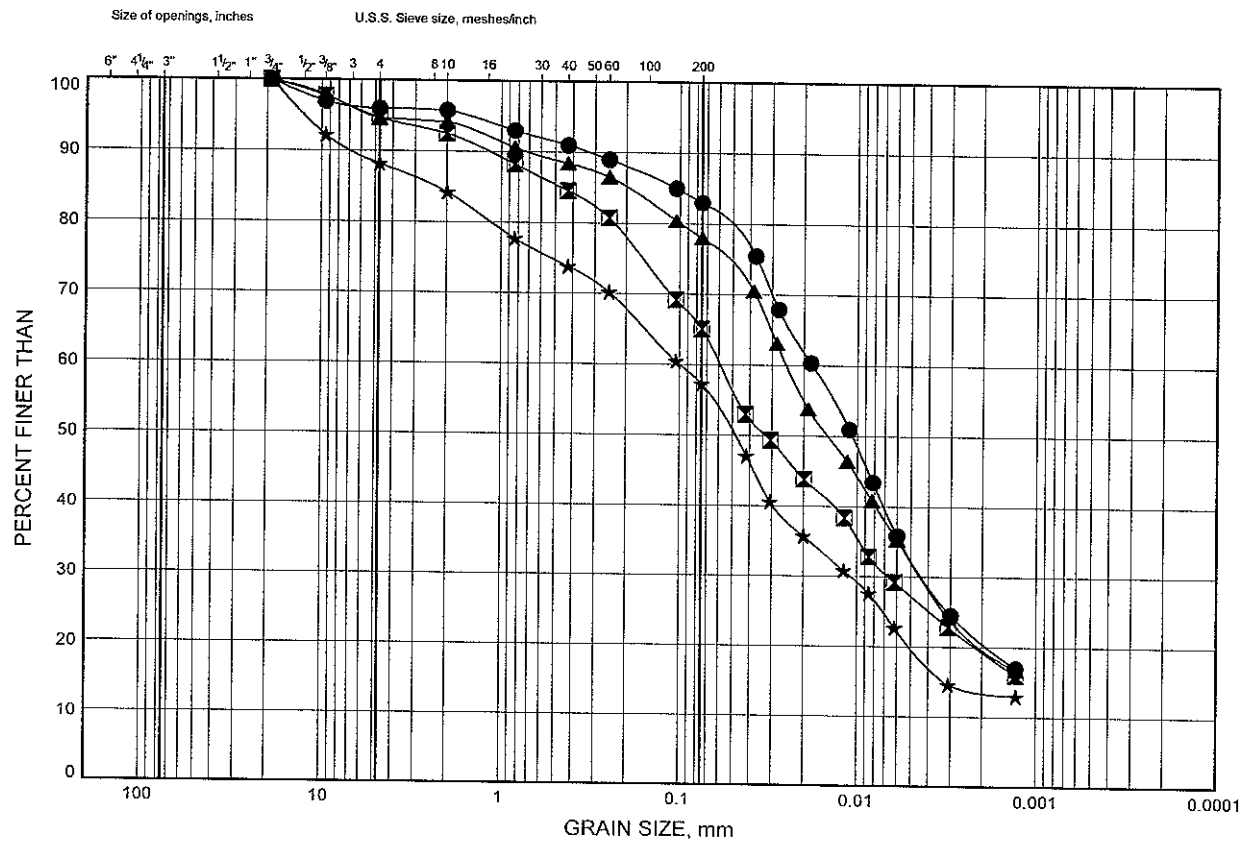
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-16

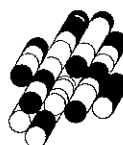
## CLAYEY SILT TO SILTY CLAY TILL



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW3	17.0	165.6
⊠	TEW3	21.5	161.1
▲	TEW4	15.4	167.2
★	TEW4	20.0	162.6

Date July 2010  
Project 1-09-4135

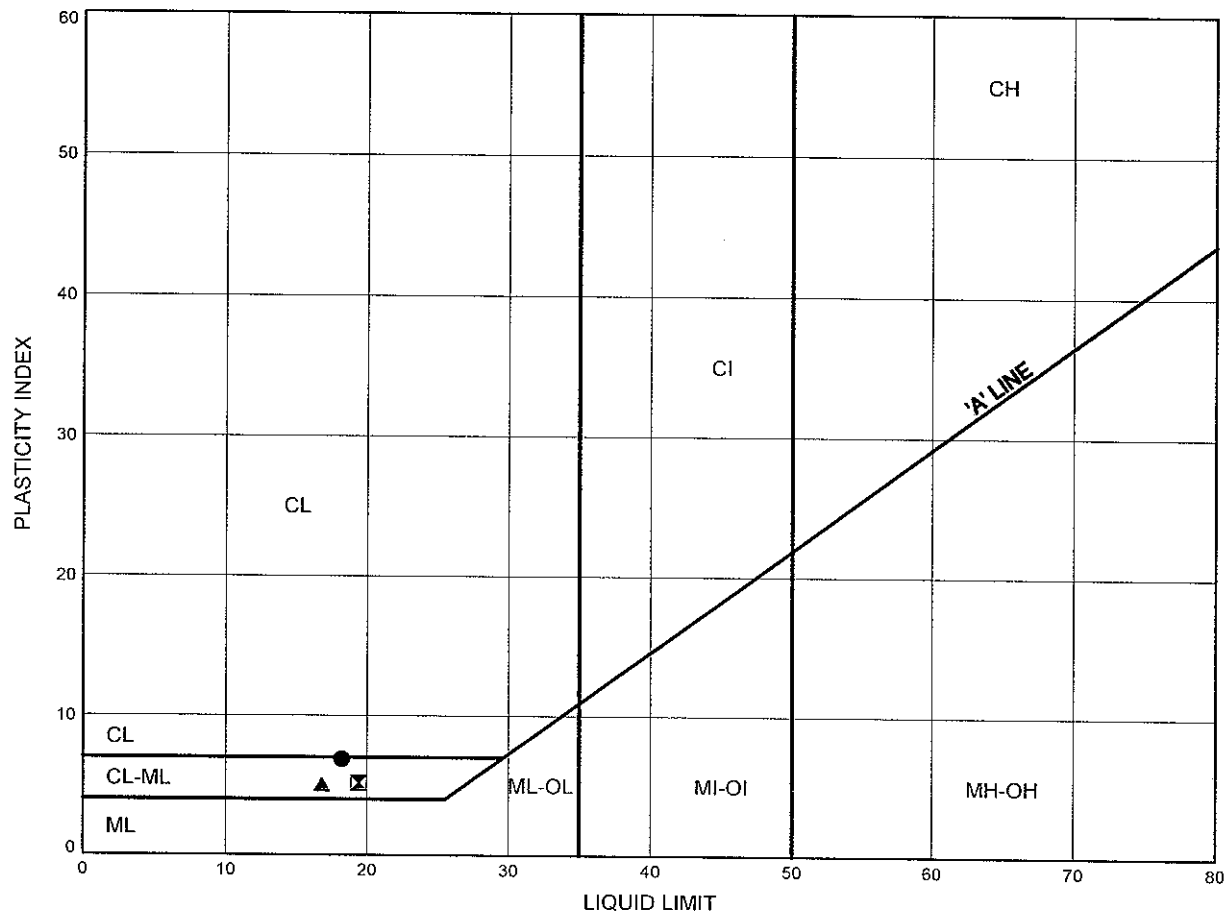


Prep'd DB  
Chkd. HW

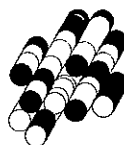
# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-17

## CLAYEY SILT TO SILTY CLAY TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW1	17.0	165.5
⊠	TEW2	15.4	167.3
▲	WE-S 10+360Lt	18.5	164.9

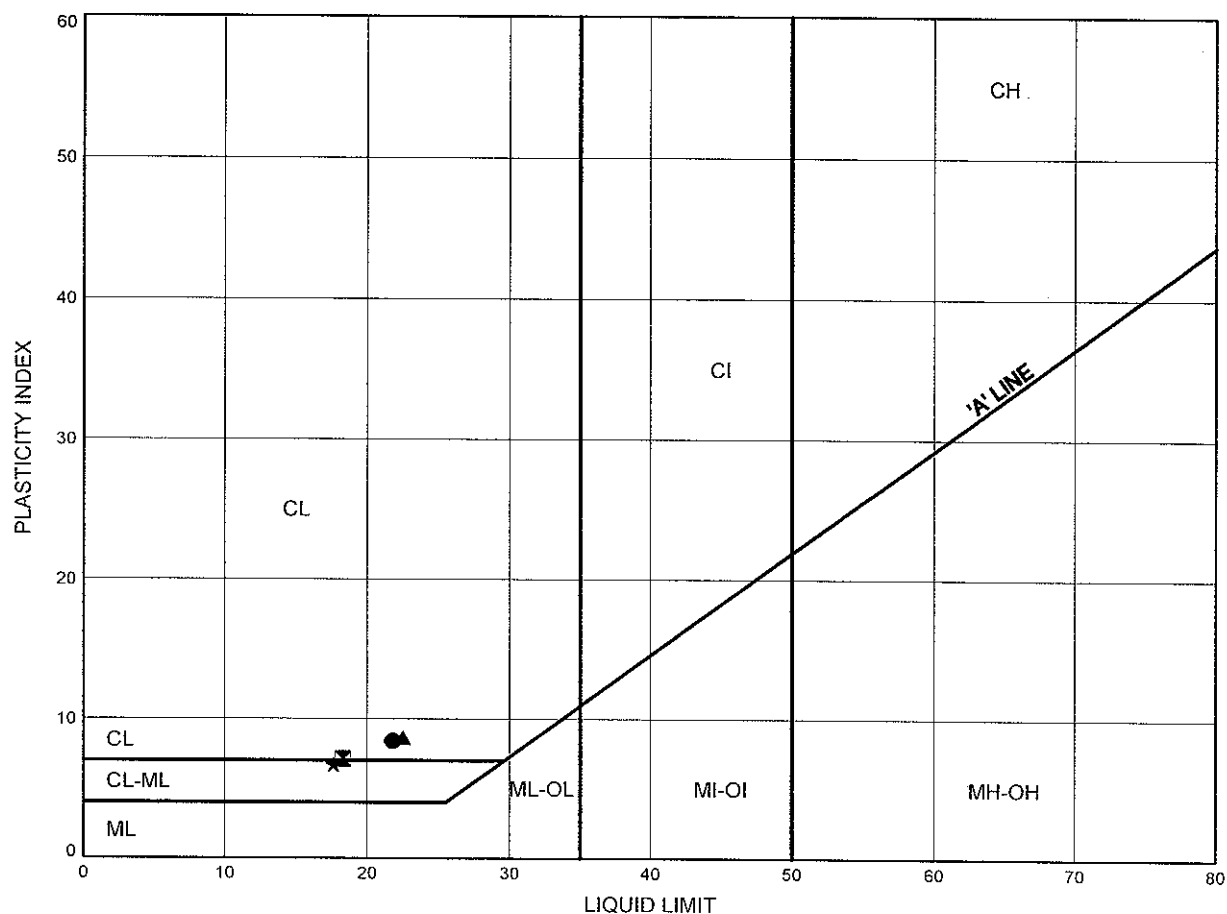




# ATTERBERG LIMITS TEST RESULTS

FIGURE B3-18

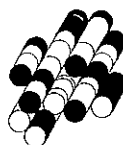
## CLAYEY SILT TO SILTY CLAY TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW3	17.0	165.6
⊠	TEW3	21.5	161.1
▲	TEW4	15.4	167.2
★	TEW4	20.0	162.6

Date July 2010

Project 1-09-4135



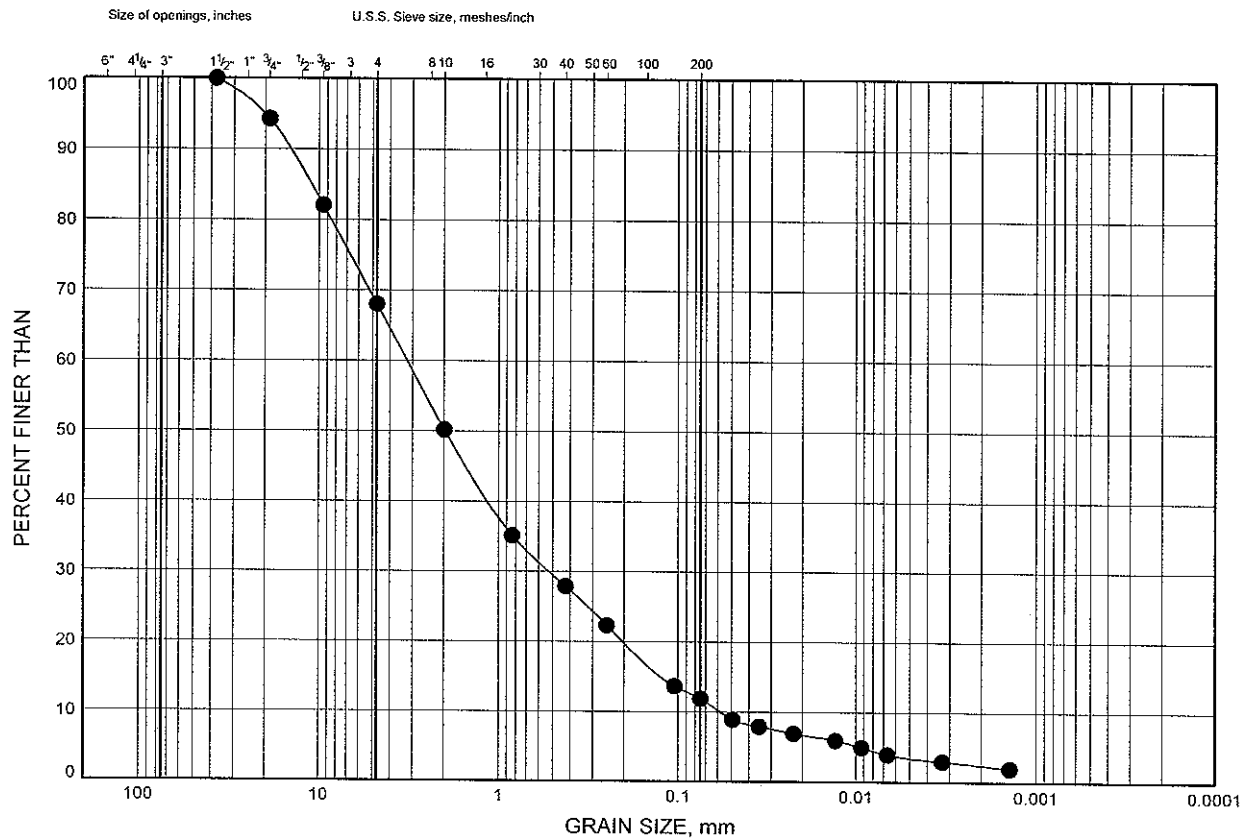
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

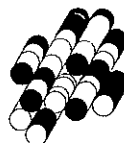
FIGURE B3-19

## SAND



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW1	21.5	161.0



Date July 2010

Project 1-09-4135

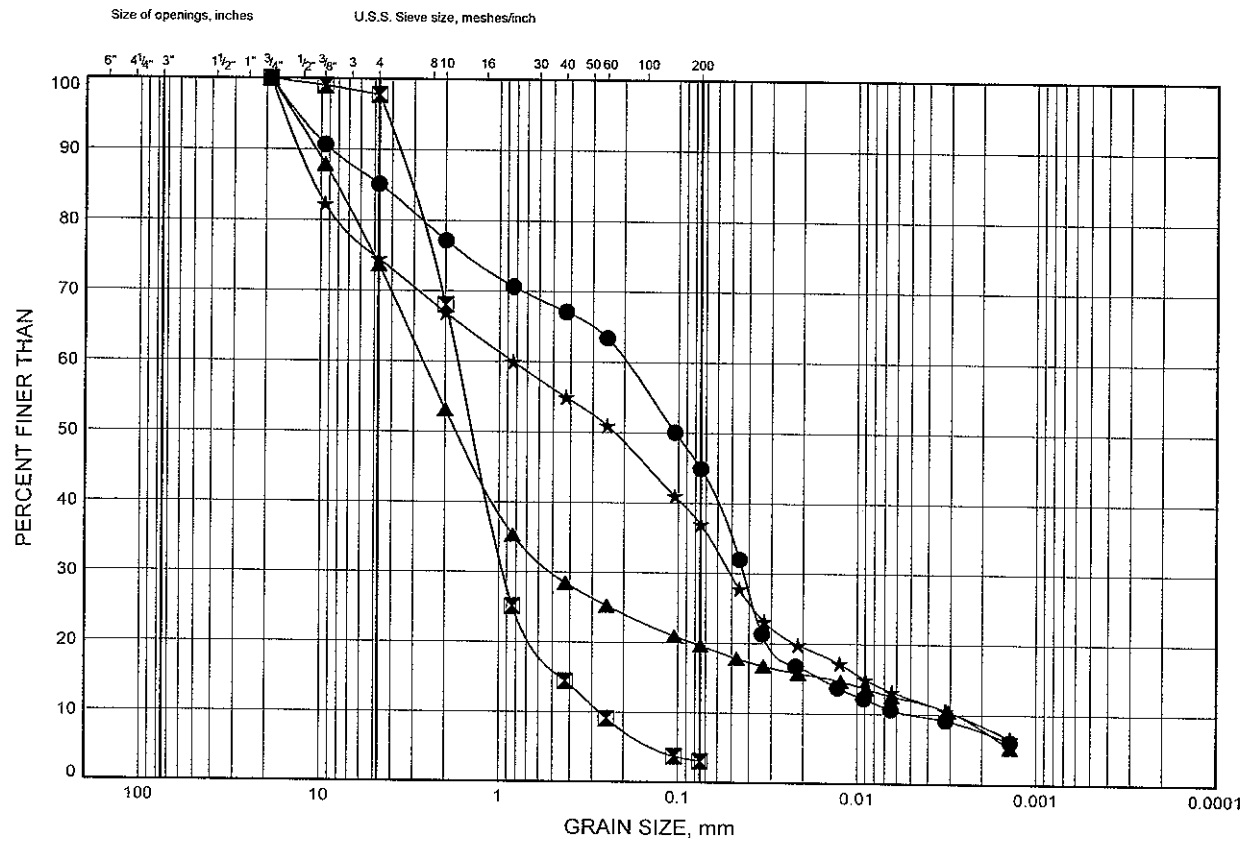
Prep'd DB

Chkd. HW

# GRAIN SIZE DISTRIBUTION

FIGURE B3-20

## SILTY SAND TO SAND AND SILT TILL

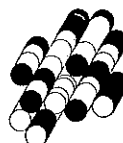


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TEW1	26.2	156.3
⊠	TEW2	24.6	158.1
▲	TEW2	27.6	155.1
★	TEW3	27.6	155.0

Date July 2010

Project 1-09-4135

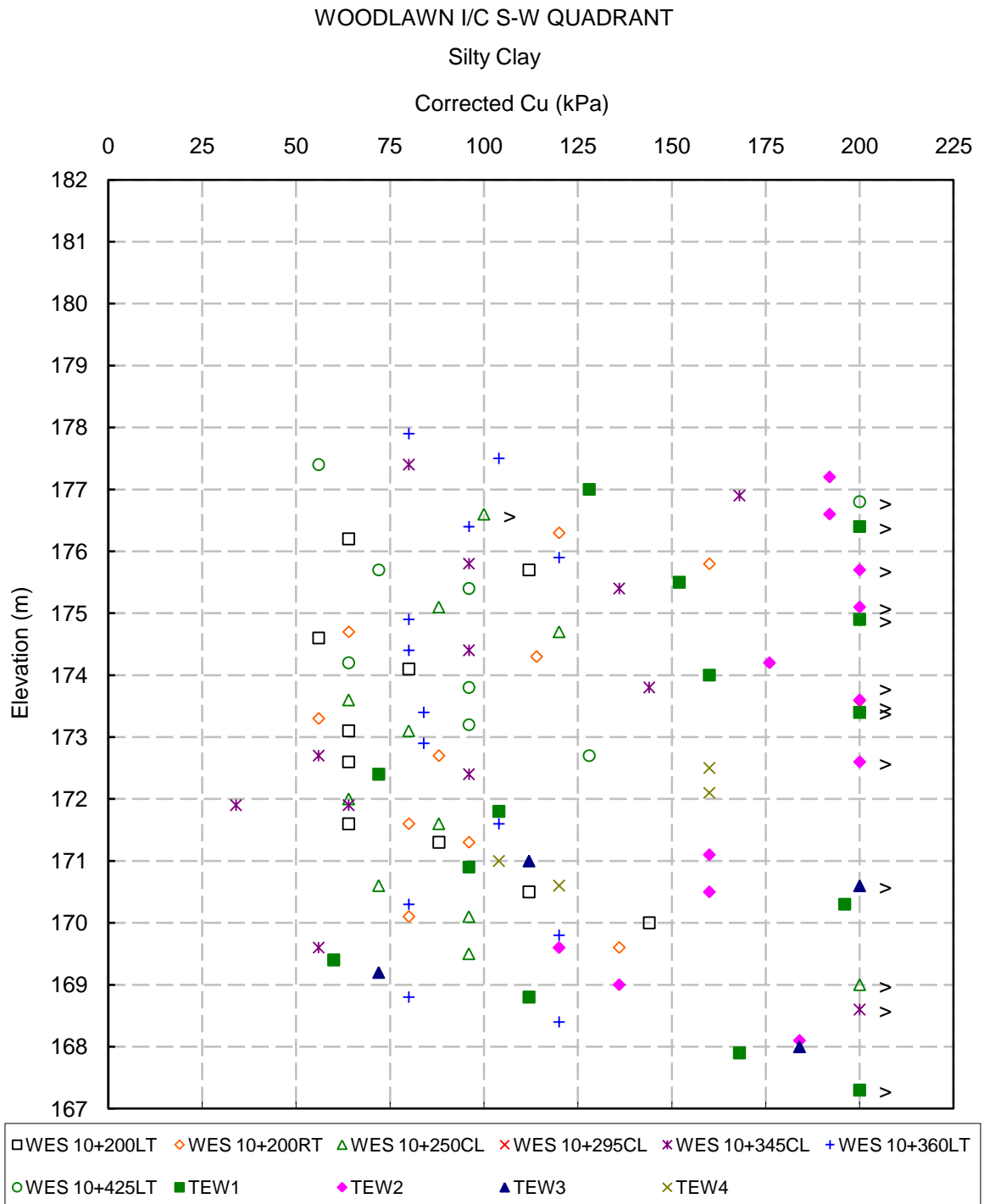


Prep'd DB

Chkd. HW

# CORRECTED UNDRAINED SHEAR STRENGTH

FIGURE B3-21



## Field Shear Vane Correction

Morris & Williams (1994)  
 $(\mu = 1.18 \text{ EXP}(-0.08 \text{ Ip}) + 0.57)$

## Applied Correction Factors

0.90 (Elev.>178m)      1.00 (Elev.<178m)

Project No. : 1-09-4135

Date : September, 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA

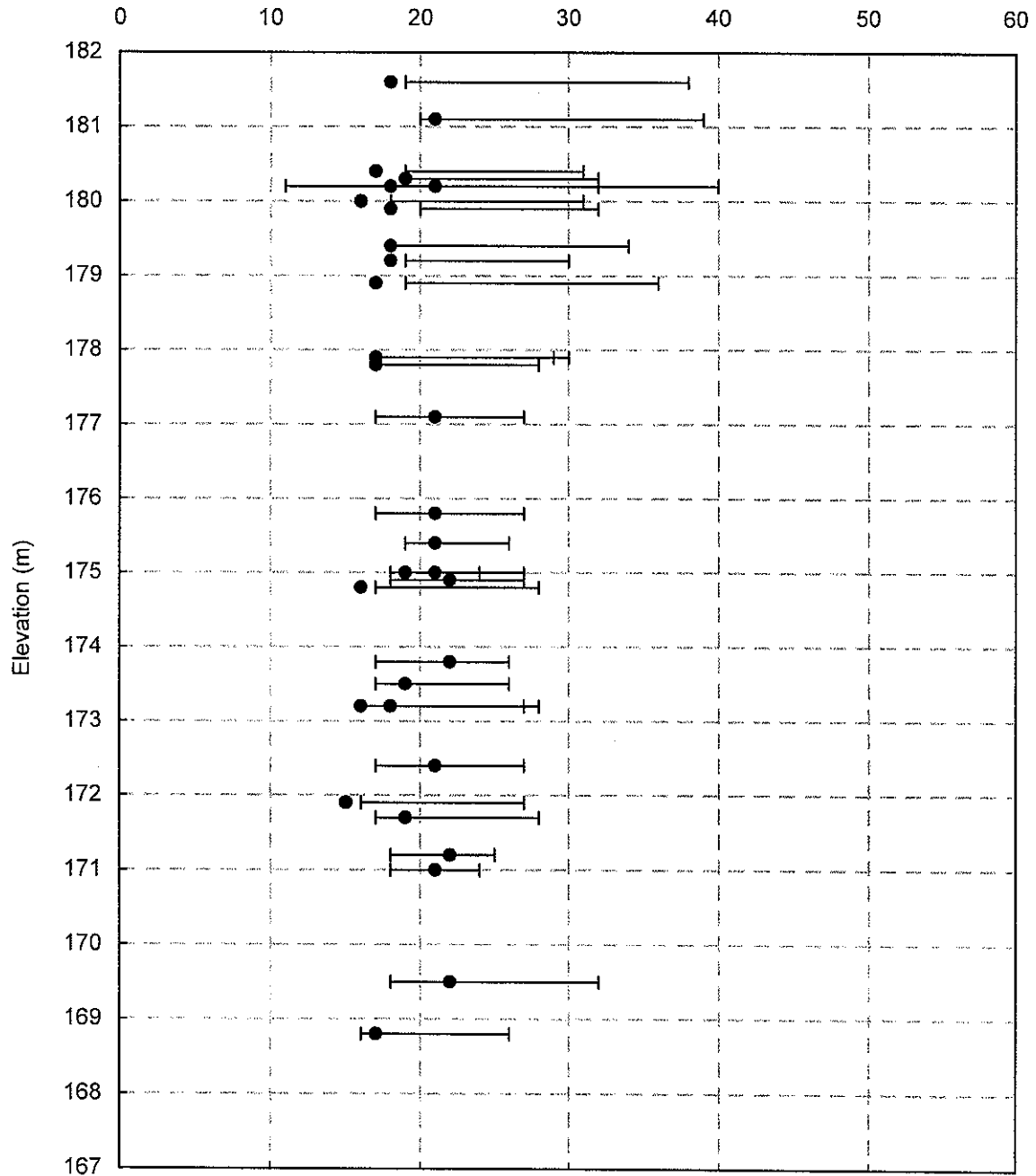
# ATTERBERG LIMITS AND WATER CONTENTS

FIGURE B3-22

## HWY 406 TWINNING - WOODLAWN I/C S-W QUADRANT

Silty Clay

Atterberg Limits & Water Contents (%)



Project No. : 1-09-4135

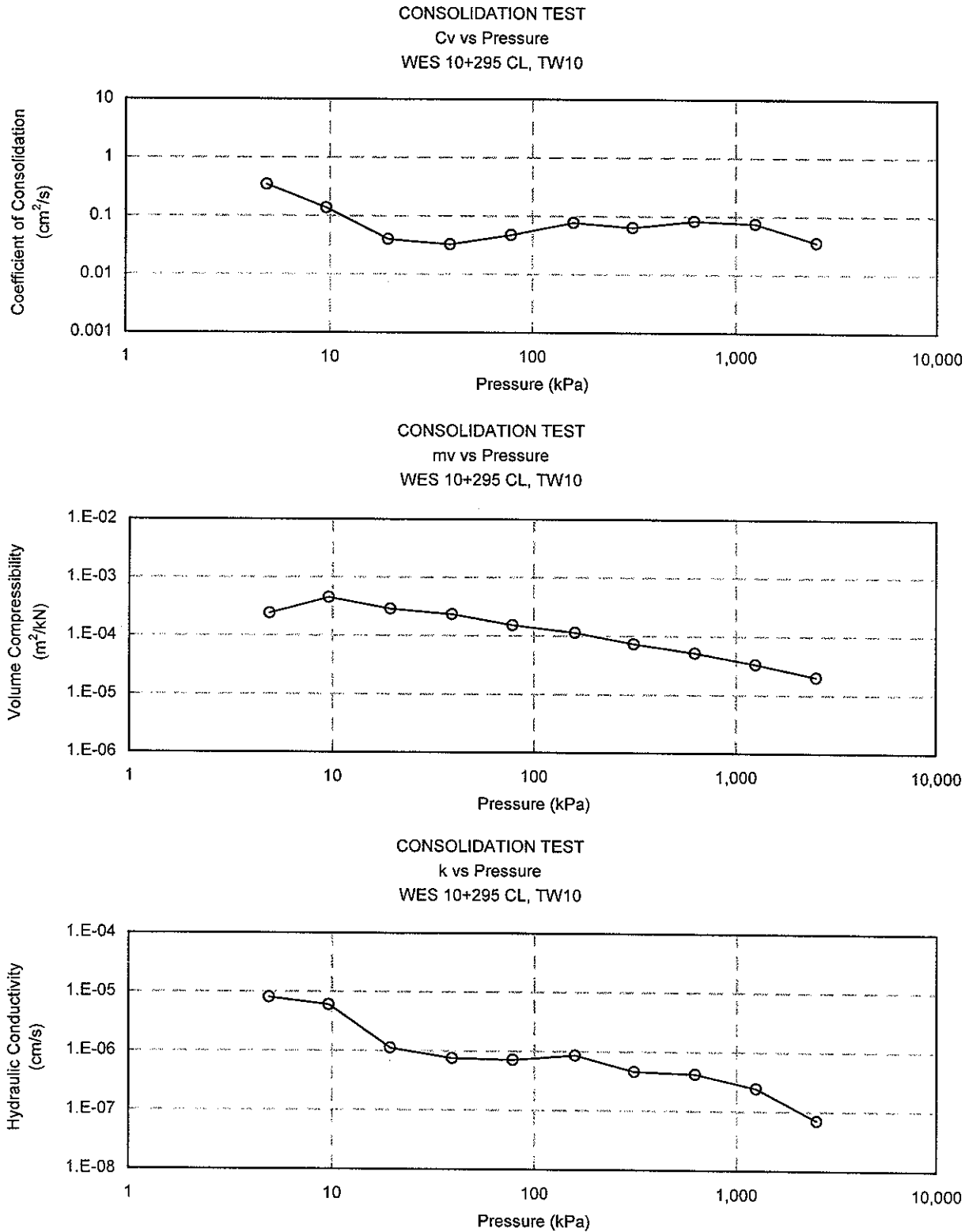
Date : June, 2010



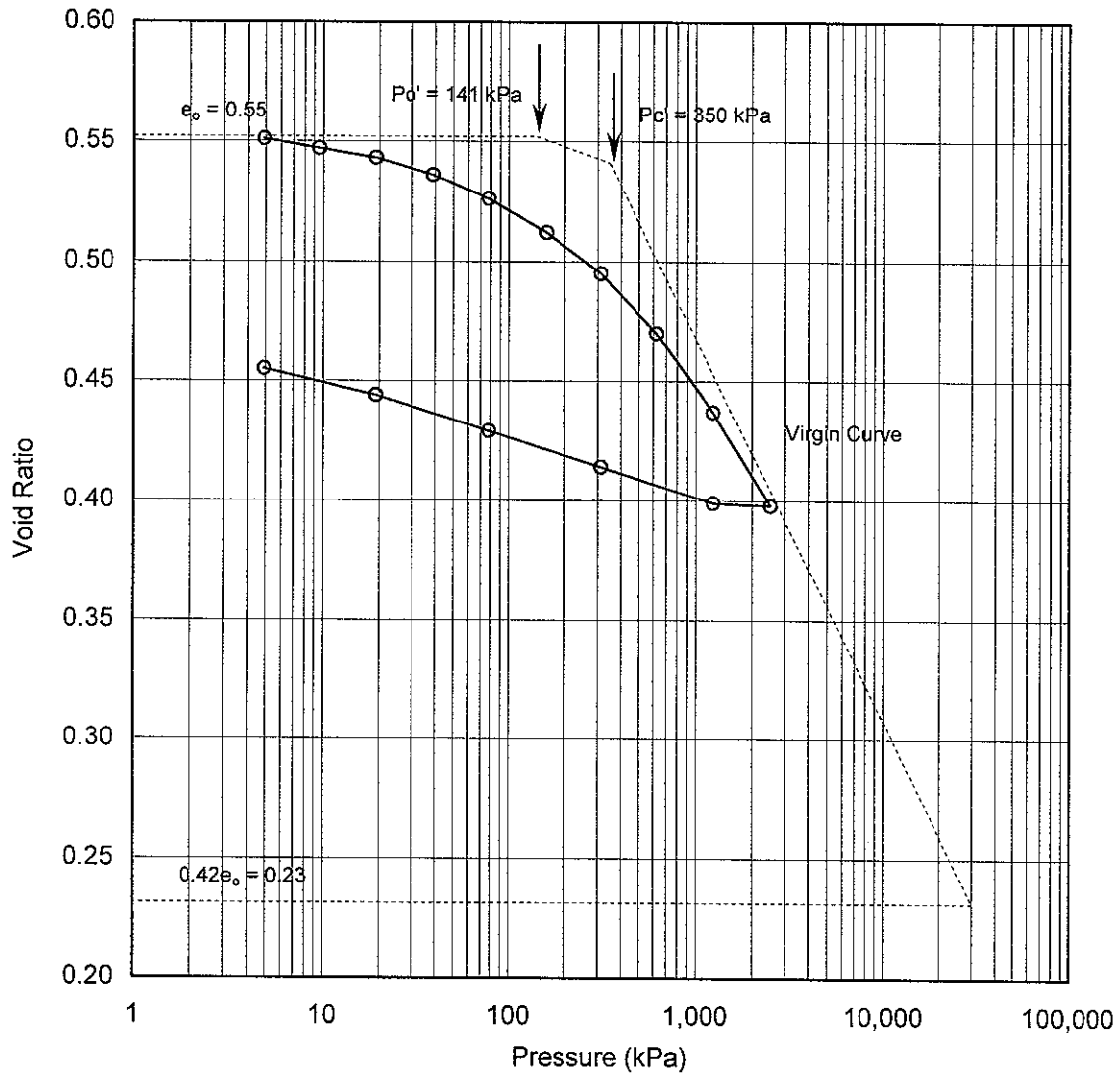
**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



CONSOLIDATION TEST  
e vs Pressure  
WES 10+295 CL, TW10



Soil Type : Silty Clay

$e_o =$	0.55	$\omega_L =$	26%	$P_o' =$	141 kPa
$\omega =$	19%	$\omega_p =$	17%	$P_c' =$	350 kPa
$\gamma =$	20.8 kN/m <sup>3</sup>	PI =	9%	Cc =	0.160
Gs =	2.77			Cr =	0.028

Project No. : 1-09-4135  
Date : June 2010



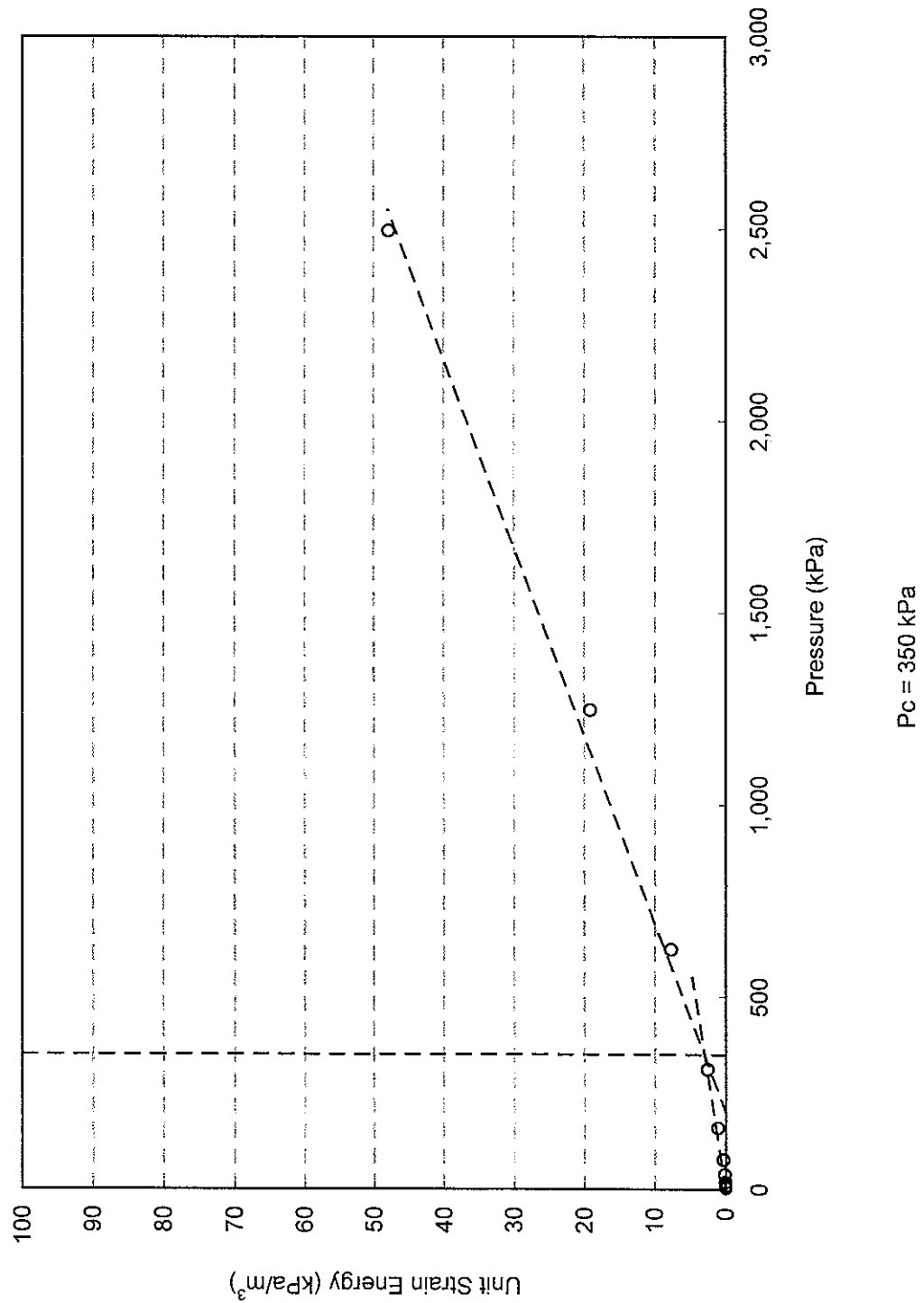
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

# HWY 406 TWINNING - WOODLAWN EW-S RAMP

FIGURE B3-25

## CONSOLIDATION TEST Unit Strain Energy vs Pressure WES 10+295 CL, TW10



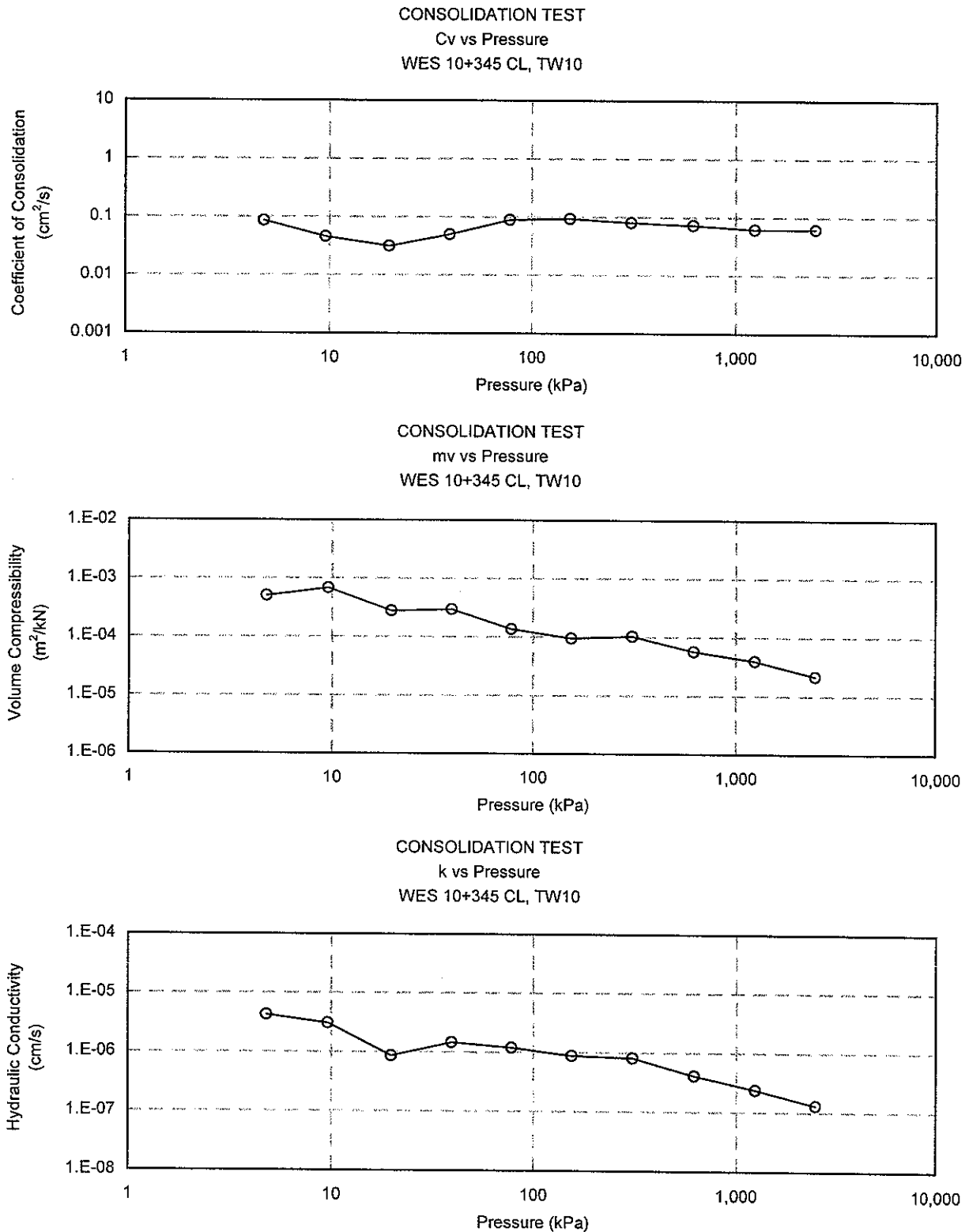
Project No. : 1-09-4135  
Date : June 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA





c:\Documents and Settings\Hongji\My Documents\Project 2009\1-09-4135 - HWY 406 Foundations\High Fill\Woodlawn S-W Quadrant\EWS Ramp\1-09-4135 Consolidation Results-WES.xls

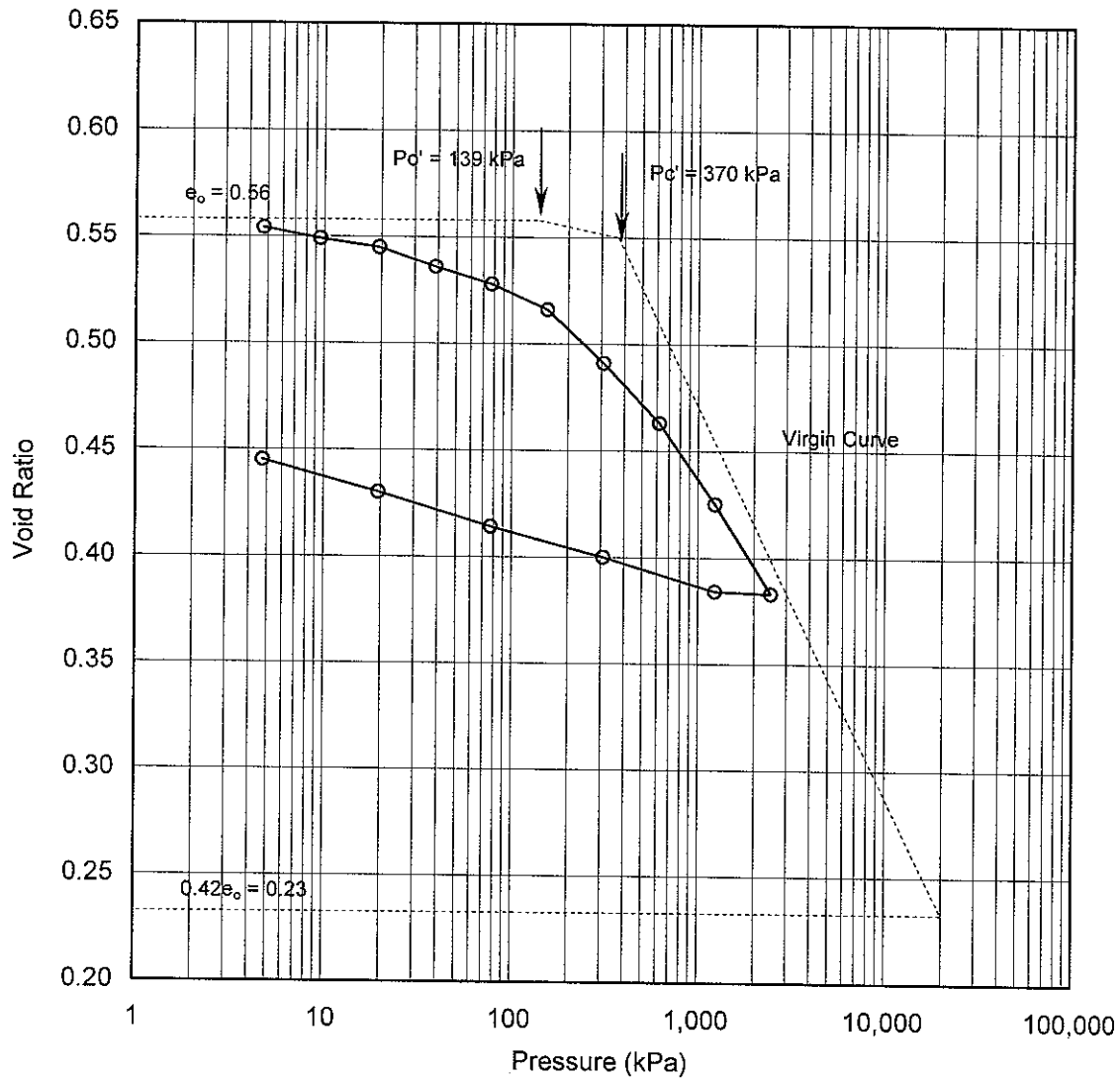
Project No. : 1-09-4135  
Date : June 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

CONSOLIDATION TEST  
e vs Pressure  
WES 10+345 CL, TW10



Soil Type : Silty Clay

$e_o =$	0.56	$\omega_L =$	27%	$P_o' =$	139 kPa
$\omega =$	15%	$\omega_p =$	16%	$P_c' =$	370 kPa
$\gamma =$	20.7 kN/m <sup>3</sup>	PI =	11%	Cc =	0.183
Gs =	2.70			Cr =	0.019

Project No. : 1-09-4135  
Date : June 2010



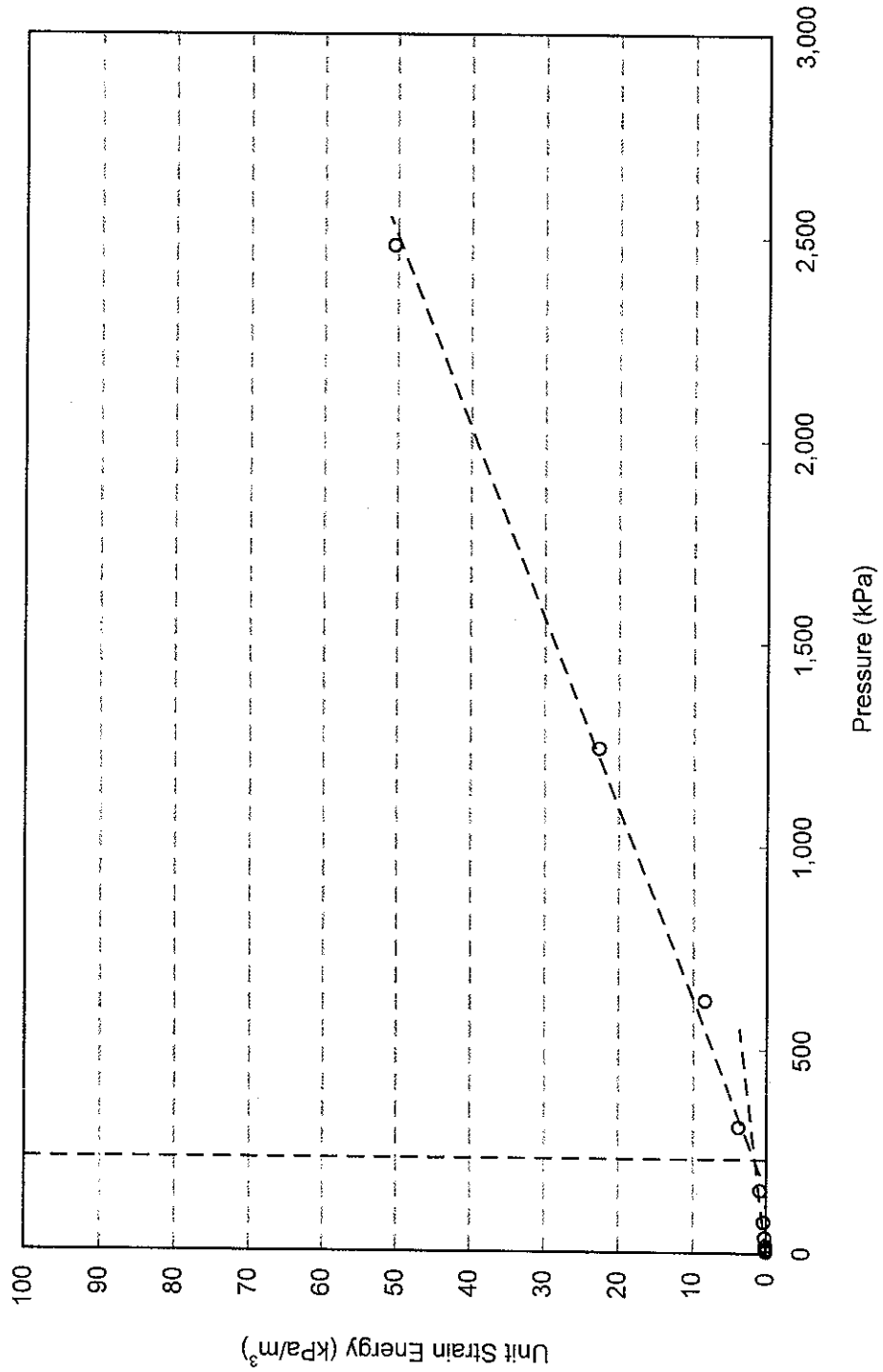
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

# HWY 406 TWINNING - WOODLAWN EW-S RAMP

FIGURE B3-28

## CONSOLIDATION TEST Unit Strain Energy vs Pressure WES 10+345 CL, TW10



$P_c = 230 \text{ kPa}$

Project No. : 1-09-4135

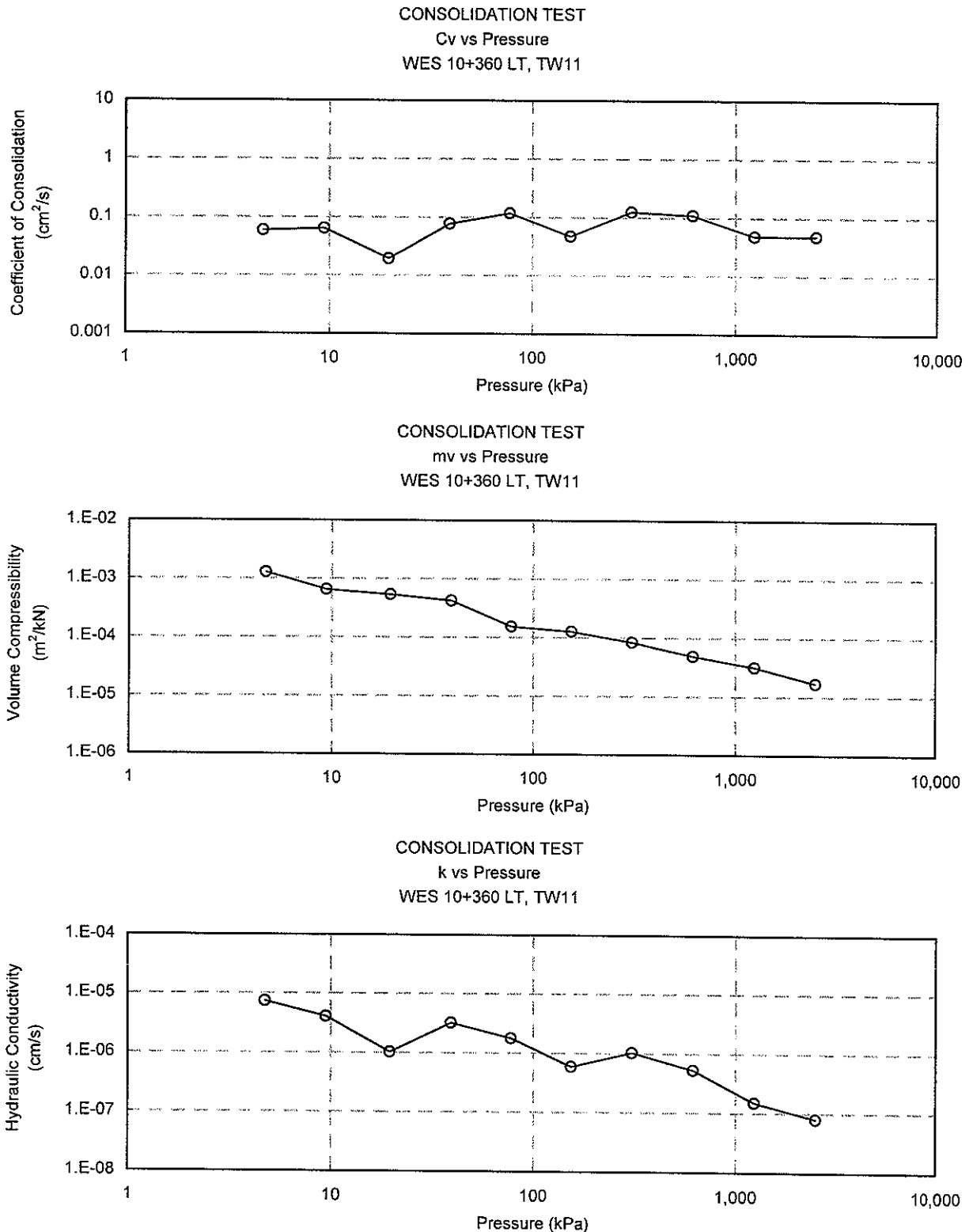
Date : June 2010



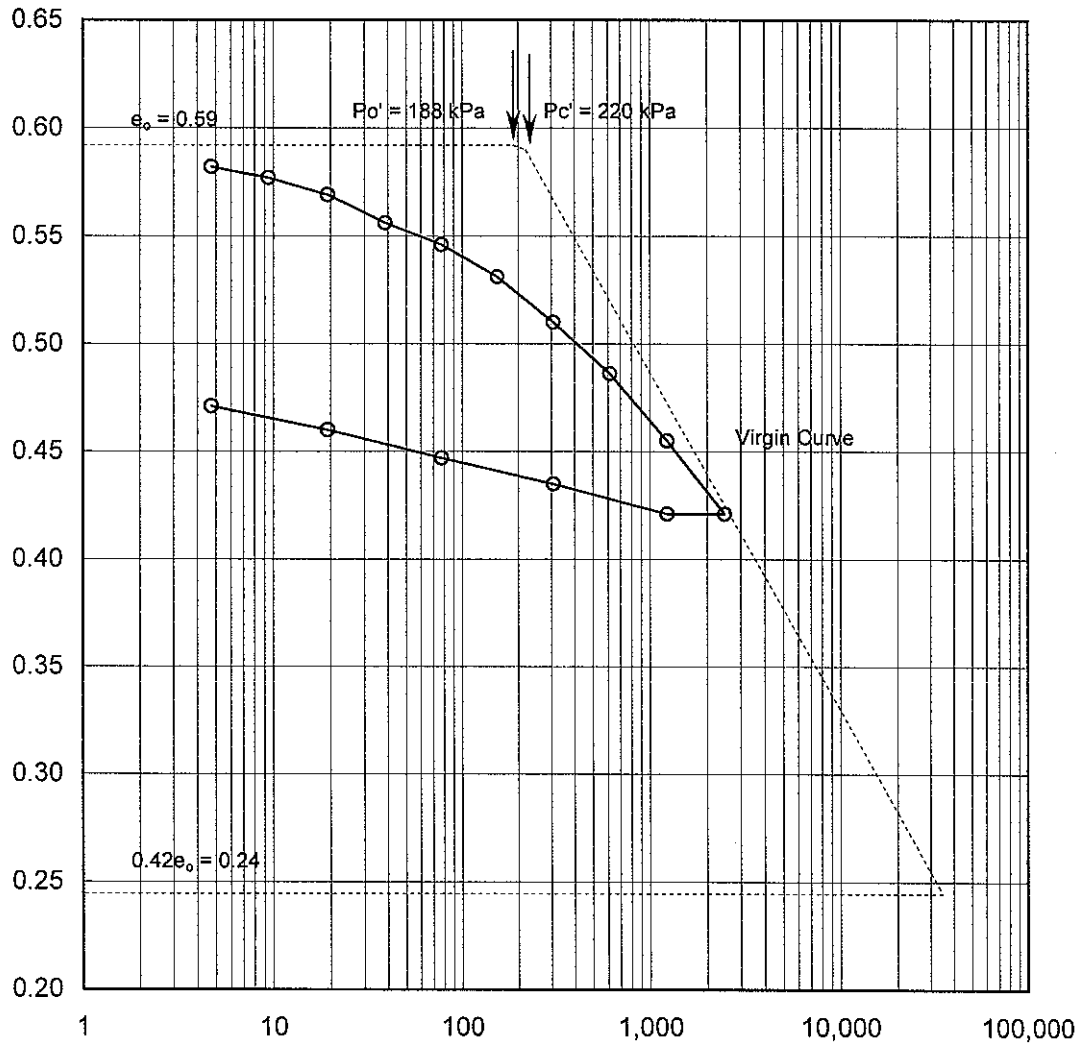
**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



CONSOLIDATION TEST  
e vs Pressure  
WES 10+360 LT, TW11



Soil Type : Silty Clay

$e_o =$	0.59	$\omega_L =$	24%	$P_o' =$	188 kPa
$\omega =$	21%	$\omega_p =$	18%	$P_c' =$	220 kPa
$\gamma =$	20.5 kN/m <sup>3</sup>	PI =	6%	Cc =	0.157
Gs =	2.75			Cr =	0.029

Project No. : 1-09-4135  
Date : June 2010



**Terraprobe Inc.**

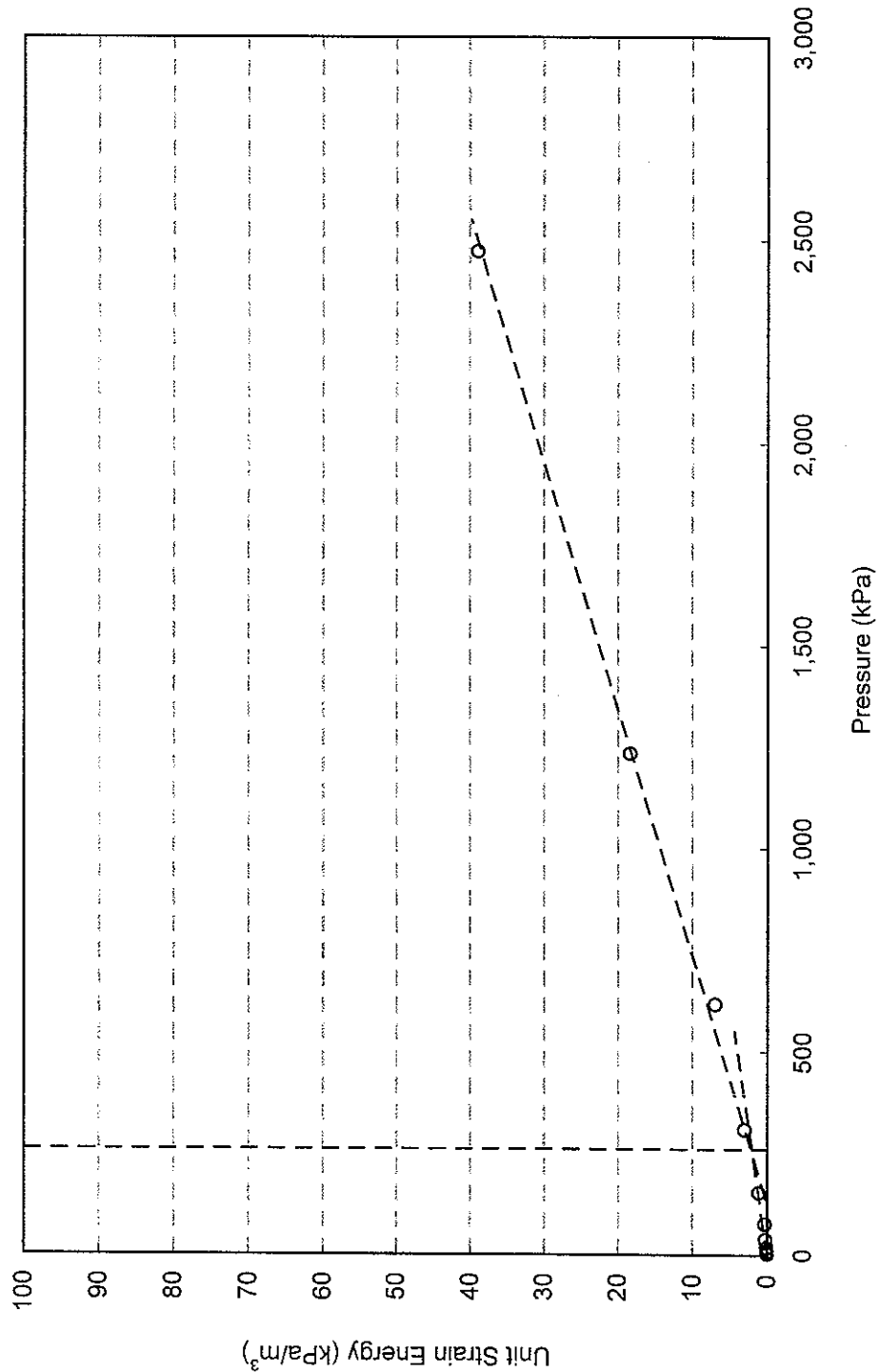
Prepared By : HW  
Checked By : RA

C:\Documents and Settings\Honglin\My Documents\Project 2009\1-09-4135 - HWY 406 Foundations\High Fill\Woodlawn S-W Quadrant\EWS Ramp\1-09-4135 Consolidation Results-WES.xls

# HWY 406 TWINNING - WOODLAWN EW-S RAMP

FIGURE B3-31

## CONSOLIDATION TEST Unit Strain Energy vs Pressure WES 10+360 LT, TW11



$P_c = 260 \text{ kPa}$

Project No. : 1-09-4135  
Date : June 2010

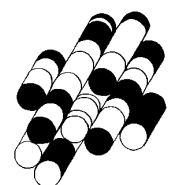


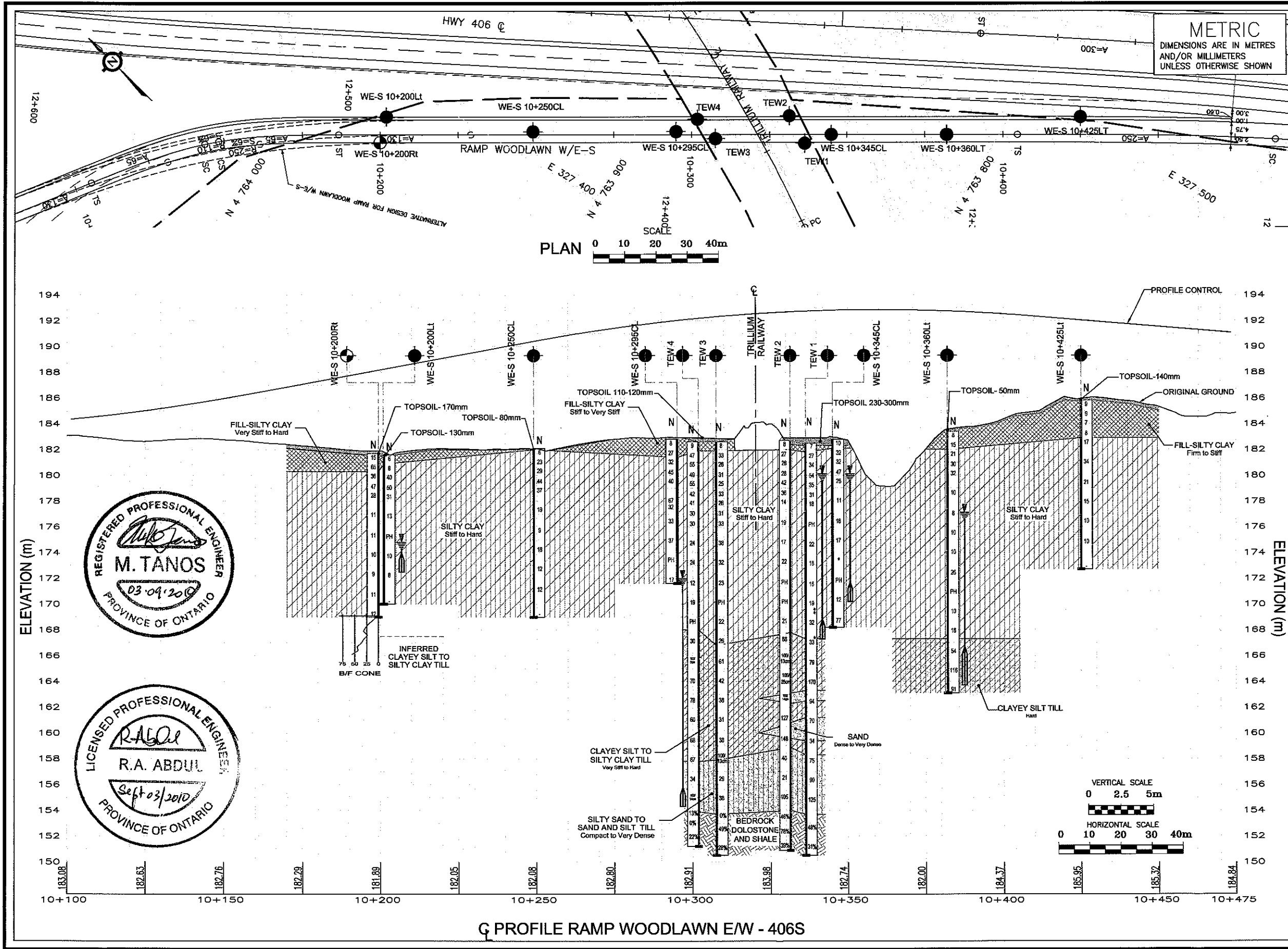
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

# C3

**TERRAPROBE INC.**



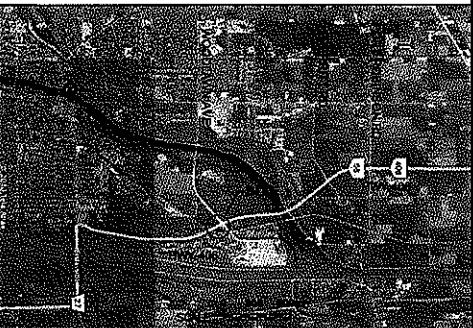


CONT No  
WP No 280-99-00

HIGHWAY 406  
RAMP WOODLAWN W/E-S  
BOREHOLE LOCATIONS AND SOIL STRATA

Giffels Associates Limited  
Consulting Engineers and Architects An IBI  
Group Company

SHEET  
1 OF



KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test
- Bore Hole And Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60' Cone, 475 J/blow)
- WL at Time of Investigation
- WL in Piezometer
- Piezometer
- Rock Quality Designation
- Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
TEW1	182.5	4 763 851.9	327 450.6
TEW2	182.7	4 763 860.7	327 455.5
TEW3	182.6	4 763 877.2	327 436.9
TEW4	182.6	4 763 885.4	327 439.2
WE-S 10+200 LT	181.6	4 763 971.1	327 388.0
WE-S 10+200 RT	181.7	4 763 968.5	327 379.8
WE-S 10+250 CL	182.1	4 763 928.5	327 408.3
WE-S 10+295 CL	182.8	4 763 889.2	327 432.2
WE-S 10+345 CL	182.8	4 763 845.9	327 457.4
WE-S 10+360 LT	183.4	4 763 814.3	327 476.6
WE-S 10+425 LT	185.8	4 763 780.6	327 503.9

NOTE

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

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

REVISIONS

DESIGN R.A. CODE CHBDC2006 LOAD DATE SEPT. 2010

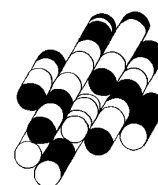
DRAWN K.C. CHK R.A. STRUCT GEOCRES 30M3-263

C:\Users\j\Documents\1-20-4135 HWY 406 HIGH FILLS UPDATED\1-20-4135 HWY 406 - Woodlawn WE-S Borehole.kml



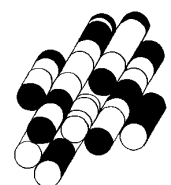
# SITE 4

**TERRAPROBE INC.**



# A4

**TERRAPROBE INC.**



# RECORD OF BOREHOLE No NBL 12+075CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763620.5 E:327614.8 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 11.24.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)														
184.6	Ground Surface																												
184.5 0.1	60mm TOPSOIL		1	SS	5									0 4 56 40															
183.9 0.7	FILL - Silty Clay, trace sand, trace organics, firm, brown, damp to moist		2	SS	11																								
	SILTY CLAY trace sand, stiff, brown, damp to moist		3	SS	14																								
	very stiff to hard		4	SS	36									0 3 60 37															
			5	SS	30																								
			6	SS	18									0 3 61 36															
178.8 5.8	End of Borehole																												
<p>Borehole was dry (not stabilized) and hole open to full depth on completion.</p> <p>Resistance to augering from 0.6-0.8m.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.20.09</td> <td>4.2</td> <td>180.4</td> </tr> <tr> <td>Dec.08.09</td> <td>1.2</td> <td>183.4</td> </tr> <tr> <td>Jan.04.10</td> <td>1.5</td> <td>183.1</td> </tr> <tr> <td>Jan.19.10</td> <td>1.8</td> <td>182.8</td> </tr> </tbody> </table>															Date	Depth(m)	Elevation(m)	Nov.20.09	4.2	180.4	Dec.08.09	1.2	183.4	Jan.04.10	1.5	183.1	Jan.19.10	1.8	182.8
Date	Depth(m)	Elevation(m)																											
Nov.20.09	4.2	180.4																											
Dec.08.09	1.2	183.4																											
Jan.04.10	1.5	183.1																											
Jan.19.10	1.8	182.8																											

## METRIC

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

[illegible]

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No NBL 12+150Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763696.8 E:327598.9 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 11.24.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
183.5 0.0	Ground Surface												
	FILL - Silty Clay, trace sand, trace organics, soft to stiff, dark brown / brown, damp to moist		1	SS	3	183							
			2	SS	10								
182.1 1.4	SILTY CLAY trace sand, very stiff, brown, damp to moist		3	SS	28	182							
			4	SS	24	181							
			5	SS	26	180							
			6	SS	19	179							
			7	SS	17	177							
	trace gravel		8	SS	15	176							
174.4 9.1	End of Borehole					175							
	Borehole was dry (not stabilized) and hole open to full depth on completion.												

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+225CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763763.5 E:327562.3 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 11.26.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
184.9	Ground Surface						20 40 60 80 100						
0.0	480mm FILL - Sand and Gravel, trace silt, dense, grey, damp		1	SS	38								
184.4			2	SS	65								
0.5	FILL - Silty Clay, trace sand, trace gravel, trace organics, occasional asphalt inclusions, hard, brown, damp to moist		3	SS	91								
			4	SS	39								
182.0			5	SS	51								
2.9	trace gravel, hard		6	SS	52								
			7	SS	30								
	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		8	SS	25								
			9	SS	21								
			10	SS	24								
			11	SS	12								
173.0	End of Borehole												
11.9	Borehole was dry (not stabilized) and hole open to full depth on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date Depth(m) Elevation(m) Dec.08.09 2.0 182.9 Apr.16.10 2.0 182.9 Apr.29.10 2.1 182.8												

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+300Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763822.6 E:327512.4 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 11.23.09 - 11.24.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL			x LAB VANE
183.1	Ground Surface						20	40	60	80	100		
182.9	220mm TOPSOIL												
0.2	FILL - Silty Clay, trace sand, trace organics, firm, brown, damp		1	SS	5								
182.4													
0.7	hard		2	SS	36								
			3	SS	33								
			4	SS	31								
	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		5	SS	23								
			6	SS	14								
			7	SS	13								
			8	TW	PH								
	trace gravel		9	SS	12								
172.6	End of Borehole												
10.5	Borehole was dry (not stabilized) and hole open to full depth on completion.												

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+300Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763834.3 E:327536.7 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers, D.C.P.T. COMPILED BY KL  
DATUM Geodetic DATE 11.24.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED	+ FIELD VANE	×						LAB VANE			
								● QUICK TRIAXIAL	×	LAB VANE									
							20	40	60	80	100	WATER CONTENT (%)			10	20	30		
182.7	Ground Surface																		
0.0	FILL - Silty Clay, trace sand, trace organics, firm to stiff, brown, damp to moist		1	SS	8														
182.0																			
0.7	very stiff to hard		2	SS	30		182												
			3	SS	27		181												
			4	SS	33		180												
	----		5	SS	17		179												
	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		6	SS	12		178												
			7	TW	PH		177												
			8	SS	10		176												
			9	SS	6		175												
	----		10	AS	-		174												
	firm, trace gravel						173												
	----						172												
							171												
							170												
169.4	End of Borehole		11	SS	22														
13.3	Borehole was dry (not stabilized) and hole open to full depth on completion.  Dynamic Cone Penetration Test (DCPT) performed from 11.6m to 12.8m.																		

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

+ 3, x 3: Numbers refer to Sensitivity  
○ 3% STRAIN AT FAILURE

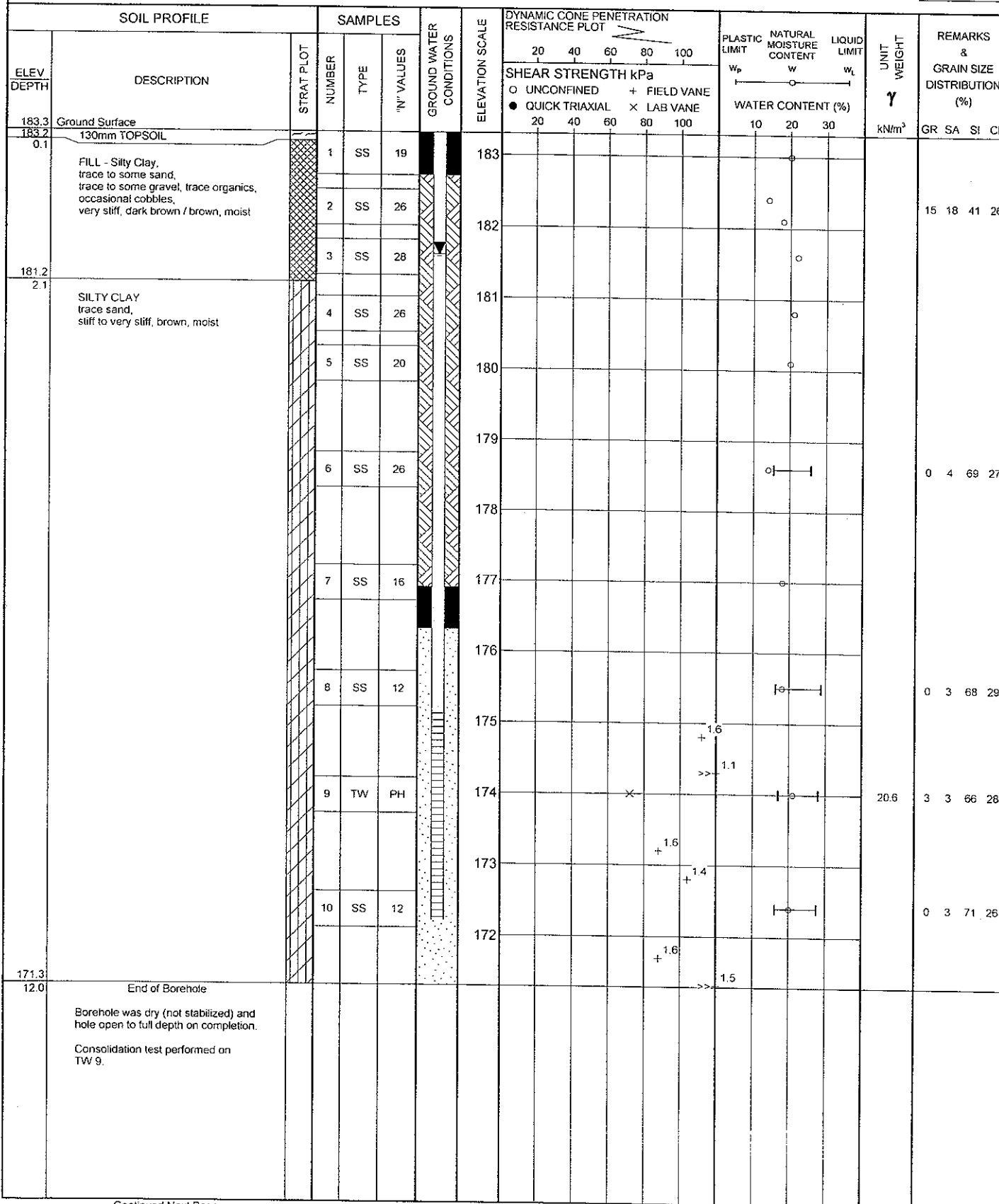


# RECORD OF BOREHOLE No NBL 12+375Lt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763888.1 E:327476.6 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA



Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-08-4135 NBL2.GPJ ONTARIO MOT.GDT 07/08/10

# RECORD OF BOREHOLE No NBL 12+375Lt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763888.1 E:327476.6 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa																										
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.19.09</td> <td>5.8</td> <td>177.5</td> </tr> <tr> <td>Nov.30.09</td> <td>3.2</td> <td>180.1</td> </tr> <tr> <td>Dec.07.09</td> <td>1.3</td> <td>182.0</td> </tr> <tr> <td>Dec.15.09</td> <td>1.8</td> <td>181.5</td> </tr> <tr> <td>Jan.19.10</td> <td>1.7</td> <td>181.6</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.19.09	5.8	177.5	Nov.30.09	3.2	180.1	Dec.07.09	1.3	182.0	Dec.15.09	1.8	181.5	Jan.19.10	1.7	181.6															
Date	Depth(m)	Elevation(m)																																
Nov.19.09	5.8	177.5																																
Nov.30.09	3.2	180.1																																
Dec.07.09	1.3	182.0																																
Dec.15.09	1.8	181.5																																
Jan.19.10	1.7	181.6																																

ONTARIO MOT 1-09-4135 NBL2 GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No TN1

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763901.9 E:327473.4 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.10.09 - 12.14.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
183.5 0.1	Ground Surface 50mm TOPSOIL						20 40 60 80 100	20 40 60 80 100	10 20 30					GR SA SI CL		
	FILL - Silty Sand, some gravel, trace organics, compact, black / brown, moist		1	SS	16						○					
			2	SS	14						○				13 65 (22)	
182.1 1.4	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, damp to moist		3	SS	24						○					
			4	SS	33						○		45		0 1 41 58	
			5	SS	36						○					
			6	SS	36						○					
			7	SS	21						○				1 4 54 41	
			8	SS	32						○					
			9	SS	22						○					
			10	SS	19						○				0 2 68 30	
															commence casing and washboring	
			11	SS	15						○					
			12	SS	20						○				1 7 69 23	
			13	TW	PH											
			14	SS	23						○					
168.8 14.7																

Continued Next Page

+ 3, x 3, Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## METRIC

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

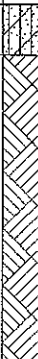
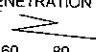
+ 3. X 3: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No TN1

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763901.9 E:327473.4 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 12.10.09 - 12.14.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						
							20	40	60	80	100							
153.0	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.																	
30.5			1	RUN	NQ		153											
								152										
								151										
150.0	End of Borehole						150											
33.6	Borehole open to full depth and filled with drill water upon completion of drilling.  Unable to push vane to 16.4m and 28.6m.  Borehole sealed with bentonite slurry to ground surface.																	

# RECORD OF BOREHOLE No TN2

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763920.1 E:327481.1 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 02.05.10 - 02.17.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
184.2	Ground Surface													
0.0	800mm FILL - Sandy Gravel, trace silt, very dense, grey, dry		1	SS	19		184							
183.4														
0.8	FILL - Silty Clay, trace to some sand, trace to some gravel, trace organics, very stiff to hard, brown / dark brown, damp to moist		2	SS	35		183							13 12 53 22
			3	SS	18									
182.1														
2.1	SILTY CLAY trace sand, occasional gravel inclusions, stiff to hard, brown, damp to moist		4	SS	37		182							
			5	SS	42		181						43	0 2 44 54
			6	SS	32		180							Jan.26
			7	SS	19									Feb.05
			8	SS	21		179							0 2 60 38
			9	SS	17		178							
							177							
			10	SS	19		176							
							175							0 5 65 30
			11	SS	10		174							
			12	SS	11		173							
							172							
			13	TW	PH									
							171							
			14	SS	16		170							1 3 72 24
169.5														
14.7														

ONTARIO MOT. 1-09-4135 NBL2.GPJ\_ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No TN2

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763920.1 E:327481.1 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 02.05.10 - 02.17.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
153.7 30.5	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		24	SS	100/ 15cm		154							Feb.12
			1	RUN	NQ		153							Feb.17
			2	RUN	NQ		152							RUN#1 TCR=0% SCR=0% RQD=0%
			3	RUN	NQ		151							RUN#2 TCR=71% SCR=66% RQD=16%
150.1 34.1	End of Borehole		4	RUN	NQ									RUN#3 TCR=100% SCR=78% RQD=44%
	Borehole filled with drill water upon completion of drilling.  No sample recovery at SS9. Sampler redriven and disturbed sample collected.  Unable to push vane to 16.1m.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date Depth(m) Elevation(m) Apr.16.10 2.6 181.6 Apr.29.10 1.6 182.6 May.04.10 6.2 178.0 May.06.10 6.2 178.0													RUN#4 TCR=93% SCR=92% RQD=54%

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT GDT 07/06/10



## METRIC

[illegible]

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No TN3

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763930.0 E:327463.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 02.02.10 - 02.11.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
							20 40 60 80 100	20 40 60 80 100						GR SA SI CL	
168.9 15.2	SILTY CLAY some sand, trace gravel, very stiff to hard, brown, damp to moist  (GLACIAL TILL)		15	SS	27					1.2				4 17 56 23	
											1.6				
			16	SS	26						1.4				
			17	SS	74						1.8				
			18	SS	100										
162.5 21.6	SANDY SILT TO SILTY SAND some gravel, trace clay, dense to very dense, brown, moist  (GLACIAL TILL)		19	120	100/ 13cm								commence casing and washboring		
			20	SS	71										
			21	SS	48										
			22	SS	43										
157.2 26.9	CLAYEY SILT TO SILTY CLAY trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)												Feb.04 Feb.08		
156.4 27.7	SAND AND GRAVEL silty, trace clay, very dense, brown, moist  (GLACIAL TILL)		23	SS	112								Feb.08 Feb.09		
154.5 29.6	BEDROCK		24	SS	108								31 33 29 7 Feb.09 Feb.11		

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No TN3										3 OF 3		METRIC					
W.P. 280-99-00		LOCATION		Coords: N:4763930.0 E:327463.7				ORIGINATED BY MP									
DIST		HWY 406		BOREHOLE TYPE Solid Stem Augers / Casing and Washboring / NQ Rock Coring				COMPILED BY DB									
DATUM Geodetic		DATE		02.02.10 - 02.11.10				CHECKED BY RA									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100					WATER CONTENT (%) 10 20 30					
150.9	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ		154										RUN#1 TCR=91% SCR=72% RQD=8%
							153								RUN#2 TCR=95% SCR=78% RQD=17%		
							152										
							151								RUN#3 TCR=98% SCR=84% RQD=16%		
33.2	End of Borehole  Borehole was open to 21.3m and filled with drill water on completion of drilling.  Unable to push vane to 13.3m.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date      Depth(m)      Elevation(m) Apr.16.10      3.9      180.2 Apr.29.10      4.7      179.4 May.04.10      8.7      175.4 May.06.10      9.4      174.7 May.18.10      3.8      180.3																

# RECORD OF BOREHOLE No TN4

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4763941.4 E:327469.8 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.26.10 - 02.17.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
184.0	Ground Surface						20 40 60 80 100	10 20 30					GR SA SI CL		
0.0	740mm FILL - Gravel, some sand, trace to some silt, dense, grey, damp		1	SS	41					○				72 17 (11)	
183.3															
0.7			FILL - Silty Clay, some gravel, trace sand, trace organics, stiff, dark brown / brown, damp to moist	2	SS	10						○			
	3	SS		15								○			
181.9	SILTY CLAY trace sand, stiff to hard, brown, damp to moist		4	SS	29							○	44	0 3 47 50	
2.1															
			5	SS	36							○			
			6	SS	50								○		0 3 74 23
			7	SS	43							○			
			8	SS	23								○		Jan.26
															Feb.05
			9	SS	17								○		0 3 65 32
							</								

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+ 3 x 3 Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No TN4

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763941.4 E:327469.8 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 01.25.10 - 02.17.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
								SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
								20 40 60 80 100						
								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
								$W_p$ $W$ $W_L$ WATER CONTENT (%)						
								10 20 30						
163.6 20.4	SILTY CLAY some sand to sandy, trace gravel, very stiff to hard, brown, damp (GLACIAL TILL)		15	SS	35		168							
			16	SS	30		167							4 22 54 20
			17	SS	87		166							
			18	SS	84		164							
			19	SS	96		163							Feb 05 Feb 12
			20	SS	129		162							27 28 34 11
			21	SS	109		161							
			22	SS	65		160							
157.5 26.5	SANDY SILT TO SILTY SAND some gravel to gravelly, trace to some clay, very dense, brown, moist to wet (GLACIAL TILL)		23	SS	40		159							
			24	SS	60		158							
							157							
155.6 28.4	SILTY CLAY trace sand, hard, brown, moist (GLACIAL TILL)						156							0 4 54 42
							155							19 39 32 10

ONTARIO MOT 1-09-4135 NBL2 GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## METRIC

ON | AKIO MO | 1-09-4133 NBLZ.GPJ UNTAKIO MO | 07/06/10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
							20	40	60	80	100							
153.4	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ												Feb. 12	
30.6																		Feb. 17
			2	RUN	NQ													RUN#1 TCR=36% SCR=7% RQD=0%
			3	RUN	NQ													RUN#2 TCR=59% SCR=45% RQD=7%
149.0																	RUN#3 TCR=97% SCR=71% RQD=27%	
35.0	End of Borehole																	
	Borehole filled with drill water upon completion of coring.																	
	Borehole sealed with bentonite slurry to ground surface.																	

+ 3, X 3: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No NBL 12+440Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763962.9 E:327465.8 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub>	W	W <sub>L</sub>		
183.0	Ground Surface							20 40 60 80 100						
182.9	130mm TOPSOIL							20 40 60 80 100						
0.1	FILL - Silty Clay, trace sand, trace gravel, trace organics, firm to stiff, brown, damp to moist		1	SS	6									
			2	SS	12									
			3	SS	13									
			4	SS	14									
180.1	SILTY CLAY trace sand, occasional gravel inclusions, stiff to very stiff, brown, moist		5	SS	17									
2.9			6	SS	26									
			7	SS	15									
			8	SS	25									
			9	SS	10									
			10	TW	PH									
			11	SS	12									
169.6	End of Borehole													
13.4	Borehole was dry (not stabilized) and hole open to full depth on completion.  Consolidation test performed on TW 10.													

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No NBL 12+440Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763962.9 E:327465.8 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.04.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100												
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.09.09</td> <td>8.2</td> <td>174.8</td> </tr> <tr> <td>Nov.19.09</td> <td>2.1</td> <td>180.9</td> </tr> <tr> <td>Nov.30.09</td> <td>1.9</td> <td>181.1</td> </tr> <tr> <td>Dec.08.09</td> <td>1.9</td> <td>181.1</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.09.09	8.2	174.8	Nov.19.09	2.1	180.9	Nov.30.09	1.9	181.1	Dec.08.09	1.9	181.1													
Date	Depth(m)	Elevation(m)																											
Nov.09.09	8.2	174.8																											
Nov.19.09	2.1	180.9																											
Nov.30.09	1.9	181.1																											
Dec.08.09	1.9	181.1																											

ONTARIO MOT 1-09-4135 NBL2 GPJ ONTARIO MOT.GDT 07/06/10



# RECORD OF BOREHOLE No NBL 12+525Lt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764023.2 E:327410.0 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers, D.C.P.T. COMPILED BY DB  
DATUM Geodetic DATE 11.13.09 - 11.16.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.8	Ground Surface							20 40 60 80 100	20 40 60 80 100					
182.6	180mm TOPSOIL													
0.2	FILL - Silty Clay, trace sand, trace organics, firm, brown, moist		1	SS	5									
182.1														
0.7	SILTY CLAY trace sand, very stiff, brown, damp		2	SS	16		182							
181.4														
1.4	SILT - trace sand, frequent silty clay seams and partings, compact, brown, moist to wet		3	SS	13		181							0 1 84 15
180.7														
2.1	hard		4	SS	32		180							
	SILTY CLAY trace sand, occasional gravel inclusions, firm to very stiff		5	SS	11		179							0 2 72 26
			6	TW	PH		178							Nov. 13 Nov. 16
							177							
			7	SS	9									1 2 68 29
							176							
			8	SS	7		175							
							174							0 4 70 26
			9	SS	10									
							173							
			10	SS	11		172							
							171							0 2 71 27
			11	SS	19									
							170							
							169							
			12	SS	27									
							168							
168.1														
14.7														

Continued Next Page

+ 3 x 3 Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+525Lt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764023.2 E:327410.0 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers, D.C.P.T. COMPILED BY DB  
DATUM Geodetic DATE 11.13.09 - 11.16.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
								20 40 60 80 100							
167.1	SILTY CLAY TO CLAYEY SILT some sand, some gravel, hard, brown, damp (GLACIAL TILL)		13	SS	36									11 20 49 20	
15.7	End of Borehole						167								
166.6															
16.2	End of Dynamic Cone Penetration Test														
	Borehole was dry (not stabilized) and hole open to full depth on completion.														
	Sampler wet at 9.1m.														
	Dynamic cone penetration test performed from 15.8m to 16.2m.														
	Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.														
	Water Level Readings: Date Depth(m) Elevation(m) Nov.30.09 9.4 173.4 Dec.07.09 6.2 176.6 Dec.15.09 4.7 178.1 Jan.04.10 3.4 179.4 Jan.11.10 3.3 179.5 Jan.19.10 3.3 179.5														

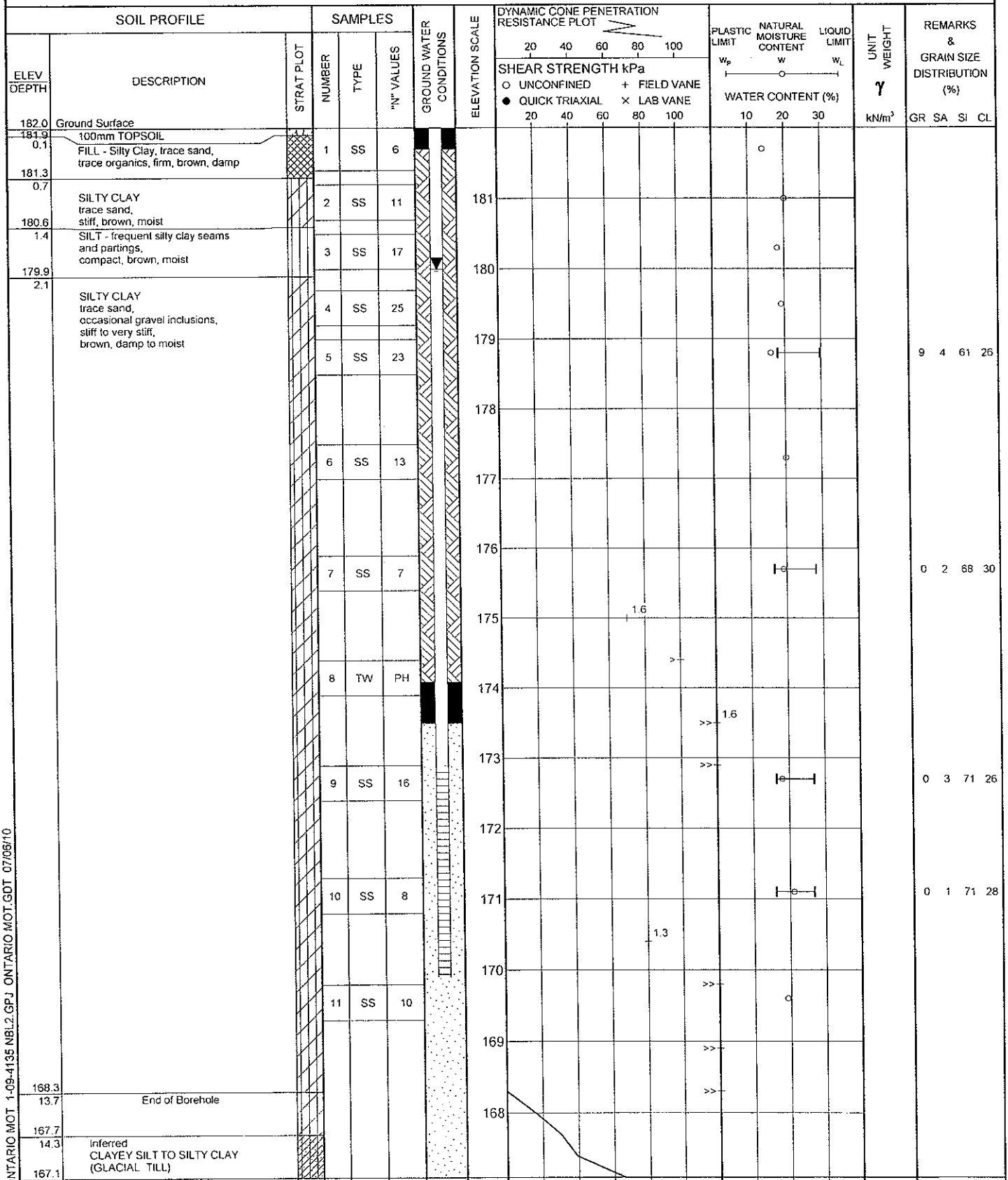
ONTARIO MOT. 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No NBL 12+525Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764039.4 E:327429.4 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers, D.C.P.T. COMPILED BY DB  
DATUM Geodetic DATE 11.05.09 CHECKED BY RA



Continued Next Page

+ 3 x 3. Numbers refer to Sensitivity  
○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No NBL 12+525Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764039.4 E:327429.4 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers, D.C.P.T. COMPILED BY DB  
DATUM Geodetic DATE 11.05.09 CHECKED BY RA

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
14.9	End of Dynamic Cone Penetration Test  Dynamic Cone Penetration Test (DCPT) performed from 13.7m to 14.9m.  Resistance to augering from 8.5m to 9.1m.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.  Water Level Readings: Date Depth(m) Elevation(m) Nov.09.09 10.8 171.2 Nov.19.09 4.6 177.4 Nov.30.09 2.4 179.6 Dec.08.09 2.0 180.0 Jan.04.10 2.0 180.0																

ONTARIO MOT 1-09-4135 NBL2 GPJ ONTARIO MOT GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+595Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764099.0 E:327404.2 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.05.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)			
181.6	Ground Surface													
0.0	25mm TOPSOIL		1	SS	6		181							
180.9	FILL - Silty Clay, trace sand, trace organics, firm, brown, moist													
0.7	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		2	SS	17		180							
			3	SS	14									
179.5	SILT - trace sand, frequent silty clay partings, compact, brown, moist						179							0 1 87 12
2.1			4	SS	22									
179.0	stiff to very stiff		5	SS	15		178							0 2 67 31
2.6														
	SILTY CLAY trace sand, occasional gravel inclusions, firm to stiff, brown, damp to moist		6	SS	7		177							
							176		2.2					
			7	SS	5		175			1.2				0 2 71 27
							174		1.5					
			8	SS	5		173			1.4				
									2.0					
			9	SS	6		172			1.2				1 2 70 27
							171		1.8					
			10	SS	5		170			1.5				
	some sand													
							169		1.6					
			11	SS	7				1.5					6 11 59 24
168.4														
13.2	SILTY CLAY TO CLAYEY SILT sandy, some gravel, very stiff, brown, damp (GLACIAL TILL)						168		1.3					13 26 44 17
167.4			12	SS	22									
14.2	End of Borehole													
	Borehole was dry (not stabilized) and hole open to full depth on completion.													

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

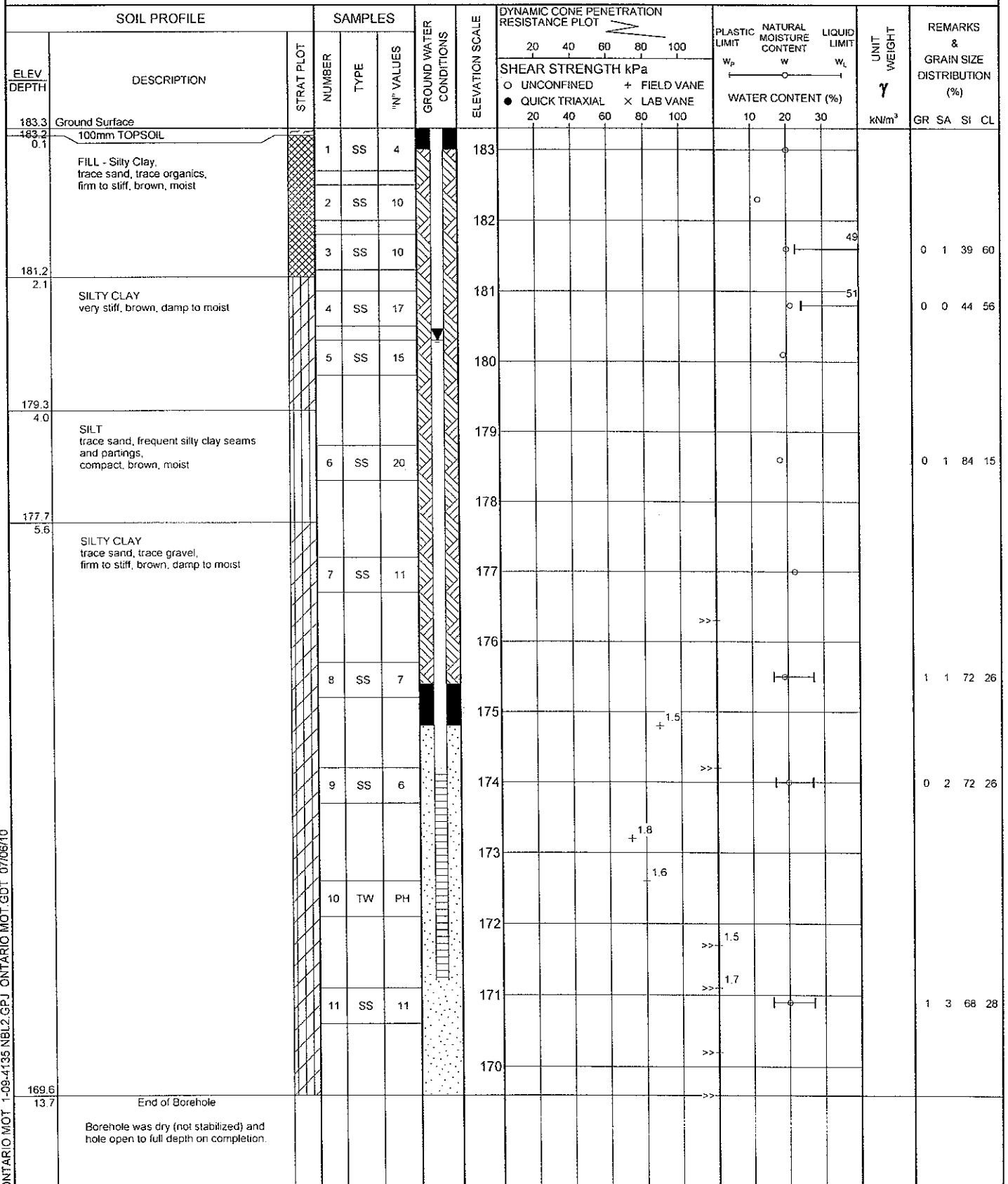
+ 3, x 3. Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No NBL 12+645Lt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764124.9 E:327356.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA



Continued Next Page

+ 3 . x 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-08-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No NBL 12+645Lt 2 OF 2 METRIC

W.P. 280-99-00 LOCATION Coords: N:4764124.9 E:327356.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																								
	<p>Unable to push vane beyond 7.0m.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.09.09</td> <td>10.3</td> <td>173.0</td> </tr> <tr> <td>Nov.19.09</td> <td>3.9</td> <td>179.4</td> </tr> <tr> <td>Nov.30.09</td> <td>5.9</td> <td>177.4</td> </tr> <tr> <td>Dec.08.09</td> <td>3.0</td> <td>180.3</td> </tr> <tr> <td>Dec.15.09</td> <td>3.0</td> <td>180.3</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.09.09	10.3	173.0	Nov.19.09	3.9	179.4	Nov.30.09	5.9	177.4	Dec.08.09	3.0	180.3	Dec.15.09	3.0	180.3													
Date	Depth(m)	Elevation(m)																														
Nov.09.09	10.3	173.0																														
Nov.19.09	3.9	179.4																														
Nov.30.09	5.9	177.4																														
Dec.08.09	3.0	180.3																														
Dec.15.09	3.0	180.3																														

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT GDT 07/06/10

RECORD OF BOREHOLE No NBL 12+645Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764140.0 E:327381.0 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.05.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100						
181.0	Ground Surface													
180.8 0.2	FILL - Sand and Silt, some clay, trace gravel, trace organics, loose, black, wet		1	SS	5									
180.3 0.7	FILL - Silty Clay, trace sand, trace organics, firm, brown, moist		2	SS	16		180							
	SILTY CLAY trace sand, very stiff, brown, damp to moist		3	SS	25		179							
178.9 2.1	SILT trace sand, frequent silty clay seams and partings, compact, brown, moist		4	SS	22		178							0 2 80 18
			5	SS	20		177							
177.0 4.0	SILTY CLAY trace sand, trace gravel, firm to very stiff, brown, moist		6	SS	7		176							
			7	SS	9		175							1 2 69 28
			8	SS	27		174							9 5 64 22
			9	SS	7		173							
			10	TW	PH		172							
			11	SS	11		171							
167.9 13.1	End of Borehole  Borehole was dry (not stabilized) and hole open to full depth on completion.  Unable to push vane beyond 13.1m.						170							
							169							
							168							

Continued Next Page

+ 3 × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MCT 1-09-4135 NBL2.GPJ ONTARIO MCT.GDT 07/06/10



RECORD OF BOREHOLE No NBL 12+645Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords. N:4764140.0 E:327381.0 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.05.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES																										
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.30.09</td> <td>2.2</td> <td>178.8</td> </tr> <tr> <td>Dec.08.09</td> <td>2.0</td> <td>179.0</td> </tr> <tr> <td>Jan.04.10</td> <td>1.5</td> <td>179.5</td> </tr> <tr> <td>Jan.11.10</td> <td>1.8</td> <td>179.2</td> </tr> <tr> <td>Jan.19.10</td> <td>1.9</td> <td>179.1</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.30.09	2.2	178.8	Dec.08.09	2.0	179.0	Jan.04.10	1.5	179.5	Jan.11.10	1.8	179.2	Jan.19.10	1.9	179.1												
Date	Depth(m)	Elevation(m)																													
Nov.30.09	2.2	178.8																													
Dec.08.09	2.0	179.0																													
Jan.04.10	1.5	179.5																													
Jan.11.10	1.8	179.2																													
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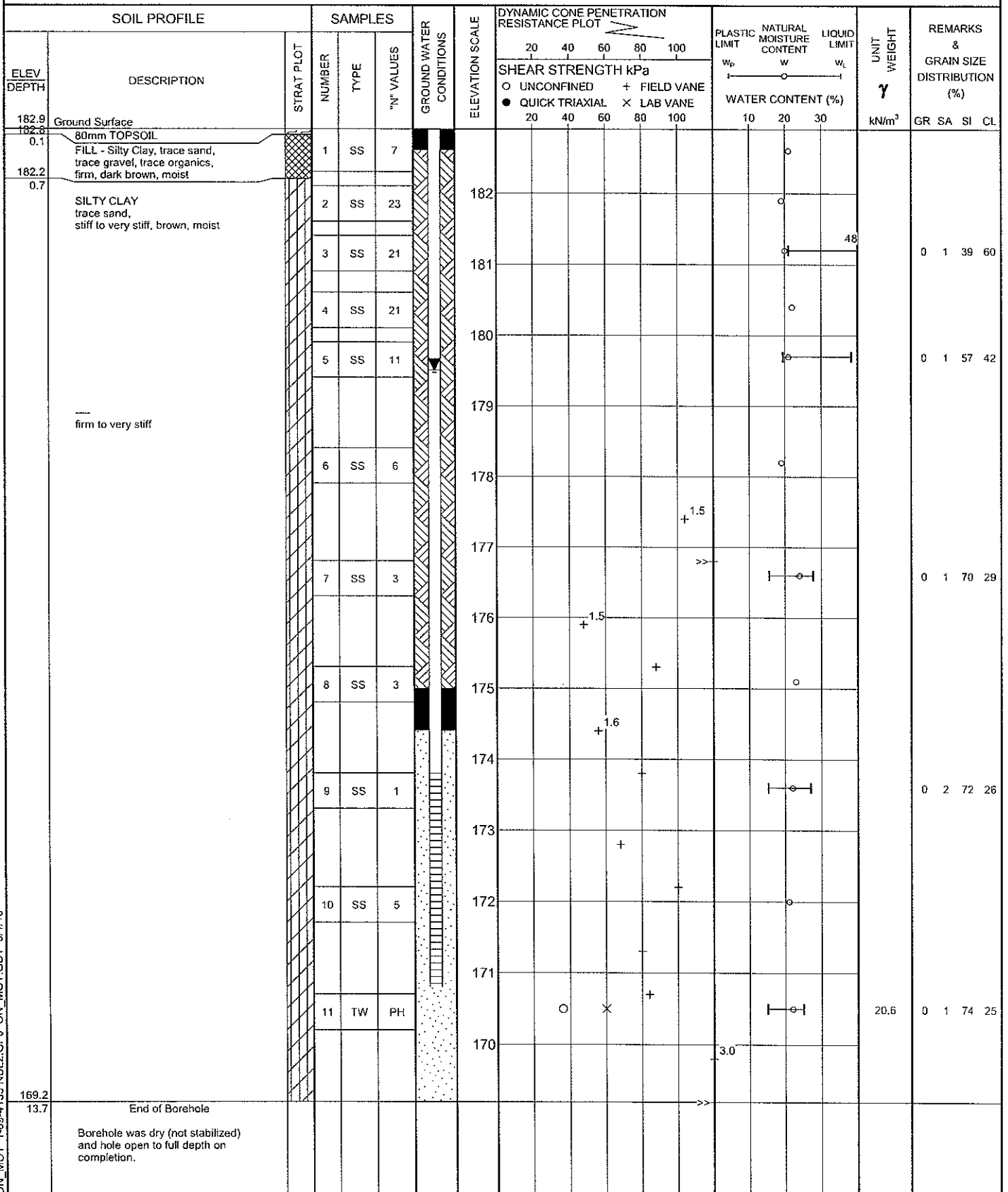
ONTARIO MOT 1-09-4135 NBL2 GPJ ONTARIO MOT.GDT 07/05/10

# RECORD OF BOREHOLE No NBL 12+695Lt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764175.1 E:327333.0 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA



ON MOT 1-09-4135 NBL2.GPJ ON MOT.GDT 9/1/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No NBL 12+695Lt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764175.1 E:327333.0 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100					
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings: Date Depth(m) Elevation(m) Nov.30.09 9.3 173.6 Dec.15.09 3.4 179.5 Jan.04.10 3.2 179.7 Jan.11.10 3.3 179.6 Jan.19.10 3.4 179.5</p> <p>Consolidation test performed on TW 11.</p>												

ON MOT 1-09-4135 NBL2.GPJ ON MOT.GDT 9/1/10

# RECORD OF BOREHOLE No WN1

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764187.0 E:327332.0 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 02.16.10 - 02.18.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
183.1	Ground Surface						20	40	60	80	100							
182.9	80mm TOPSOIL		1	SS	13		183											
0.1	FILL - Silty Clay, trace sand, trace organics, stiff to very stiff, brown, moist		2	SS	23		182											
			3	SS	24		181											
181.0	SILTY CLAY trace sand, stiff to very stiff, brown, moist		4	SS	25		180											
2.1			5	SS	14		179											
			6	SS	15		178											
178.7	SILT frequent silty clay seams and partings, compact, brown, moist		7	SS	16		177											
4.4			8	SS	11		176											
177.9	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		9	SS	11		175											
5.2			10	SS	11		174											
			11	TW	PH		173											
			12	SS	8		172											
			13	SS	9		171											
			14	SS	10		170											
168.4							169											
14.7																		

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No WN1

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords N:4764187.0 E:327332.0 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 02.16.10 - 02.18.10 CHECKED BY RA


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
	SILTY CLAY TO CLAYEY SILT some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		15	SS	18		168							5 17 57 21
							167							
			16	SS	32		166							
165.3 17.8	SILTY SAND TO SANDY SILT trace to some clay, trace to some gravel, very dense, brown, damp (GLACIAL TILL)		17	SS	42		165							14 33 42 11
							164							Feb.16 Feb.17
			18	SS	28		163							
							162							
			19	SS	172/ 23cm		161							
							160							
			20	SS	167/ 25cm		159							
							158							
			21	SS	138		157							8 39 41 12
			22	SS	100/ 15cm		156							
155.7 27.4	---- frequent dolostone inclusions		23	SS	100/ 2.5cm		155							Feb.17 Feb.18
	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs		1	RUN	NQ		154							RUN#1 TCR=72% SCR=67% RQD=34%

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/08/10

Continued Next Page

+ 3. X 3. Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## METRIC

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 $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
													
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
							20 40 60 80 100 20 40 60 80 100						
								WATER CONTENT (%)					
									10 20 30				

[illegible][illegible]

# RECORD OF BOREHOLE No WN2

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764202.3 E:327354.1 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.10.09 - 12.14.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
181.6	Ground Surface							20 40 60 80 100							
181.5	150mm TOPSOIL							20 40 60 80 100							
0.2	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		1	SS	8		181								
			2	SS	16									0 2 55 43	
			3	SS	16										
179.3	SILT trace sand, frequent silty clay seams and partings, compact, brown, moist		4	SS	19		179							0 1 80 19	
2.3			5	SS	12										
178.1	SILTY CLAY trace sand, trace gravel, firm to very stiff, brown, moist		6	SS	6		178								
3.5			7	SS	7		177							0 3 64 33	
			8	SS	6		176	1.2						1 5 65 29	
			9	SS	2		175	2.3							
			10	TW	PH		174	1.7							
			11	SS	8		173	1.6						Dec.10 Dec.11	
			12	SS	9		172	1.8						1 2 73 24	
			13	SS	25		171	1.7							
168.4	SILTY CLAY TO CLAYEY SILT some sand, trace gravel, very stiff to hard, brown, damp  (GLACIAL TILL)						170	1.6							
13.2								169	1.5						8 19 54 19
							168	1.4							
							167								

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No WN2

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764202.3 E:327354.1 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.10.09 - 12.14.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
165.4 16.2	some clay		14	SS	35		166							
			15	SS	46		165							3 23 61 13
			16	SS	44		164							
	SILTY SAND TO SANDY SILT trace to some gravel, trace clay, frequent cobbles, very dense, brown, damp to moist (GLACIAL TILL)		17	SS	144		163							9 44 39 8
			18	SS	142		162							
			19	SS	170/ 23cm		161							
			20	SS	91		160							21 38 34 7
155.7 25.9	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ		159							Dec.11
			2	RUN	NQ		158							Dec.14
			3	RUN	NQ		157							RUN#1 TCR=95% SCR=89% RQD=70%
							156							RUN#2 TCR=100% SCR=83% RQD=58%
151.8 29.8	End of Borehole						155							RUN#3 TCR=100% SCR=77% RQD=50%

Continued Next Page

+ 3, x 3. Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL 2 GPJ ONTARIO MOT.GDT 07/06/10



RECORD OF BOREHOLE No WN2

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764202.3 E:327354.1 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.10.09 - 12.14.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100																				
	<p>Borehole open to full depth and filled with drill water upon completion of drilling.</p> <p>No sample recovery at SS7. Sampler redriven and disturbed sample collected.</p> <p>Resistance to augering from 18.2m to 19.2m, 22.9m to 23.2m and at 25.1m.</p> <p>Unable to push vane beyond 13.1m.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.9m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Jan.04.10</td> <td>5.2</td> <td>176.4</td> </tr> <tr> <td>Jan.11.10</td> <td>4.2</td> <td>177.4</td> </tr> <tr> <td>Jan.19.10</td> <td>5.2</td> <td>176.4</td> </tr> <tr> <td>Jan.27.10</td> <td>5.2</td> <td>176.4</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Jan.04.10	5.2	176.4	Jan.11.10	4.2	177.4	Jan.19.10	5.2	176.4	Jan.27.10	5.2	176.4																
Date	Depth(m)	Elevation(m)																														
Jan.04.10	5.2	176.4																														
Jan.11.10	4.2	177.4																														
Jan.19.10	5.2	176.4																														
Jan.27.10	5.2	176.4																														

# RECORD OF BOREHOLE No WN3

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764212.0 E:327314.7 ORIGINATED BY KB  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 02.18.10 - 02.22.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100												
								SHEAR STRENGTH kPa							WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
182.1	Ground Surface					182														
0.0	FILL - Sand and Gravel, some silt, trace clay, dense, grey, damp		1	SS	48									41 44 13 2						
181.4																				
0.7	firm		2	SS	6															
	SILTY CLAY trace sand, trace gravel, very stiff, brown, damp		3	SS	22															
			4	SS	14															
			5	SS	27															
178.4																				
3.7	SILT trace sand, frequent silty clay seams and partings, compact, brown, damp		6	SS	26									0 1 84 15						
177.4																				
4.7	SILTY CLAY trace sand, trace gravel, stiff to hard, brown, damp		7	SS	9															
			8	SS	12															
			9	SS	10															
			10	SS	11									0 3 70 27						
			11	SS	8									1 3 69 27						
			12	TW	PH															
			13	SS	17									1 2 72 25						
			14	SS	60															
167.8																				
14.3																				

Continued Next Page

+ 3 x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI C
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)			
164.3 17.8	SILTY CLAY TO CLAYEY SILT some sand to sandy, trace gravel, hard, brown, damp to moist  (GLACIAL TILL)		15	SS	31								7 25 53 1	
			16	SS	62									
			17	SS	182								12 48 36	
			18	SS	40								Feb.18 Feb.19	
			19	SS	128									
			20	SS	125									
			21	SS	98									
	---- gravelly		22	SS	100/ 15cm								Feb.19 Feb.22	
155.7 26.4	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ								RUN#1 TCR=50% SCR=11% RQD=0%	
			2	RUN	NQ								RUN#2 TCR=100% SCR=95% RQD=40%	
			3	RUN	NQ								RUN#3 TCR=97% SCR=92% RQD=45%	

ONTARIO MOT 1-09.4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No WN3

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764212.0 E:327314.7 ORIGINATED BY KB  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 02.18.10 - 02.22.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)																			
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>																		
30.0	<p>End of Borehole</p> <p>Borehole open to full depth and filled with drill water upon completion of drilling.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Apr. 16.10</td> <td>7.7</td> <td>174.4</td> </tr> <tr> <td>Apr. 29.10</td> <td>3.9</td> <td>178.2</td> </tr> <tr> <td>May 04.10</td> <td>5.2</td> <td>176.9</td> </tr> <tr> <td>May 06.10</td> <td>4.8</td> <td>177.3</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Apr. 16.10	7.7	174.4	Apr. 29.10	3.9	178.2	May 04.10	5.2	176.9	May 06.10	4.8	177.3																
Date	Depth(m)	Elevation(m)																														
Apr. 16.10	7.7	174.4																														
Apr. 29.10	3.9	178.2																														
May 04.10	5.2	176.9																														
May 06.10	4.8	177.3																														

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No WN4

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords N:4764228.4 E:327343.4 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.14.09 - 12.15.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.5	Ground Surface							20 40 60 80 100						
182.4	150mm TOPSOIL							20 40 60 80 100						
0.2	soft		1	SS	3		182							
	----													
	FILL - Silty Clay, trace sand, trace gravel, firm to stiff, brown, damp		2	SS	6		181							0 2 67 31
			3	SS	9									
			4	SS	8		180							5 3 56 36
			5	SS	5									
178.8							179							
3.7	SILT trace clay, trace sand, frequent silty clay seams and partings, compact, brown, damp		6	SS	16									
							178							
177.6			7	SS	22									
4.9	SILTY CLAY trace to some gravel, trace sand, stiff to very stiff, brown, damp		8	SS	5		177							17 10 37 36
			9	SS	10		176							
			10	TW	PH		175							
							174							
			11	SS	9		173							1 2 72 25
			12	SS	8		172							1 3 73 23
							171							Dec.14
			13	SS	12		170							Dec.15
							169							
			14	SS	12		168							1 8 68 23
167.8														
14.7														

ONTARIO MOT 1-09-4135 NBL2 GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3 x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No WN4

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4764228.4 E:327343.4 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.14.09 - 12.15.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
								SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL x LAB VANE						
								20	40	60	80	100		
								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
								w <sub>p</sub> w w <sub>L</sub>						
								WATER CONTENT (%)						
								10	20	30				
164.7	SILTY CLAY TO CLAYEY SILT sandy, trace to some gravel, occasional cobbles, hard, brown, damp (GLACIAL TILL)		15	SS	37		167							
17.8			16	SS	43		166							
			17	SS	64		164							6 35 47 12
			18	SS	100/ 13cm		163							
			19	SS	89		161							
			20	SS	84		160							18 41 31 10
			21	SS	90		158							
156.5			1	RUN	NQ		156							RUN#1 TCR=92% SCR=77% RQD=44%
26.0	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		2	RUN	NQ		155							RUN#2 TCR=100% SCR=90% RQD=35%
153.6			3	RUN	NQ		154							RUN#3 TCR=98% SCR=95% RQD=36%
28.9	End of Borehole													

Continued Next Page

+ 3 x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No WN4

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764228.4 E:327343.4 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.14.09 - 12.15.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	<p>Borehole open to full depth and filled with drill water upon completion of drilling</p> <p>Borehole sealed with bentonite slurry to ground surface.</p> <p>Resistance to augering at 22.9m and 24.3m.</p> <p>Unable to push vane beyond 13.1m and 14.2m.</p>																

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+750Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764237.5 E:327341.9 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY KL  
 DATUM Geodetic DATE 12.02.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
182.8	Ground Surface																
182.7 0.1	60mm TOPSOIL FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	9								49	0 4 39 57			
182.1 0.7	SILTY CLAY trace sand, very stiff to hard, brown, moist		2	SS	39												
			3	SS	41								43	0 2 47 51			
			4	SS	35												
			5	SS	25												
			6	SS	23									0 2 55 40			
			7	SS	18												
			8	SS	10												
			9	TW	PH									0 2 70 28			
			10	SS	12												
			11	SS	13									1 2 69 28			
169.1 13.7	End of Borehole																

Continued Next Page

+ 3, × 3. Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10



RECORD OF BOREHOLE No NBL 12+750Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords. N.4764237.5 E.327341.9 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 12.02.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL														
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100																			
	<p>Borehole was dry (not stabilized) and hole open to full depth on completion.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Dec.15.09</td> <td>5.1</td> <td>177.7</td> </tr> <tr> <td>Jan.04.10</td> <td>2.7</td> <td>180.1</td> </tr> <tr> <td>Jan.11.10</td> <td>2.7</td> <td>180.1</td> </tr> <tr> <td>Jan.19.10</td> <td>2.8</td> <td>180.0</td> </tr> </tbody> </table> <p>Consolidation test performed on TW 9.</p>	Date	Depth(m)	Elevation(m)	Dec.15.09	5.1	177.7	Jan.04.10	2.7	180.1	Jan.11.10	2.7	180.1	Jan.19.10	2.8	180.0															
Date	Depth(m)	Elevation(m)																													
Dec.15.09	5.1	177.7																													
Jan.04.10	2.7	180.1																													
Jan.11.10	2.7	180.1																													
Jan.19.10	2.8	180.0																													

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+835Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764311.2 E:327301.1 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY KL  
 DATUM Geodetic DATE 11.26.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)					
181.2	Ground Surface						20	40	60	80	100						
0.0	460mm FILL - Gravelly Sand, some silt, trace clay, compact, grey, damp		1	SS	29											30 51 16 3	
180.7																	
0.5	SILTY CLAY stiff to very stiff, brown, damp to moist		2	SS	26												
			3	SS	18												
			4	SS	15											0 0 64 36	
			5	SS	8												
177.2																	
4.0	CLAYEY SILT hard, brown, damp		6	SS	34												
175.6																	
5.6	SILTY CLAY trace sand, stiff to very stiff, brown, damp		7	SS	22												
			8	SS	14											0 3 71 26	
172.2																	
9.0	End of Borehole																
	Borehole was dry (not stabilized) and hole open to full depth on completion																

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No NBL 12+835Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764316.1 E:327316.7 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.02.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
182.9	Ground Surface						20 40 60 80 100	20 40 60 80 100					
0.0	FILL - Silty Clay, trace sand, trace organics, very stiff to hard, brown, damp		1	SS	23								
			2	SS	39								
181.5													
1.4	SILTY CLAY trace sand, very stiff to hard, brown, damp to moist		3	SS	30								
			4	SS	25								
			5	SS	29								0 0 49 51
			6	SS	18								
177.3	CLAYEY SILT very stiff, brown, damp		7	SS	15								0 0 87 13
5.6													
175.8	SILTY CLAY trace sand, stiff to very stiff, brown, damp to moist		8	SS	18								
7.1			9	SS	12								0 2 70 28
	trace gravel		10	SS	9								3 3 68 26
			11	AS	-								
169.8	End of Borehole												
13.1	Borehole was dry (not stabilized) and hole open to full depth on completion.												

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No NBL 12+835Rt 2 OF 2 METRIC

W.P. 280-99-00 LOCATION Coords: N:4764316.1 E:327316.7 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.02.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100																							
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.09.09</td> <td>6.7</td> <td>176.2</td> </tr> <tr> <td>Nov.19.09</td> <td>2.7</td> <td>180.2</td> </tr> <tr> <td>Nov.30.09</td> <td>2.5</td> <td>180.4</td> </tr> <tr> <td>Dec.08.09</td> <td>2.3</td> <td>180.6</td> </tr> <tr> <td>Dec.15.09</td> <td>2.3</td> <td>180.6</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.09.09	6.7	176.2	Nov.19.09	2.7	180.2	Nov.30.09	2.5	180.4	Dec.08.09	2.3	180.6	Dec.15.09	2.3	180.6																
Date	Depth(m)	Elevation(m)																																	
Nov.09.09	6.7	176.2																																	
Nov.19.09	2.7	180.2																																	
Nov.30.09	2.5	180.4																																	
Dec.08.09	2.3	180.6																																	
Dec.15.09	2.3	180.6																																	

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No NBL 12+910CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764385.0 E:327289.2 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.02.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
182.7	Ground Surface							20 40 60 80 100							
0.0	40mm TOPSOIL		1	SS	6		182								
182.0	FILL - Silty Clay, trace sand, trace organics, firm, brown, moist														
0.7	SILTY CLAY trace sand, occasional sand seams, very stiff to hard, brown, moist		2	SS	36		181								
			3	SS	39										
			4	SS	36		180								
			5	SS	19		179								
			6	SS	15		178								
	stiff		7	SS	12		177								
			8	SS	13		176								
			9	SS	9		175								
			10	SS	9		174								
							173								
							172								
171.1	End of Borehole		11	AS	-										
11.6	Borehole was dry (not stabilized) and hole open to full depth on completion.														

ONTARIO MOT. 1-09-4135 NBL2.GPJ ONTARIO MOT. GDT. 07/06/10

# RECORD OF BOREHOLE No NBL 12+985Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764453.0 E:327257.8 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY KL  
DATUM Geodetic DATE 11.27.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
181.1	Ground Surface						181							
0.0	460mm FILL - Sand and Gravel, some silt, trace clay, compact, grey, damp		1	SS	25		181							38 43 15 4
180.6														
0.5	hard		2	SS	43		180							
	SILTY CLAY trace sand, occasional gravel inclusions, stiff to very stiff, brown, damp to moist		3	SS	26		179							
			4	SS	23		178							
			5	SS	25		177							0 1 53 46
							176							
			6	SS	20		175							
							174							
173.6	End of Borehole													
7.5	Borehole was dry (not stabilized) and hole open to full depth on completion.													

ONTARIO MOT 1-09-4135 NBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No NBL 12+985Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764455.6 E:327271.1 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.03.09 CHECKED BY RA

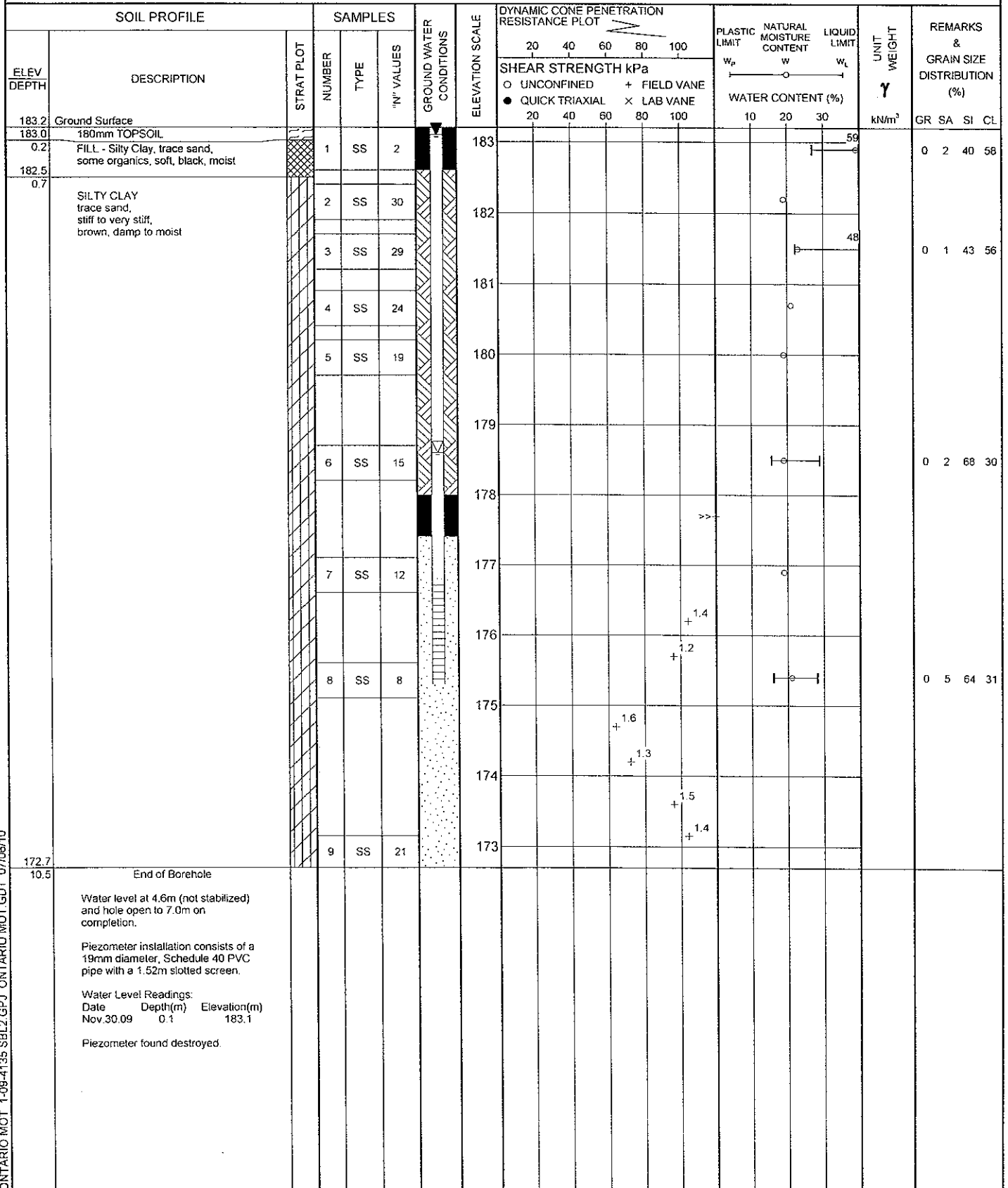
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100					
182.3	Ground Surface															
182.2	120mm TOPSOIL															
0.1	FILL - Silty Clay, trace sand, trace organics, very stiff, brown / dark brown, moist		1	SS	16											
181.6																
0.7	SILTY CLAY trace sand, very stiff to hard, brown, damp to moist		2	SS	42											
			3	SS	42											
			4	SS	30											
			5	SS	32											
			6	SS	14											
176.8	End of Borehole															
5.5	Borehole was dry (not stabilized) and hole open to full depth on completion.  Unable to push vane beyond 5.5m.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date Depth(m) Elevation(m) Nov.19.09 3.1 179.2 Nov.30.09 2.9 179.4 Dec.08.09 2.5 179.8 Dec.15.09 1.9 180.4 Jan.04.10 1.9 180.4															

RECORD OF BOREHOLE No SBL 12+185Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763707.6 E:327535.6 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.13.09 - 11.16.09 CHECKED BY RA



ONTARIO MOT 1-08-4135 SBL2.GPJ ONTARIO MOT GDT 07/06/10



RECORD OF BOREHOLE No SBL 12+185Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763715.5 E:327553.2 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.16.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
183.6	Ground Surface													
183.5	140mm TOPSOIL													
0.1	FILL - Silty Clay, trace sand, trace organics, firm, brown, damp		1	SS	7		183							
182.9														
0.7	SILTY CLAY trace sand, very stiff to hard, brown, damp to moist		2	SS	27		182							
			3	SS	28									
			4	SS	31		181						0 1 66 33	
			5	SS	17									
	firm to very stiff						180							
			6	SS	8		179						0 3 67 30	
							178							
			7	SS	6		177							
							176						0 3 68 29	
			8	SS	6		175							
							174							
173.5	End of Borehole		9	AS	-									
10.1	Borehole was dry (not stabilized) and hole open to full depth on completion.													

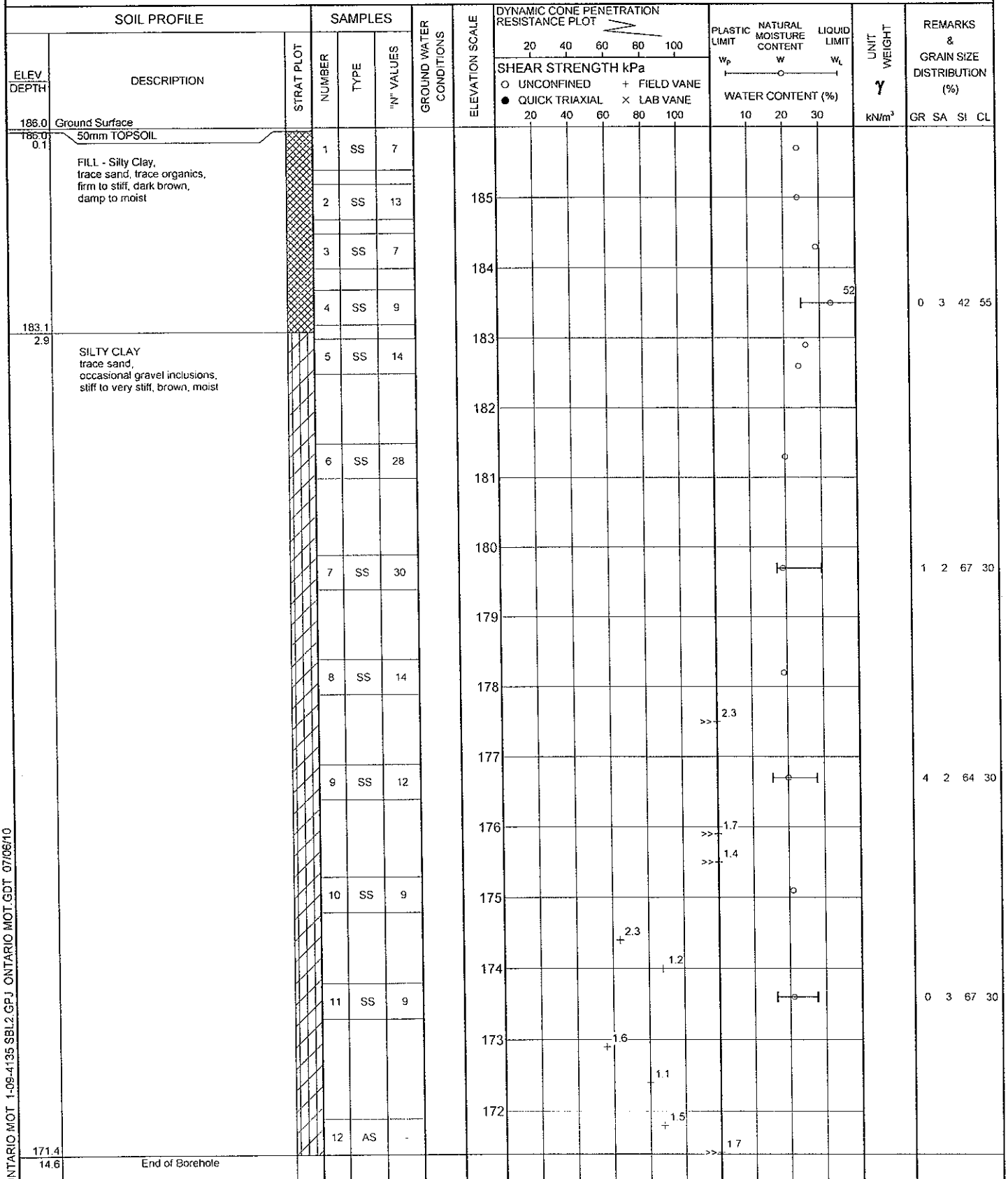
ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT GDT 07/06/10

RECORD OF BOREHOLE No SBL 12+260CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763783.4 E:327515.0 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 CHECKED BY RA



ONTARIO MOT 1-08-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3 . × 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+260CL

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763783.4 E:327515.0 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					10 20 30 w <sub>p</sub> w w <sub>L</sub>					
	Borehole was dry (not stabilized) and hole open to full depth on completion.															

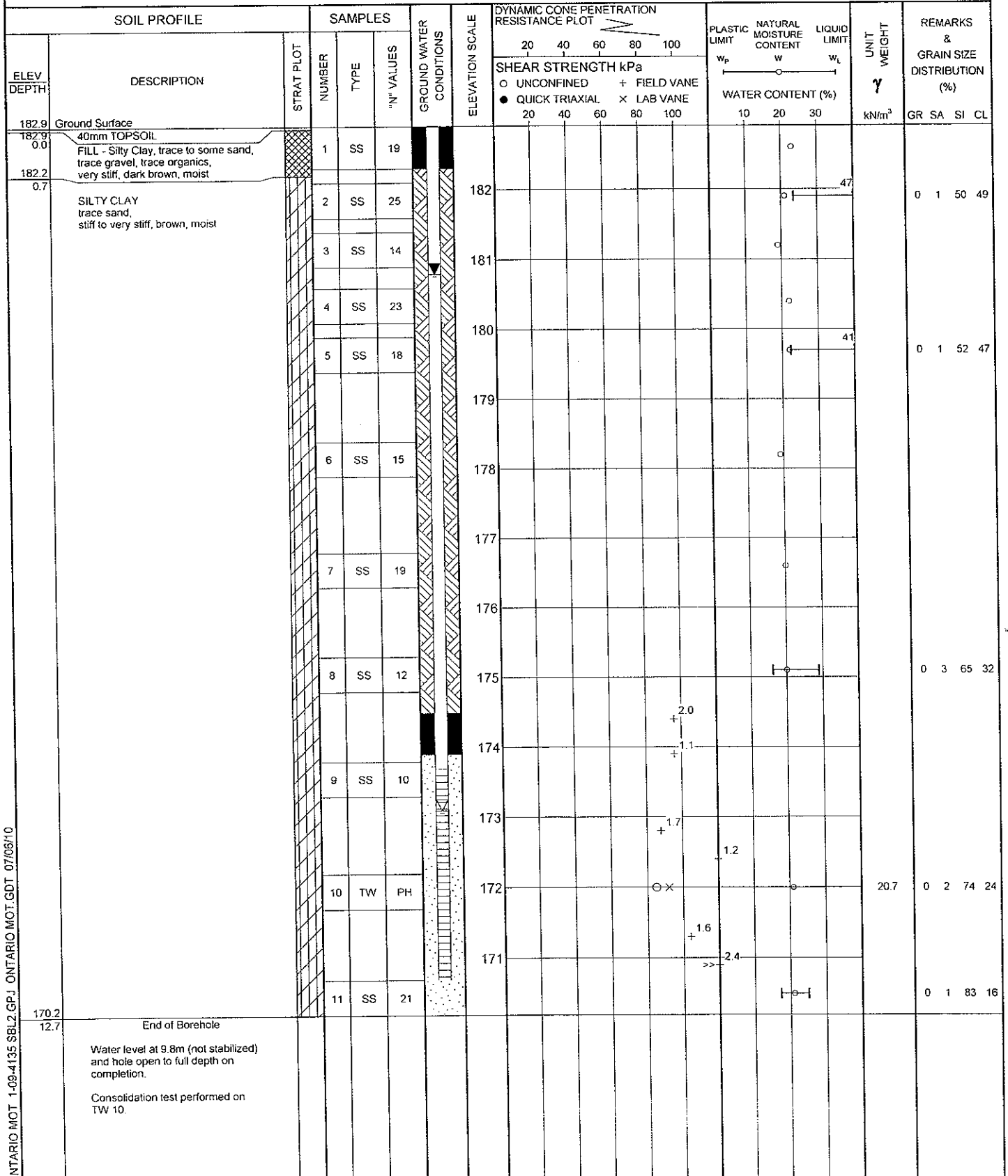
ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/08/10

RECORD OF BOREHOLE No SBL 12+360CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763866.5 E:327470.3 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 CHECKED BY RA



ONTARIO MOT 1-09-4135 SBL2 GPJ ONTARIO MOT GDT 07/06/10

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity  
O 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+360CL

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763866.5 E:327470.3 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100																		
	<p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov. 19.09</td> <td>5.0</td> <td>177.9</td> </tr> <tr> <td>Nov. 30.09</td> <td>2.6</td> <td>180.3</td> </tr> <tr> <td>Dec. 07.09</td> <td>2.4</td> <td>180.5</td> </tr> <tr> <td>Dec. 15.09</td> <td>2.3</td> <td>180.6</td> </tr> <tr> <td>Jan. 04.10</td> <td>2.1</td> <td>180.8</td> </tr> <tr> <td>Jan. 11.10</td> <td>2.1</td> <td>180.8</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov. 19.09	5.0	177.9	Nov. 30.09	2.6	180.3	Dec. 07.09	2.4	180.5	Dec. 15.09	2.3	180.6	Jan. 04.10	2.1	180.8	Jan. 11.10	2.1	180.8													
Date	Depth(m)	Elevation(m)																																	
Nov. 19.09	5.0	177.9																																	
Nov. 30.09	2.6	180.3																																	
Dec. 07.09	2.4	180.5																																	
Dec. 15.09	2.3	180.6																																	
Jan. 04.10	2.1	180.8																																	
Jan. 11.10	2.1	180.8																																	

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

## RECORD OF BOREHOLE No TS1

1 OF 3

METRIC

W.P.	280-99-00	LOCATION	Coords: N:4763865.7 E:327459.1	ORIGINATED BY	MP
DIST	HWY 406	BOREHOLE TYPE	Hollow Stem Augers / Casing and Washboring / NO Rock Coring	COMPILED BY	DB
DATUM	Geodetic	DATE	01.11.10 - 01.13.10	CHECKED BY	RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa	W <sub>p</sub>	w	W <sub>L</sub>		
182.6	Ground Surface											
0.0	380mm TOPSOIL		1	SS	2							
182.2	FILL - Silty Clay, some organics, trace sand, soft, black, moist		2	SS	20							
0.4			3	SS	23							
181.9			4	SS	37							
0.7	SILTY CLAY trace sand, stiff to hard, brown, damp to moist		5	SS	38							
			6	SS	26							
			7	SS	22							
			8	SS	24							
			9	SS	17							
	trace gravel		10	SS	18							
			11	TW	PH							
			12	SS	14							
			13	SS	17							

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No TS1

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4763865.7 E:327459.1 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.11.10 - 01.13.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
166.9 15.7	CLAYEY SILT TO SILTY CLAY some sand to sandy, trace to some gravel, hard, brown, damp to moist  (GLACIAL TILL)  occasional to frequent cobbles		14	SS	16		167							
							166							
			15	SS	164		165							12 24 48 16
			16	SS	110		164							
			17	SS	100/ 10cm		163							
161.8 20.8	SAND gravelly, some silt, frequent cobbles, very dense, grey, wet						162							
161.0 21.6			18	SS	175		161							32 56 (12)
160.2 22.4	SAND gravelly, trace silt, occasional cobbles, dense to very dense, grey, moist to wet						160							
			19	SS	98		159							
157.8 24.8			20	SS	40		158							
	CLAYEY SILT sandy, trace gravel, hard, brown, damp  (GLACIAL TILL)						157							Jan. 12 Jan. 13
			21	SS	38		156							1 23 57 19
155.7 26.9	SAND AND GRAVEL trace to some silt, frequent cobbles, very dense, grey / brown, moist (GLACIAL TILL)		22	SS	100/ 13cm		155							
154.2 28.4			1	RUN	NQ		154							RUN#1 TCR=75% SCR=16% RQD=16%
	BEDROCK		2	RUN	NQ		153							RUN#2 TCR=100% SCR=90% RQD=76%

ONTARIO MOT 1-09-4135 SBL2 GPJ ONTARIO MOT GDT 07/06/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No TS1

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763865.7 E:327459.1 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.11.10 - 01.13.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)										
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20	40	60	80	100	10	20
151.4 31.2	<p>BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.</p> <p>End of Borehole</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings: Date Depth(m) Elevation(m) Jan. 19.10 10.6 172.0 Jan. 27.10 10.4 172.2 Feb. 08.10 10.5 172.1</p> <p>Borehole sealed with bentonite slurry from 31.2m to 28.1m and from 25.0m to ground surface.</p>		3	RUN	NQ		152																	

ONTARIO MOT 1-09-4135 SBL2 GPJ ONTARIO MOT.GDT 07/06/10



RECORD OF BOREHOLE No TS2

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4763881.2 E:327466.3 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 11.30.09 - 12.08.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
183.3 0.0	Ground Surface		1	SS	12		183							
	FILL - Silty Clay, trace sand, trace gravel, trace organics, stiff to very stiff, dark brown / brown, damp to moist		2	SS	12		182							3 7 58 32
			3	SS	21									
181.2 2.1	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp to moist		4	SS	32		181							Nov.30 Dec.03
			5	SS	61		180							
			6	SS	25		179							
			7	SS	25		178							1 3 66 30
			8	SS	21		177							
			9	SS	15		176							
	stiff to very stiff		10	SS	13		175							
			11	SS	16		174							0 3 67 30
							173							
			12	SS	14		172							
							171							
			13	SS	14		170							
							169							
			14	SS	18									7 1 66 26
			15	TW	PH									

Continued Next Page

+ 3, x 3, Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No TS2

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4763881.2 E:327466.3 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 11.30.09 - 12.08.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE										
								● QUICK TRIAXIAL	× LAB VANE										
						20	40	60	80	100	10	20	30	GR	SA	SI	CL		
168.1 15.2	SILTY CLAY trace to some sand, trace gravel, very stiff to hard, brown, damp to moist  (GLACIAL TILL)  ----- frequent wet sand and gravel inclusions -----		16	SS	22										8	15	50	27	
																Dec.03			
																Dec.04			
					17	SS	26												
			18	SS	121														
			19	SS	47														
162.5 20.8	SAND gravelly, some silt, dense, brown, wet		20	SS	50														
160.9 22.4	CLAYEY SILT and sand, trace gravel, very stiff, brown, damp  (GLACIAL TILL)		21	SS	30														
159.4 23.9	SAND gravelly, trace silt, dense, grey, moist to wet		22	SS	47														
157.1 26.2	CLAYEY SILT sandy, trace gravel, hard, brown, damp (GLACIAL TILL)		23	SS	61														
156.2 27.1	SAND AND GRAVEL some silt, trace to some clay, occasional cobbles, very dense, brown / grey, moist  (GLACIAL TILL)		24	SS	77														
153.9 29.4	BEDROCK		25	SS	155/ 18cm														

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/08/10

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## METRIC

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDI 07/06/10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
							20	40	60	80	100							

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No TS3

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4763891.8 E:327445.1 ORIGINATED BY LY  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.15.09 - 12.16.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							20 40 60 80 100					WATER CONTENT (%) 10 20 30					
182.5	Ground Surface																
0.0	FILL - Silty Clay, trace sand, trace gravel, trace organics, firm, brown, moist		1	SS	5		182										
181.8																	
0.7	SILTY CLAY trace sand, very stiff to hard, brown, damp to moist		2	SS	46		181								0 2 36 62		
			3	SS	39												
			4	SS	32		180										
			5	SS	36		179										
			6	SS	44		178								0 6 61 33		
			7	SS	46		177										
			8	SS	28		176								0 3 64 33		
			9	SS	29		175										
			10	SS	19		174								Dec.15 Dec.16		
			11	TW	PH		173										
			12	SS	18		172								0 3 69 28		
			13	SS	18		171										
	stiff		14	SS	26		170										
167.8							169										
14.7							168										

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

Continued Next Page

+ 3 x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



## METRIC

[illegible]

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No TS4

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763903.8 E:327455.3 ORIGINATED BY LY  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 12.17.09 - 12.22.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.4	Ground Surface							20 40 60 80 100						
0.0	FILL - Silty Clay, trace sand, trace gravel, trace organics, firm, brown, moist		1	SS	6		182							
181.7														
0.7	SILTY CLAY trace sand, stiff to hard, brown, damp to moist		2	SS	51									
			3	SS	36		181							
			4	SS	39		180							
			5	SS	52		179							
			6	SS	29		178							
			7	SS	26		177							
			8	SS	16		176							
			9	TW	PH		175							
			10	SS	14		174							
			11	SS	27		173							
			12	SS	13		172							
			13	SS	17		171							
							170							
							169							
							168							
167.7														
14.7														

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No TS4

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763903.8 E:327455.3 ORIGINATED BY LY  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 12.17.09 - 12.22.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
								SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL x LAB VANE						
								20	40	60	80	100		
								WATER CONTENT (%)						
								w <sub>p</sub> w w <sub>L</sub>						
								PLASTIC NATURAL LIQUID						
								LIMIT MOISTURE LIMIT						
								>>						
164.3	CLAYEY SILT TO SILTY CLAY some sand, some gravel, frequent cobbles, stiff to hard, brown, damp (GLACIAL TILL)		14	SS	10		167							15 19 49 16
18.1			15	SS	100/ 28cm		166							
			16	SS	77		164							
	SAND AND GRAVEL trace to some silt, trace clay, occasional cobbles, very dense, grey, damp to moist (GLACIAL TILL)		17	SS	80		163							
			18	SS	76		162							
			19	SS	100/ 28cm		161							
158.5			20	SS	25		160							
23.9	CLAYEY SILT trace sand, trace gravel, very stiff, brown, damp (GLACIAL TILL)		21	SS	100/ 25cm		159							
157.0			22	SS	100/ 18cm		158							
25.4	GRAVEL AND SAND some silt, occasional cobbles, very dense, grey, moist to wet (GLACIAL TILL)						157							
154.1							156							
28.4	BEDROCK						155							45 41 (14)
			1	RUN	NQ		154							Dec.21
							153							RUN#1 TCR=90% SCR=72% RQD=41%
														RUN#2

Continued Next Page

+ 3, x 3. Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT. 1-09-4135 SEL2 GPJ ONTARIO MOT.GOT 07/06/10



RECORD OF BOREHOLE No TS4										3 OF 3		METRIC																		
W.P. 280-99-00		LOCATION		Coords: N:4763903.8 E:327455.3				ORIGINATED BY LY																						
DIST HWY 406		BOREHOLE TYPE		Hollow Stem Augers / Casing and Washboring / NQ Rock Coring				COMPILED BY DB																						
DATUM Geodetic		DATE		12.17.09 - 12.22.09				CHECKED BY RA																						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL														
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE																						
150.4	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		2	RUN	NQ		152									TCR=99% SCR=92% RQD=43%														
32.0			3	RUN	NQ		151																							
32.0	End of Borehole																													
	<p>Unable to push vane beyond 8.8m, 11.4m and 14.9m.</p> <p>No sample recovery at SS12 and SS13. Sampler redriven and disturbed sample collected.</p> <p>Resistance to augering at 23.2m, 25.0m and 27.1m.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Jan.11.10</td> <td>9.4</td> <td>173.0</td> </tr> <tr> <td>Jan.19.10</td> <td>9.9</td> <td>172.5</td> </tr> <tr> <td>Jan.27.10</td> <td>10.2</td> <td>172.2</td> </tr> <tr> <td>Feb.08.10</td> <td>10.4</td> <td>172.0</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Jan.11.10	9.4	173.0	Jan.19.10	9.9	172.5	Jan.27.10	10.2	172.2	Feb.08.10	10.4	172.0														
Date	Depth(m)	Elevation(m)																												
Jan.11.10	9.4	173.0																												
Jan.19.10	9.9	172.5																												
Jan.27.10	10.2	172.2																												
Feb.08.10	10.4	172.0																												

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT GDT 07/06/10

# RECORD OF BOREHOLE No SBL 12+410CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763911.8 E:327444.8 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							20 40 60 80 100	20 40 60 80 100						
182.5	Ground Surface													
182.3	180mm TOPSOIL													
182.3 0.2	FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	13									
181.8 0.7	SILTY CLAY trace sand, stiff to hard, brown, moist		2	SS	45									
			3	SS	36									0 3 62 35
			4	SS	39									
			5	SS	40									
			6	SS	20									0 4 66 30
			7	SS	20									
			8	SS	14									
	trace gravel													
			9	TW	PH								20.4	1 3 70 26
			10	SS	11									0 2 72 26
			11	SS	16									
168.9 13.6	End of Borehole													
	Borehole was dry (not stabilized) and hole open to full depth on completion.													
	Consolidation test performed on TW 9													

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No SBL 12+410CL

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763911.8 E:327444.8 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
	<p>No sample recovery at SS8. Sampler redriven and disturbed sample collected.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings: Date Depth(m) Elevation(m) Nov.30.09 1.7 180.8 Dec.07.09 1.4 181.1 Dec.15.09 1.3 181.2</p>																

RECORD OF BOREHOLE No SBL 12+485Lt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763974.6 E:327403.3 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 - 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE								
182.0	Ground Surface						20 40 60 80 100									
181.8	200mm TOPSOIL						20 40 60 80 100									
0.2	FILL - Silty Clay, trace sand, trace gravel, trace organics, stiff, brown, damp		1	SS	9											
181.3																
0.7	occasional gravel inclusions, hard		2	SS	41		181									
			3	SS	31		180									
			4	SS	49		179							1 2 69 28		
			5	SS	34		178									
							177									
	SILTY CLAY trace sand, firm to very stiff, brown, damp to moist		6	SS	12		176							0 2 73 25		
							175									
			7	SS	12		174							0 2 72 26		
							173									
							172									
							171									
			10	TW	PH		170									
							169									
			11	SS	17		168									
168.8																
13.2	SILTY CLAY TO CLAYEY SILT trace sand, very stiff, brown, damp to moist  (GLACIAL TILL)		12	SS	22									0 3 76 21		

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2 GPJ ONTARIO MOT GDT 07/06/10

RECORD OF BOREHOLE No SBL 12+485Lt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763974.6 E:327403.3 ORIGINATED BY PK  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.17.09 - 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
166.9 15.7	End of Borehole  Borehole was dry (not stabilized) and hole open to full depth on completion.	2422												

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No SBL 12+485Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords N:4763980.3 E:327413.8 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE						
181.8	Ground Surface							20 40 60 80 100						
181.6	200mm TOPSOIL							20 40 60 80 100						
0.2	FILL - Silty Clay, trace sand, trace to some organics, stiff, black, damp		1	SS	10									
181.1														
0.7	very stiff to hard		2	SS	29									
			3	SS	28									
			4	SS	39									
			5	SS	34									
	----													
	SILTY CLAY trace sand, occasional gravel inclusions, stiff to very stiff, brown, damp to moist		6	SS	13									
			7	SS	18									
			8	TW	PH									
			9	SS	12									
			10	SS	13									
			11	SS	13									
168.6														
13.2	SILTY CLAY TO CLAYEY SILT sandy, trace gravel, very stiff, brown, damp to moist (GLACIAL TILL)		12	SS	21									

Continued Next Page

+ 3 x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2 GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No SBL 12+485Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4763980.3 E:327413.8 ORIGINATED BY PK  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.17.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
166.7 15.1	End of Borehole  Borehole was dry (not stabilized) and hole open to full depth on completion.  No sample recovery at SS6 and SS10. Sampler redriven and disturbed sample collected.  Resistance to augering from 11.1m to 11.6m.	6.442															

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

## 1 OF 2

METRIC

W.P. 280-99-00

LOCATION

Coords: N:4764013.1 E:327390.2

ORIGINATED BY PK

DIST HWY 406

BOREHOLE TYPE

### Hollow Stem Augers

COMPILED BY DB

DATUM Geodetic

DATE \_\_\_\_\_

11.19.09

CHECKED BY RA

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE



## 2 OF 2

METRIC

SOIL PROFILE	SAMPLES			DYNAMIC CONE PENETRATION			
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+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No SBL 12+600Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764077.3 E:327349.6 ORIGINATED BY PK  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.13.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										
								● QUICK TRIAXIAL × LAB VANE										
182.7	Ground Surface					20	40	60	80	100	10	20	30	kN/m <sup>3</sup>	GR SA SI CU			
182.5	200mm TOPSOIL																	
0.2	FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	8													
182.0																		
0.7	SILTY CLAY trace sand, occasional gravel inclusions, hard, brown, damp to moist		2	SS	45													
	occasional silt partings		3	SS	30										1 1 40 58			
			4	SS	33													
	firm to very stiff		5	SS	14										0 1 47 52			
			6	SS	20													
			7	TW	PH													
			8	SS	11													
			9	SS	9										2 2 65 31			
			10	SS	10													
			11	SS	18										0 3 71 26			
169.1	End of Borehole																	
13.6	Borehole was dry (not stabilized) and hole open to full depth on completion.																	
	No sample recovery at SS10. Sampler redriven and disturbed sample collected.																	

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

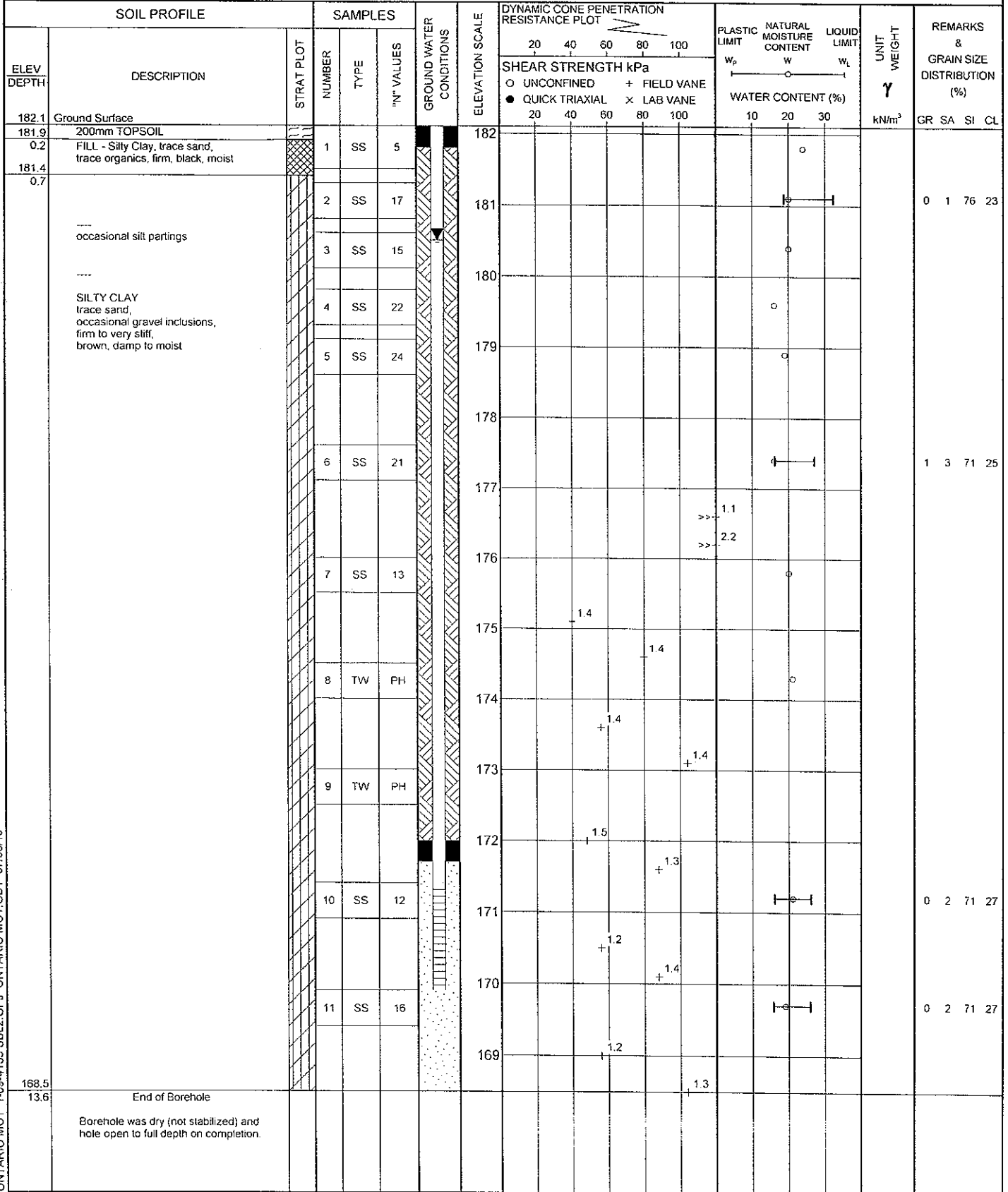
+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+600Rt

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764082.6 E:327360.4 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.12.09 CHECKED BY RA



ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/09/10

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+600Rt

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764082.6 E:327360.4 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.12.09 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W <sub>p</sub>	W			W <sub>L</sub>																				
	<p>No sample recovery at TW8. Split spoon sampler driven and disturbed sample collected.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth(m)</th> <th>Elevation(m)</th> </tr> </thead> <tbody> <tr> <td>Nov.19.09</td> <td>6.4</td> <td>175.7</td> </tr> <tr> <td>Nov.30.09</td> <td>8.3</td> <td>173.8</td> </tr> <tr> <td>Dec.08.09</td> <td>2.7</td> <td>179.4</td> </tr> <tr> <td>Jan.04.10</td> <td>1.4</td> <td>180.7</td> </tr> <tr> <td>Jan.11.10</td> <td>1.8</td> <td>180.3</td> </tr> <tr> <td>Jan.19.10</td> <td>1.6</td> <td>180.5</td> </tr> </tbody> </table>	Date	Depth(m)	Elevation(m)	Nov.19.09	6.4	175.7	Nov.30.09	8.3	173.8	Dec.08.09	2.7	179.4	Jan.04.10	1.4	180.7	Jan.11.10	1.8	180.3	Jan.19.10	1.6	180.5															
Date	Depth(m)	Elevation(m)																																			
Nov.19.09	6.4	175.7																																			
Nov.30.09	8.3	173.8																																			
Dec.08.09	2.7	179.4																																			
Jan.04.10	1.4	180.7																																			
Jan.11.10	1.8	180.3																																			
Jan.19.10	1.6	180.5																																			

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No SBL 12+650CL

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764126.1 E:327334.4 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
183.7	Ground Surface						20	40	60	80	100							
183.7	50mm TOPSOIL																	
183.5	FILL - Silty Clay, trace sand, trace gravel, trace organics, stiff, brown, moist		1	SS	10								○	○		17 57 18 8		
183.0	FILL - Sand, some silt, some gravel, trace clay, compact, grey, damp		2	SS	7									○				
182.3	FILL - Silty Clay, trace sand, trace gravel, firm, brown, moist																	
182.3	SILTY CLAY trace sand, very stiff, brown, damp		3	SS	19									○				
			4	SS	15									○				
			5	SS	15										42	0 1 46 53		
179.7																		
179.7	SILT - frequent silty clay seams and partings, compact, brown, moist		6	SS	14									○				
178.1																		
178.1	SILTY CLAY trace sand, occasional gravel inclusions, firm to very stiff, brown, damp to moist		7	SS	8									○				
			8	SS	6													
			9	SS	11											1 3 70 26		
			10	SS	5													
			11	SS	7											0 3 72 25		

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+650CL

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764126.1 E:327334.4 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.18.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
	Borehole was dry (not stabilized) and hole open to full depth on completion.																

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No SBL 12+685CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764160.4 E:327319.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.17.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
							20	40	60	80	100					
182.7	Ground Surface															
0.0	470mm FILL - Sand and Gravel, some silt, trace clay, compact, grey, damp		1	SS	11											41 42 13 4
182.2			2	SS	18											
0.5	SILTY CLAY trace sand, occasional gravel inclusions, very stiff, brown, moist		3	SS	15											
			4	SS	16											0 1 50 49
			5	SS	19											
			6	SS	15											
			7	SS	13											0 2 68 30
			8	SS	11											
			9	SS	8											1 5 68 26
			10	TW	PH											0 3 70 27
170.5	End of Borehole															
12.2	Borehole was dry (not stabilized) and hole open to full depth on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.  Water Level Readings: Date      Depth(m)      Elevation(m)  Piezometer destroyed after drilling.  Consolidation test performed on TW 10.															

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT GDT 07/06/10

RECORD OF BOREHOLE No WS1

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4764163.6 E:327303.9 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.19.10 - 04.29.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
182.7	Ground Surface																
182.6 0.1	80mm TOPSOIL		1	SS	7		182										
	FILL - Silty Clay, trace sand, firm to hard, brown, damp		2	SS	28											53	0 2 36 62
			3	SS	37		181										
180.6 2.1	SILTY CLAY trace sand, trace gravel, hard, brown, damp		4	SS	32		180										
			5	SS	33												
			6	SS	52		179										
178.3 4.4	SILT trace sand, trace gravel, frequent silty clay seams and partings, dense, brown, damp		7	SS	47		178										1 2 75 22
			8	SS	39		177										
176.8 5.9	SILTY CLAY trace sand, trace gravel, very stiff to hard, brown, damp to moist		9	SS	15		176										
			10	SS	23		175										0 5 83 12
			11	SS	25		174										0 4 62 34
							173										
			12	TW	PH		172										
			13	SS	41		171										
							170										
			14	SS	28		169										1 3 72 24
168.0 14.7							168										

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 8BL2 GPJ ONTARIO MOT.GDT 07/06/10



RECORD OF BOREHOLE No WS1

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764163.6 E:327303.9 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.19.10 - 04.29.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED		+ FIELD VANE						● QUICK TRIAXIAL			x LAB VANE	
							20	40	60	80	100									
	SILTY CLAY sandy, trace gravel, hard, brown, damp to moist  (GLACIAL TILL)		15	SS	55		167								4 24 55 17					
			16	SS	66		166													
164.1 18.6	SANDY SILT some clay, trace gravel, very dense, brown, damp to moist  (GLACIAL TILL)		17	SS	104		164								Jan.19 Jan.20					
162.1 20.6	CLAYEY SILT sandy, trace gravel, hard, brown, damp  (GLACIAL TILL)		18	SS	100/ 13cm		163													
160.4 22.3	SANDY SILT trace to some gravel, trace clay, very dense, brown, moist to wet  (GLACIAL TILL)		19	SS	129		161								2 31 48 19					
			20	SS	100/ 13cm		160								Jan.20 Apr.29					
			21	SS	192		158													
155.2 27.5	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ		155								RUN#1 TCR=19% SCR=11% RQD=0%					
			2	RUN	NQ		154								RUN#2 TCR=62% SCR=34% RQD=18%					
							153													

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No WS1

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764163.6 E:327303.9 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / Casing and Washboring / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.19.10 - 04.29.10 CHECKED BY RA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
							20 40 60 80 100	20 40 60 80 100	10 20 30				GR SA SI CL
	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs. (continued)		3	RUN	NQ		152						RUN#3 TCR=91% SCR=69% RQD=43%
			4	RUN	NQ		151						RUN#4 TCR=94% SCR=80% RQD=30%
150.5 32.2	End of Borehole  Water level at 6.1m (not stabilized) and hole open to full depth on completion.  Unable to push vane beyond 12.0m.  Resistance to augering below 23.6m.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date      Depth(m)      Elevation(m) Jan.27.10      6.8      175.9 Feb.08.10      6.8      175.9  April 29, 2010 borehole drilled 1m south of original borehole location.												

ONTARIO MOT 1-09-4135.SBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No WS2

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords N:4764174.7 E:327313.4 ORIGINATED BY AW  
 DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 01/28/10 - 02/01/10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
183.1 0.0	Ground Surface						183										GR SA SI CL
	firm		1	SS	7												
			2	SS	38		182									45	2 3 37 58
	SILTY CLAY trace sand, trace gravel, hard, brown, damp		3	SS	43		181										
			4	SS	36		180									47	0 1 51 48
			5	SS	29		179										
178.7 4.4			6	SS	24		178										
	SILT trace sand, frequent silty clay seams and partings, dense, brown, damp		7	SS	37		177										0 1 79 20
			8	SS	36		176										
177.2 5.9			9	SS	21		175										
	SILTY CLAY trace sand, trace gravel, stiff to very stiff, brown, damp to moist		10	SS	22		174										0 5 68 27
			11	TW	PH		173										
			12	SS	10		172										0 3 70 27
			13	SS	15		171										0 2 72 26
			14	SS	28		170										
168.4 14.7							169										

Continued Next Page

+ 3. x 3. Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT. 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No WS2

2 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords N:4764174.7 E:327313.4 ORIGINATED BY AW  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.28.10 - 02.01.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
	SILTY CLAY trace sand, trace gravel, hard, brown, damp (GLACIAL TILL)		15	SS	40		168							
							167							
			16	SS	52		166							
165.1 18.0	SANDY SILT trace to some clay, trace gravel to gravelly, very dense, brown, damp to moist (GLACIAL TILL)		17	SS	111		165							Jan 28
							164							Jan 29
			18	SS	100/ 13cm		163							26 17 45 12
162.4 20.7	CLAYEY SILT and sand, some gravel, hard, brown, damp (GLACIAL TILL)		19	SS	87		162							
							161							
160.8 22.3	SANDY SILT and gravel, trace clay, very dense, brown, moist (GLACIAL TILL)		20	SS	100/ 10cm		160							
							159							
			21	SS	100/ 10cm		158							
							157							
			22	SS	100/ 5cm		156							Jan 29
							155							Feb 01
155.8 27.3	--- frequent cobbles						154							
	BEDROCK - INTERBEDDED DOLOSTONE AND SHALE Unweathered, thinly laminated, grey, medium strength, argillaceous with unweathered, laminated, white, very low strength gypsum and calcite layers / veins and frequent unweathered, white, low strength, coarse grained calcitic vugs.		1	RUN	NQ									RUN#1 TCR=71% SCR=57% RQD=18%
			2	RUN	NQ									RUN#2 TCR=89% SCR=85% RQD=30%
153.2														

Continued Next Page

+ 3 . X 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/08/10

## METRIC

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No WS3

1 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords. N:4764192.6 E:327292.7 ORIGINATED BY MP  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 01.20.10 - 01.22.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
183.0 0.1	Ground Surface 50mm TOPSOIL						20 40 60 80 100								
	FILL - Silty Clay, trace sand, very stiff to hard, brown, damp		1	SS	17										
			2	SS	23										
			3	SS	36										
			4	SS	43										
180.1 2.9	SILTY CLAY trace sand, trace gravel, stiff to hard, brown, damp		5	SS	39										
			6	SS	30										
			7	SS	24										
			8	SS	20										
			9	TW	PH										
			10	SS	9										
			11	SS	13										
			12	SS	17										
			13	SS	23										
			14	SS	23										
168.3 14.7															

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT GDT 07/05/10

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No WS3

2 OF 2

METRIC

W.P. 280-99-00 LOCATION Coords. N:4764192.6 E:327292.7 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 01.20.10 - 01.22.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								WATER CONTENT (%)					
164.8	SILTY CLAY trace sand to sandy, trace gravel, hard, brown, damp  (GLACIAL TILL)		15	SS	46								
18.2													
163.2	SANDY SILT some clay, trace gravel, dense to very dense, brown, damp to moist  (GLACIAL TILL)		16	SS	79								
19.8													
160.7	CLAYEY SILT sandy, trace to some gravel, hard, brown, damp  (GLACIAL TILL)		17	SS	65								
22.3													
	CLAYEY SILT sandy, trace to some gravel, hard, brown, damp  (GLACIAL TILL)		18	SS	44								
	SANDY SILT trace to some gravel, trace clay, very dense, brown, damp to moist  (GLACIAL TILL)		19	SS	68								

+ 3, x 3: Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

# RECORD OF BOREHOLE No WS4

1 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords. N:4764202.3 E:327305.2 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 01.28.10 - 02.01.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub> W W <sub>L</sub>			
182.7 0.0	Ground Surface 25mm TOPSOIL		1	SS	13		182	20 40 60 80 100		10 20 30			
	FILL - Silty Clay, trace sand, trace gravel, stiff to very stiff, brown, damp to moist		2	SS	17		181	20 40 60 80 100		10 20 30			
180.6 2.1	SILTY CLAY trace sand, trace gravel, hard, brown, damp		3	SS	13		180	20 40 60 80 100		10 20 30			1 1 48 50
			4	SS	45		179	20 40 60 80 100		10 20 30			
			5	SS	45		178	20 40 60 80 100		10 20 30			
			6	SS	43		177	20 40 60 80 100		10 20 30			
177.7 5.0	SILT trace clay, trace sand, frequent silty clay seams and partings, very dense, brown, damp		7	SS	61		176	20 40 60 80 100		10 20 30			
176.8 5.9	SILTY CLAY trace sand, trace gravel, stiff to hard, brown, damp		8	SS	64		175	20 40 60 80 100		10 20 30			
			9	SS	37		174	20 40 60 80 100		10 20 30			
			10	SS	37		173	20 40 60 80 100		10 20 30			
			11	SS	20		172	20 40 60 80 100		10 20 30			0 3 67 30
			12	TW	PH		171	20 40 60 80 100		10 20 30			
			13	SS	25		170	20 40 60 80 100		10 20 30			1 6 71 22
			14	SS	23		169	20 40 60 80 100		10 20 30			
168.0 14.7							168	20 40 60 80 100		10 20 30			

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/08/10



## METRIC

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No WS4

3 OF 3

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764202.3 E:327305.2 ORIGINATED BY MP  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 01.28.10 - 02.01.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)																				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100																									
	<p>Water level at approx. 9.1m (not stabilized) and hole open to full depth on completion.</p> <p>Unable to push vane beyond 14.7m.</p> <p>Resistance to augering from 25.0m to 25.8m.</p> <p>Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>Water Level Readings:</p> <table><tr><td>Date</td><td>Depth(m)</td><td>Elevation(m)</td></tr><tr><td>Feb.08.10</td><td>4.7</td><td>178.0</td></tr><tr><td>Apr.16.10</td><td>2.1</td><td>180.6</td></tr><tr><td>Apr.29.10</td><td>5.1</td><td>177.6</td></tr><tr><td>May.04.10</td><td>5.7</td><td>177.0</td></tr><tr><td>May.06.10</td><td>4.1</td><td>178.6</td></tr><tr><td>May.18.10</td><td>5.9</td><td>176.8</td></tr></table>	Date	Depth(m)	Elevation(m)	Feb.08.10	4.7	178.0	Apr.16.10	2.1	180.6	Apr.29.10	5.1	177.6	May.04.10	5.7	177.0	May.06.10	4.1	178.6	May.18.10	5.9	176.8															
Date	Depth(m)	Elevation(m)																																			
Feb.08.10	4.7	178.0																																			
Apr.16.10	2.1	180.6																																			
Apr.29.10	5.1	177.6																																			
May.04.10	5.7	177.0																																			
May.06.10	4.1	178.6																																			
May.18.10	5.9	176.8																																			

RECORD OF BOREHOLE No SBL 12+750CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764219.9 E:327296.2 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Hollow Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
182.9	Ground Surface							20 40 60 80 100							
182.7	200mm TOPSOIL							20 40 60 80 100							
0.2	FILL - Silty Clay, trace sand, trace organics, stiff, dark brown, moist		1	SS	8										
182.2															
0.7	SILTY CLAY trace sand, very stiff to hard, brown, moist		2	SS	24		182								
			3	SS	37		181								
			4	SS	46		180								
			5	SS	33		179								
			6	SS	20		178								
			7	SS	27		177								
			8	SS	34		176								
			9	SS	21		175								
			10	TW	PH		174								
							173								
							172								
171.6	End of Borehole														
11.3															
	Water level at 10.4m (not stabilized) and hole open to full depth on completion.														
	Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 3.0m slotted screen.														
	Water Level Readings:														
	Date      Depth(m)      Elevation(m)														
	Nov.19.09      4.6      178.3														
	Nov.30.09      7.8      175.1														
	Dec.08.09      4.1      178.8														
	Dec.15.09      3.2      179.7														
	Jan.04.10      2.7      180.2														
	Jan.11.10      2.7      180.2														
	Jan.19.10      2.6      180.3														
	Consolidation test performed on TW 10.														

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

Water level at 10.4m (not stabilized)  
and hole open to full depth on  
completion.

Piezometer installation consists of a  
19mm diameter, Schedule 40 PVC  
pipe with a 3.0m slotted screen.

Water Level Readings:

Date	Depth(m)	Elevation(m)
Nov.19.09	4.6	178.3
Nov.30.09	7.8	175.1
Dec.08.09	4.1	178.8
Dec.15.09	3.2	179.7
Jan.04.10	2.7	180.2
Jan.11.10	2.7	180.2
Jan.19.10	2.6	180.3

Consolidation test performed on  
TW 10.

+ 3. x 3. Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No SBL 12+825Lt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764289.3 E:327265.5 ORIGINATED BY PK  
 DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
 DATUM Geodetic DATE 11.09.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      x LAB VANE									
183.0	Ground Surface						20	40	60	80	100						
182.8	180mm TOPSOIL																
0.2	FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	8												
182.3																	
0.7	SILTY CLAY trace sand, occasional gravel inclusions, very stiff to hard, brown, damp to moist		2	SS	36												
			3	SS	25												
			4	SS	38												
			5	SS	26												
			6	SS	29												
			7	SS	37												
			8	SS	17												
175.7		End of Borehole															
7.3	Water level at 6.1m (not stabilized) and hole open to full depth on completion.																

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/08/10

# RECORD OF BOREHOLE No SBL 12+825Rt

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764290.1 E:327278.0 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
182.3	Ground Surface						20	40	60	80	100	10	20	30	GR SA SI CL	
182.1	200mm TOPSOIL															
0.2	FILL - Silty Clay, trace sand, trace organics, very stiff, dark brown, moist		1	SS	15											
181.6																
0.7	SILTY CLAY trace sand, very stiff to hard, brown, moist		2	SS	30									48	0 1 41 58	
			3	SS	56											
			4	SS	33										0 1 47 52	
			5	SS	18											
			6	SS	31											
			7	SS	17										0 2 70 28	
			8	SS	22											
	firm to stiff															
174.1																
8.2	End of Borehole															
	Borehole was dry (not stabilized) and hole open to full depth on completion.															
	No sample recovery at SS7 and SS8. Sampler redriven and disturbed sample collected.															

ONTARIO MOT 1-09-4135 SBL2.GPJ ONTARIO MOT.GDT 07/06/10

RECORD OF BOREHOLE No SBL 12+900CL

1 OF 1

METRIC

W.P. 280-99-00 LOCATION Coords: N:4764364.1 E:327251.1 ORIGINATED BY PK  
DIST HWY 406 BOREHOLE TYPE Solid Stem Augers COMPILED BY DB  
DATUM Geodetic DATE 11.10.09 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		$w_p$	$w$	$w_L$		
182.7	Ground Surface							20 40 60 80 100						
182.5	180mm TOPSOIL							20 40 60 80 100						
0.2	FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	15		182							
182.0														
0.7	SILTY CLAY trace sand, occasional sand seams, very stiff to hard, brown, moist		2	SS	38		181							0 1 61 38
			3	SS	32		180							
			4	SS	27		179							
			5	SS	33		178							
							177							1 3 76 20
			6	SS	32		176							
			7	SS	30									
	firm to very stiff							2.4						
176.0	End of Borehole									2.8				
6.7	Borehole was dry (not stabilized) and hole open to full depth on completion.  Piezometer installation consists of a 19mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen.  Water Level Readings: Date Depth(m) Elevation(m) Nov.19.09 2.5 180.2 Nov.30.09 2.3 180.4 Dec.08.09 2.0 180.7 Dec.15.09 1.5 181.2 Jan.04.10 1.7 181.0 Jan.11.10 1.9 180.8 Jan.19.10 1.7 181.0													

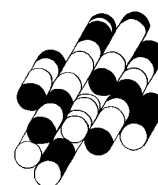
ONTARIO MOT. 1-09-4135 SBL2 GPJ ONTARIO MOT. GDT 07/06/10

+ 3, x 3. Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

# B4

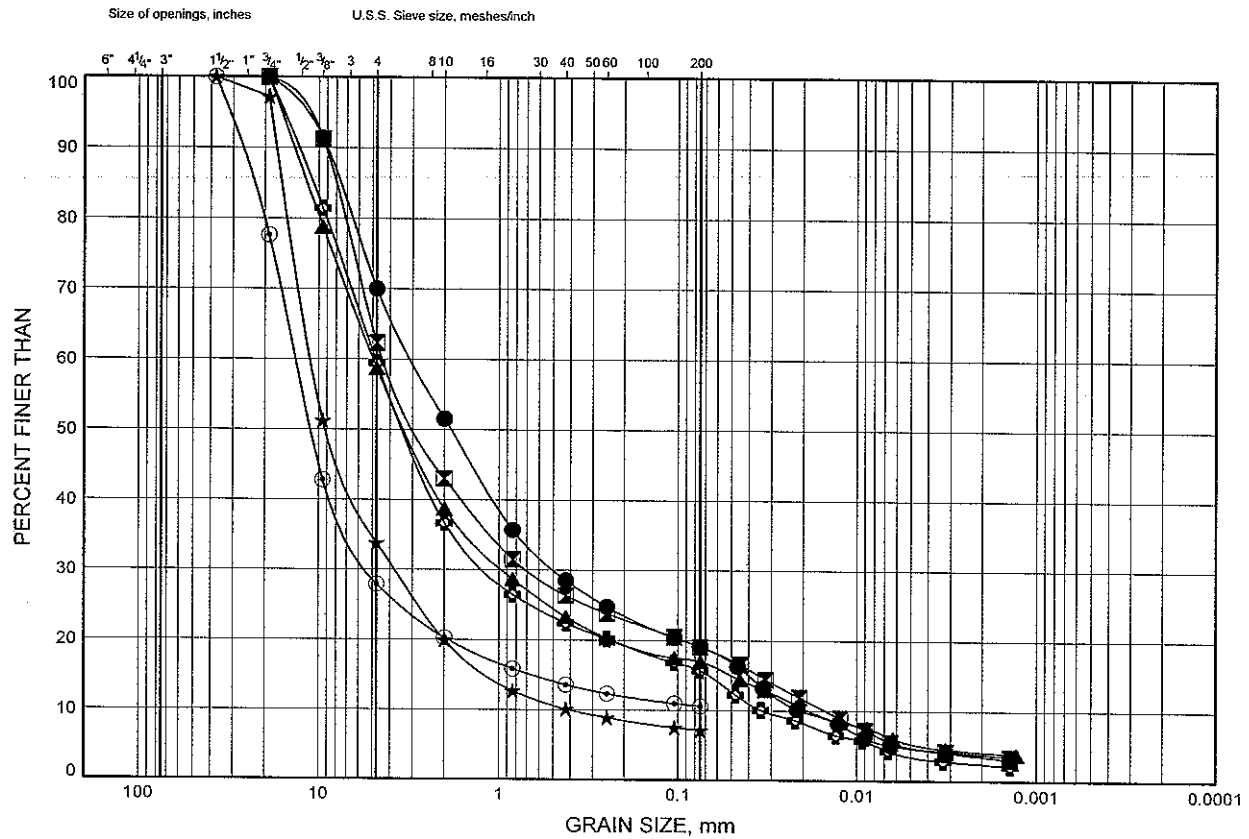
**TERRAPROBE INC.**



# GRAIN SIZE DISTRIBUTION

FIGURE B4-1

## FILL - Sandy Gravel to Gravelly Sand

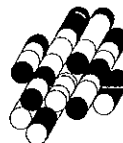


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+835Lt	0.3	180.9
⊠	NBL 12+985Lt	0.3	180.8
▲	SBL 12+685CL	0.3	182.4
★	TN3	0.3	183.8
⊙	TN4	0.3	183.7
⊕	WN3	0.3	181.8

Date July 2010

Project 1-09-4135



Prep'd DB

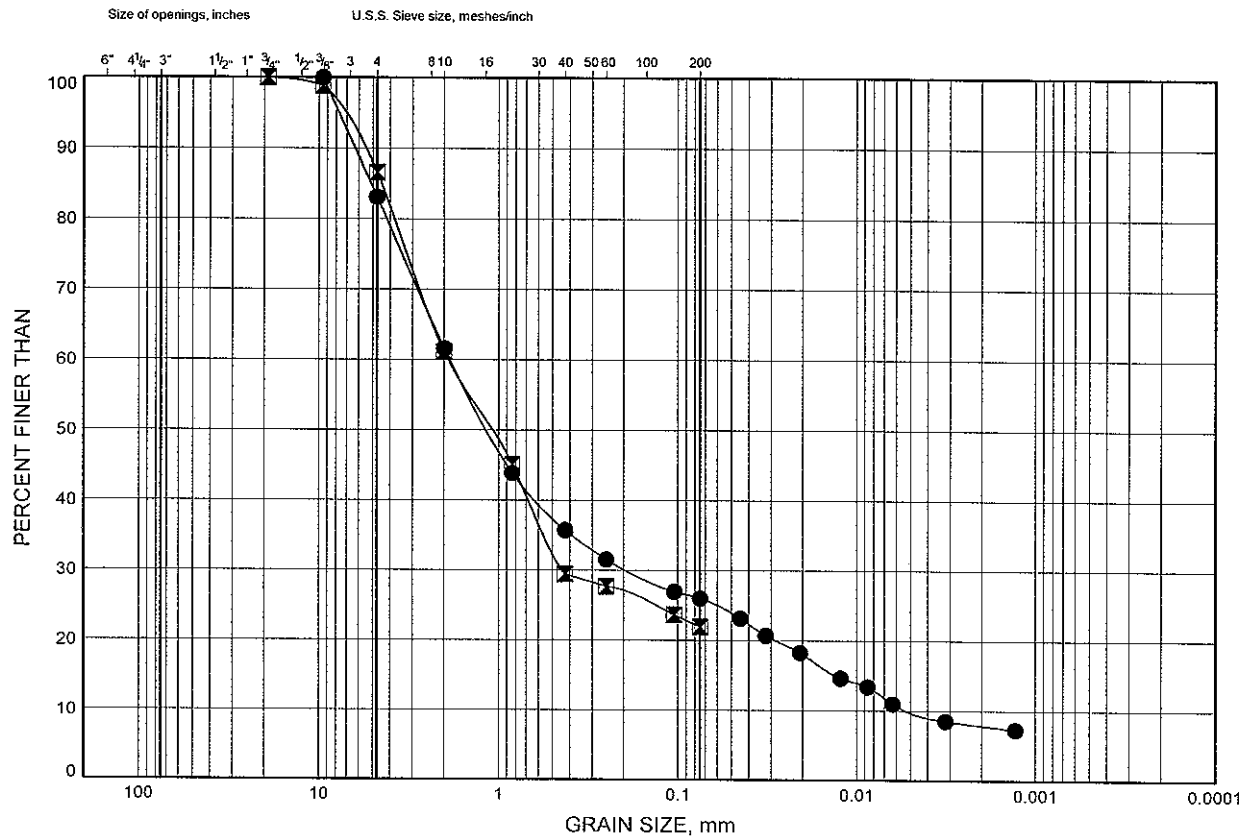
Chkd. MP



# GRAIN SIZE DISTRIBUTION

FIGURE B4-2

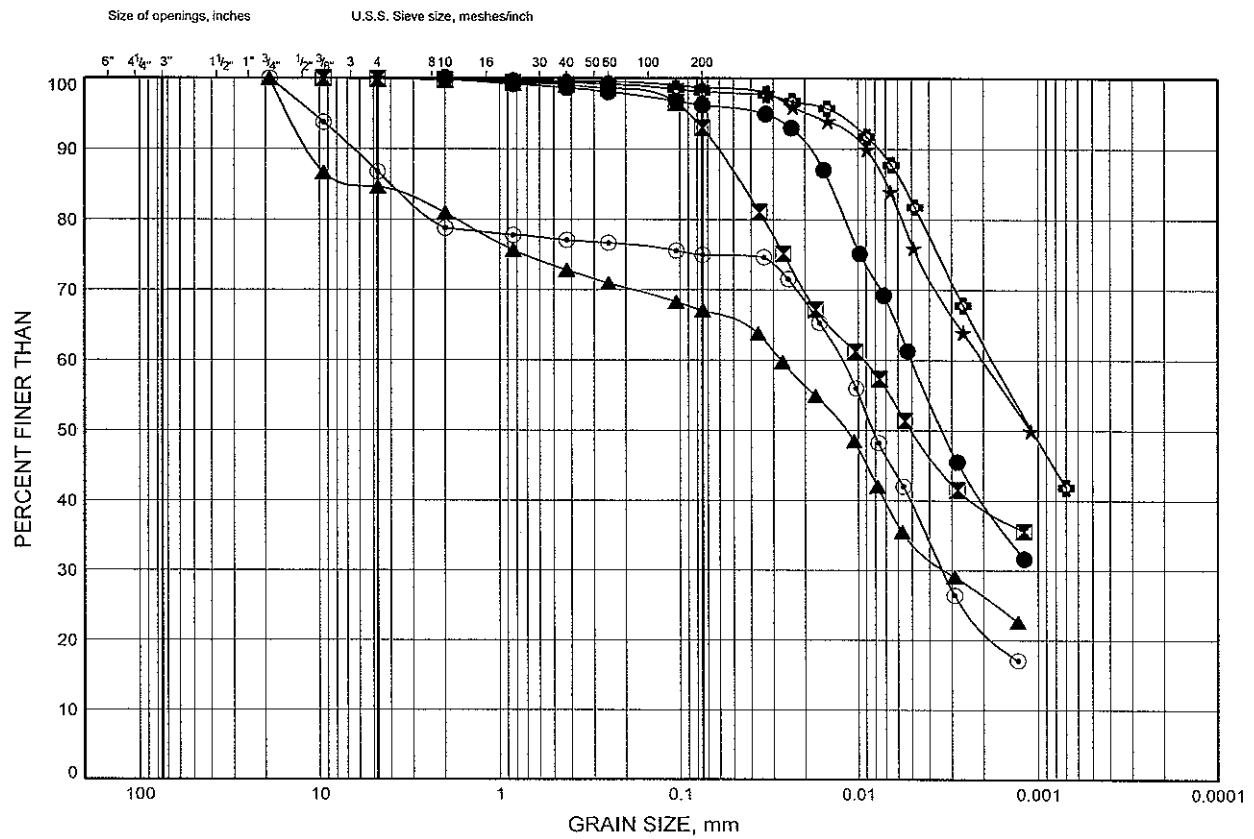
## FILL - Silty Sand to Sand and Silt



# GRAIN SIZE DISTRIBUTION

FIGURE B4-3

## FILL - Silty Clay



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

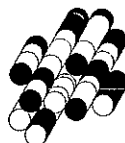
SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+075CL	0.3	184.3
⊠	NBL 12+150Rt	1.0	182.5
▲	NBL 12+375Lt	1.0	182.3
★	NBL 12+645Lt	1.7	181.6
⊙	TN2	1.0	183.2
⊗	WN1	1.0	182.1

GSD 1-09-4135 SITE4.GPJ 07/06/10

Date July 2010

Project 1-09-4135



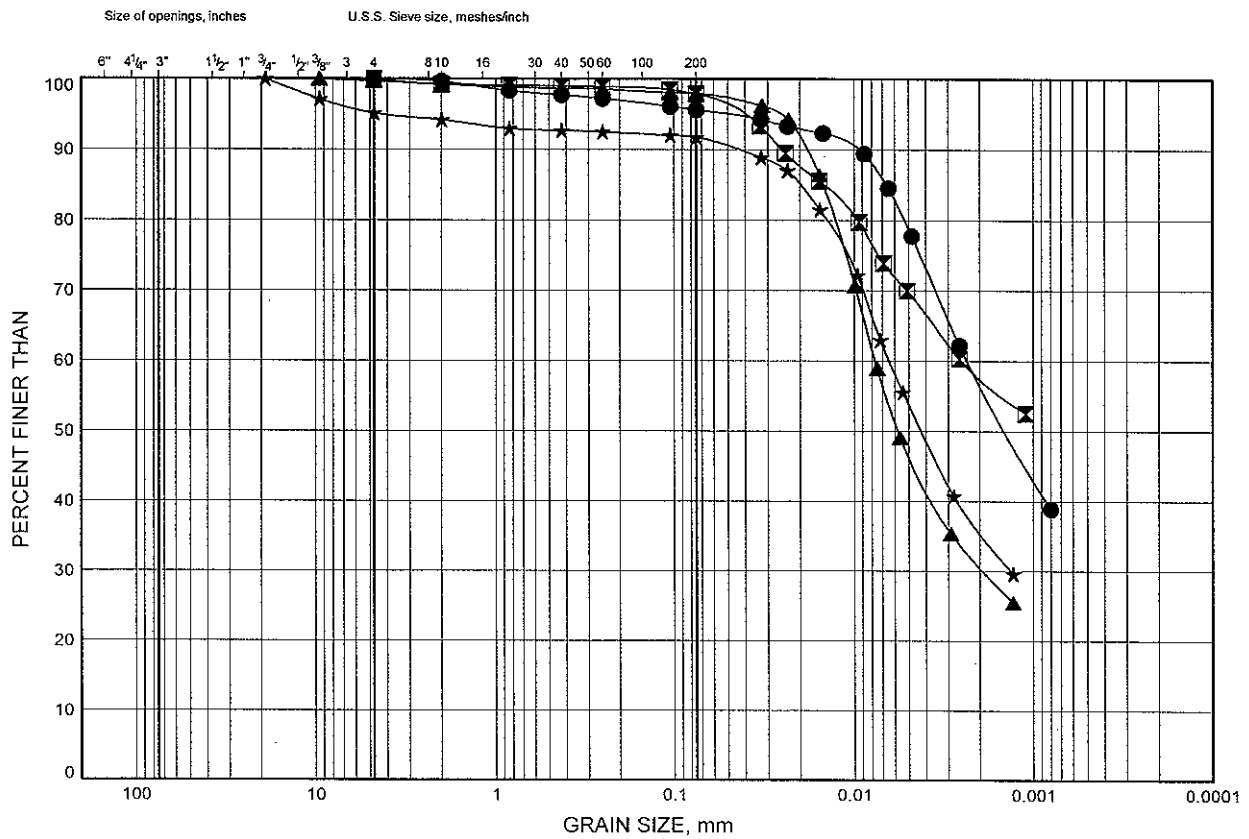
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-4

## FILL - Silty Clay

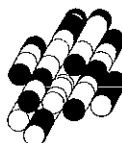


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+750Rt	0.3	182.5
⊠	SBL 12+185Lt	0.3	182.9
▲	WN4	1.0	181.5
★	WN4	2.5	180.0

Date July 2010

Project 1-09-4135



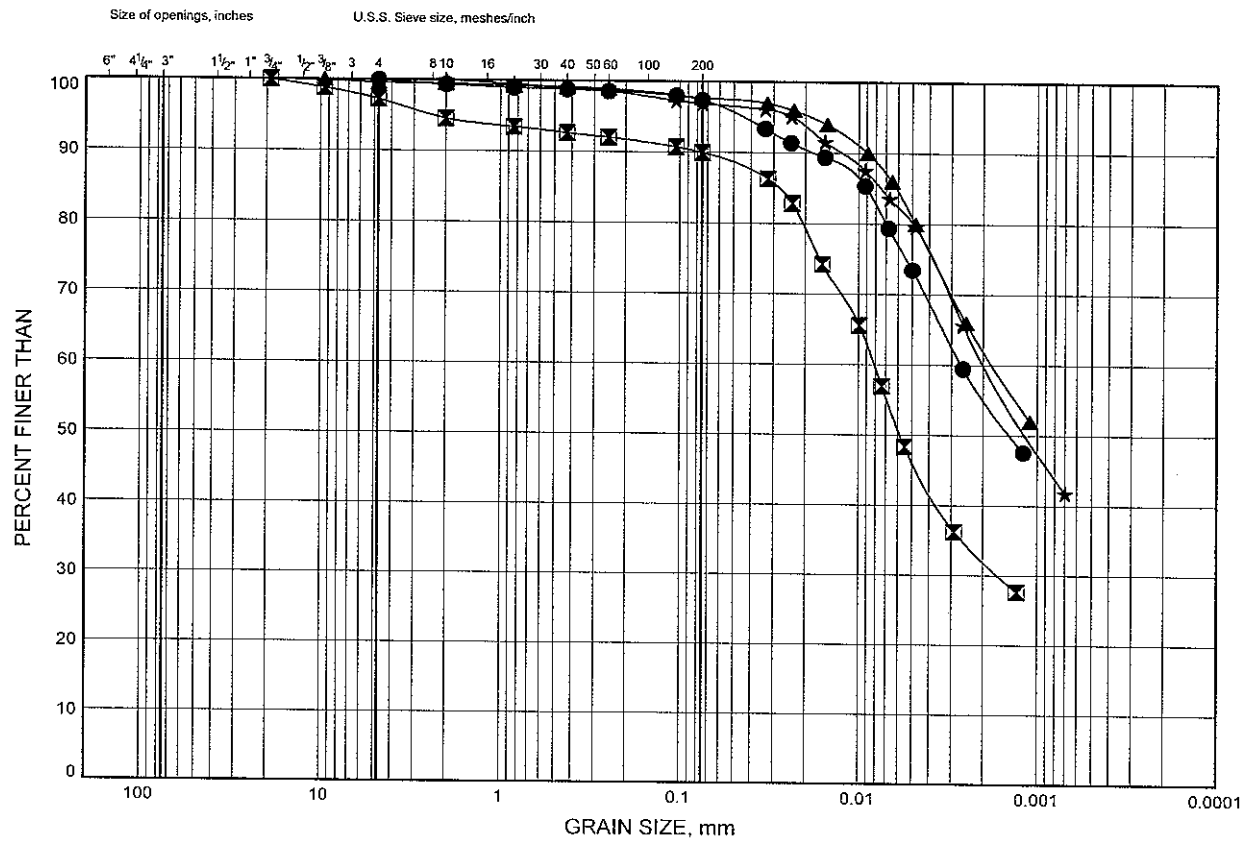
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-5

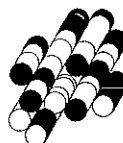
## FILL - Silty Clay



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+260CL	2.5	183.5
⊠	TS2	1.0	182.3
▲	WS1	1.0	181.7
★	WS3	1.7	181.3

Date July 2010  
Project 1-09-4135

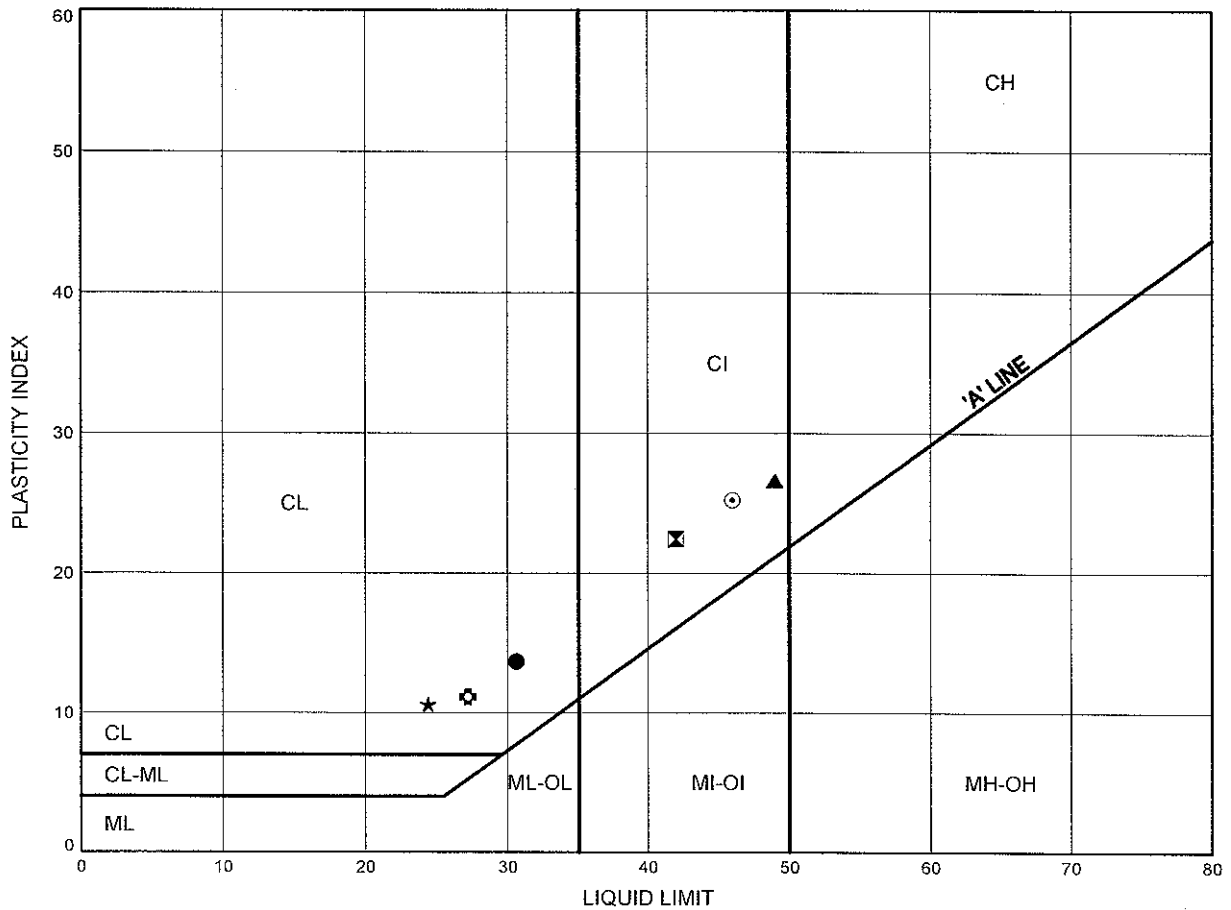


Prep'd DB  
Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

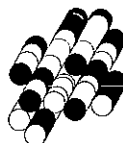
FIGURE B4-6

## FILL - Silty Clay



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+075CL	0.3	184.3
⊠	NBL 12+150Rt	1.0	182.5
▲	NBL 12+645Lt	1.7	181.6
★	TN2	1.0	183.2
⊙	WN1	1.0	182.1
⊛	WN4	1.0	181.5

Date July 2010  
Project 1-09-4135

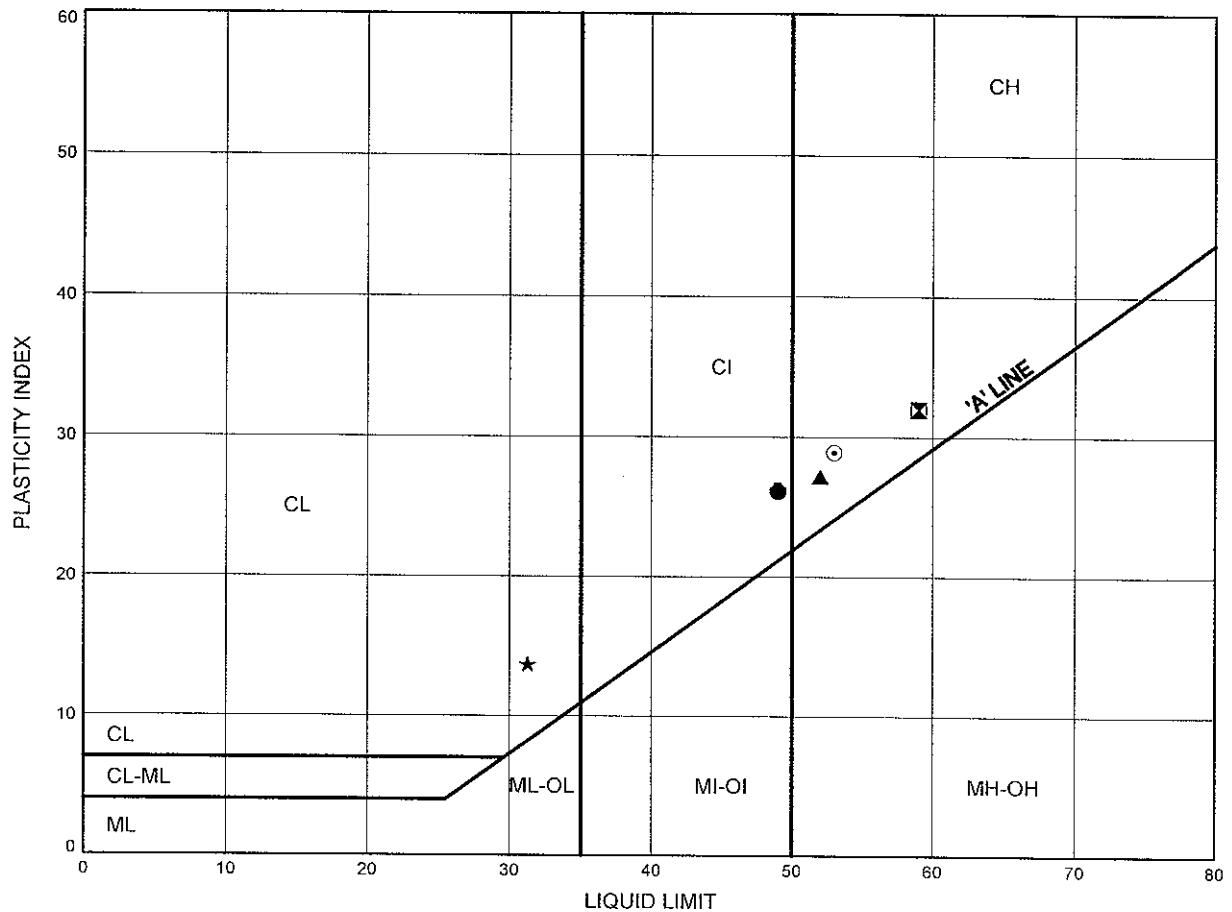


Prep'd DB  
Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-7

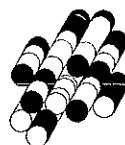
## FILL - Silty Clay



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+750Rt	0.3	182.5
⊠	SBL 12+185Lt	0.3	182.9
▲	SBL 12+260CL	2.5	183.5
★	TS2	1.0	182.3
⊙	WS1	1.0	181.7
⊕	WS3	1.7	181.3

Date July 2010

Project 1-09-4135



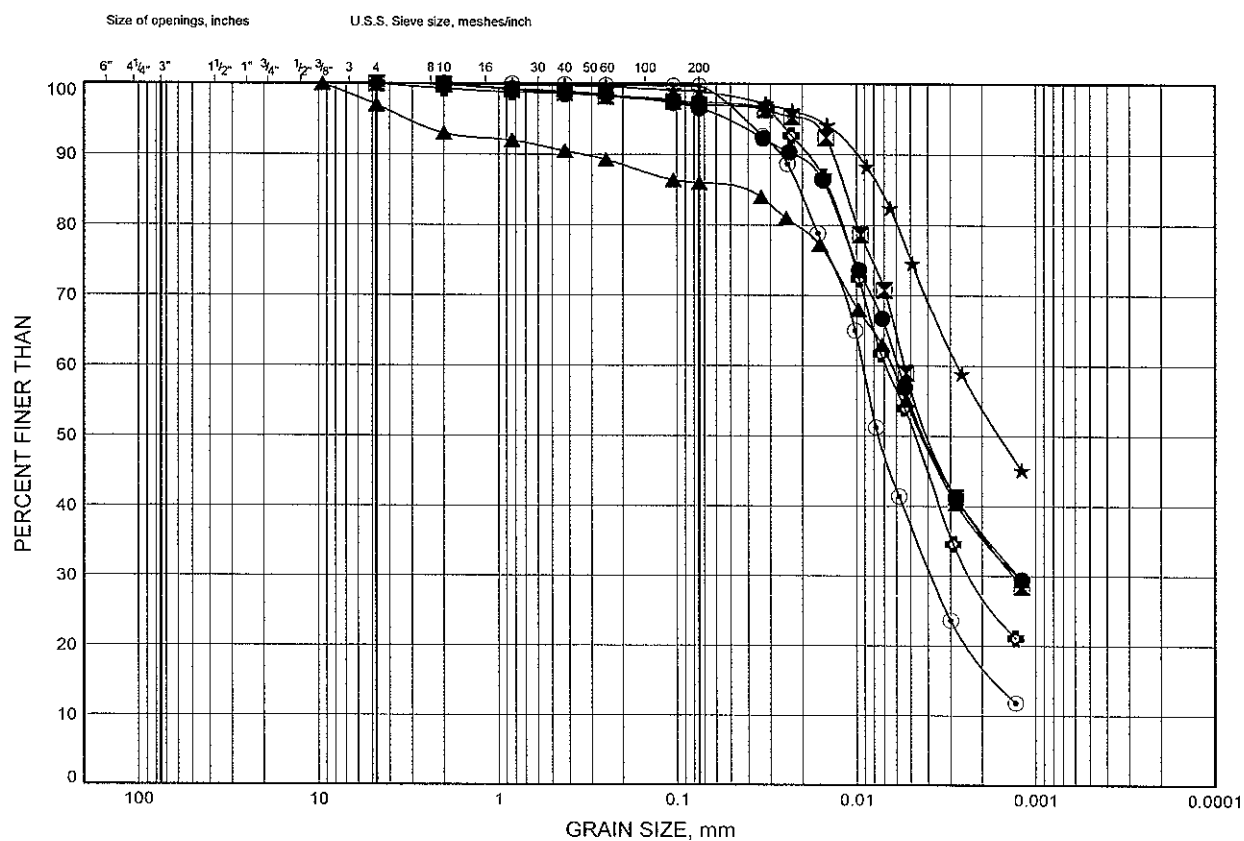
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-8

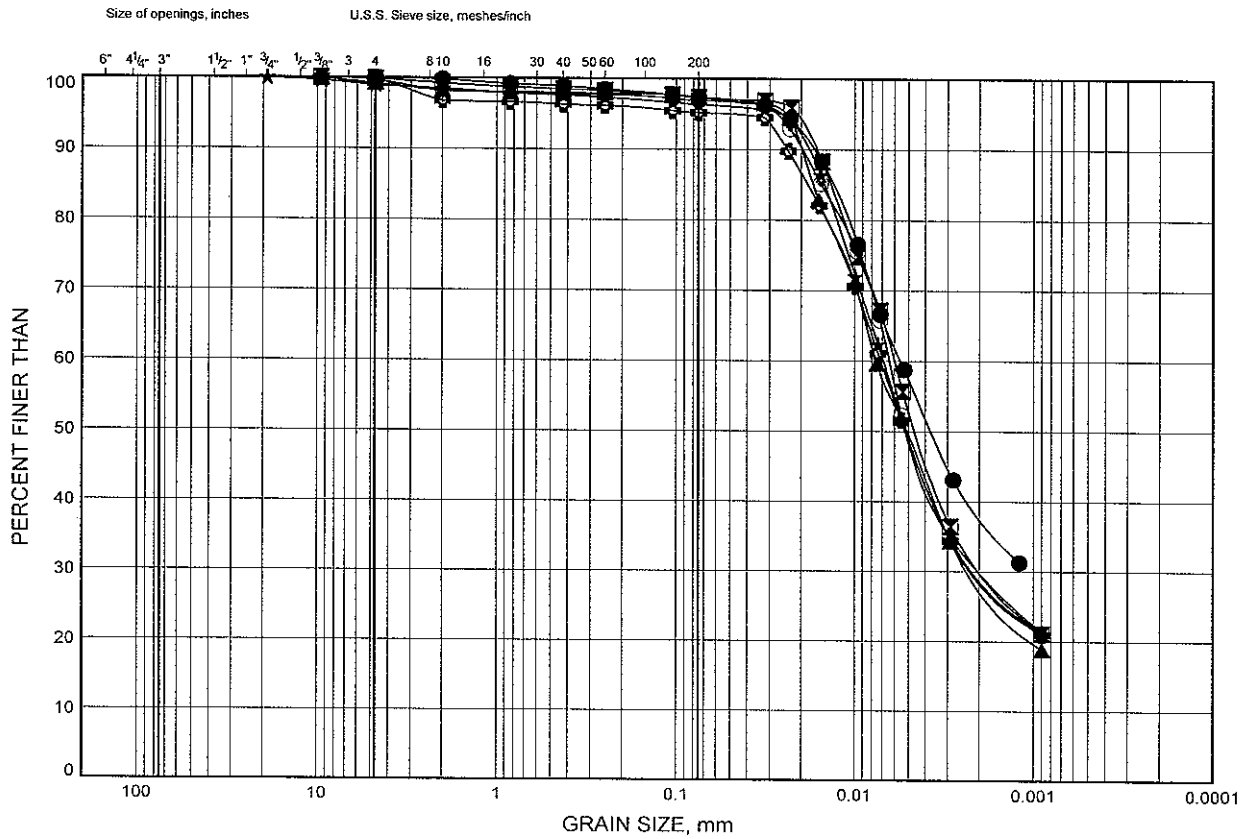
## SILTY CLAY



# GRAIN SIZE DISTRIBUTION

FIGURE B4-9

## SILTY CLAY

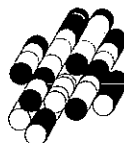


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+150Rt	2.5	181.0
⊠	NBL 12+150Rt	4.7	178.8
▲	NBL 12+150Rt	7.9	175.6
★	NBL 12+225CL	4.7	180.2
⊙	NBL 12+225CL	7.8	177.1
⊛	NBL 12+225CL	10.9	174.0

Date July 2010

Project 1-09-4135



Prep'd DB

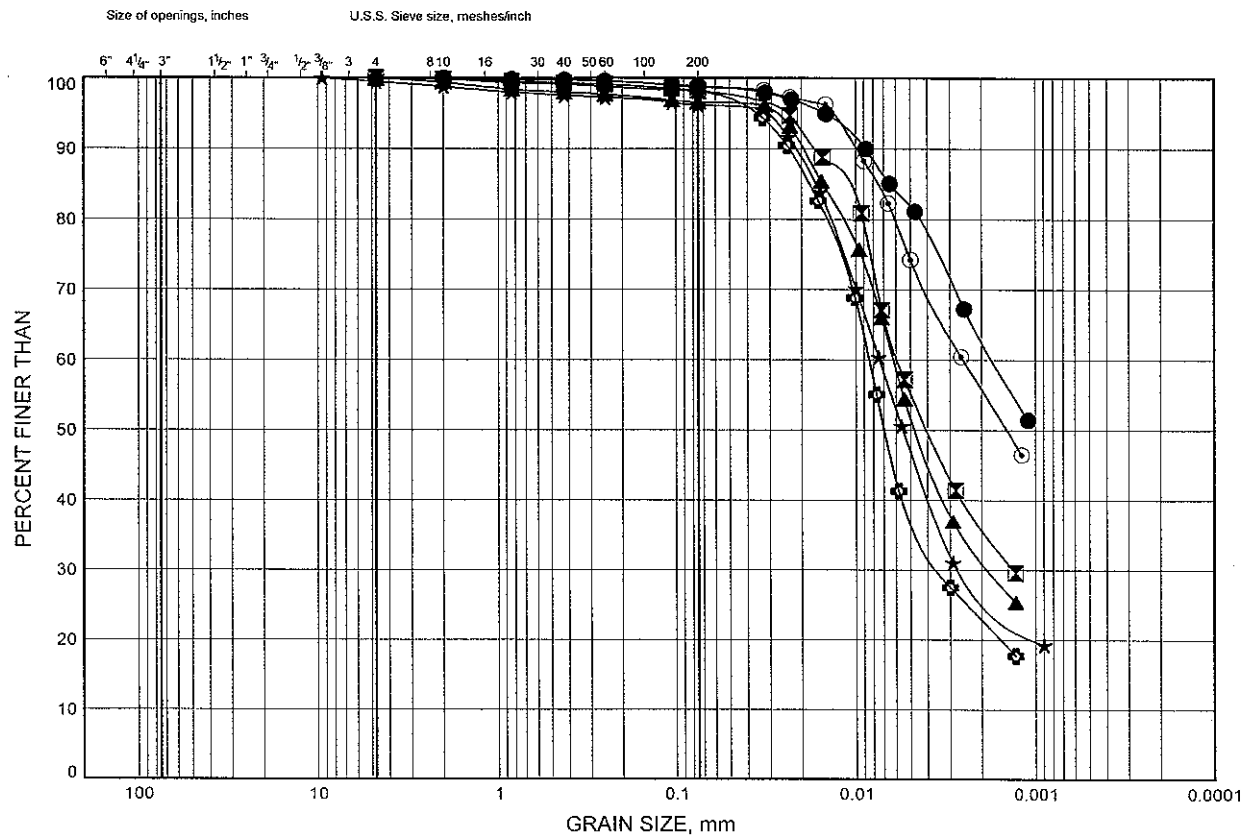
Chkd. MP



# GRAIN SIZE DISTRIBUTION

FIGURE B4-10

## SILTY CLAY



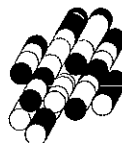
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+300Lt	1.1	182.0
⊠	NBL 12+300Lt	3.2	179.9
▲	NBL 12+300Lt	6.3	176.8
★	NBL 12+300Lt	9.3	173.8
⊙	NBL 12+300Rt	1.0	181.7
⊛	NBL 12+300Rt	4.7	178.0

Date July 2010

Project 1-09-4135



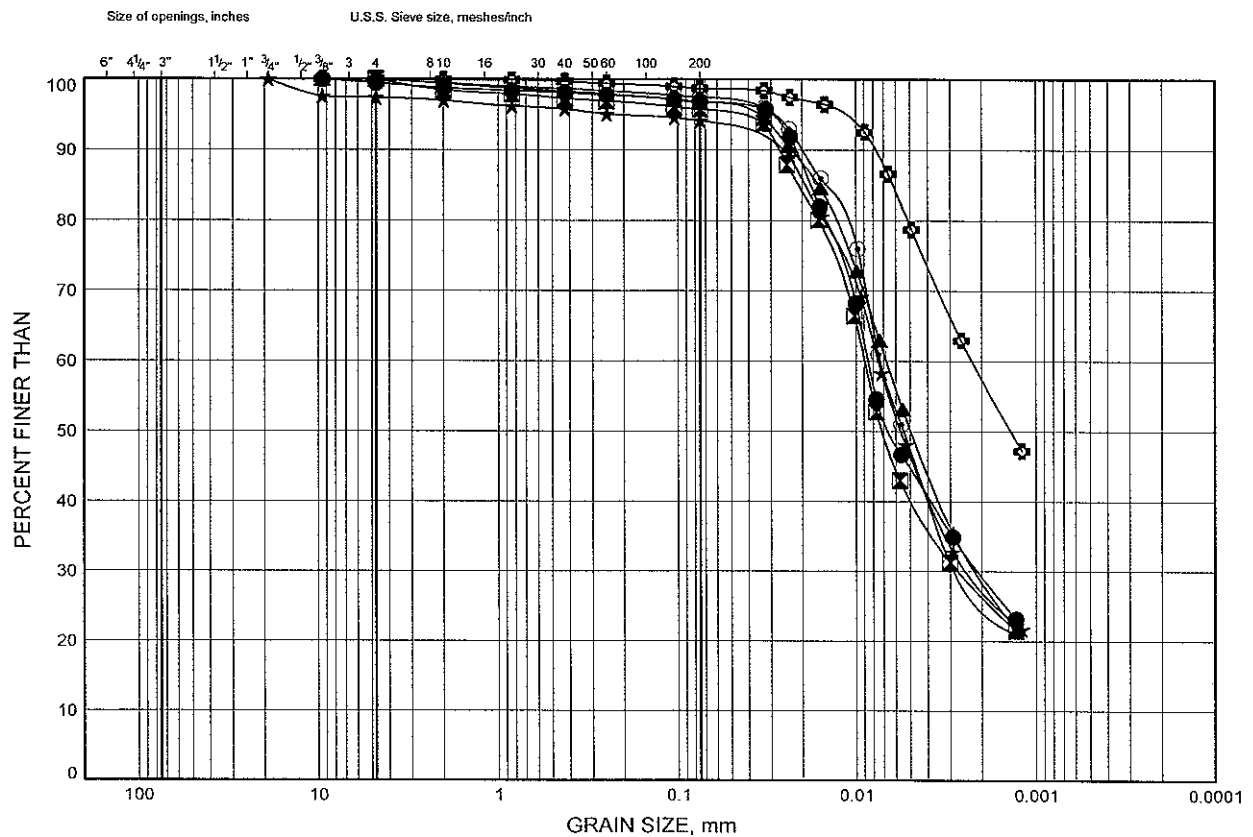
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-11

## SILTY CLAY

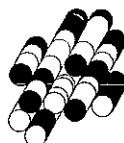


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+300Rt	9.3	173.4
⊠	NBL 12+375Lt	4.7	178.6
▲	NBL 12+375Lt	7.8	175.5
★	NBL 12+375Lt	9.3	174.0
⊙	NBL 12+375Lt	10.9	172.4
⊛	TN1	2.5	181.0

Date July 2010

Project 1-09-4135



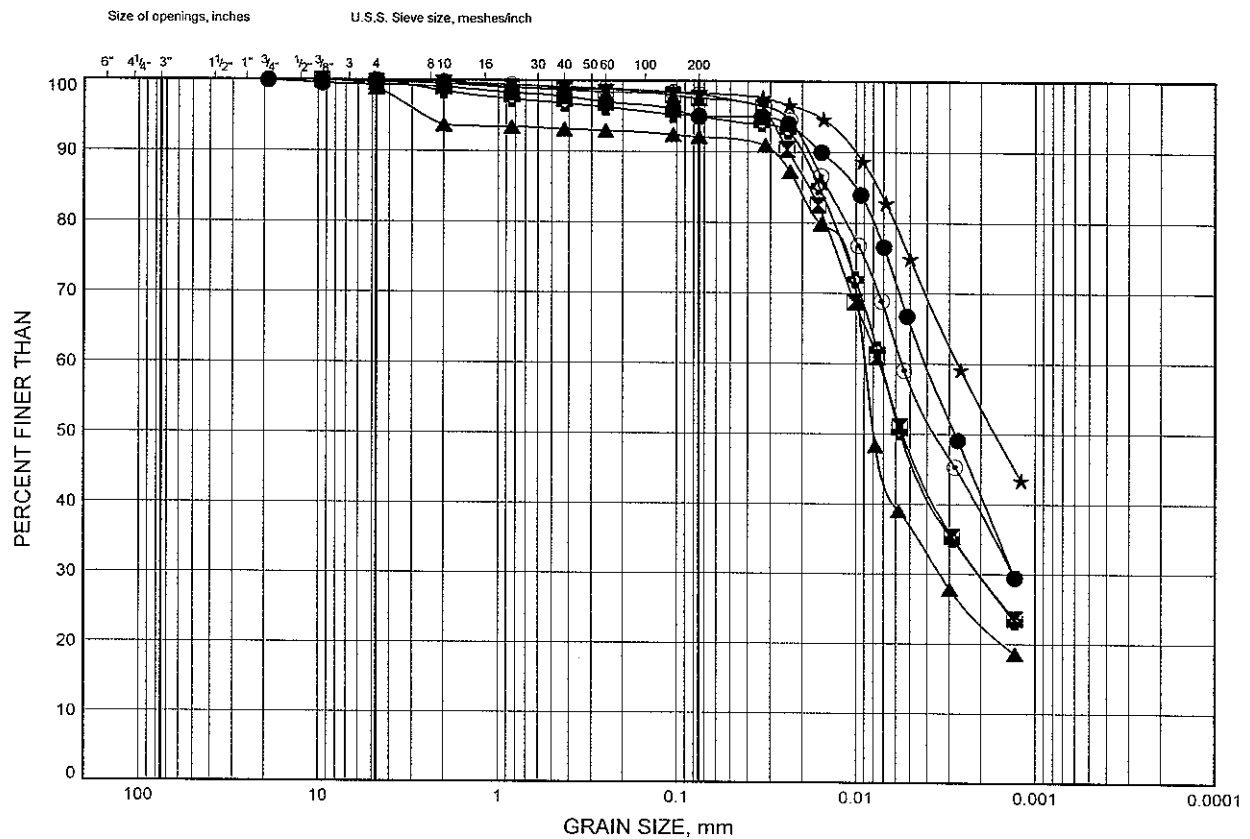
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-12

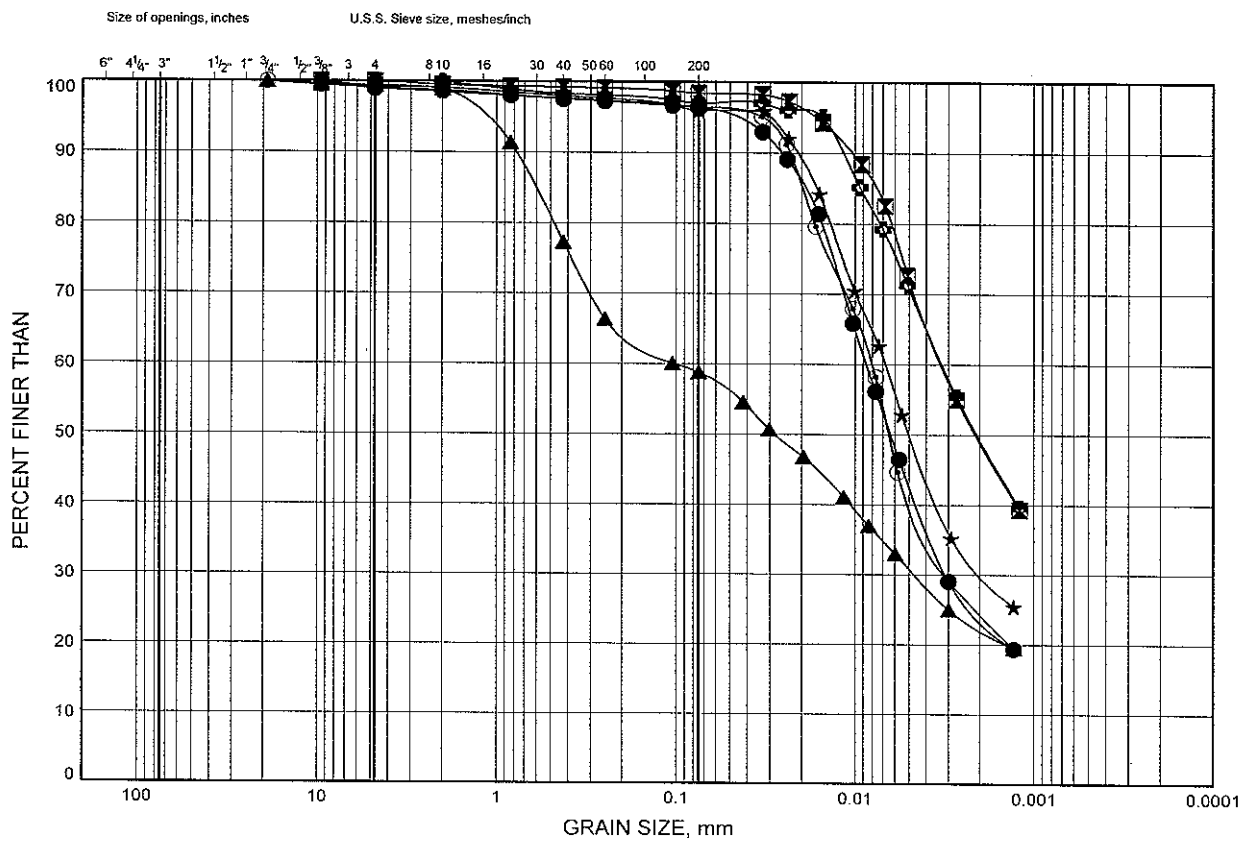
## SILTY CLAY



# GRAIN SIZE DISTRIBUTION

FIGURE B4-13

## SILTY CLAY

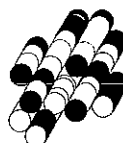


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TN2	13.9	170.3
⊠	TN3	4.0	180.1
▲	TN3	5.5	178.6
★	TN3	9.3	174.8
⊙	TN3	13.9	170.2
⊕	TN4	2.5	181.5

Date July 2010

Project 1-09-4135



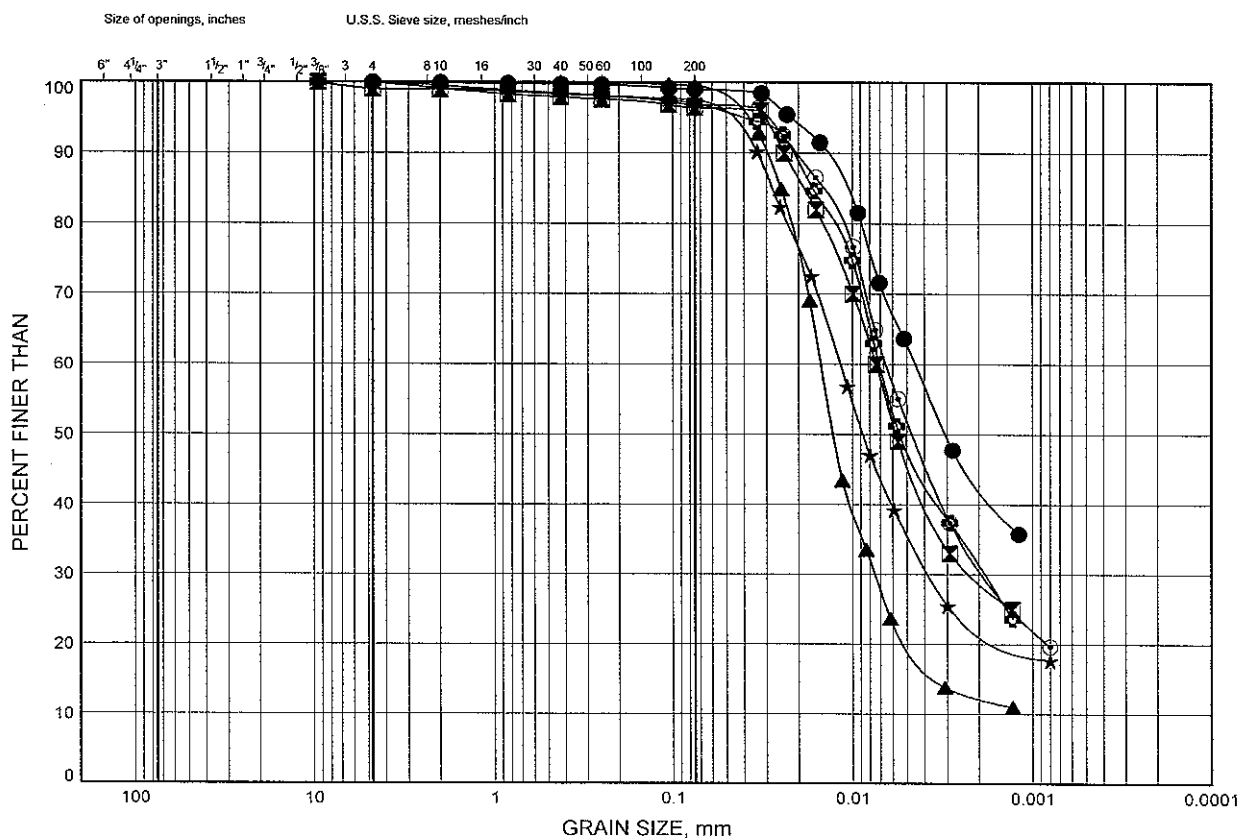
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-14

## SILTY CLAY



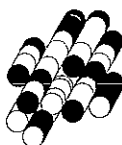
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+440Rt	3.2	179.8
⊠	NBL 12+440Rt	6.3	176.7
▲	NBL 12+440Rt	7.8	175.2
★	TN4	4.0	180.0
⊙	TN4	5.5	178.5
⊕	TN4	9.3	174.7

Date July 2010

Project 1-09-4135



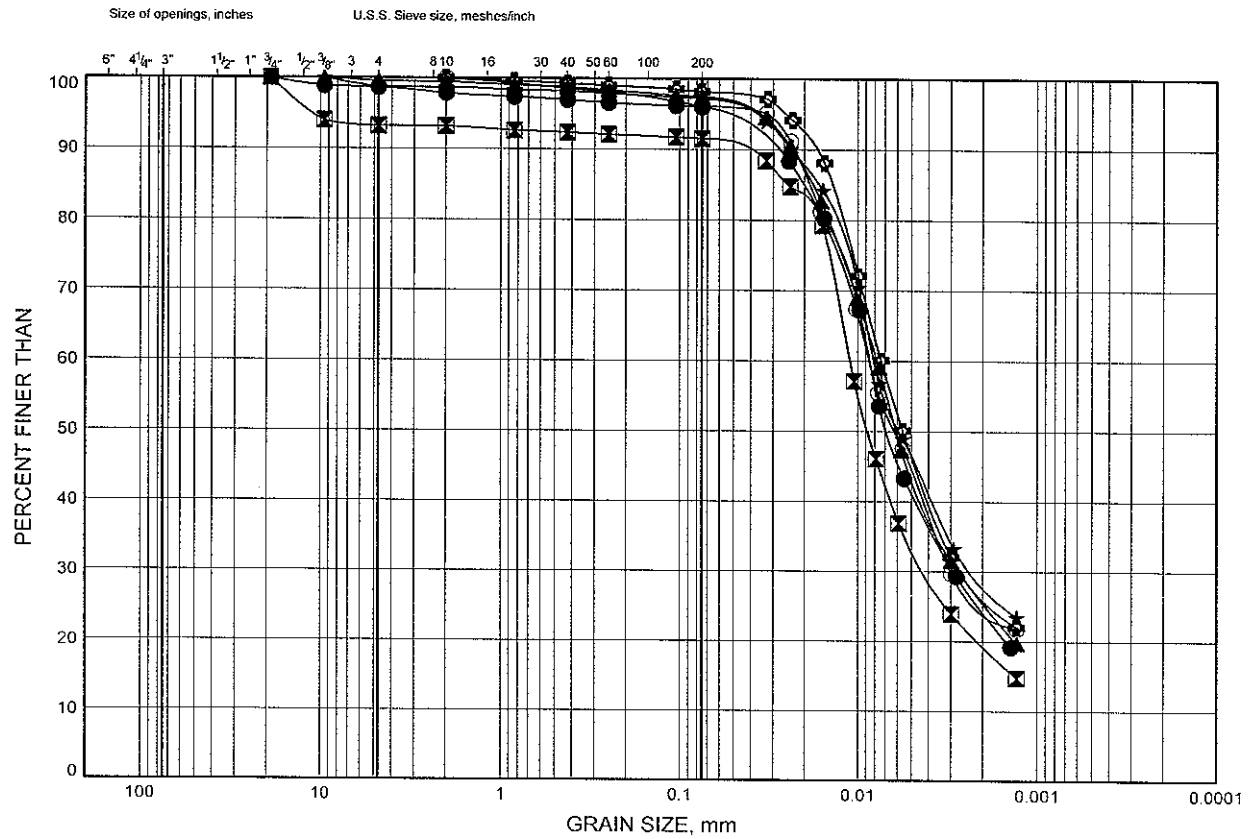
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-15

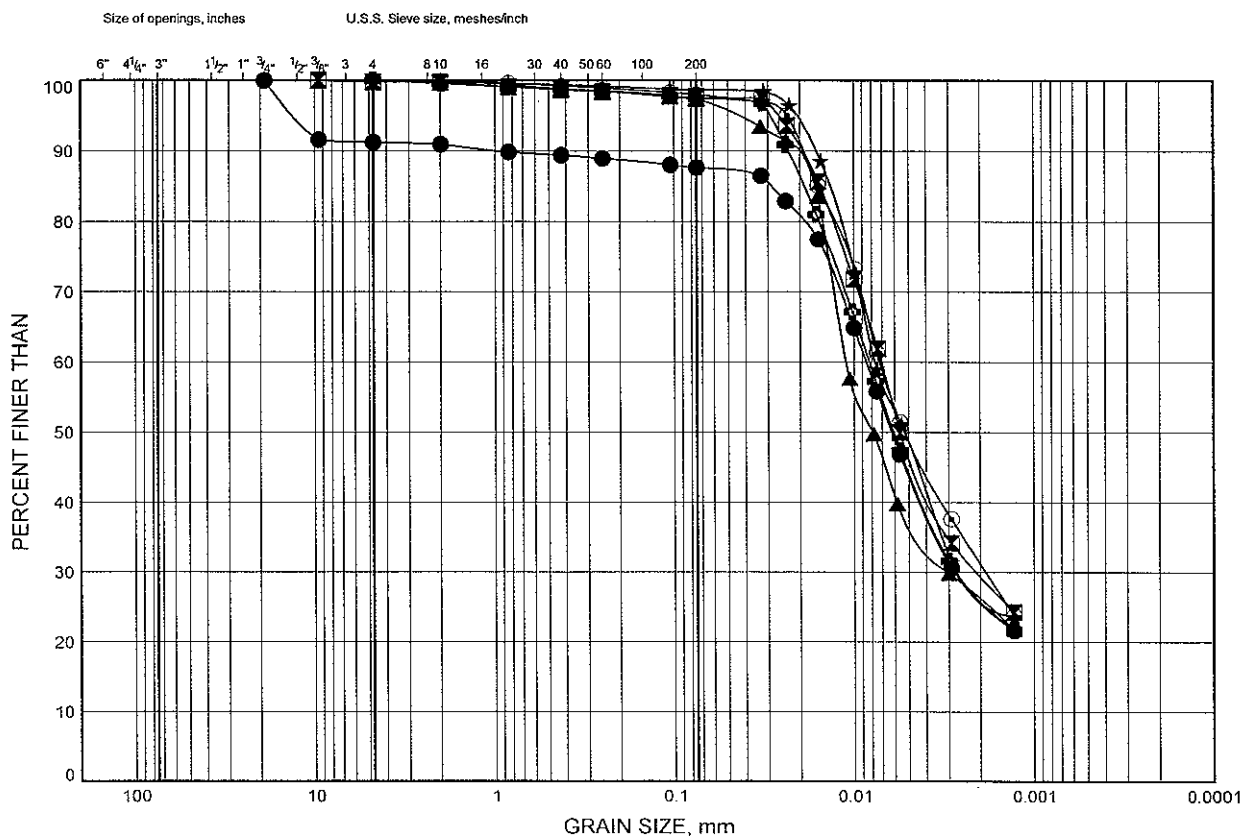
## SILTY CLAY



# GRAIN SIZE DISTRIBUTION

FIGURE B4-16

## SILTY CLAY



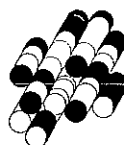
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
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●	NBL 12+525Rt	3.2	178.8
⊠	NBL 12+525Rt	6.3	175.7
▲	NBL 12+525Rt	9.3	172.7
★	NBL 12+525Rt	10.9	171.1
⊙	NBL 12+595Rt	3.2	178.4
⊕	NBL 12+595Rt	6.3	175.3

Date July 2010

Project 1-09-4135



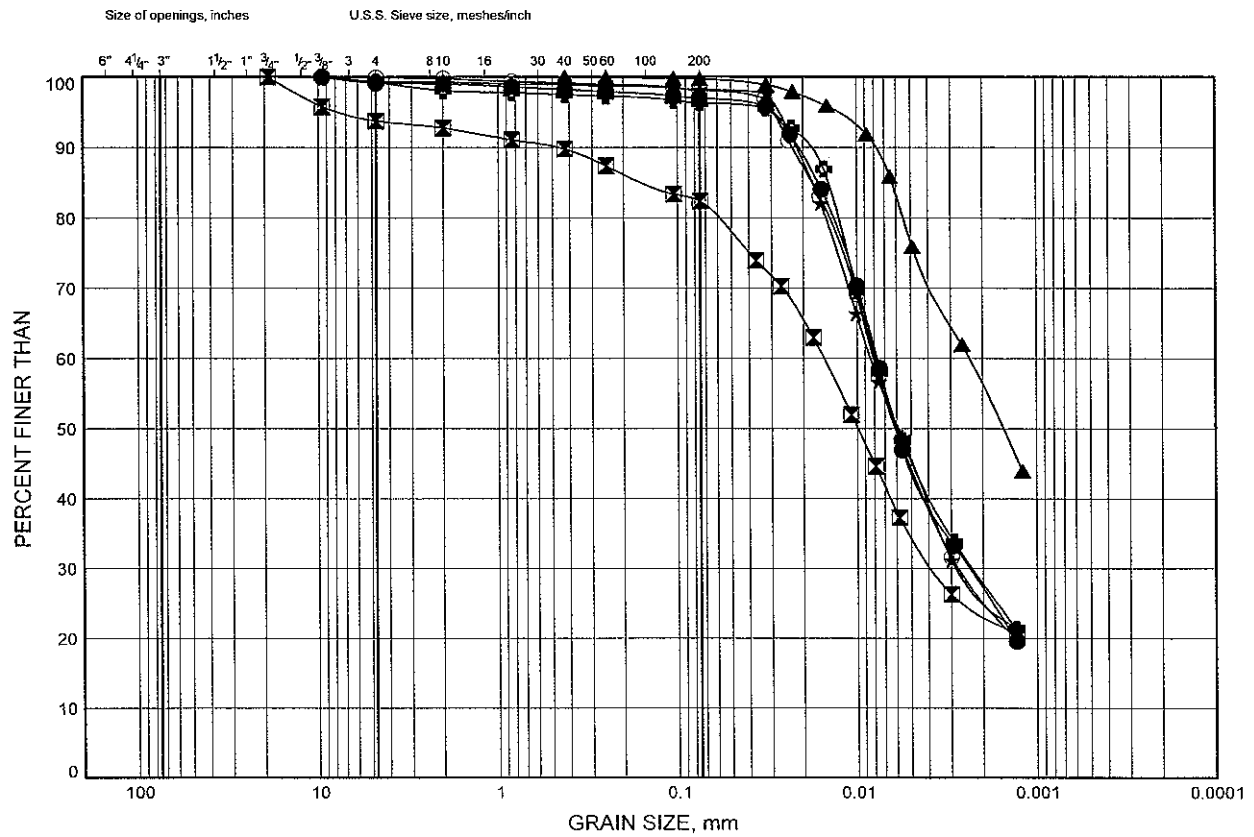
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-17

## SILTY CLAY

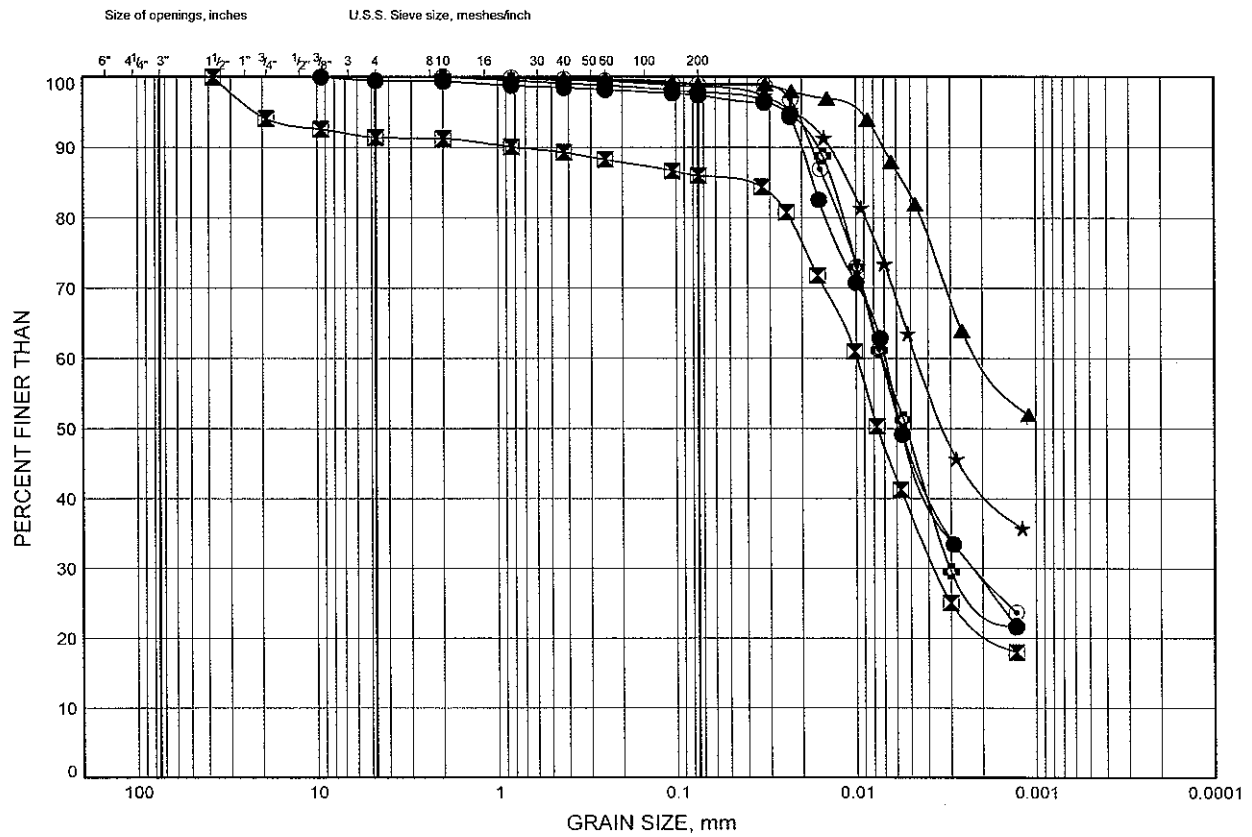




# GRAIN SIZE DISTRIBUTION

FIGURE B4-18

## SILTY CLAY



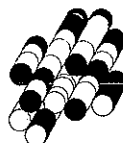
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	NBL 12+645Rt	6.3	174.7
⊠	NBL 12+645Rt	7.8	173.2
▲	NBL 12+695Lt	1.7	181.2
★	NBL 12+695Lt	3.2	179.7
⊙	NBL 12+695Lt	6.3	176.6
⊛	NBL 12+695Lt	9.3	173.6

Date July 2010

Project 1-09-4135



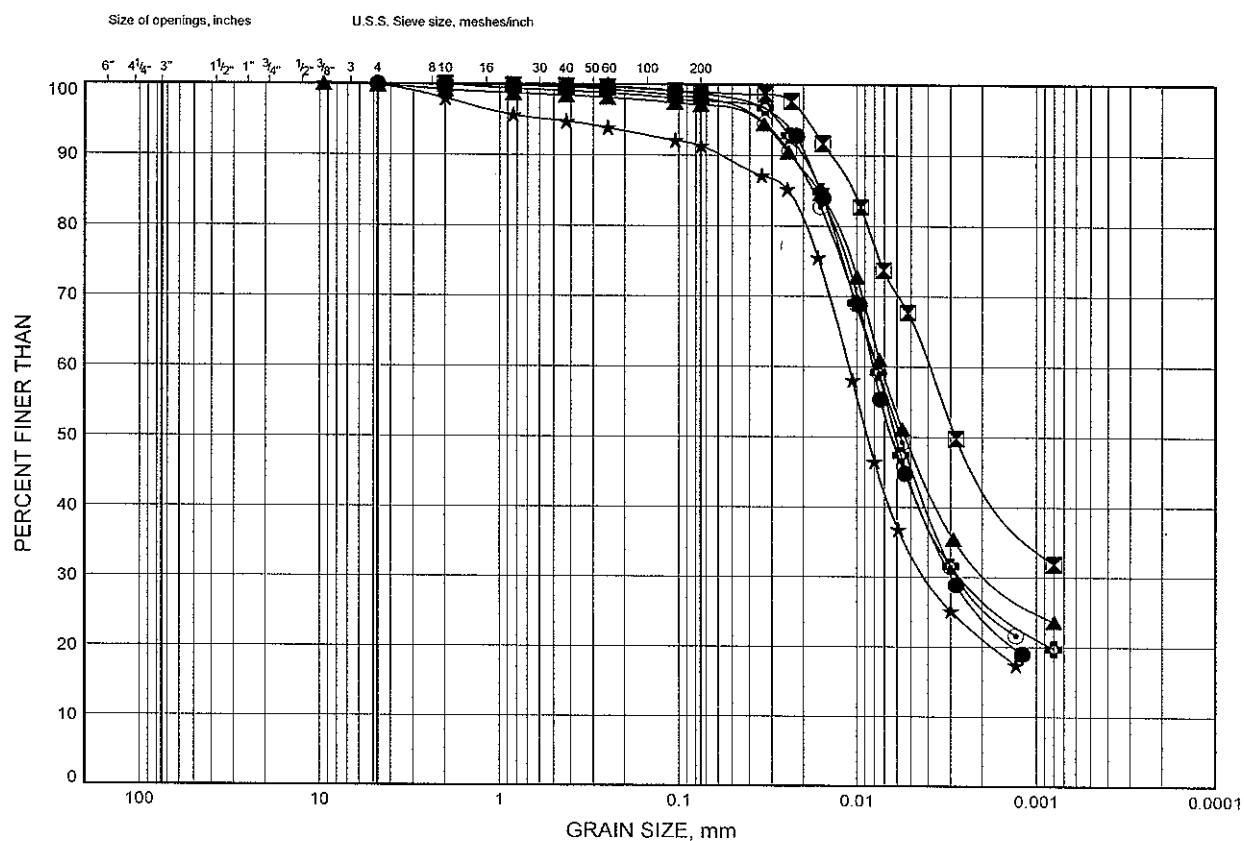
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-19

## SILTY CLAY



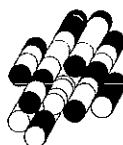
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+695Lt	12.4	170.5
⊠	WN1	3.2	179.9
▲	WN1	6.3	176.8
★	WN1	7.8	175.3
⊙	WN1	10.9	172.2
⊛	WN1	13.9	169.2

Date July 2010

Project 1-09-4135



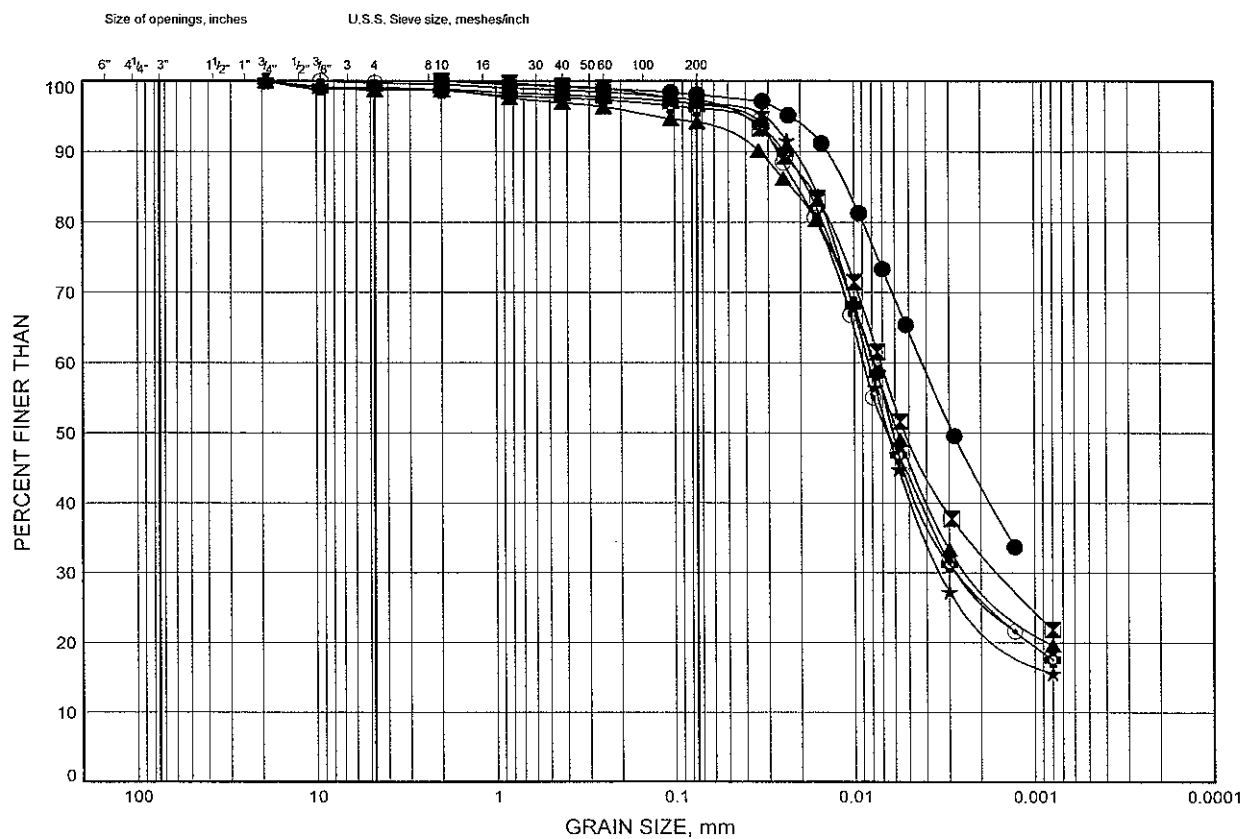
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-20

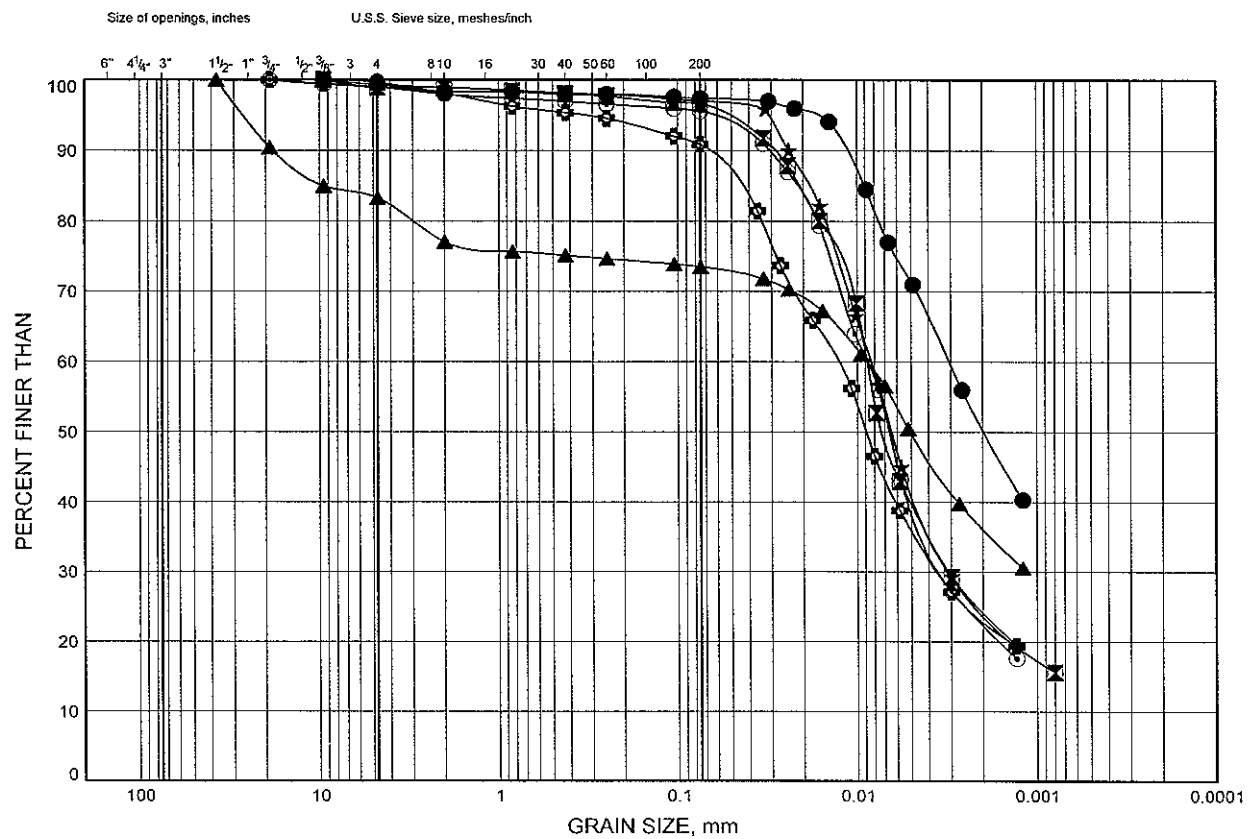
## SILTY CLAY



# GRAIN SIZE DISTRIBUTION

FIGURE B4-21

## SILTY CLAY



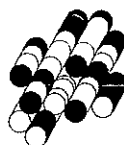
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+750Rt	1.7	181.1
⊠	WN3	12.4	169.7
▲	WN4	5.5	177.0
★	WN4	9.3	173.2
⊙	WN4	10.9	171.6
⊕	WN4	13.9	168.6

Date July 2010

Project 1-09-4135



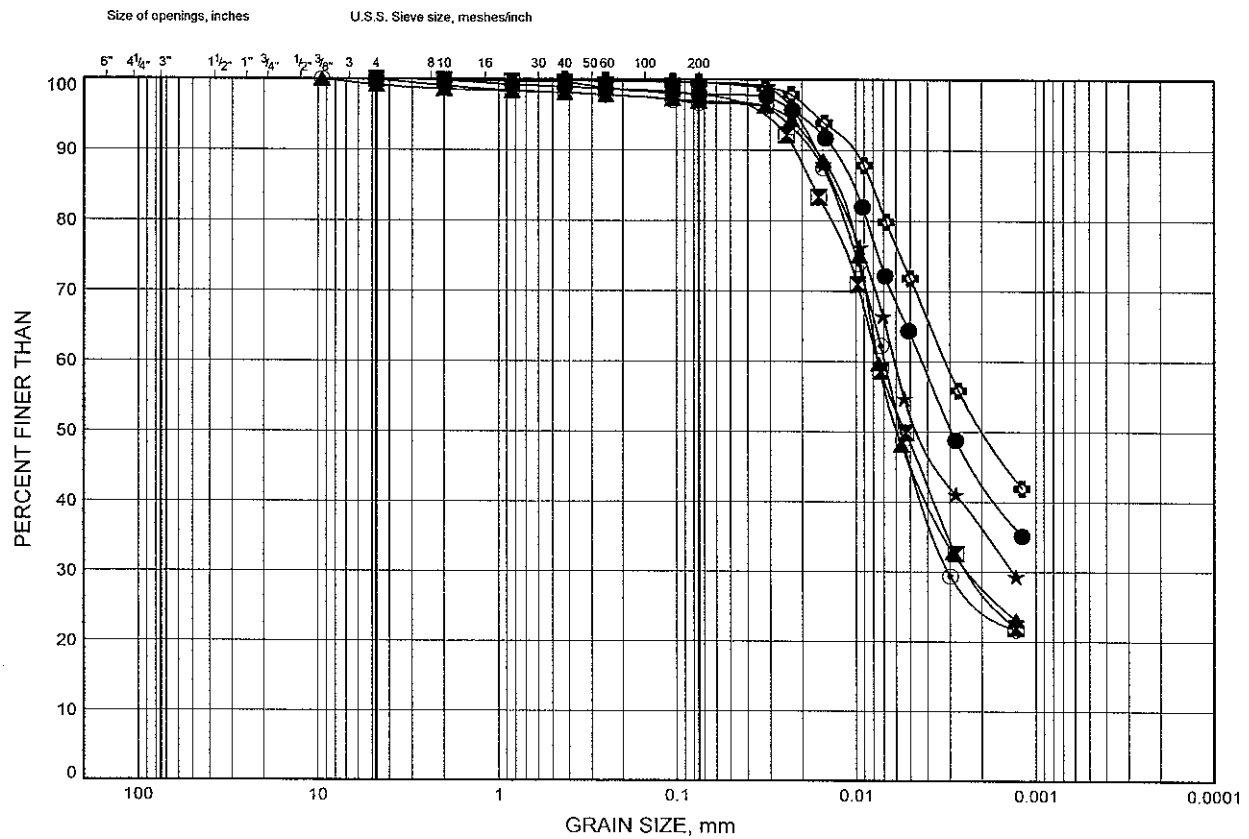
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-22

## SILTY CLAY



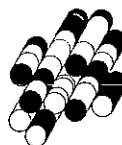
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+750Rt	4.7	178.1
⊠	NBL 12+750Rt	9.3	173.5
▲	NBL 12+750Rt	12.4	170.4
★	NBL 12+835Lt	2.5	178.7
⊙	NBL 12+835Lt	7.8	173.4
⊕	NBL 12+835Rt	3.2	179.7

Date July 2010

Project 1-09-4135



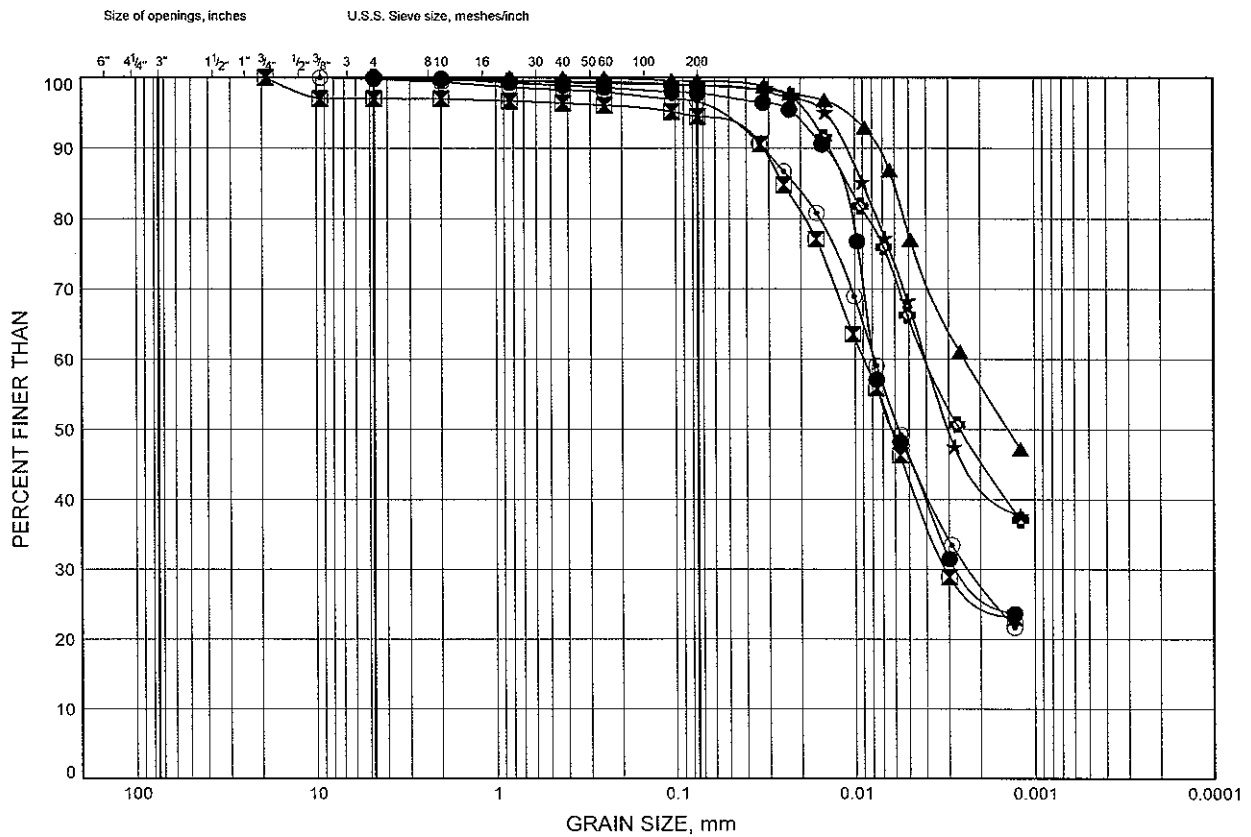
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-23

## SILTY CLAY



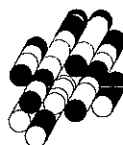
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+835Rt	9.3	173.6
⊠	NBL 12+835Rt	10.9	172.0
▲	NBL 12+910CL	1.7	181.0
★	NBL 12+910CL	4.7	178.0
⊙	NBL 12+910CL	9.3	173.4
⊕	NBL 12+985Lt	3.2	177.9

Date July 2010

Project 1-09-4135



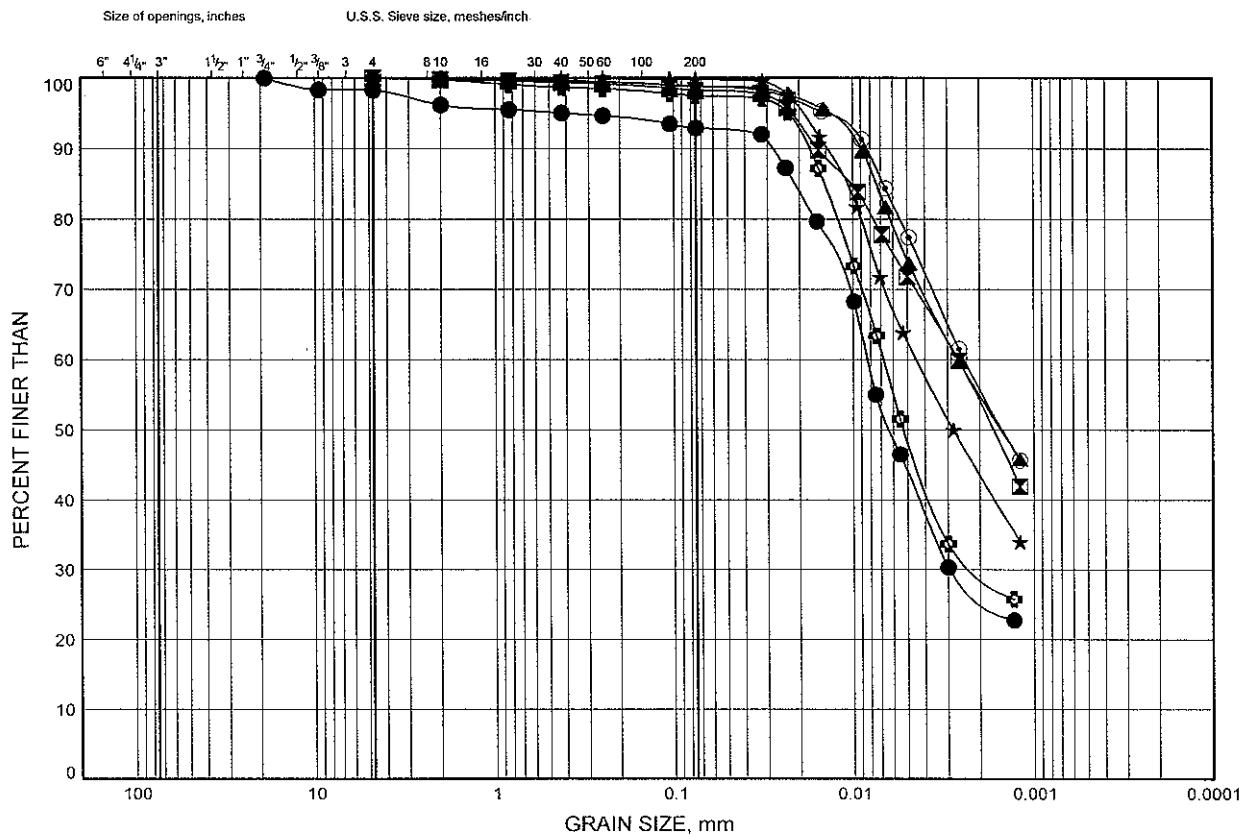
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-24

## SILTY CLAY



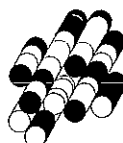
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	NBL 12+985Lt	6.3	174.8
⊠	NBL 12+985Rt	1.7	180.6
▲	NBL 12+985Rt	3.2	179.1
★	NBL 12+985Rt	4.7	177.6
⊙	SBL 12+185Lt	1.7	181.5
⊕	SBL 12+185Lt	4.7	178.5

Date July 2010

Project 1-09-4135



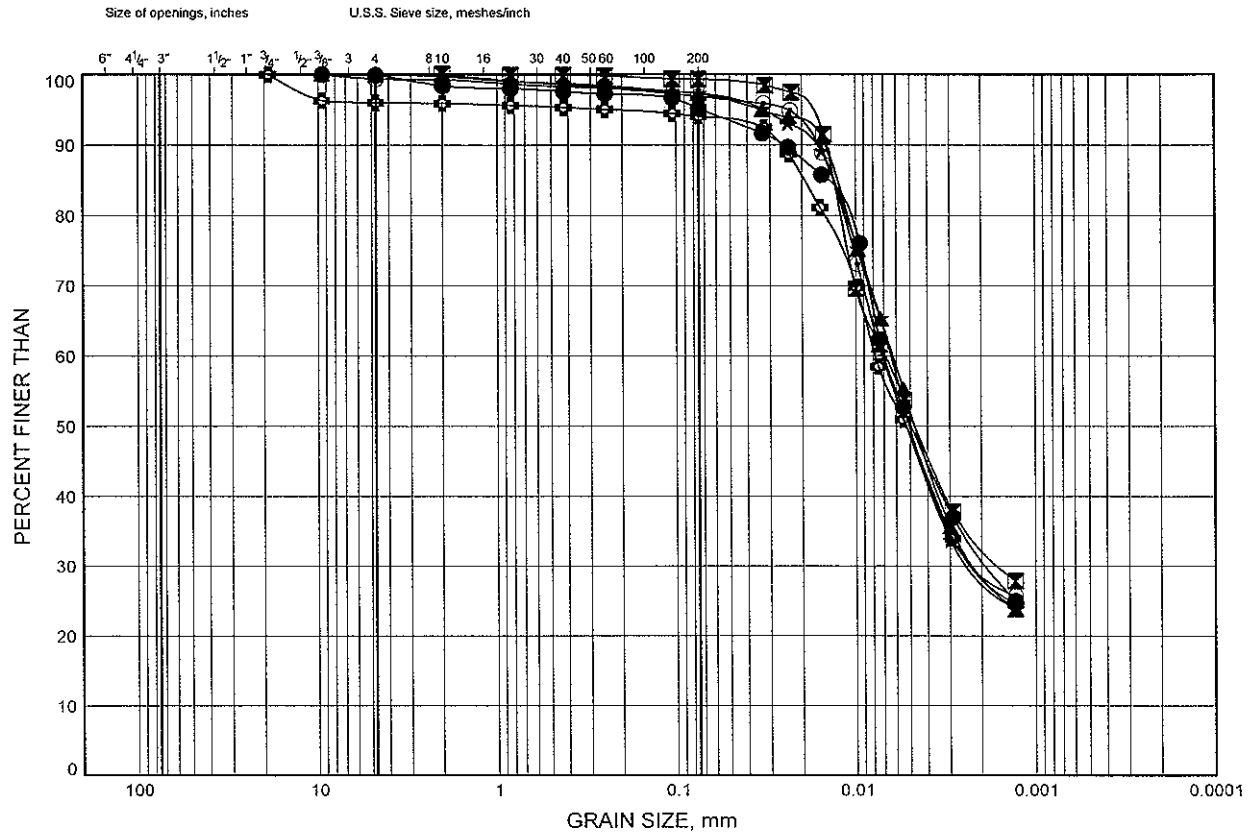
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-25

## SILTY CLAY



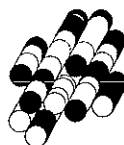
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	SBL 12+185Lt	7.8	175.4
⊠	SBL 12+185Rt	2.5	181.1
▲	SBL 12+185Rt	4.7	178.9
★	SBL 12+185Rt	7.8	175.8
⊙	SBL 12+260CL	6.3	179.7
⊛	SBL 12+260CL	9.3	176.7

Date July 2010

Project 1-09-4135



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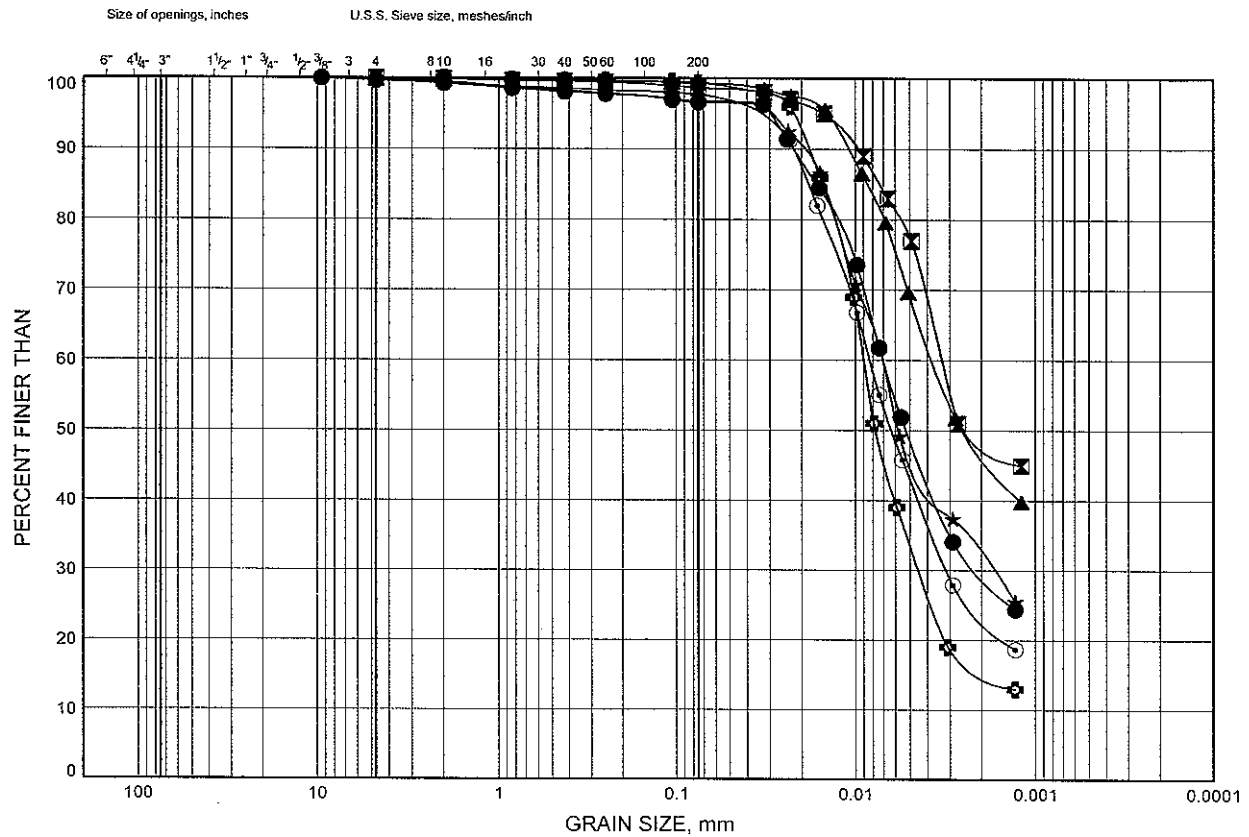
Chkd. MP



# GRAIN SIZE DISTRIBUTION

FIGURE B4-26

## SILTY CLAY



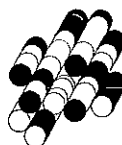
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	SBL 12+260CL	12.4	173.6
⊠	SBL 12+360CL	1.0	181.9
▲	SBL 12+360CL	3.2	179.7
★	SBL 12+360CL	7.8	175.1
⊙	SBL 12+360CL	10.9	172.0
⊛	SBL 12+360CL	12.4	170.5

Date July 2010

Project 1-09-4135



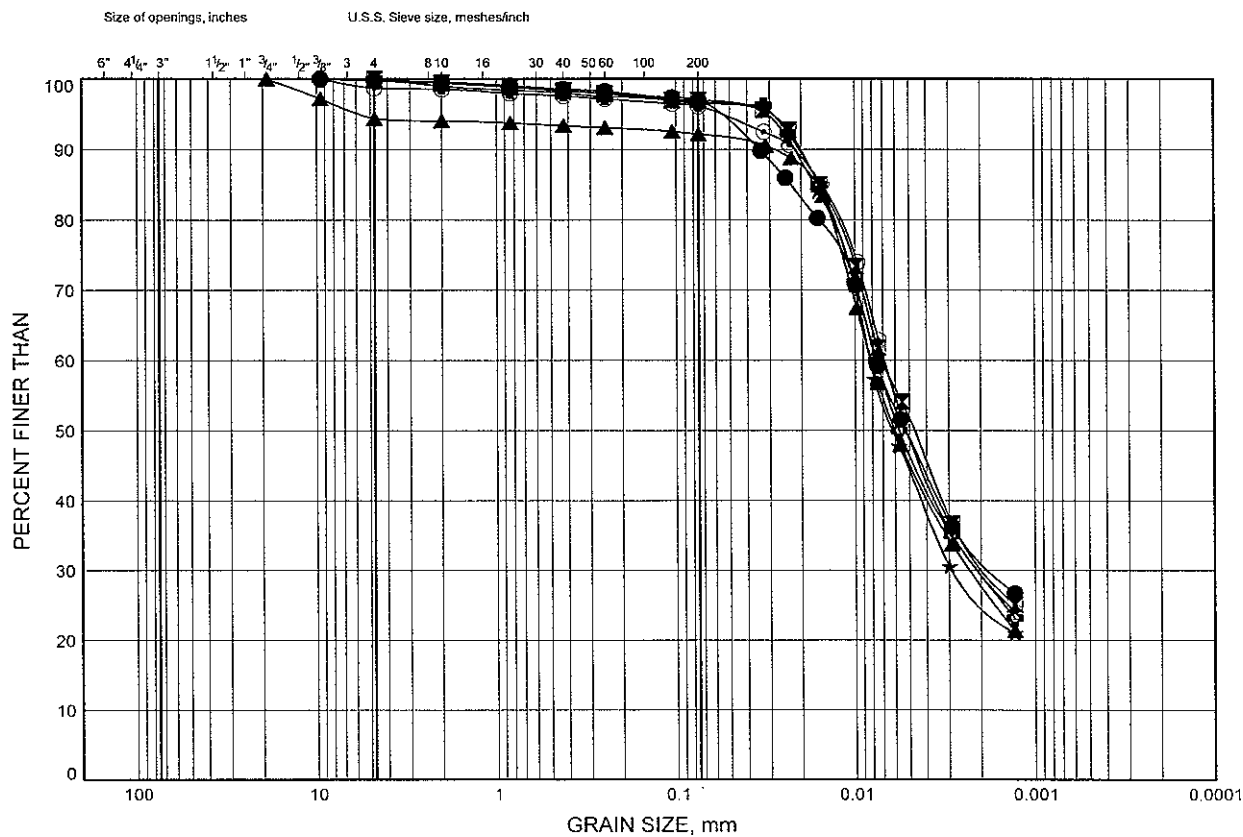
Prep'd BD

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-27

## SILTY CLAY

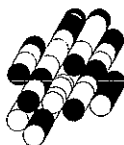


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TS1	2.5	180.1
⊠	TS1	4.7	177.9
▲	TS1	9.3	173.3
★	TS1	13.9	168.7
⊙	TS2	5.5	177.8
⊕	TS2	9.3	174.0

Date July 2010

Project 1-09-4135



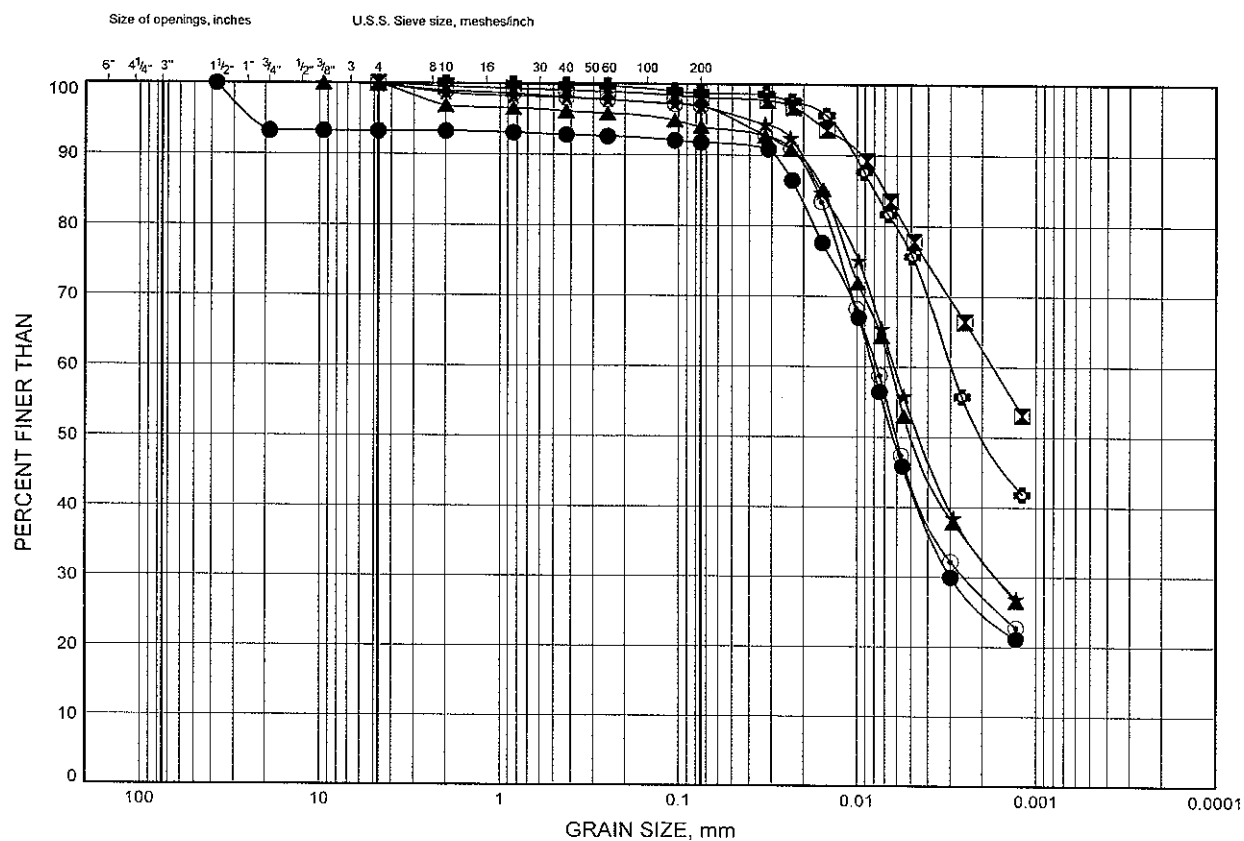
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-28

## SILTY CLAY



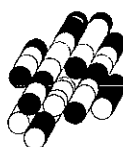
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
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●	TS2	13.9	169.4
⊠	TS3	1.7	180.8
▲	TS3	4.0	178.5
★	TS3	6.3	176.2
⊙	TS3	10.9	171.6
⊛	TS4	1.0	181.4

Date July 2010

Project 1-09-4135



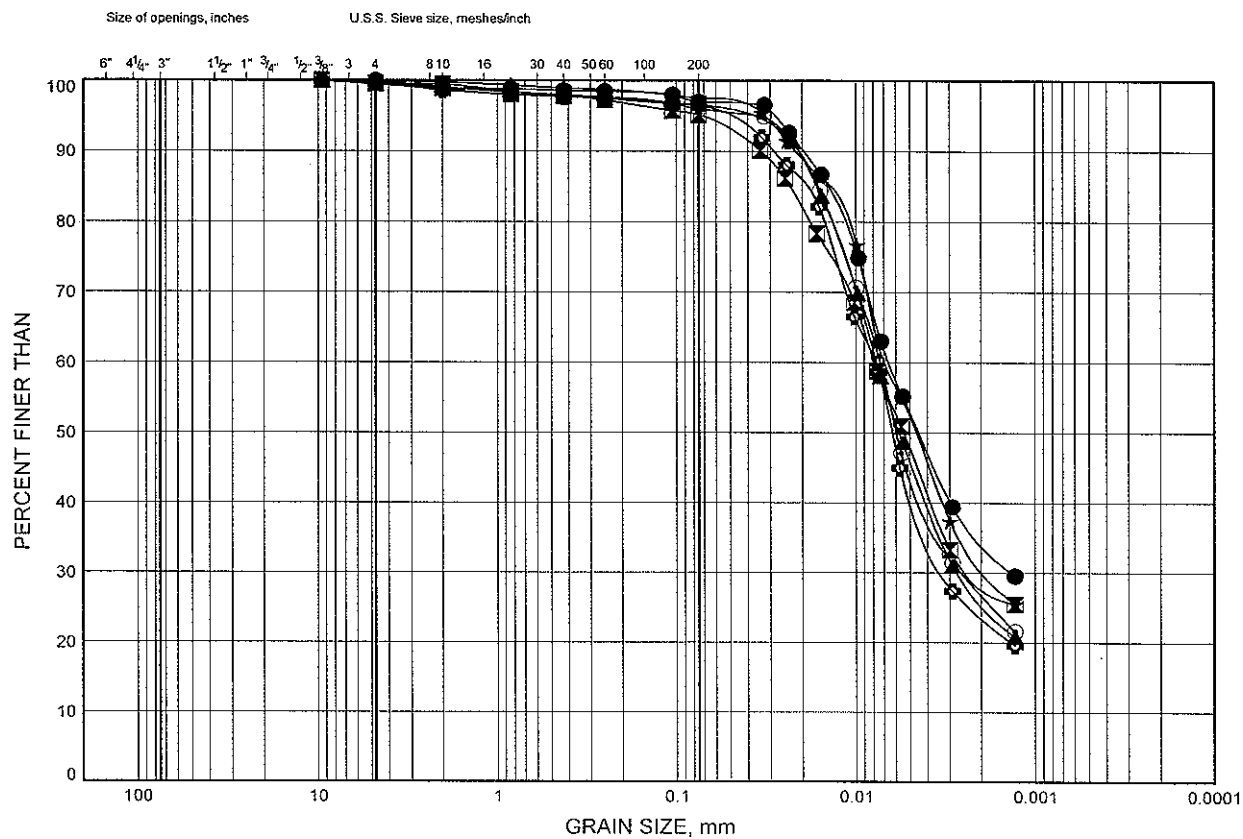
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-29

## SILTY CLAY



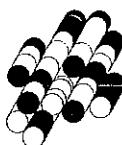
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+410CL	1.7	180.8
⊠	SBL 12+410CL	4.7	177.8
▲	SBL 12+410CL	9.3	173.2
★	TS4	3.2	179.2
⊙	TS4	6.3	176.1
⊛	TS4	9.3	173.1

Date July 2010

Project 1-09-4135



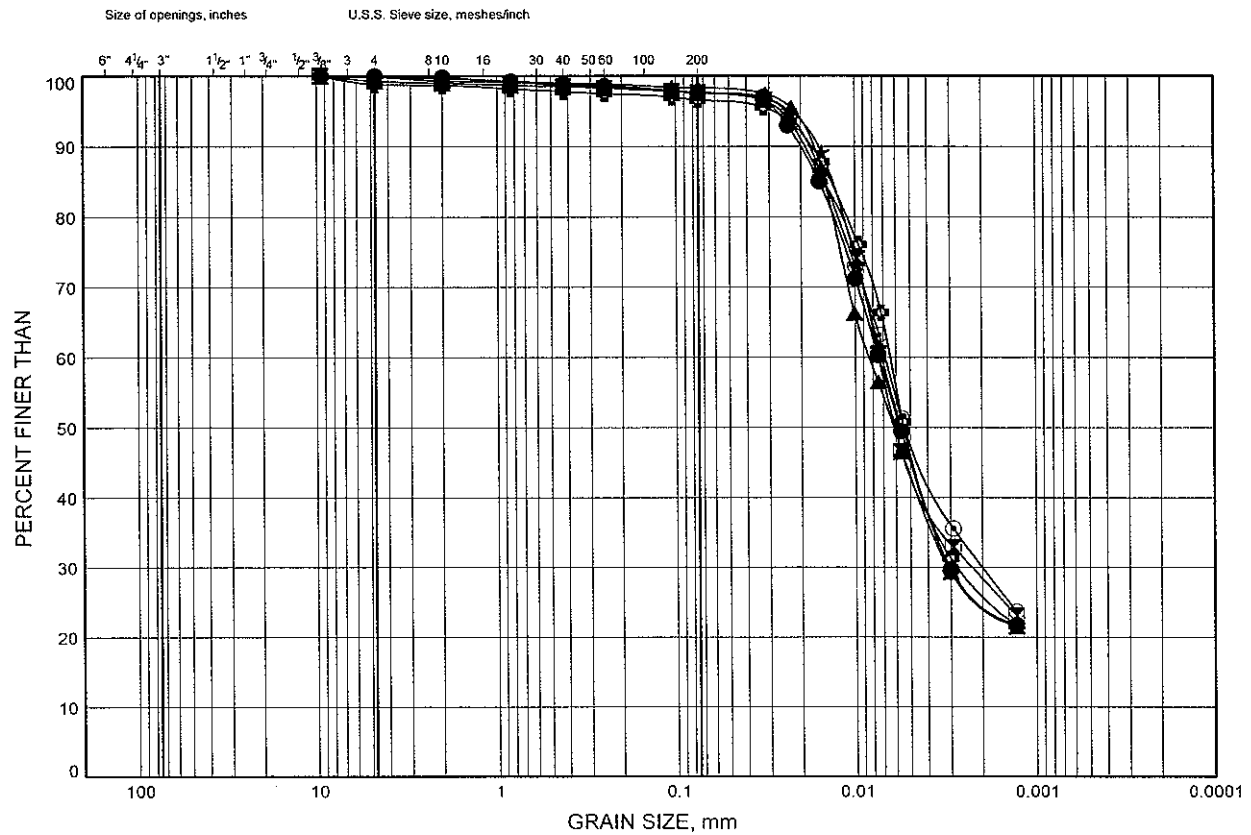
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-30

## SILTY CLAY



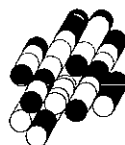
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+410CL	10.9	171.6
⊠	SBL 12+485Lt	2.5	179.5
▲	SBL 12+485Lt	4.7	177.3
★	SBL 12+485Lt	7.8	174.2
⊙	SBL 12+485Rt	3.2	178.6
⊕	SBL 12+485Rt	9.3	172.5

Date July 2010

Project 1-09-4135



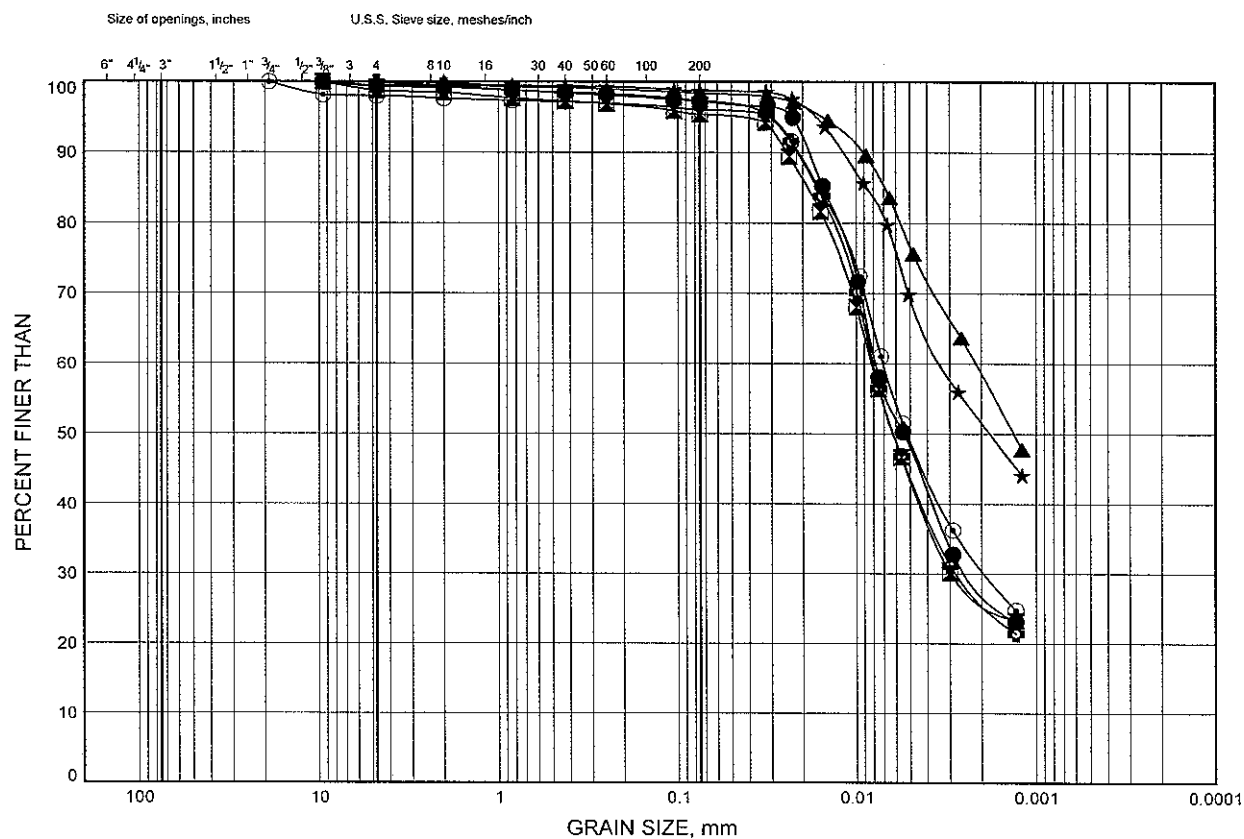
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# GRAIN SIZE DISTRIBUTION

FIGURE B4-31

## SILTY CLAY



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

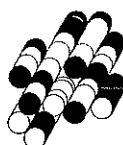
SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	SBL 12+525CL	4.7	177.1
⊠	SBL 12+525CL	9.3	172.5
▲	SBL 12+600Lt	1.7	181.0
★	SBL 12+600Lt	3.2	179.5
⊙	SBL 12+600Lt	9.3	173.4
⬠	SBL 12+600Lt	12.4	170.3

GSD 1-09-4135 SITE4.GPJ 07/07/10

Date July 2010

Project 1-09-4135



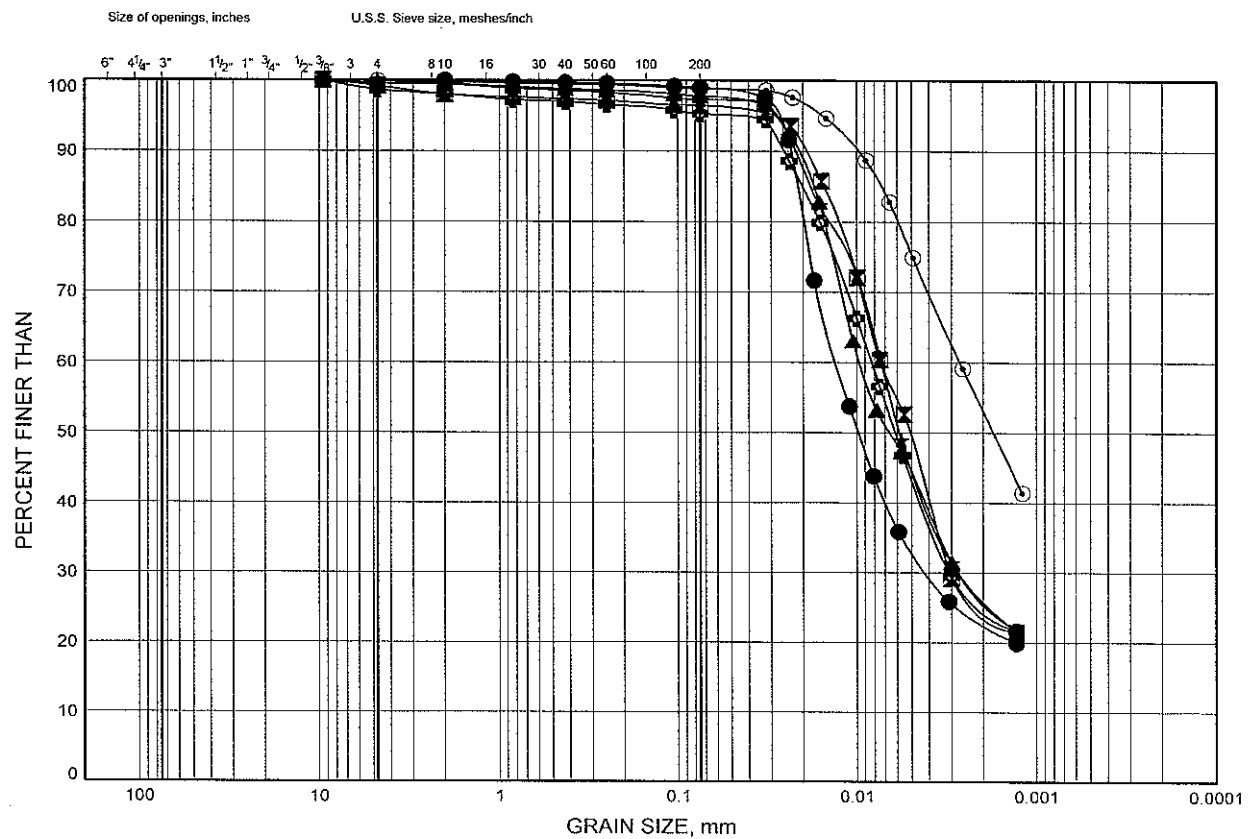
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-32

## SILTY CLAY



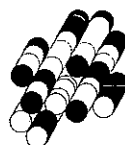
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+600Rt	1.0	181.1
⊠	SBL 12+600Rt	4.7	177.4
▲	SBL 12+600Rt	10.9	171.2
★	SBL 12+600Rt	12.4	169.7
⊙	SBL 12+650CL	3.2	180.5
⊛	SBL 12+650CL	9.3	174.4

Date July 2010

Project 1-09-4135



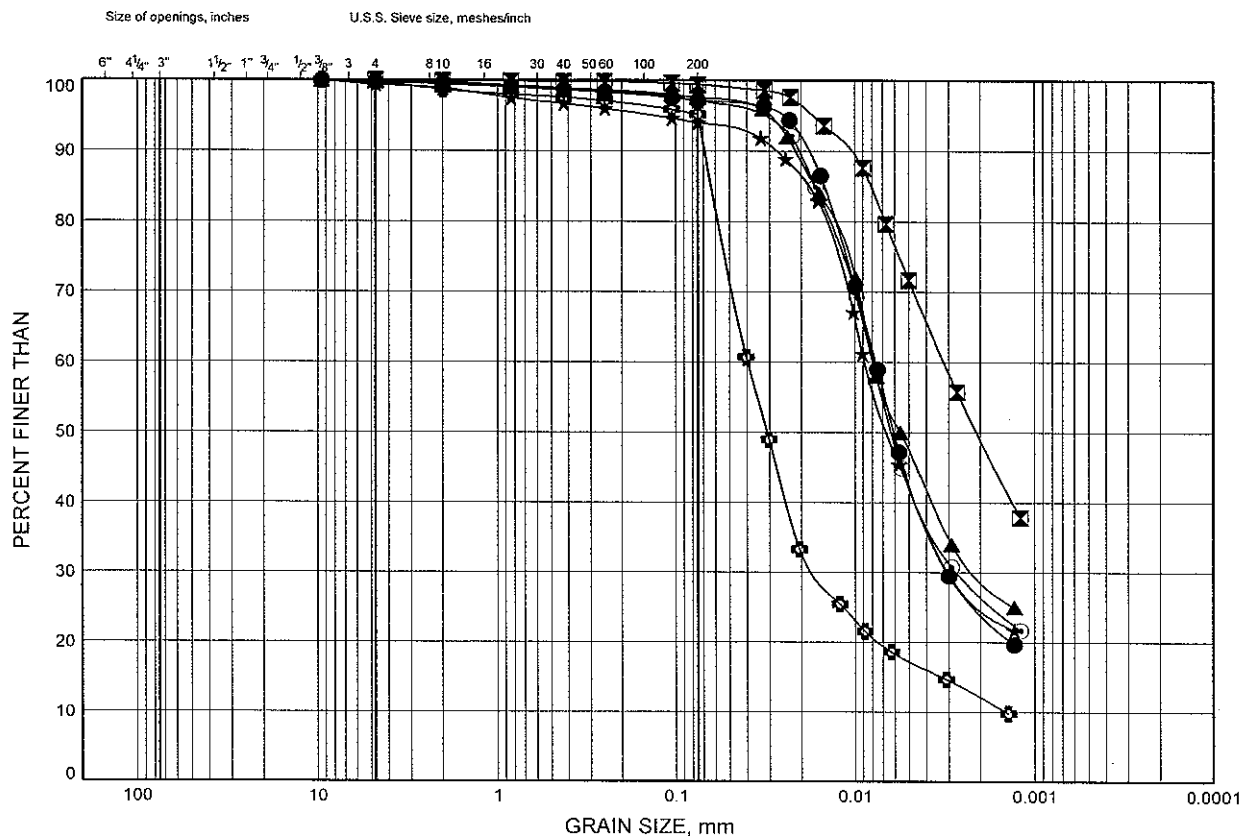
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-33

## SILTY CLAY



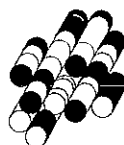
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+650CL	12.4	171.3
⊠	SBL 12+685CL	2.5	180.2
▲	SBL 12+685CL	6.3	176.4
★	SBL 12+685CL	9.3	173.4
⊙	SBL 12+685CL	10.9	171.8
⊛	WS1	7.8	174.9

Date July 2010

Project 1-09-4135



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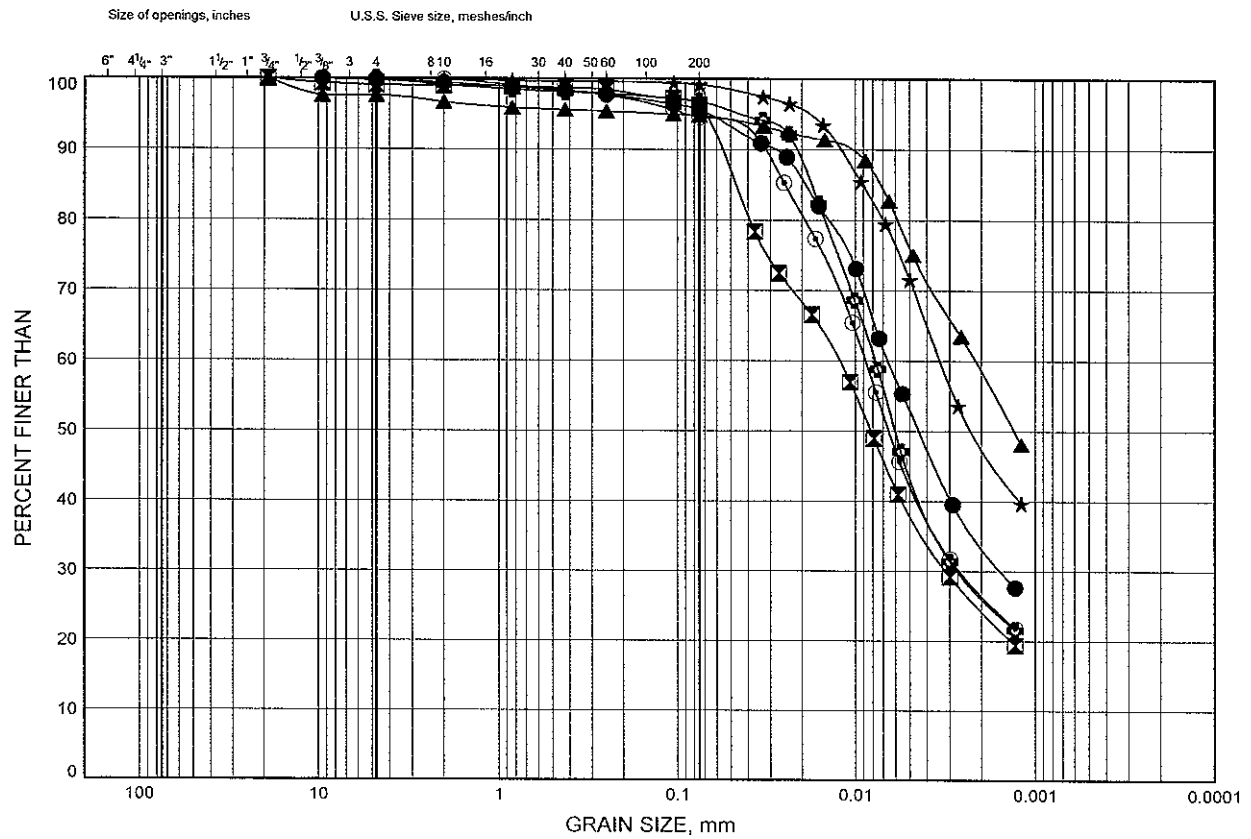
Chkd. MP



# GRAIN SIZE DISTRIBUTION

FIGURE B4-34

## SILTY CLAY



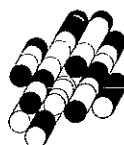
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	WS1	9.3	173.4
⊠	WS1	13.9	168.8
▲	WS2	1.0	182.1
★	WS2	2.5	180.6
⊙	WS2	6.3	176.8
⊕	WS2	10.9	172.2

Date July 2010

Project 1-09-4135



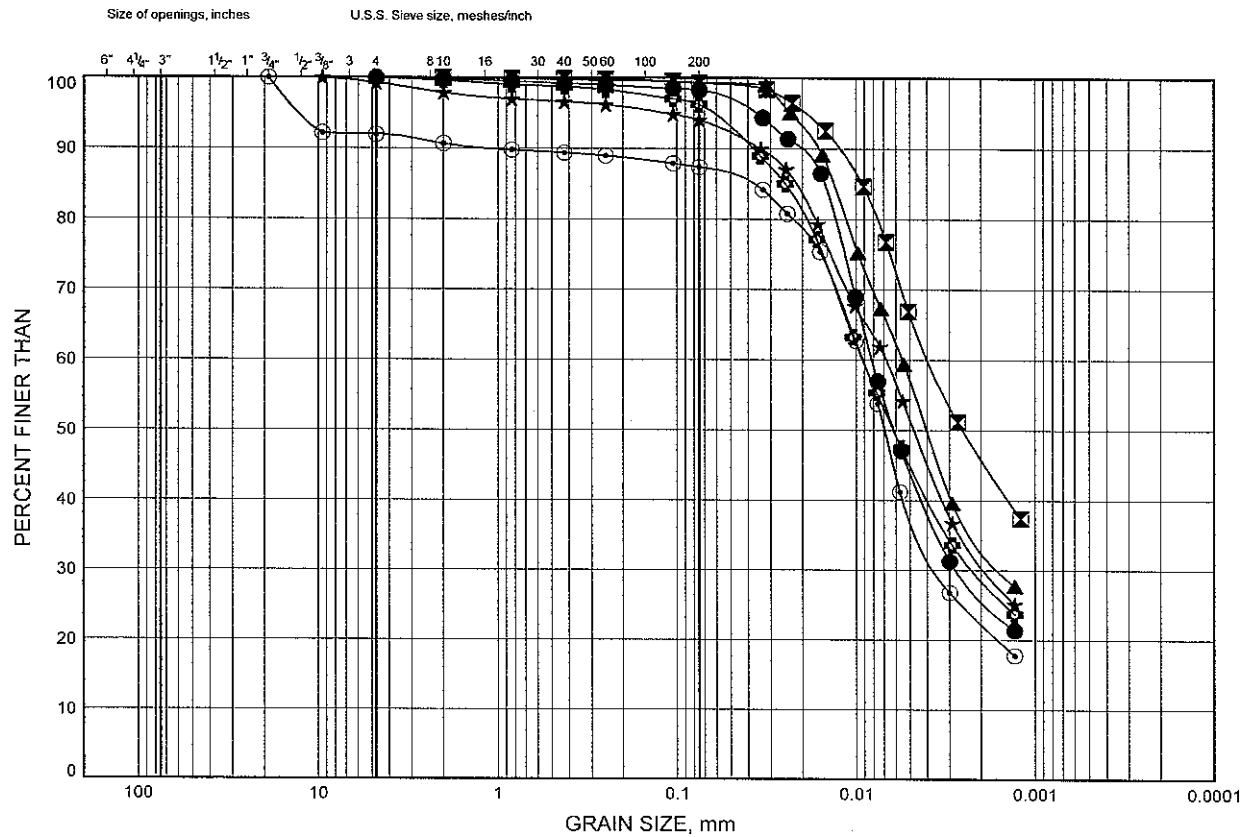
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-35

## SILTY CLAY



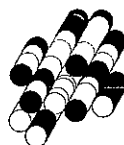
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	WS2	12.4	170.7
⊠	WS3	3.2	179.8
▲	WS3	4.7	178.3
★	WS3	7.8	175.2
⊙	WS3	10.9	172.1
⊗	WS3	13.9	169.1

Date July 2010

Project 1-09-4135



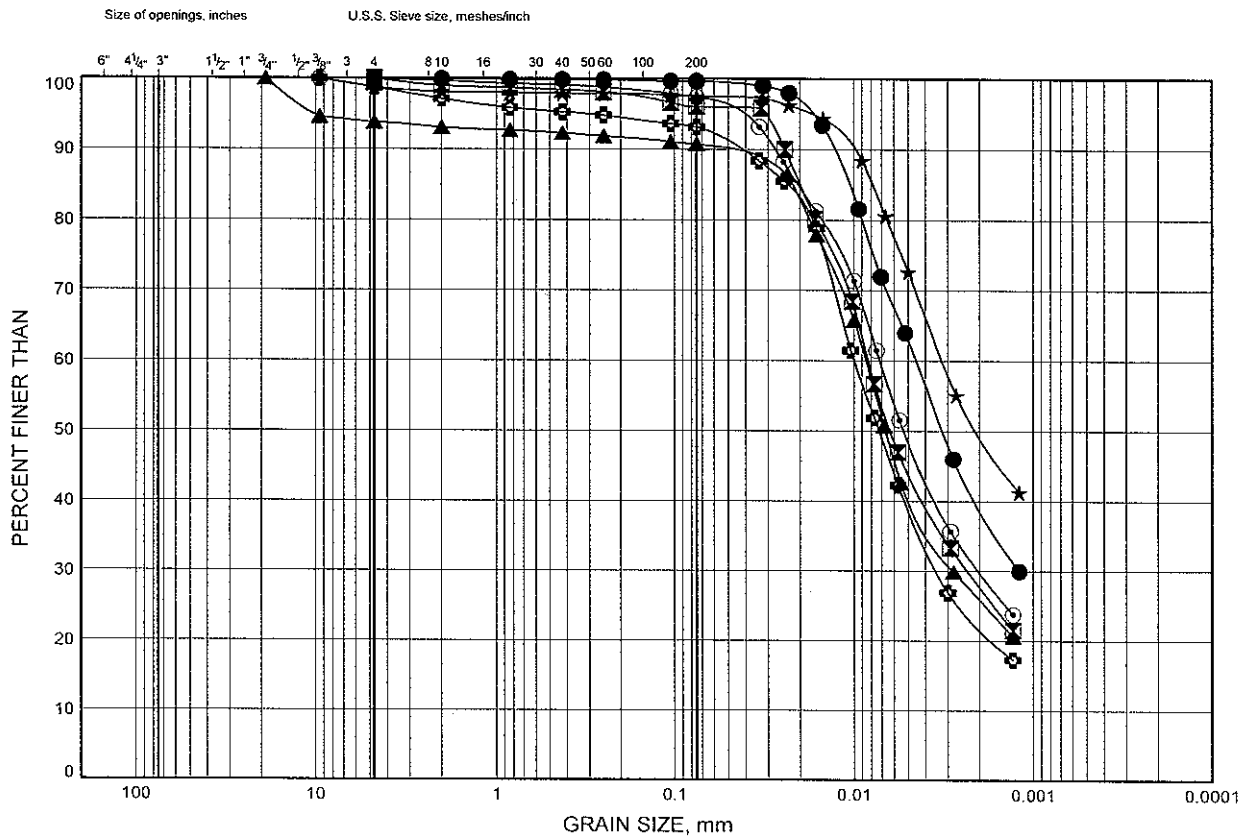
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-36

## SILTY CLAY

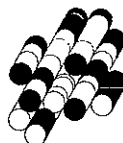


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+750CL	3.2	179.7
⊠	SBL 12+750CL	7.8	175.1
▲	SBL 12+750CL	10.1	172.8
★	WS4	2.5	180.2
⊙	WS4	9.3	173.4
⊛	WS4	12.4	170.3

Date July 2010

Project 1-09-4135



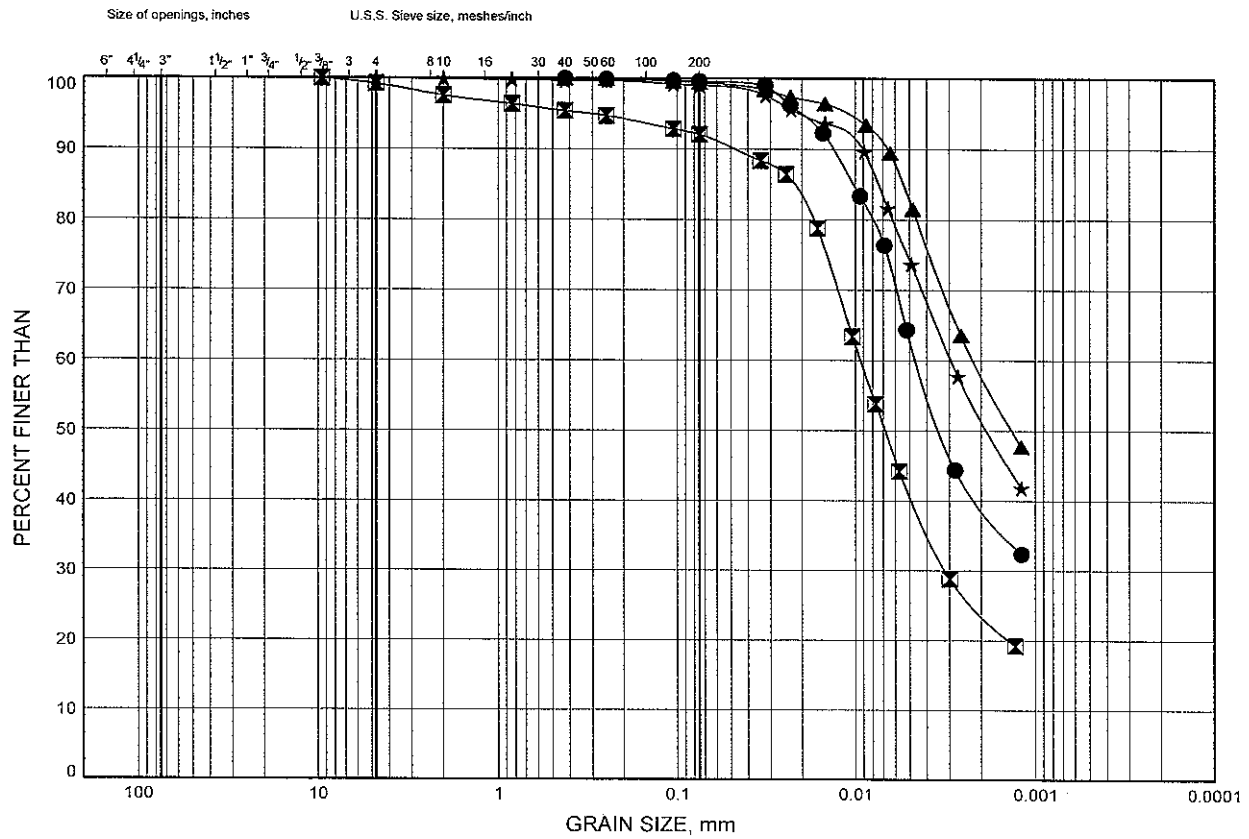
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-37

## SILTY CLAY



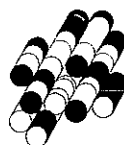
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+825Lt	3.2	179.8
⊠	SBL 12+825Lt	7.1	175.9
▲	SBL 12+825Rt	1.0	181.3
★	SBL 12+825Rt	2.5	179.8

Date July 2010

Project 1-09-4135



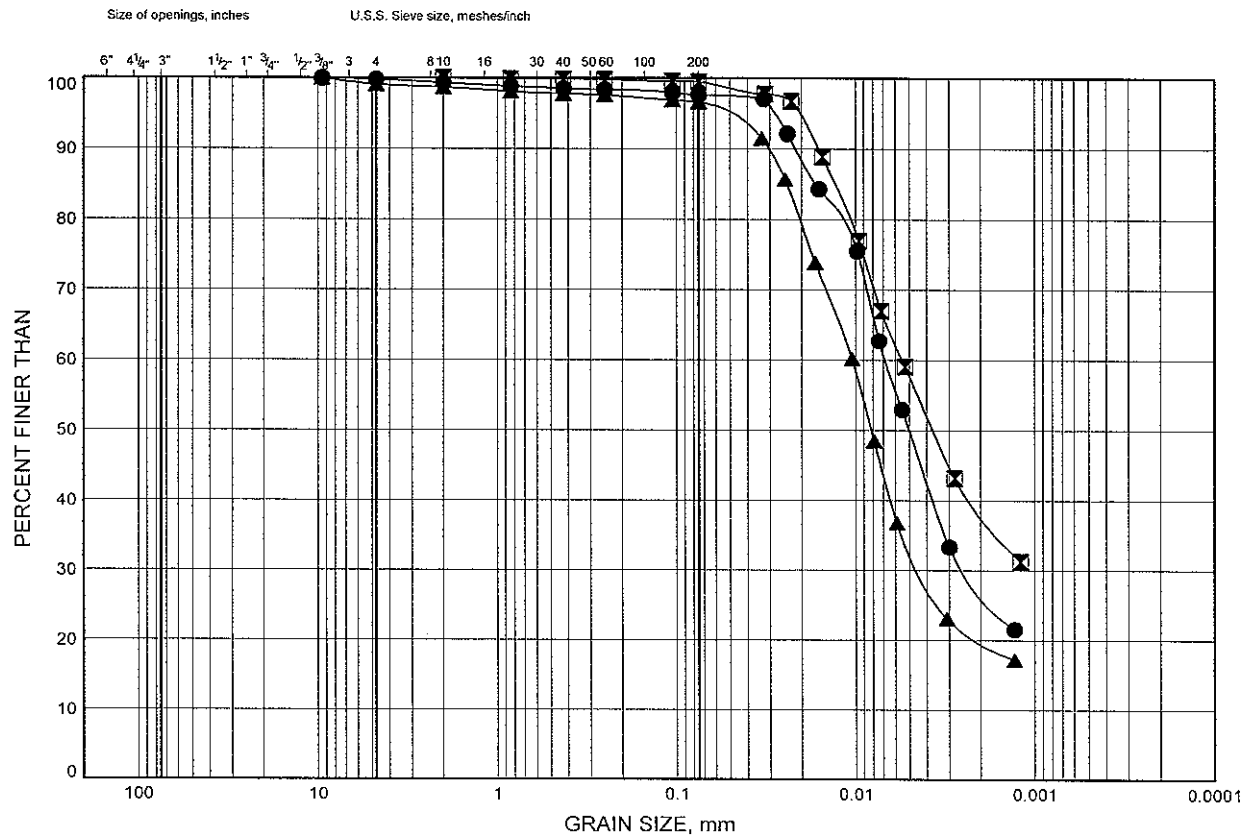
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-38

## SILTY CLAY



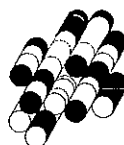
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+825Rt	6.3	176.0
⊗	SBL 12+900CL	1.7	181.0
▲	SBL 12+900CL	5.5	177.2

Date July 2010

Project 1-09-4135



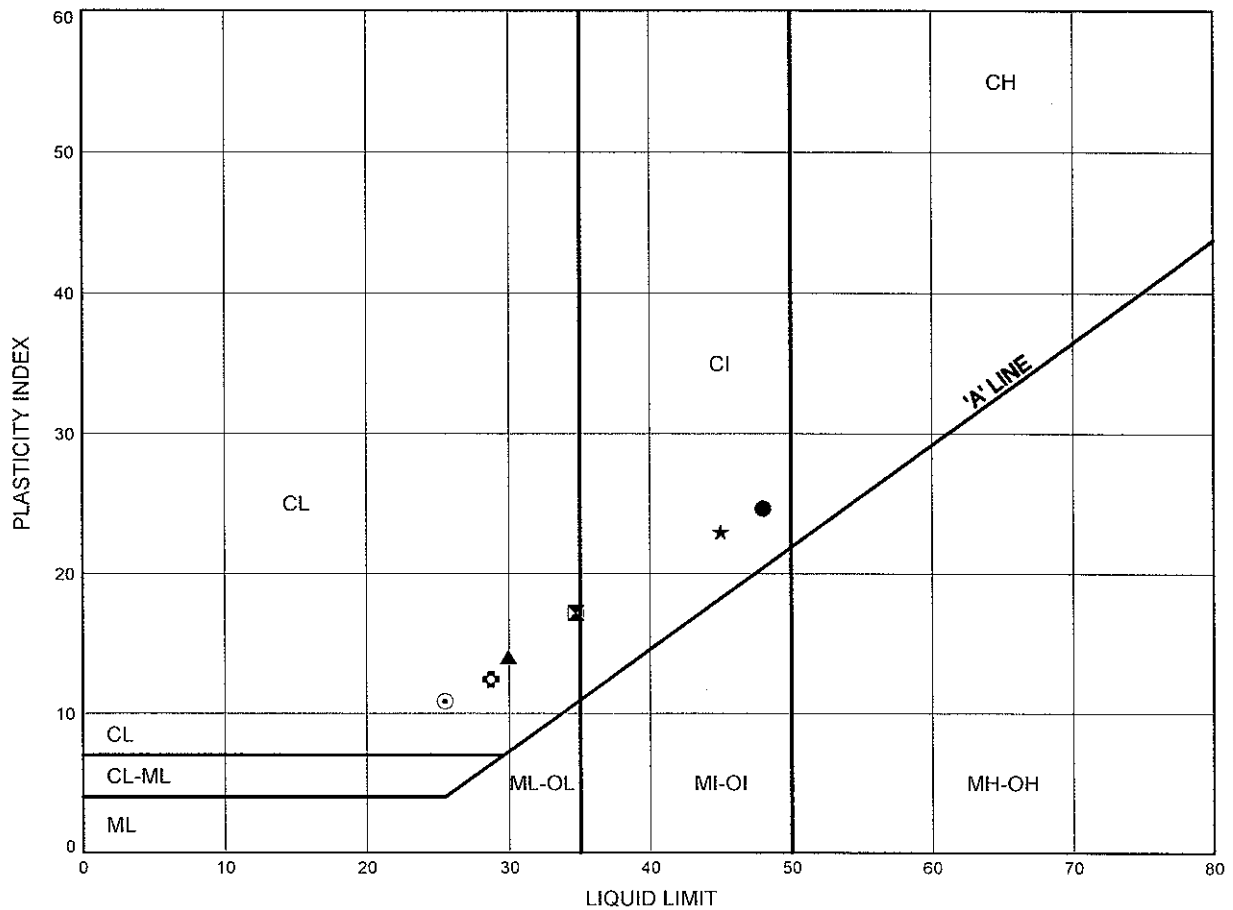
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-39

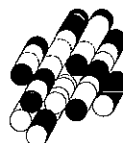
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+075CL	2.5	182.1
⊠	NBL 12+075CL	4.9	179.7
▲	NBL 12+150Lt	1.7	183.6
★	NBL 12+150Lt	4.0	181.3
⊙	NBL 12+150Lt	6.3	179.0
⊛	NBL 12+150Lt	9.3	176.0

Date July 2010

Project 1-09-4135



Prep'd DB

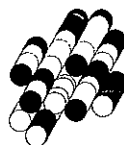
Chkd. MP

## FIGURE B4-40

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+150Rt	2.5	181.0
⊗	NBL 12+150Rt	4.7	178.8
▲	NBL 12+150Rt	7.9	175.6
★	NBL 12+225CL	4.7	180.2
⊙	NBL 12+225CL	7.8	177.1
⊕	NBL 12+225CL	10.9	174.0

Date July 2010

Project 1-09-4135...



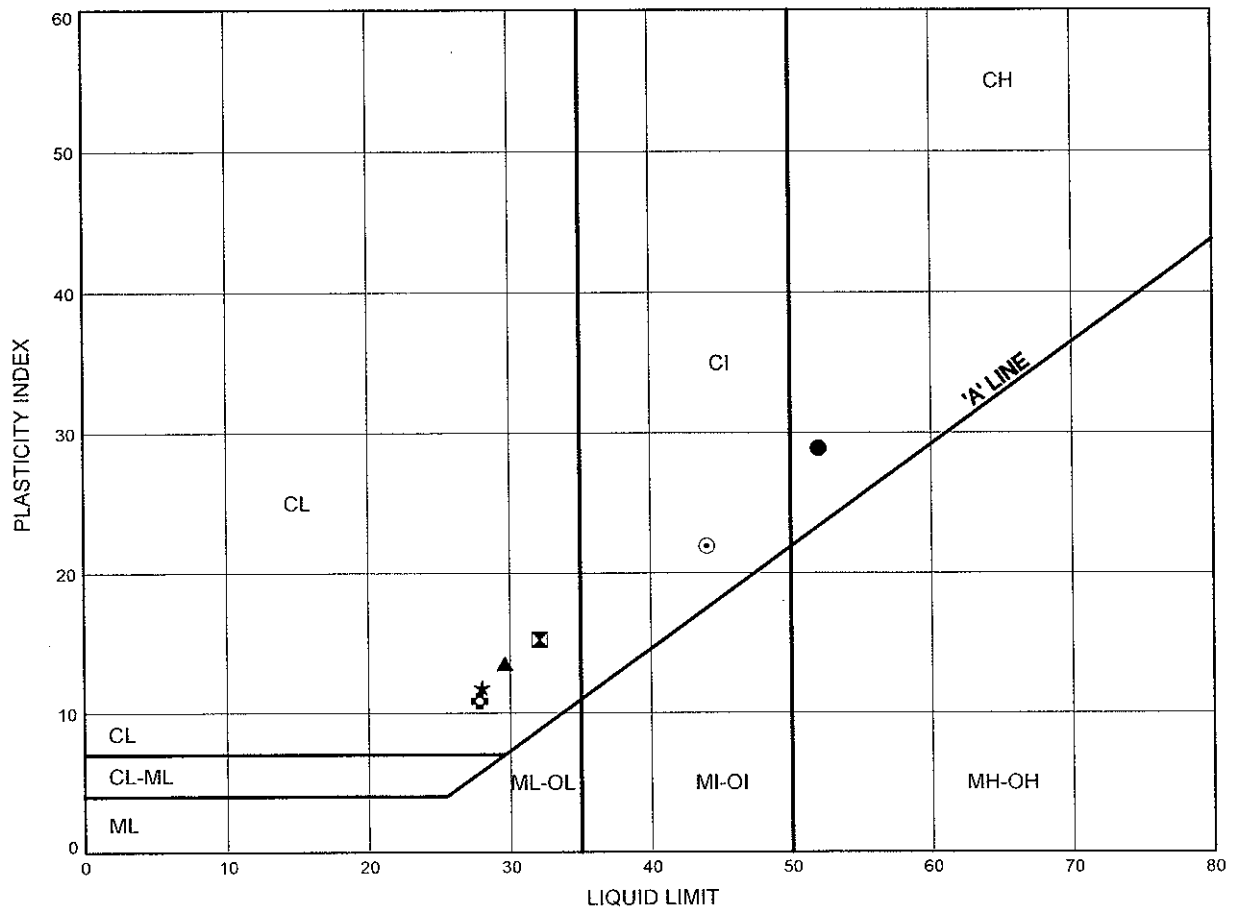
Prep'd ..... DB.....

Chkd. ....MP.....

# 

FIGURE B4-41

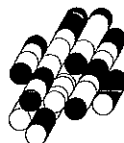
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+300Lt	1.1	182.0
⊠	NBL 12+300Lt	3.2	179.9
▲	NBL 12+300Lt	6.3	176.8
★	NBL 12+300Lt	9.3	173.8
⊙	NBL 12+300Rt	1.0	181.7
⊛	NBL 12+300Rt	4.7	178.0

Date July 2010

Project 1-09-4135



Prep'd DB

Chkd. MP

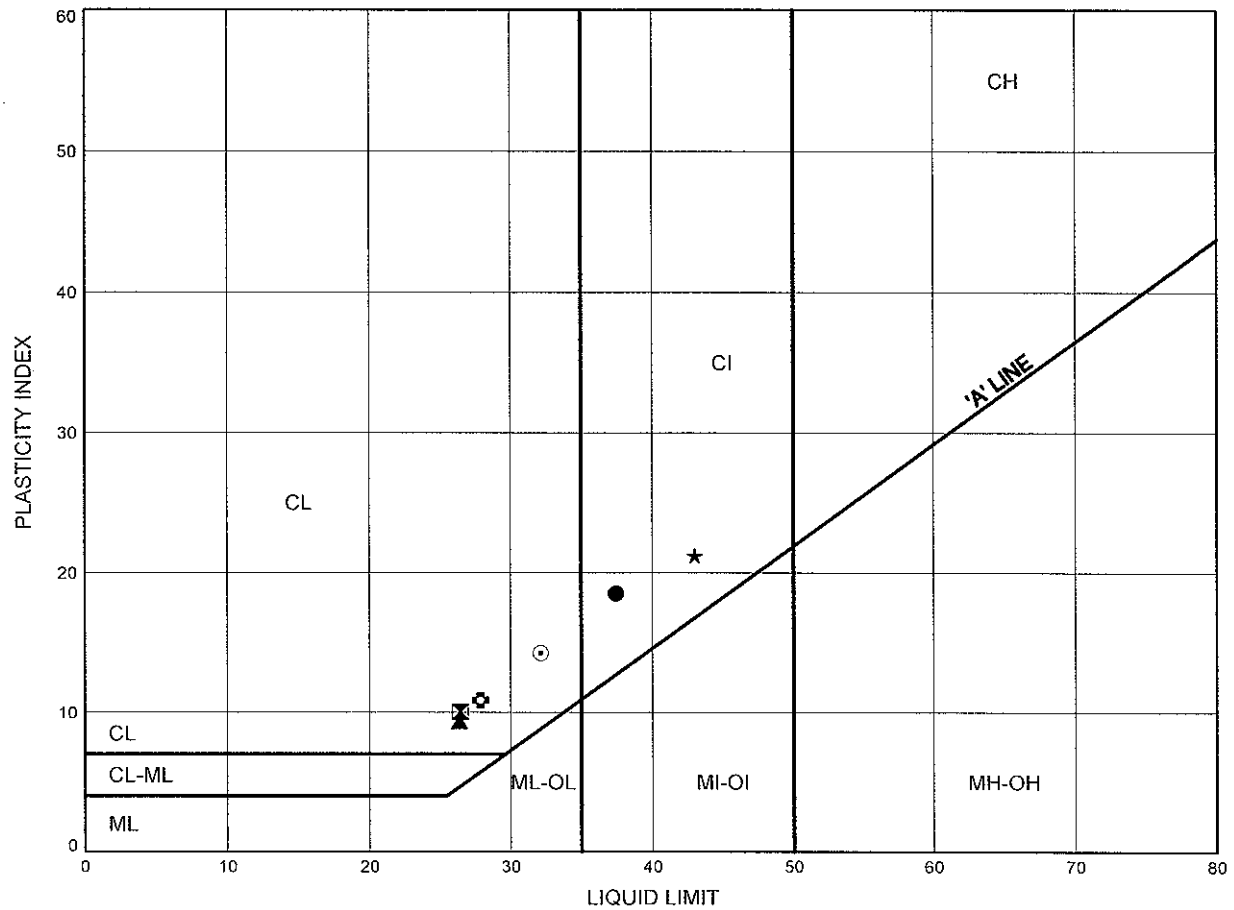




# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-43

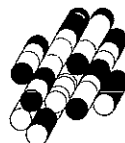
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TN1	4.7	178.8
⊗	TN1	7.8	175.7
▲	TN1	10.9	172.6
★	TN2	3.2	181.0
⊙	TN2	5.5	178.7
⊕	TN2	9.3	174.9

Date July 2010

Project 1-09-4135



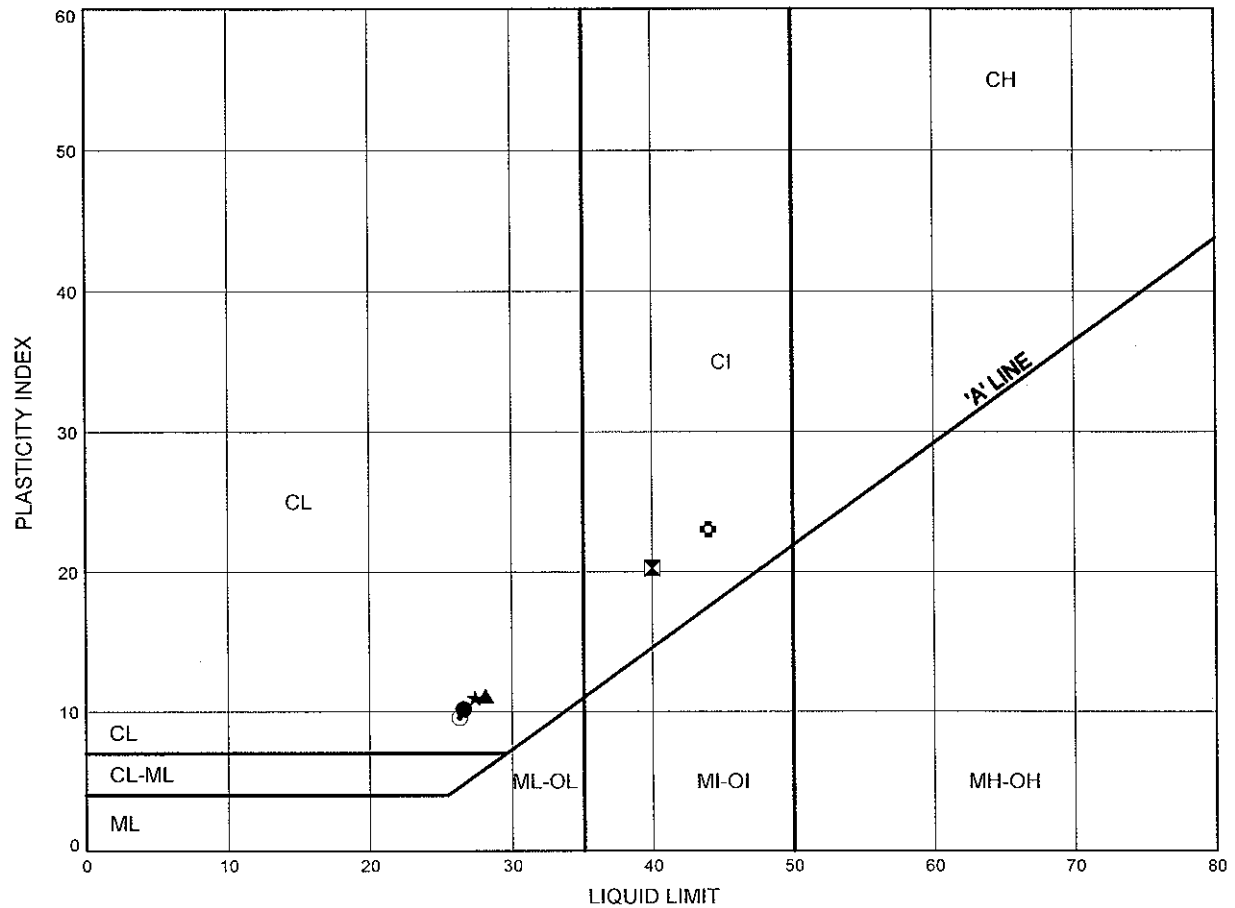
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-44

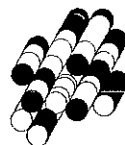
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TN2	13.9	170.3
⊠	TN3	4.0	180.1
▲	TN3	5.5	178.6
★	TN3	9.3	174.8
⊙	TN3	13.9	170.2
⊛	TN4	2.5	181.5

Date July 2010

Project 1-09-4135



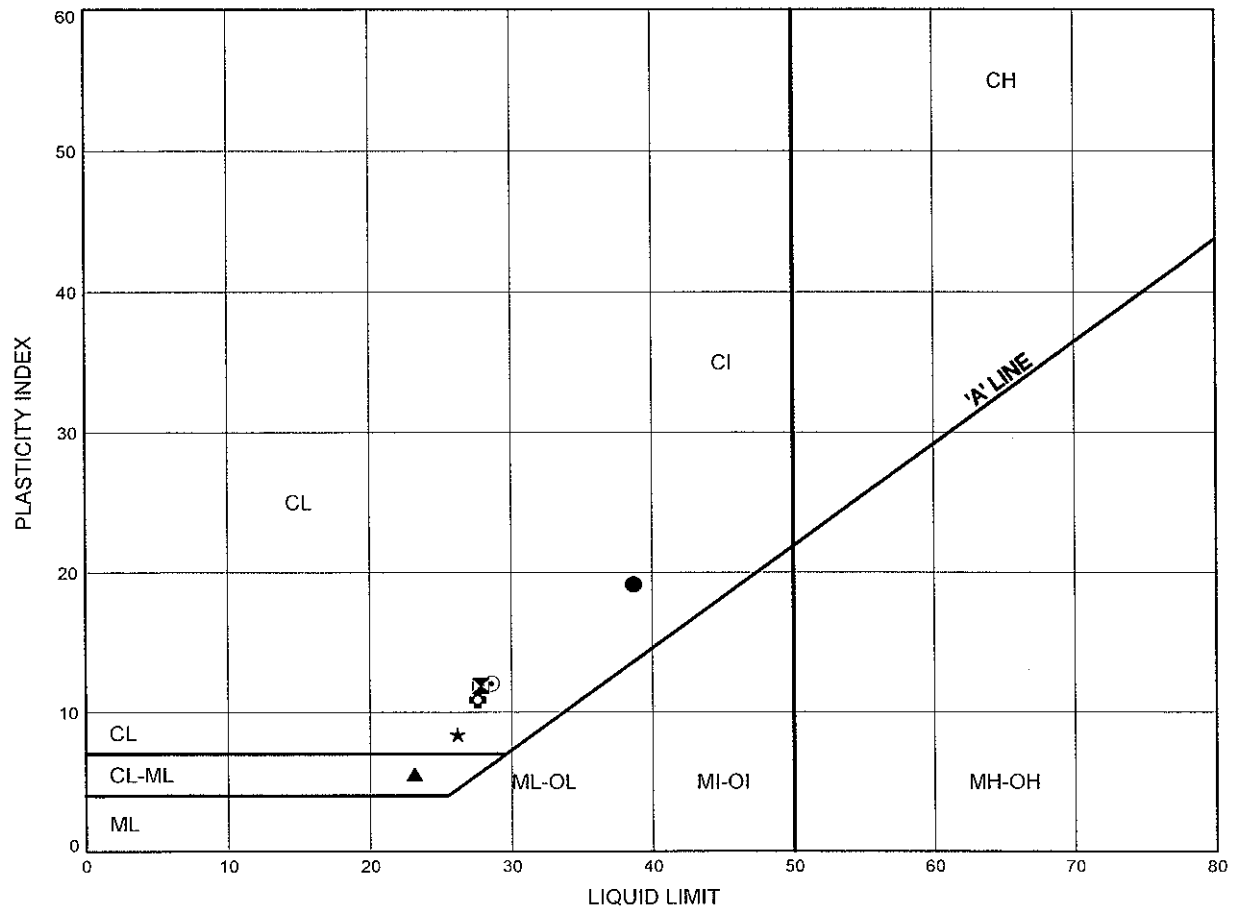
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-45

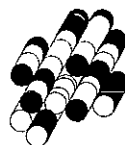
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+440Rt	3.2	179.8
⊗	NBL 12+440Rt	6.3	176.7
▲	NBL 12+440Rt	7.8	175.2
★	TN4	4.0	180.0
⊙	TN4	5.5	178.5
⊕	TN4	9.3	174.7

Date July 2010

Project 1-09-4135



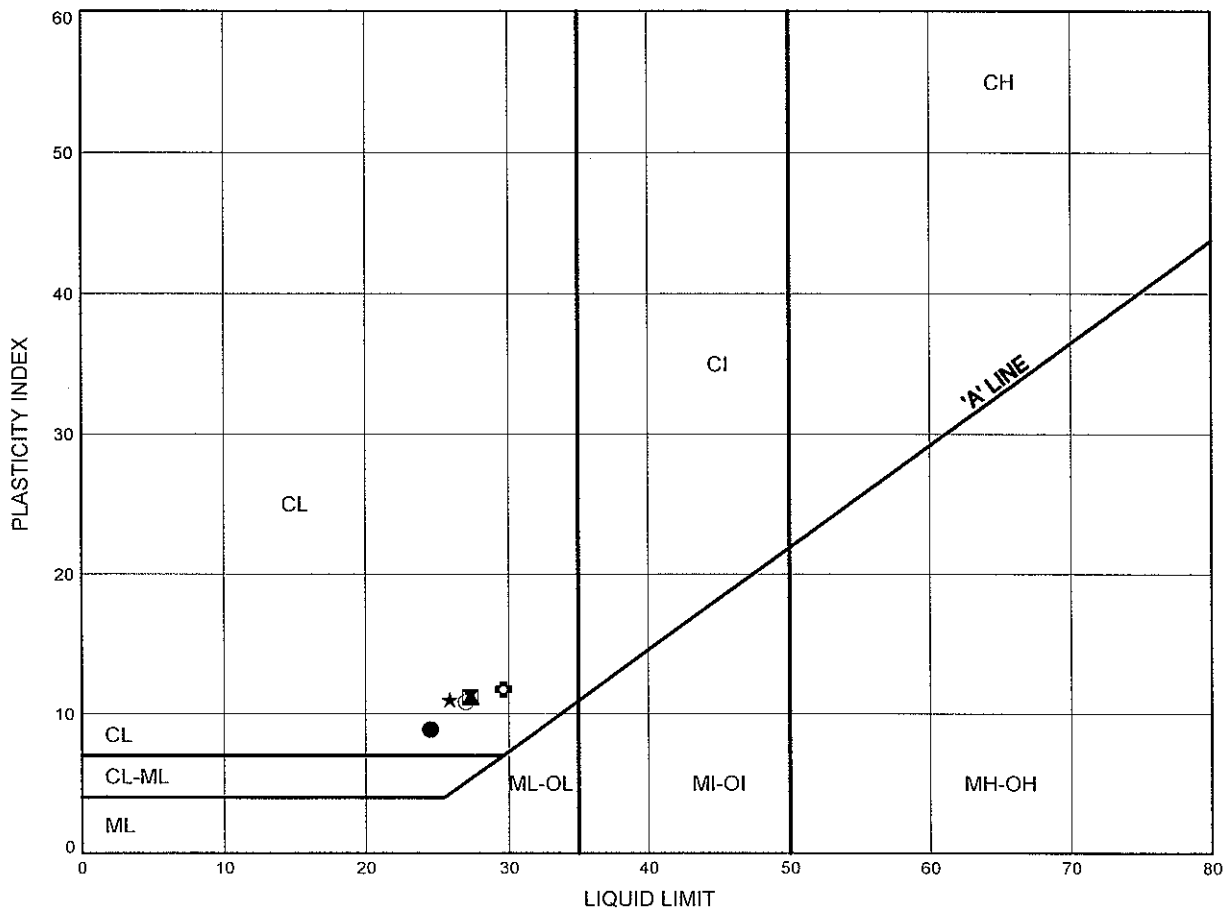
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-46

## SILTY CLAY

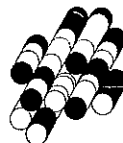


SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+440Rt	12.4	170.6
⊠	NBL 12+525Lt	3.2	179.6
▲	NBL 12+525Lt	6.3	176.5
★	NBL 12+525Lt	9.3	173.5
⊙	NBL 12+525Lt	12.4	170.4
⊛	NBL 12+525Rt	3.2	178.8

ALTR 1-09-4135 SITE4 GPJ 07/07/10

Date July 2010

Project 1-09-4135



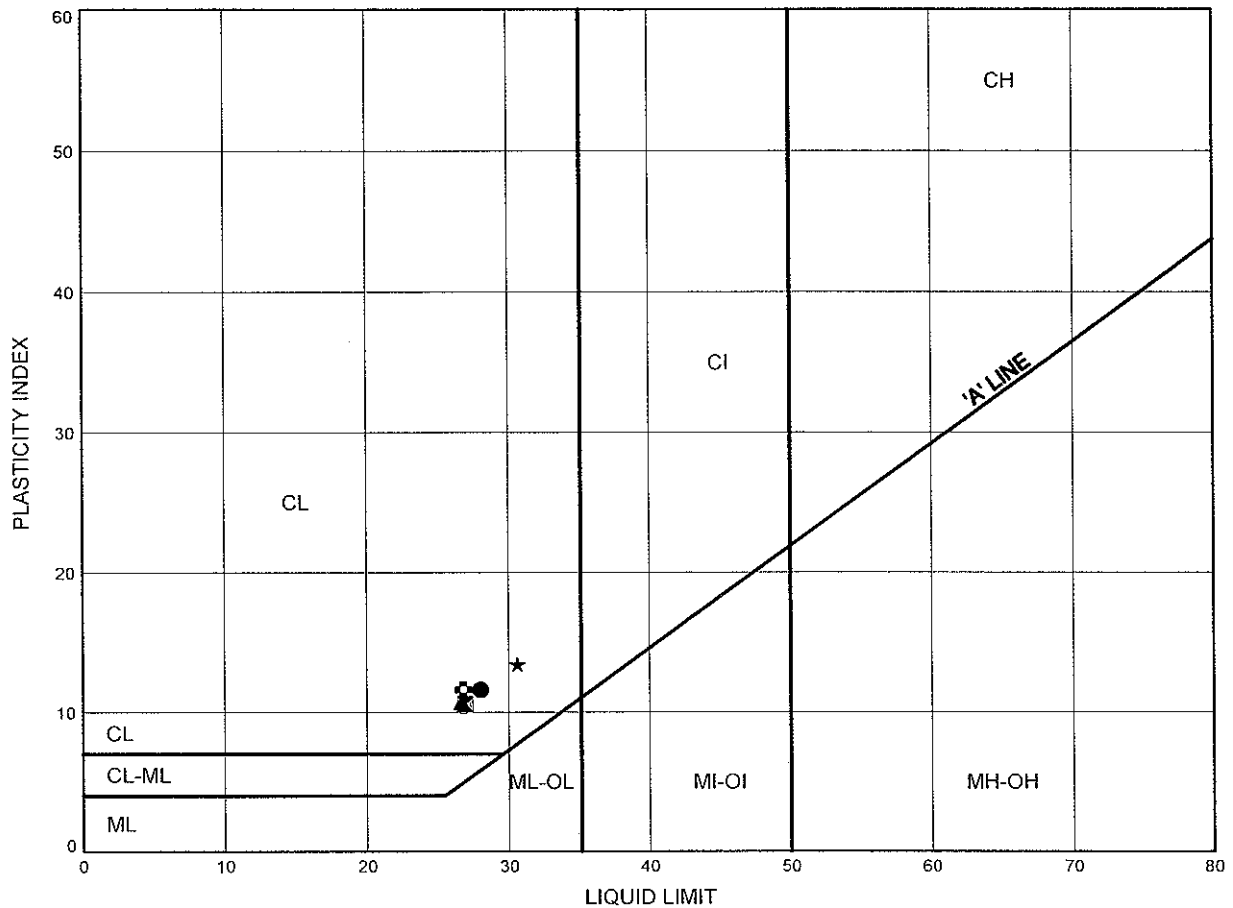
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-47

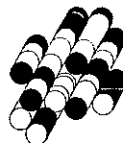
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+525Rt	6.3	175.7
☒	NBL 12+525Rt	9.3	172.7
▲	NBL 12+525Rt	10.9	171.1
★	NBL 12+595Rt	3.2	178.4
⊙	NBL 12+595Rt	6.3	175.3
⊕	NBL 12+595Rt	9.3	172.3

Date July 2010

Project 1-09-4135



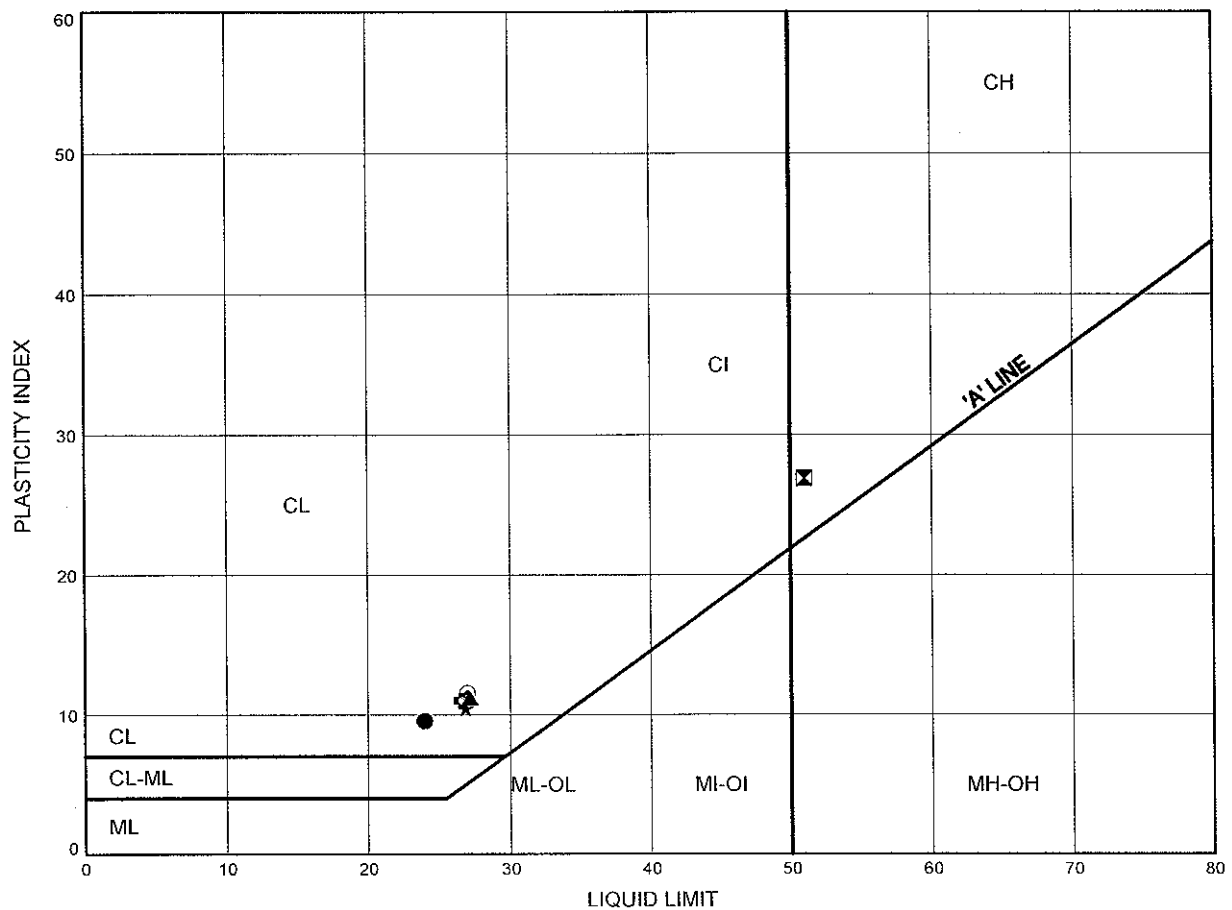
Prep'd DB

Chkd. MP

# 

FIGURE B4-48

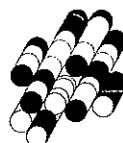
### SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+595Rt	12.4	169.2
⊠	NBL 12+645Lt	2.5	180.8
▲	NBL 12+645Lt	7.8	175.5
★	NBL 12+645Lt	9.3	174.0
⊙	NBL 12+645Lt	12.4	170.9
⊗	NBL 12+645Rt	6.3	174.7

Date July 2010

Project 1-09-4135



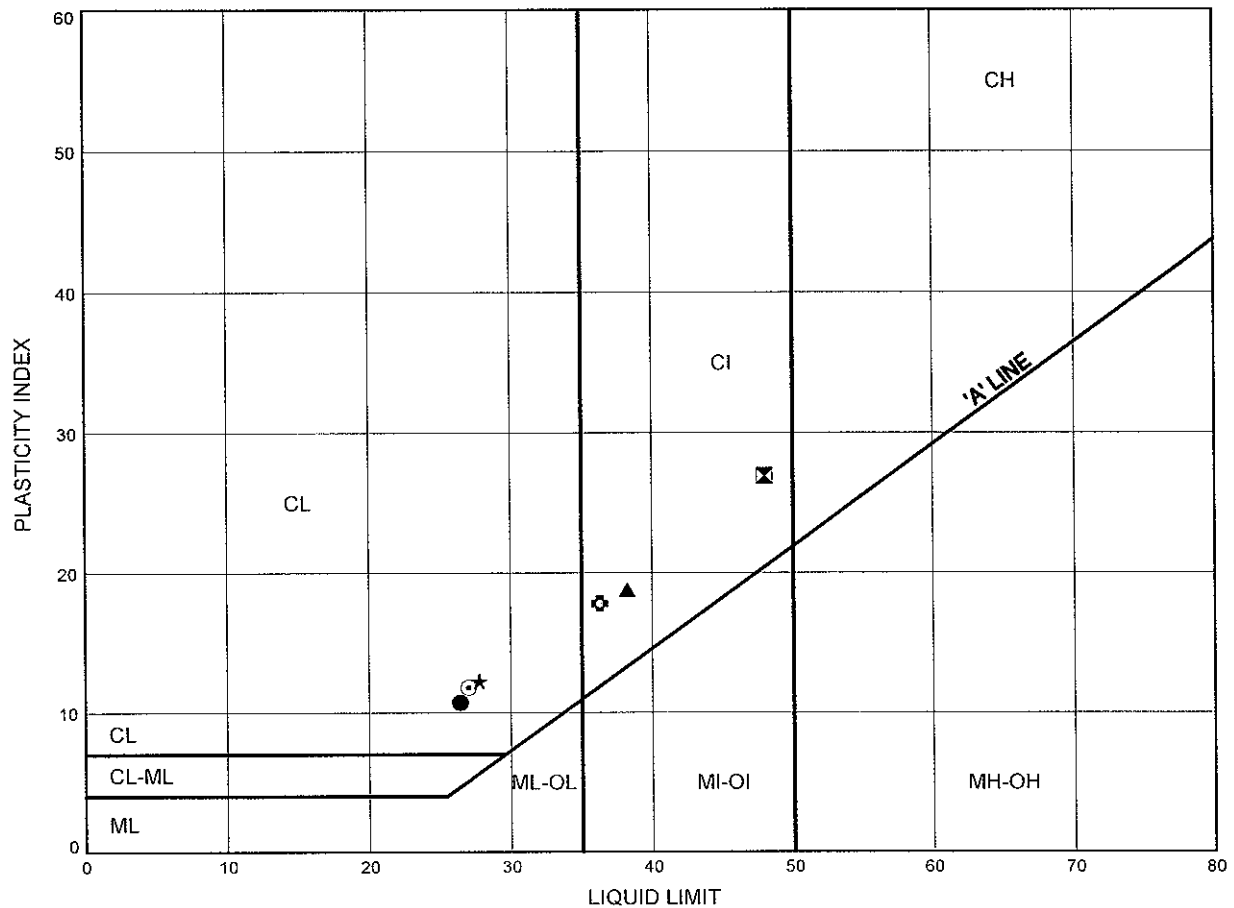
Prep'd DB

Chkd. MP

# 

FIGURE B4-49

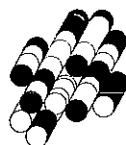
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+645Rt	7.8	173.2
⊠	NBL 12+695Lt	1.7	181.2
▲	NBL 12+695Lt	3.2	179.7
★	NBL 12+695Lt	6.3	176.6
⊙	NBL 12+695Lt	9.3	173.6
⊛	WN1	3.2	179.9

Date July 2010

Project 1-09-4135



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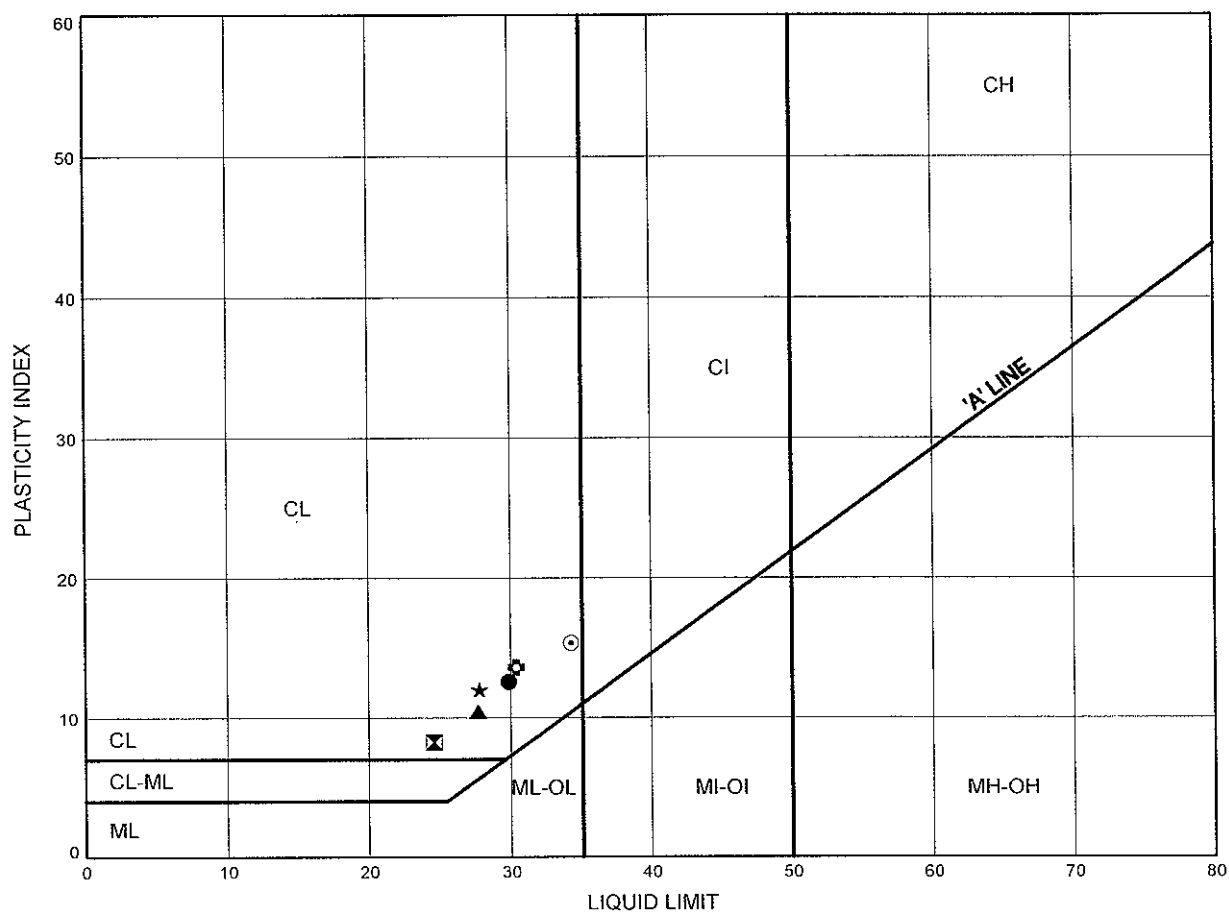
Chkd. MP



# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-50

## SILTY CLAY

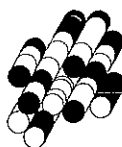


SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WN1	6.3	176.8
⊠	WN1	7.8	175.3
▲	WN1	10.9	172.2
★	WN1	13.9	169.2
⊙	WN2	1.0	180.6
⊕	WN2	4.0	177.6

ALTR 1-09-4135 SITE4 GPJ 07/07/10

Date July 2010

Project 1-09-4135



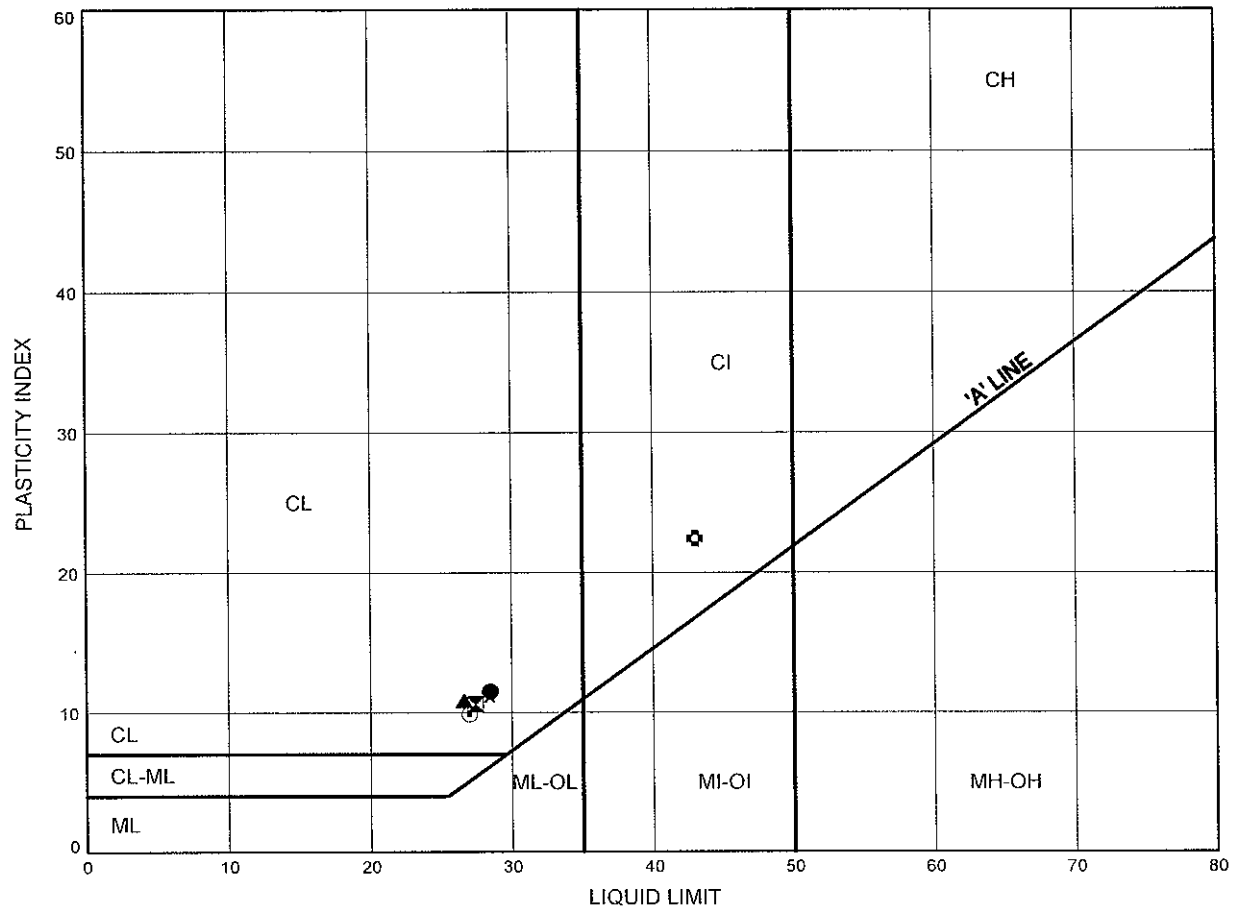
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-51

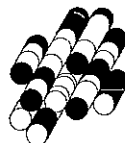
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WN2	6.3	175.3
⊠	WN2	10.9	170.7
▲	WN3	7.8	174.3
★	WN3	9.3	172.8
⊙	WN3	12.4	169.7
⊛	WN4	5.5	177.0

Date July 2010

Project 1-09-4135



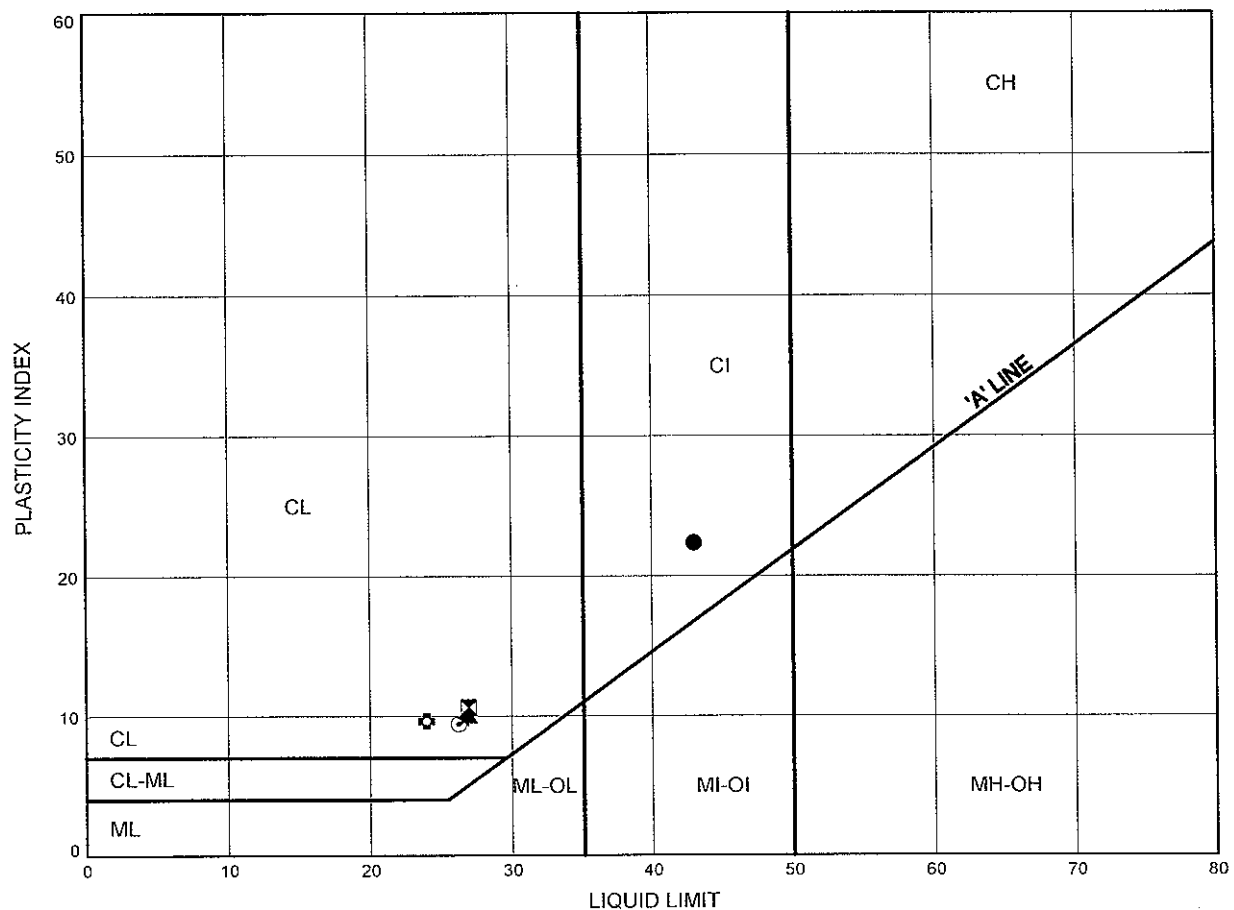
Prep'd DB

Chkd MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-52

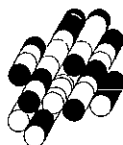
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+750Rt	1.7	181.1
⊠	NBL 12+750Rt	4.7	178.1
▲	NBL 12+750Rt	9.3	173.5
★	WN4	9.3	173.2
⊙	WN4	10.9	171.6
⊛	WN4	13.9	168.6

Date July 2010

Project 1-09-4135



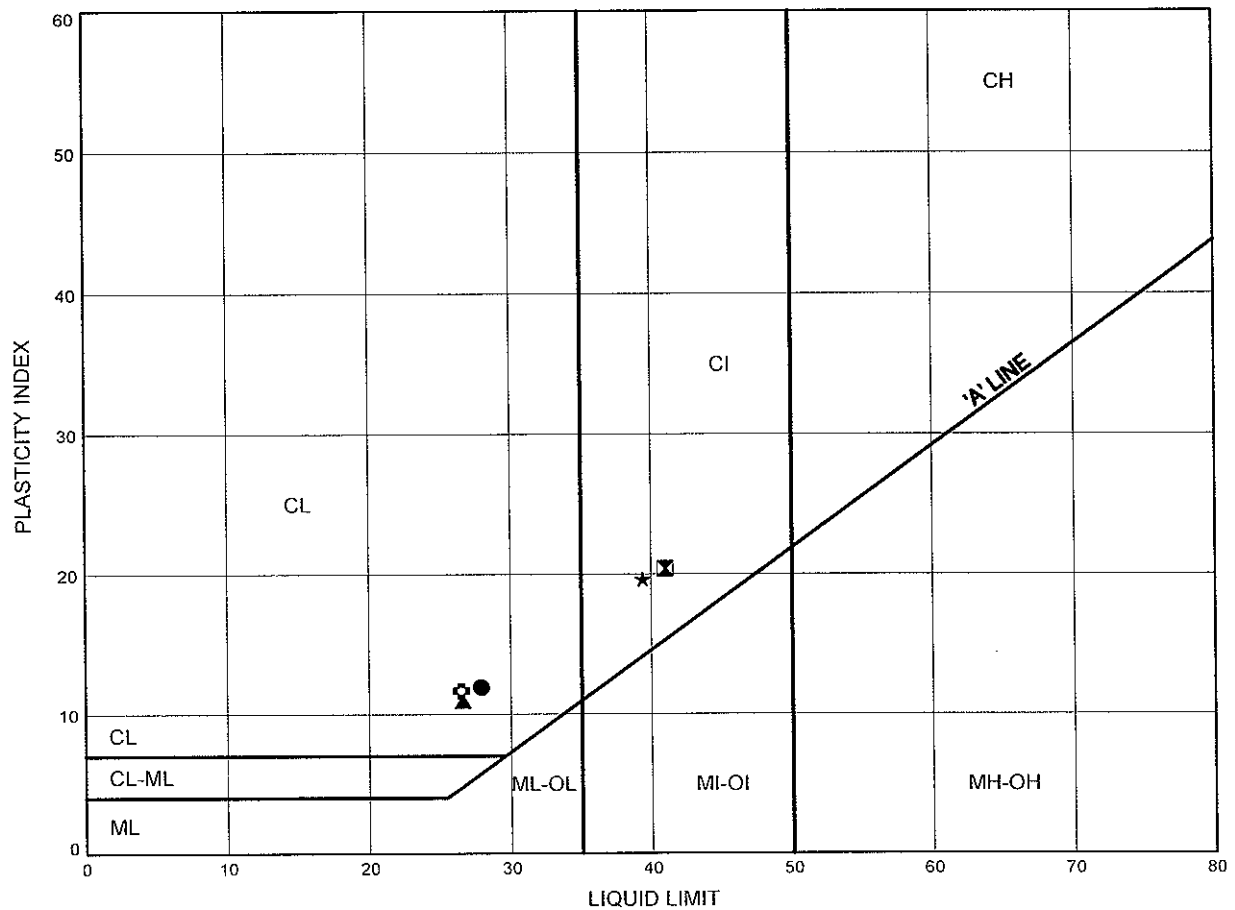
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-53

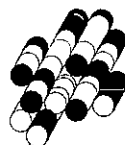
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+750Rt	12.4	170.4
⊠	NBL 12+835Lt	2.5	178.7
▲	NBL 12+835Lt	7.8	173.4
★	NBL 12+835Rt	3.2	179.7
⊙	NBL 12+835Rt	9.3	173.6
⊕	NBL 12+835Rt	10.9	172.0

Date July 2010

Project 1-09-4135



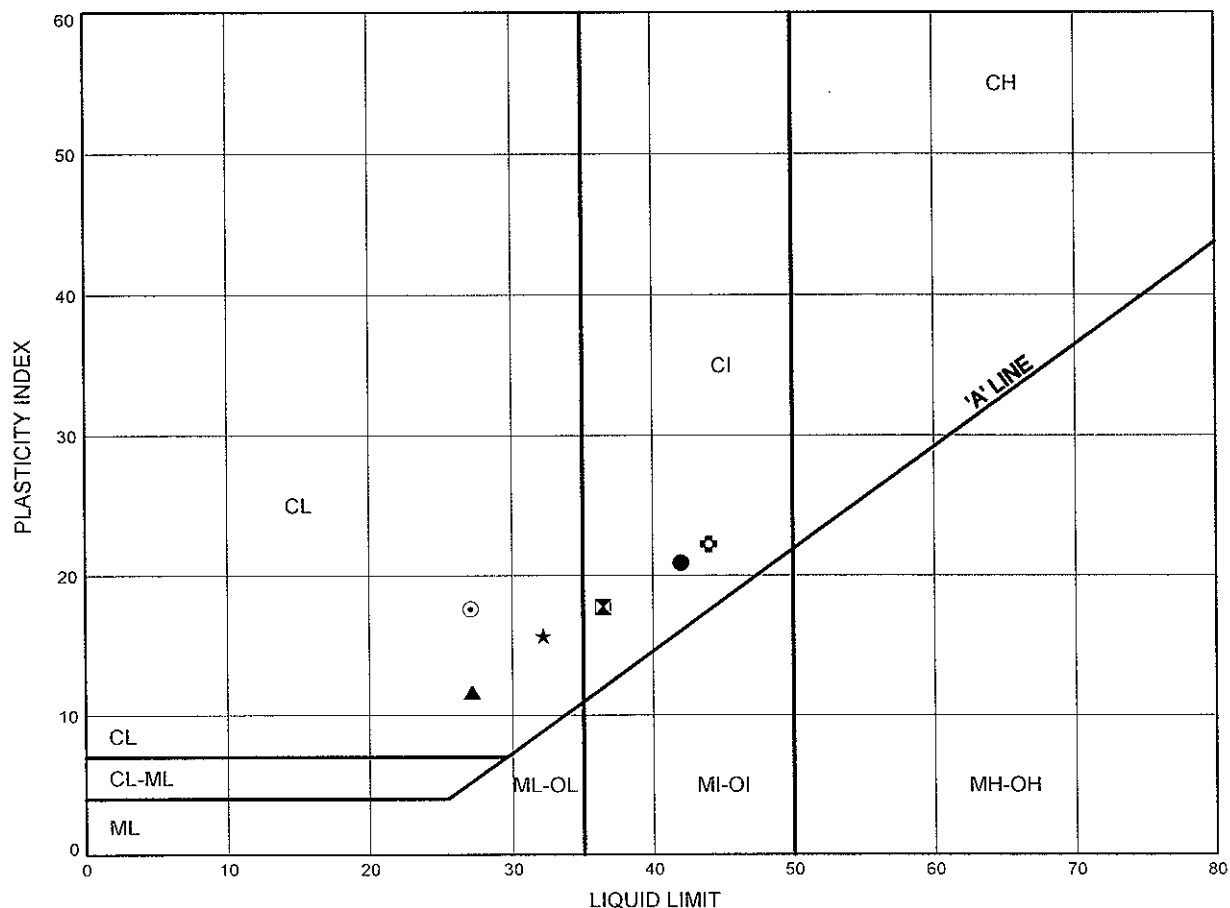
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-54

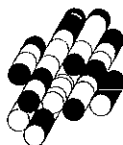
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+910CL	1.7	181.0
⊠	NBL 12+910CL	4.7	178.0
▲	NBL 12+910CL	9.3	173.4
★	NBL 12+985Lt	3.2	177.9
⊙	NBL 12+985Lt	6.3	174.8
⊕	NBL 12+985Rt	1.7	180.6

Date July 2010

Project 1-09-4135



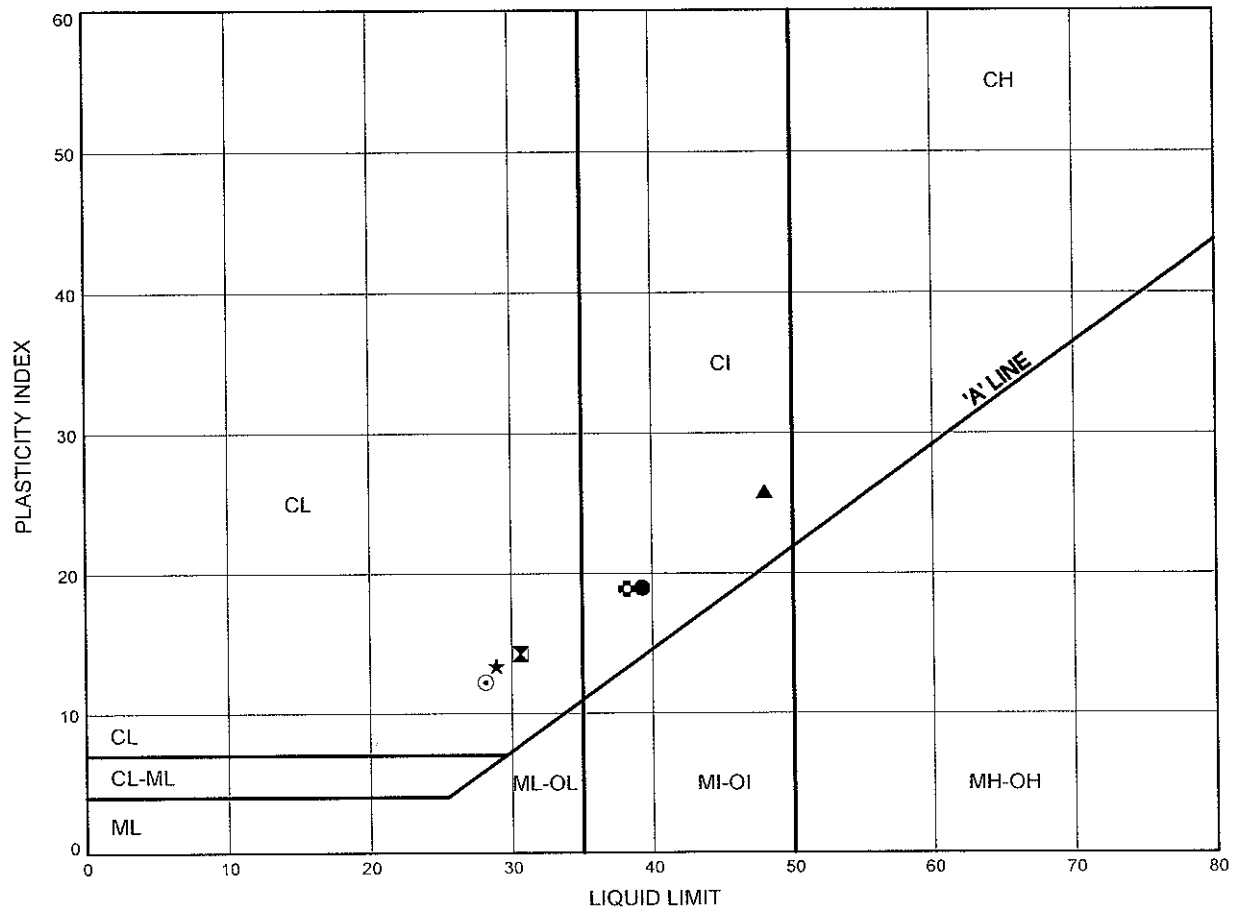
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-55

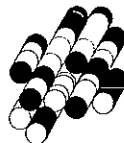
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+985Rt	3.2	179.1
⊠	NBL 12+985Rt	4.7	177.6
▲	SBL 12+185Lt	1.7	181.5
★	SBL 12+185Lt	4.7	178.5
⊙	SBL 12+185Lt	7.8	175.4
⊛	SBL 12+185Rt	2.5	181.1

Date July 2010

Project 1-09-4135



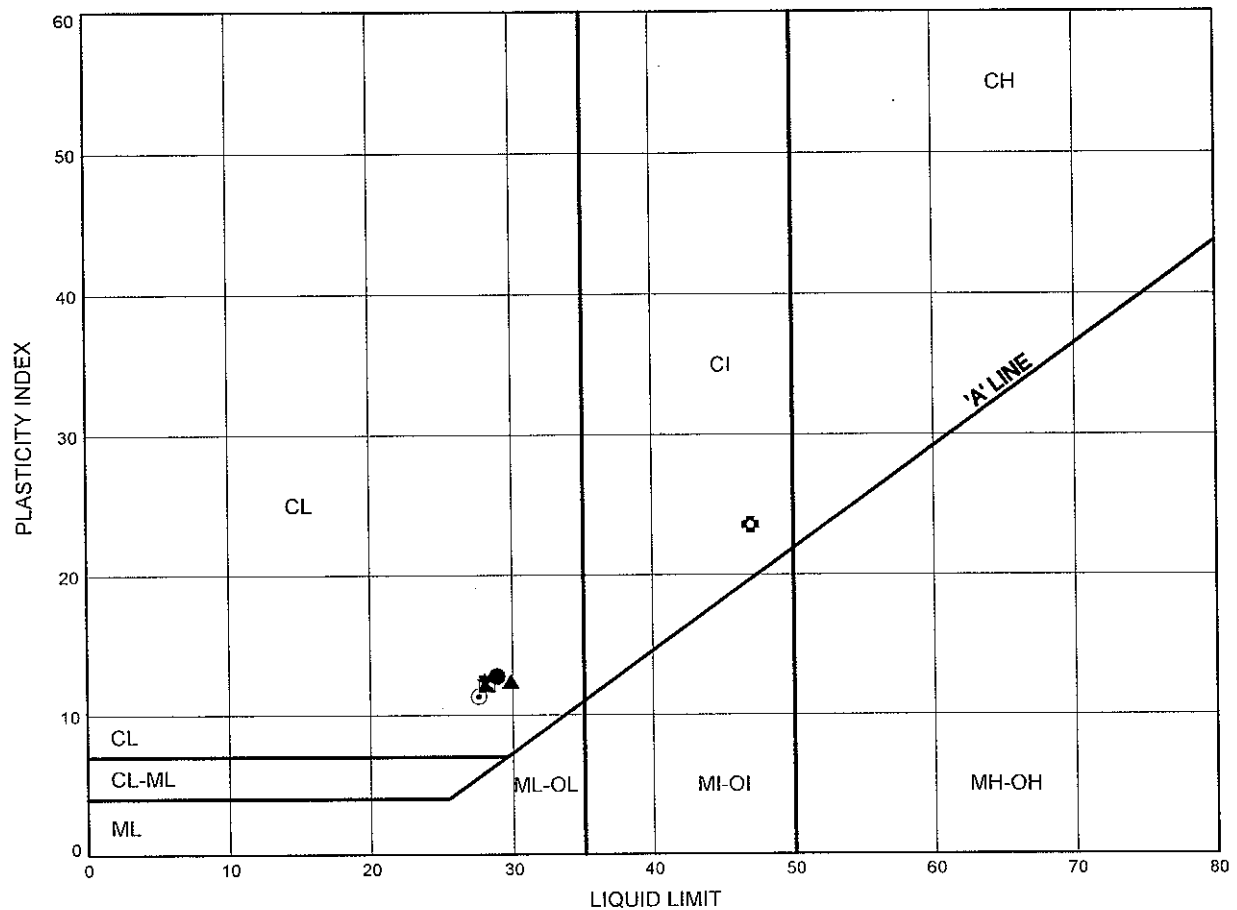
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-56

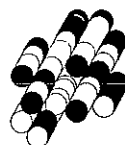
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+185Rt	4.7	178.9
⊠	SBL 12+185Rt	7.8	175.8
▲	SBL 12+260CL	6.3	179.7
★	SBL 12+260CL	9.3	176.7
⊙	SBL 12+260CL	12.4	173.6
⊕	SBL 12+360CL	1.0	181.9

Date July 2010

Project 1-09-4135



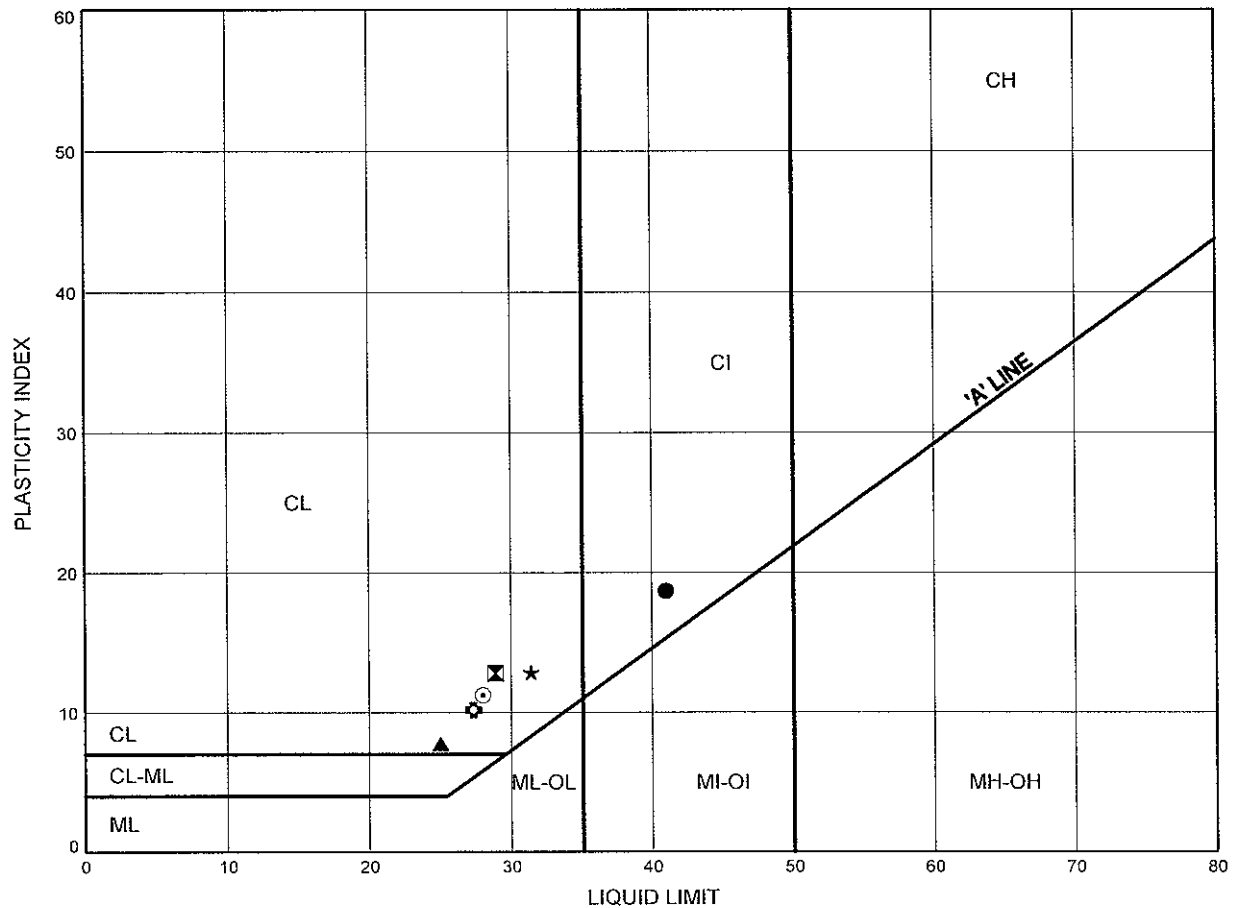
Prep'd DB

Chkd. MP

# 

FIGURE B4-57

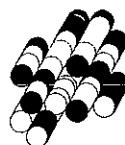
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+360CL	3.2	179.7
⊠	SBL 12+360CL	7.8	175.1
▲	SBL 12+360CL	12.4	170.5
★	TS1	2.5	180.1
⊙	TS1	4.7	177.9
⊗	TS1	9.3	173.3

Date July 2010

Project 1-09-4135



Prep'd DB

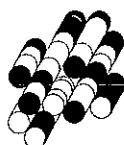
Chkd. MP



## FIGURE B4-58

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TS1	13.9	168.7
☒	TS2	5.5	177.8
▲	TS2	9.3	174.0
★	TS2	13.9	169.4
⊙	TS3	1.7	180.8
⊛	TS3	4.0	178.5

Project 1-09-4135

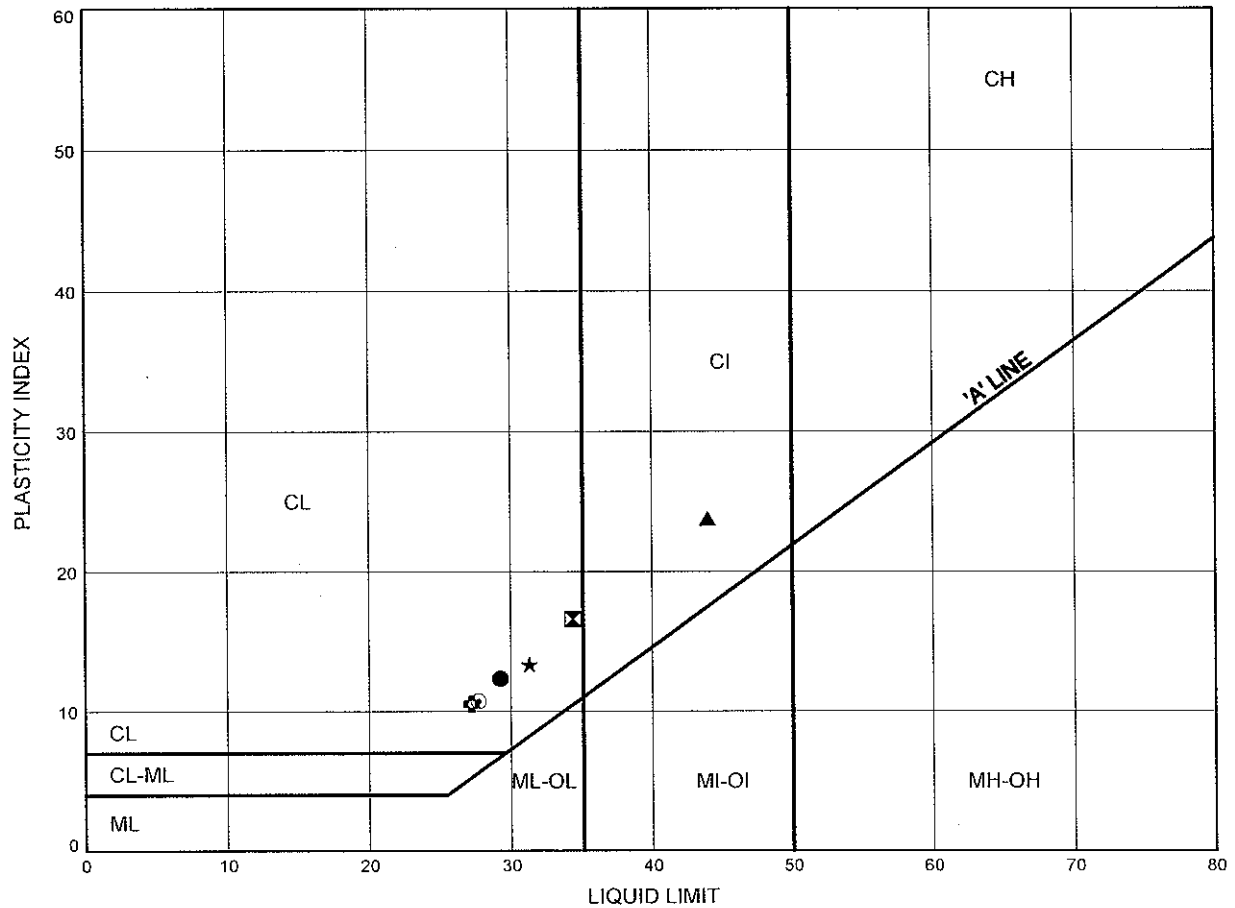


Chkd, .....MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-59

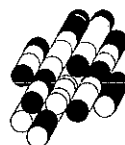
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TS3	6.3	176.2
⊠	TS3	10.9	171.6
▲	TS4	1.0	181.4
★	TS4	3.2	179.2
⊙	TS4	6.3	176.1
⊠	TS4	9.3	173.1

Date July 2010

Project 1-09-4135



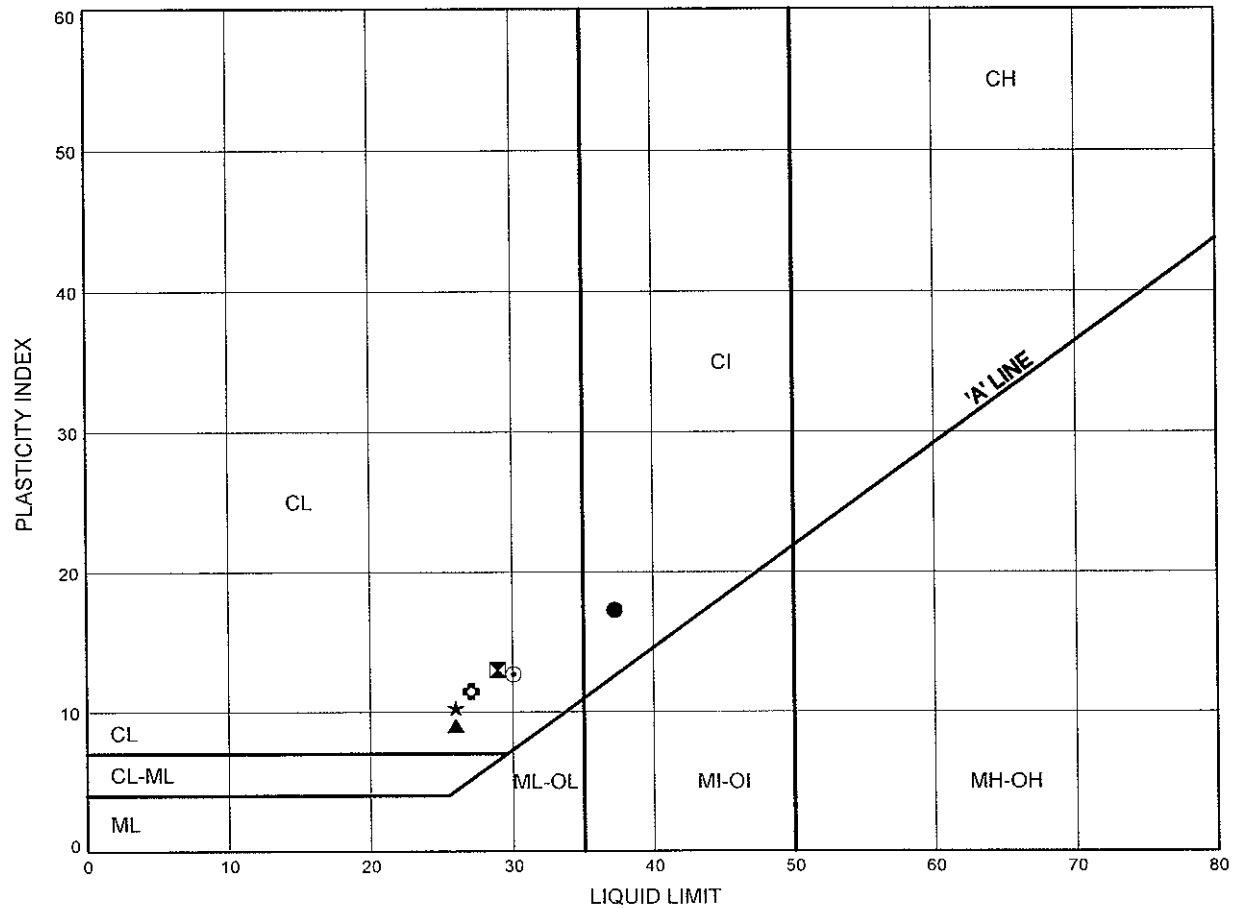
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-60

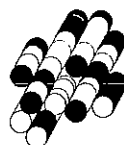
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+410CL	1.7	180.8
⊠	SBL 12+410CL	4.7	177.8
▲	SBL 12+410CL	9.3	173.2
★	SBL 12+410CL	10.9	171.6
⊙	SBL 12+485Lt	2.5	179.5
⊞	SBL 12+485Lt	4.7	177.3

Date July 2010

Project 1-09-4135



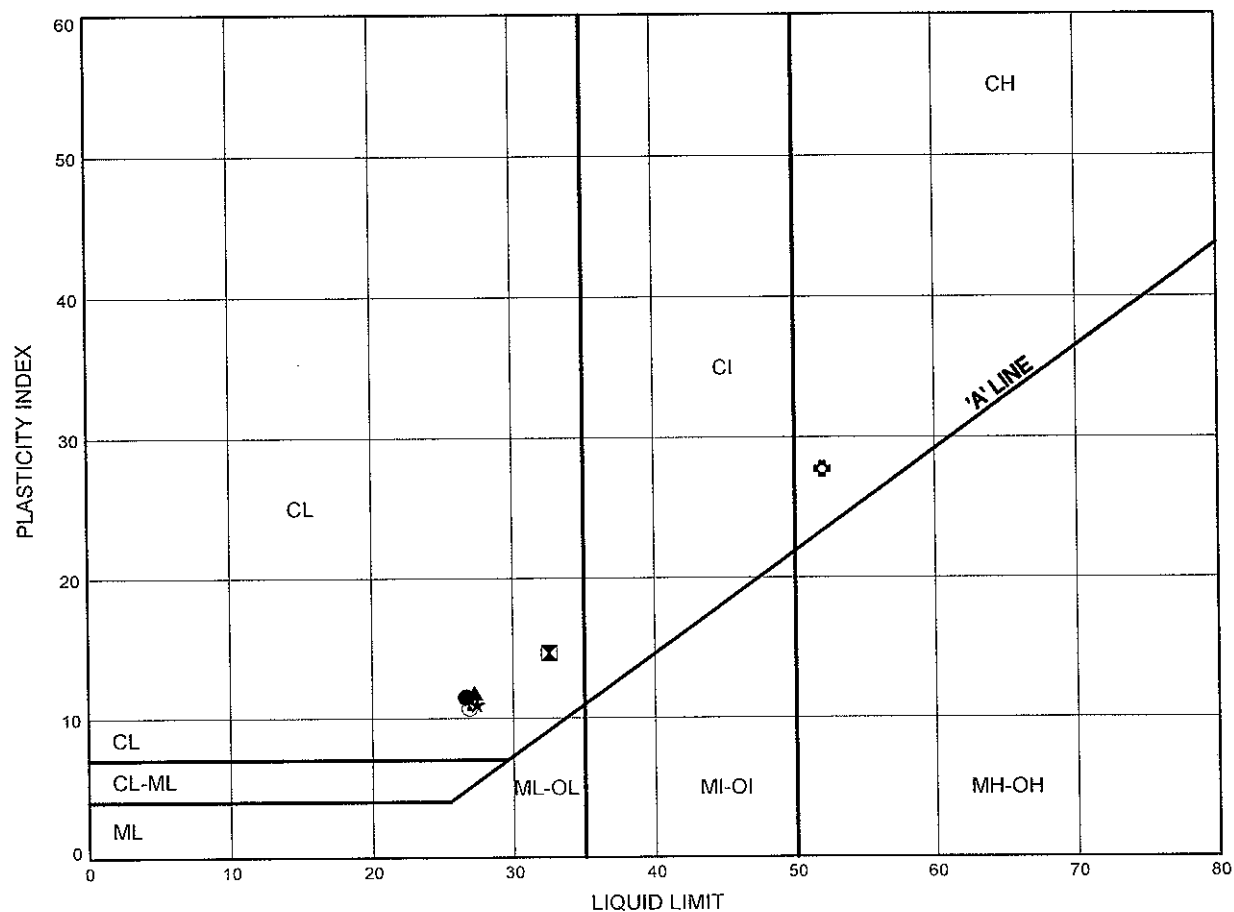
Prep'd DB

Chkd. MP

# 

FIGURE B4-61

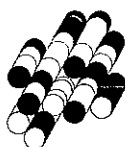
### SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+485Lt	7.8	174.2
⊠	SBL 12+485Rt	3.2	178.6
▲	SBL 12+485Rt	9.3	172.5
★	SBL 12+525CL	4.7	177.1
⊙	SBL 12+525CL	9.3	172.5
⊛	SBL 12+600Lt	1.7	181.0

Date July 2010

Project 1-09-4135



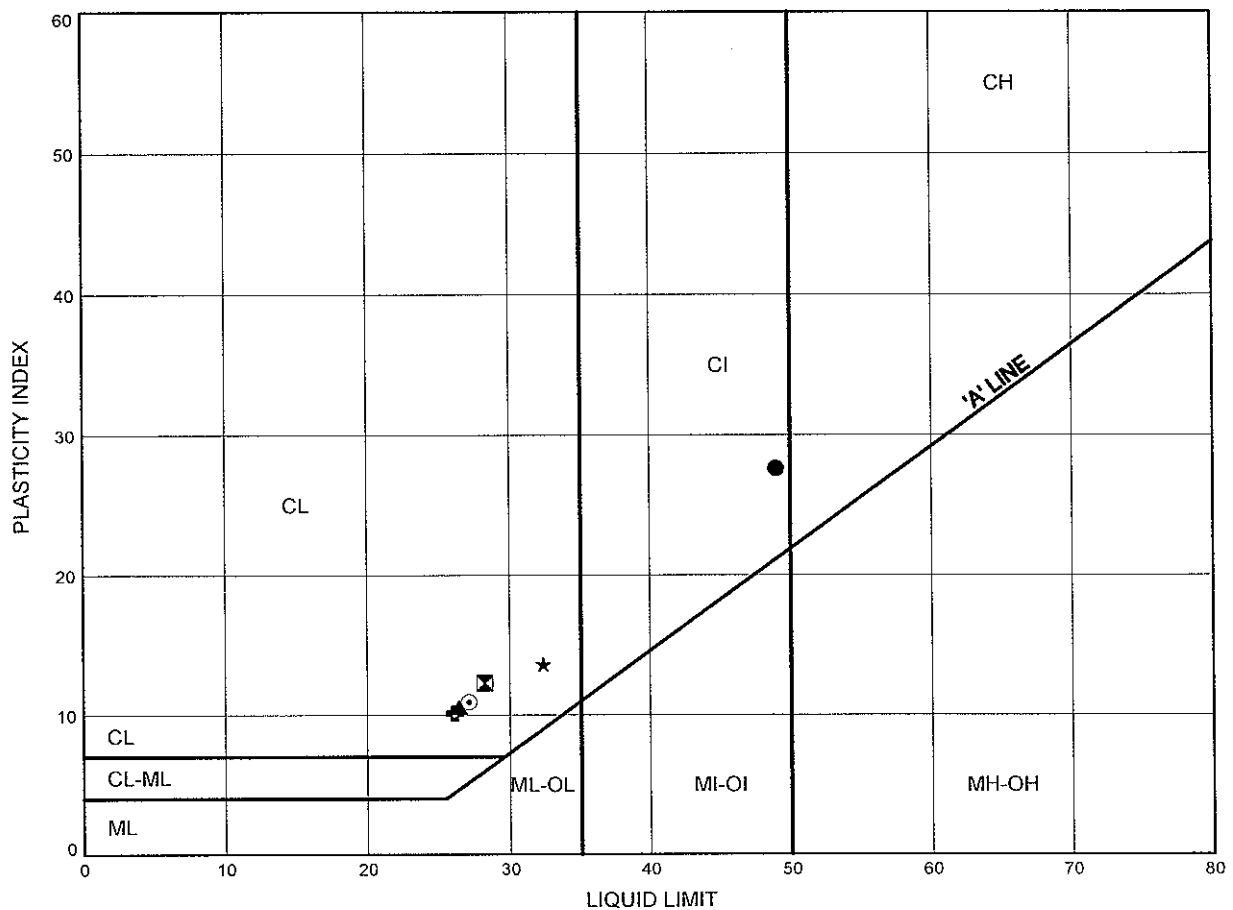
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-62

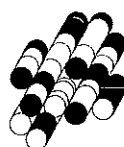
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+600Lt	3.2	179.5
⊠	SBL 12+600Lt	9.3	173.4
▲	SBL 12+600Lt	12.4	170.3
★	SBL 12+600Rt	1.0	181.1
⊙	SBL 12+600Rt	4.7	177.4
⊛	SBL 12+600Rt	10.9	171.2

Date July 2010

Project 1-09-4135



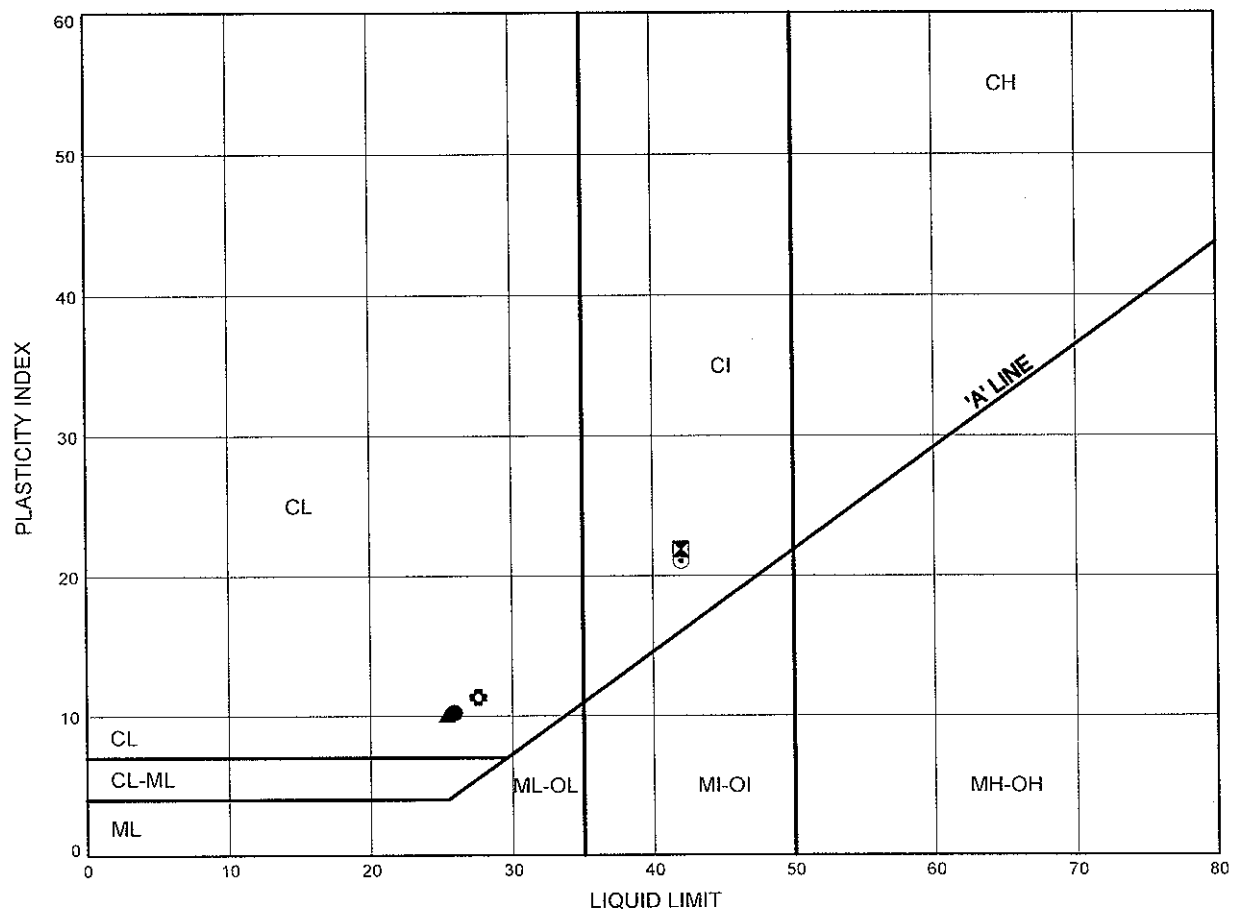
Prep'd DB

Chkd. MP

# 

FIGURE B4-63

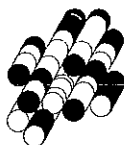
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+600Rt	12.4	169.7
⊠	SBL 12+650CL	3.2	180.5
▲	SBL 12+650CL	9.3	174.4
★	SBL 12+650CL	12.4	171.3
⊙	SBL 12+685CL	2.5	180.2
⊛	SBL 12+685CL	6.3	176.4

Date July 2010

Project 1-09-4135

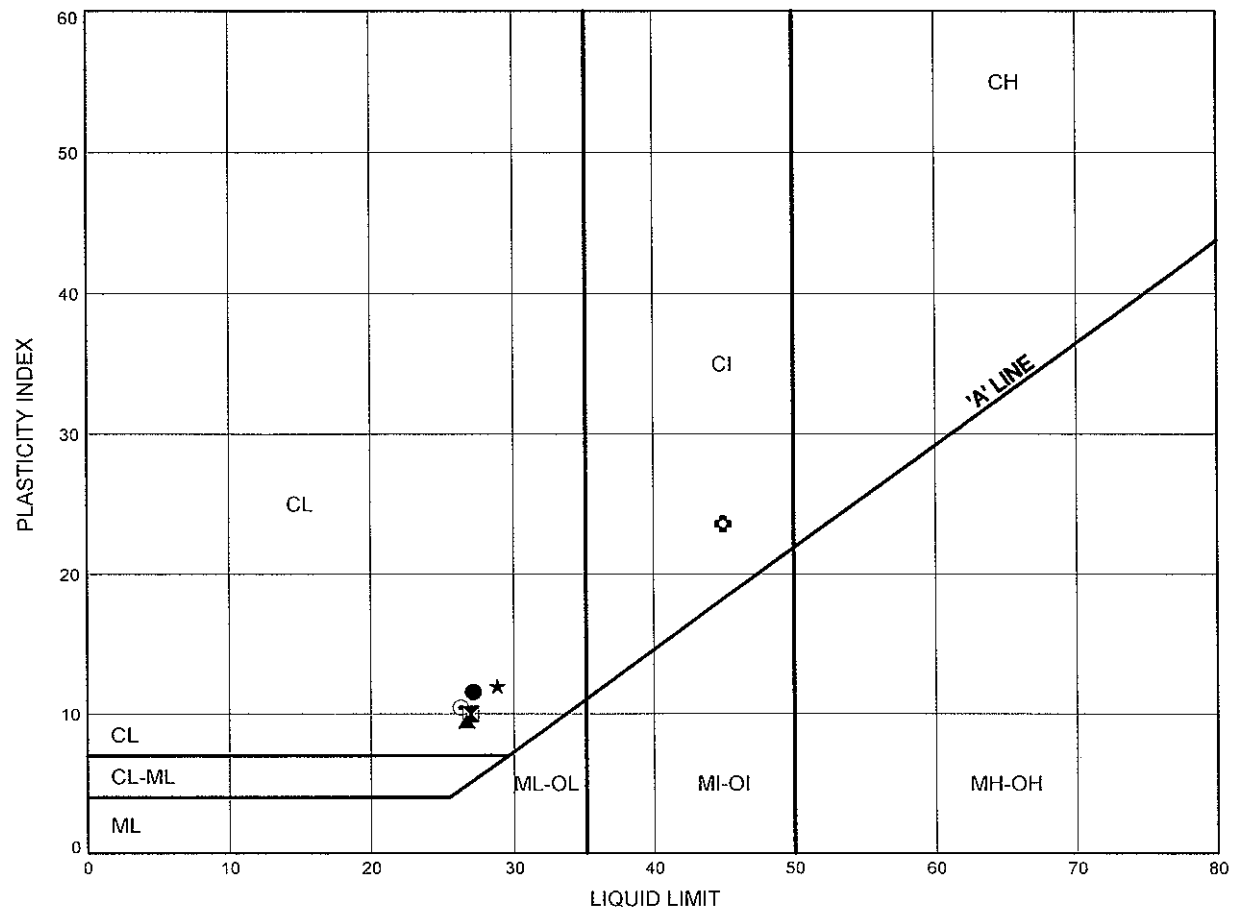


Prep'd DB

Chkd MP

## FIGURE B4-64

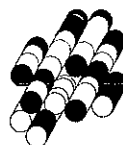
SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+685CL	9.3	173.4
⊠	SBL 12+685CL	10.9	171.8
▲	WS1	7.8	174.9
★	WS1	9.3	173.4
⊙	WS1	13.9	168.8
⊕	WS2	1.0	182.1

Date July 2010

Project 1-09-4135



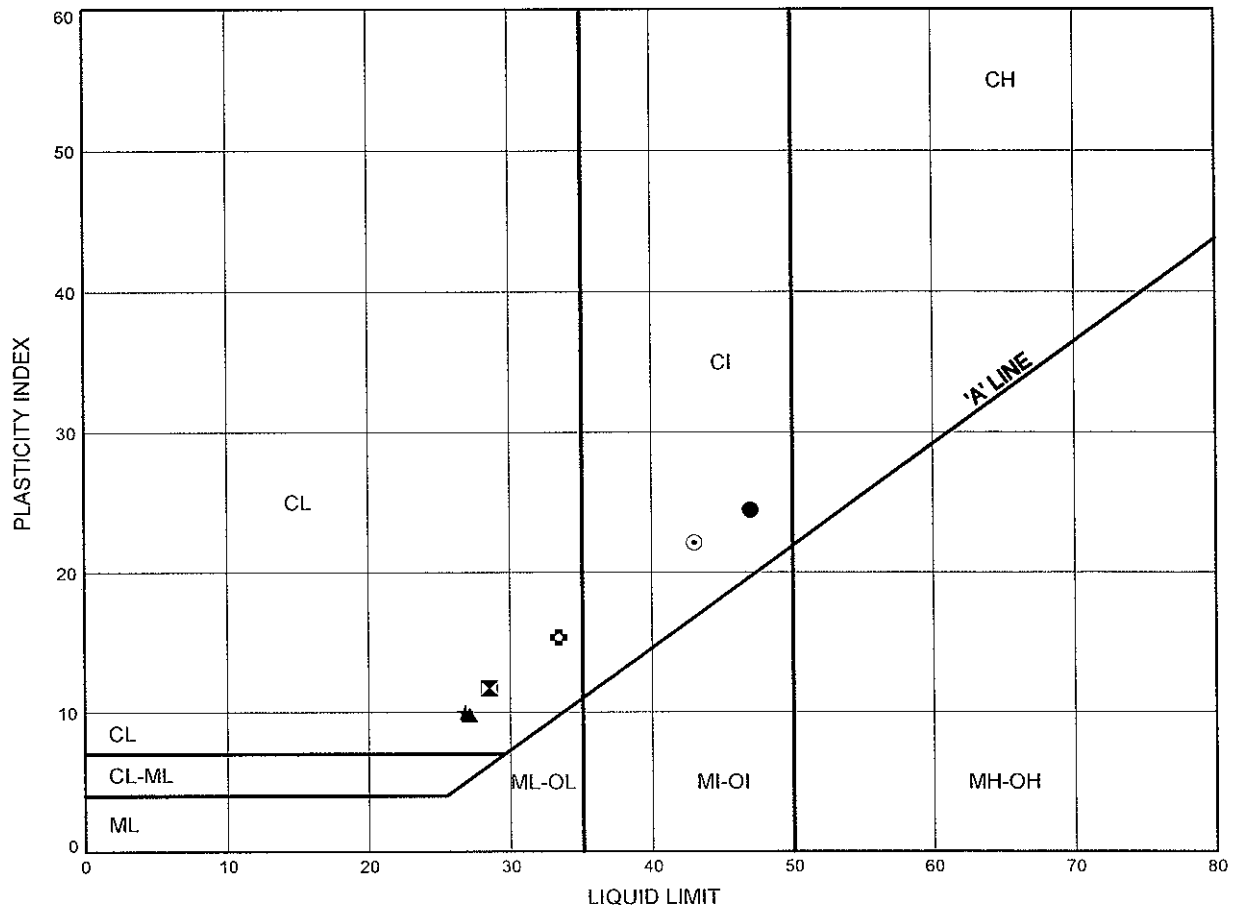
Prep'd ..... DB .....

Chkd. ....MP.....

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-65

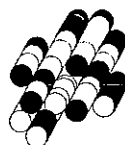
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WS2	2.5	180.6
⊠	WS2	6.3	176.8
▲	WS2	10.9	172.2
★	WS2	12.4	170.7
⊙	WS3	3.2	179.8
⊠	WS3	4.7	178.3

Date July 2010

Project 1-09-4135



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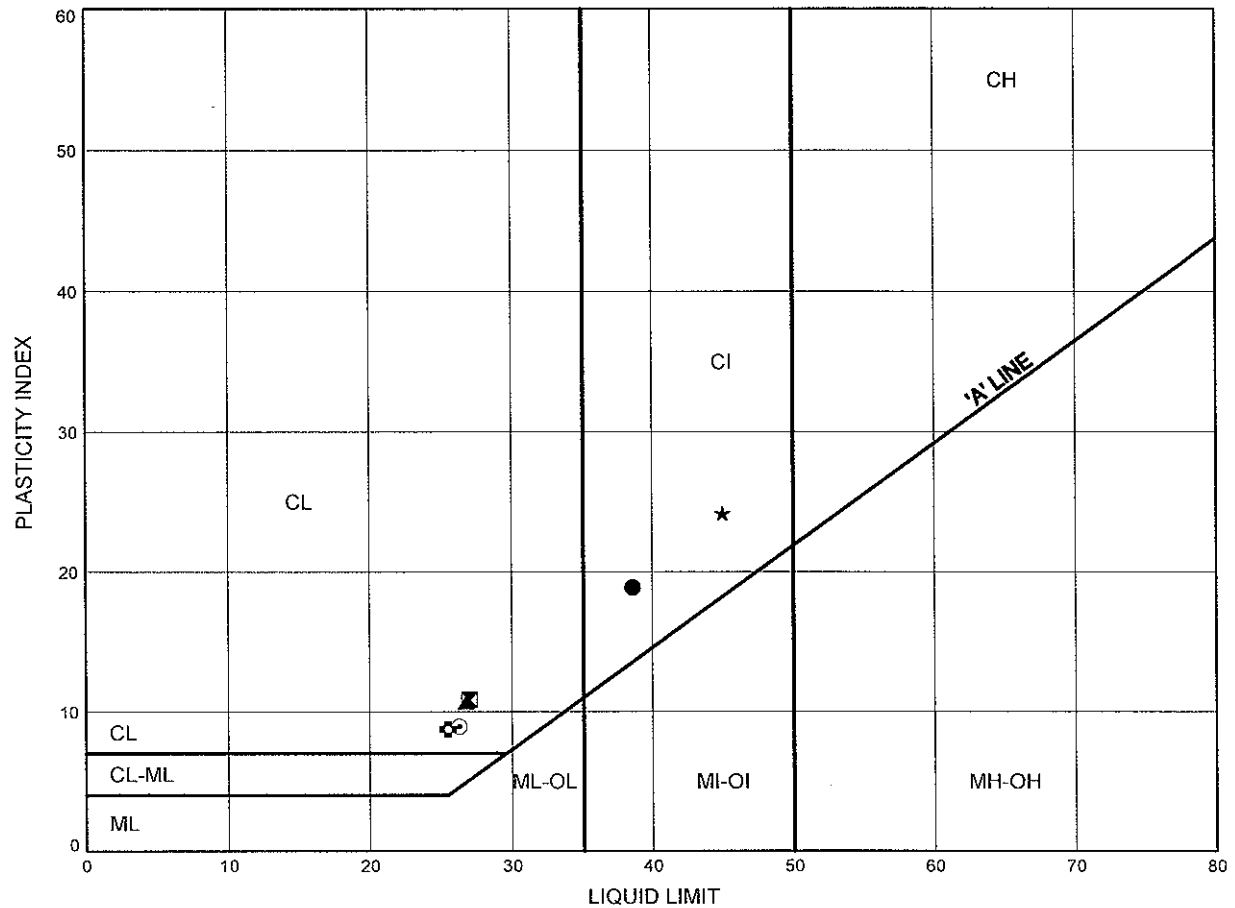
Chkd. MP



# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-66

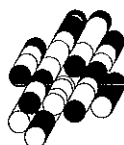
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WS3	7.8	175.2
⊠	WS3	10.9	172.1
▲	WS3	13.9	169.1
★	WS4	2.5	180.2
⊙	WS4	9.3	173.4
⊛	WS4	12.4	170.3

Date July 2010

Project 1-09-4135



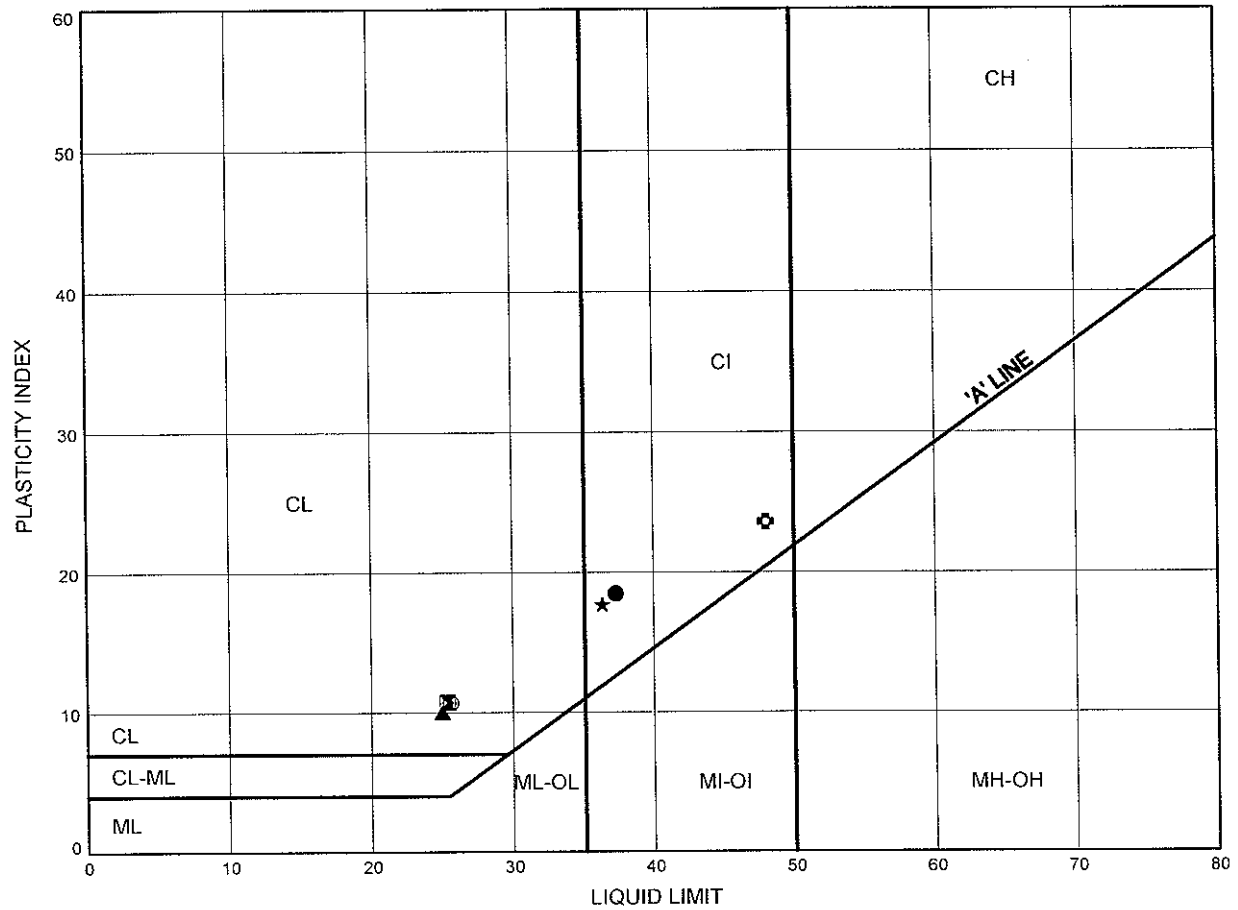
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

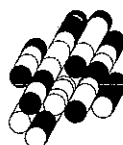
FIGURE B4-67

## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+750CL	3.2	179.7
⊠	SBL 12+750CL	7.8	175.1
▲	SBL 12+750CL	10.1	172.8
★	SBL 12+825Lt	3.2	179.8
⊙	SBL 12+825Lt	7.1	175.9
⊛	SBL 12+825Rt	1.0	181.3

Date July 2010  
Project 1-09-4135

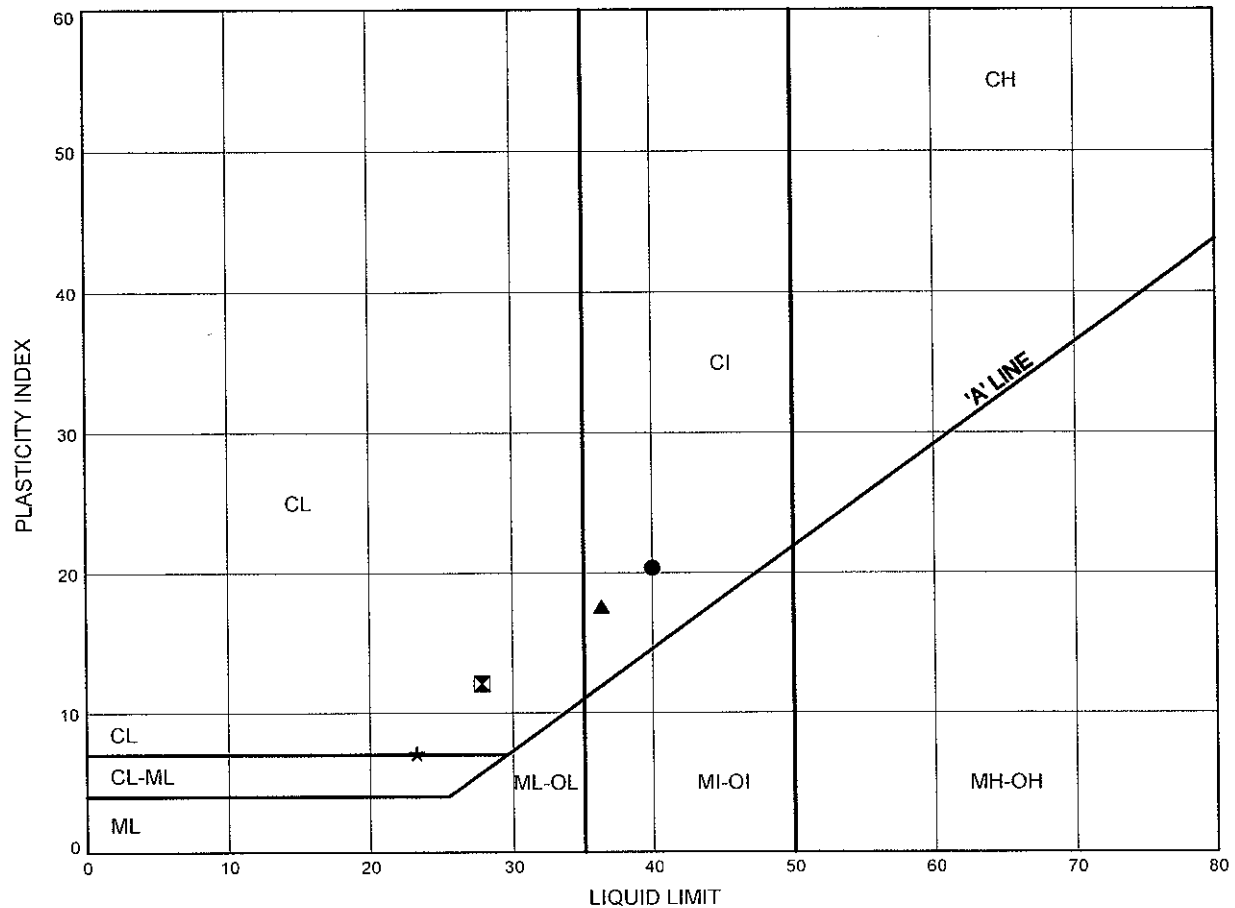


Prep'd DB  
Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-68

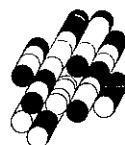
## SILTY CLAY



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+825Rt	2.5	179.8
⊠	SBL 12+825Rt	6.3	176.0
▲	SBL 12+900CL	1.7	181.0
★	SBL 12+900CL	5.5	177.2

Date July 2010

Project 1-09-4135



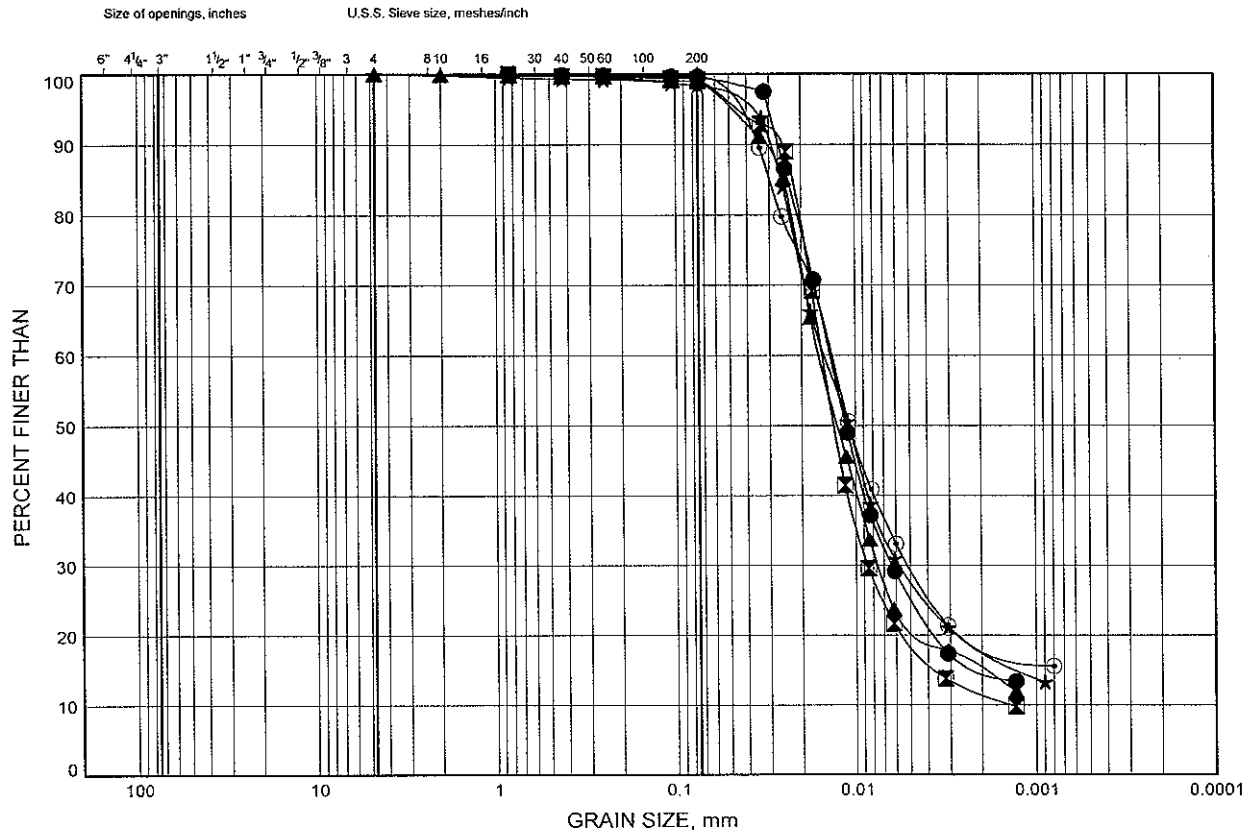
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-69

## SILT

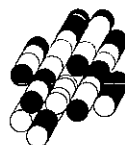


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+525Lt	1.7	181.1
⊠	NBL 12+595Rt	2.5	179.1
▲	NBL 12+645Lt	4.7	178.6
★	NBL 12+645Rt	3.2	177.8
⊙	WN1	4.7	178.4

Date July 2010

Project 1-09-4135



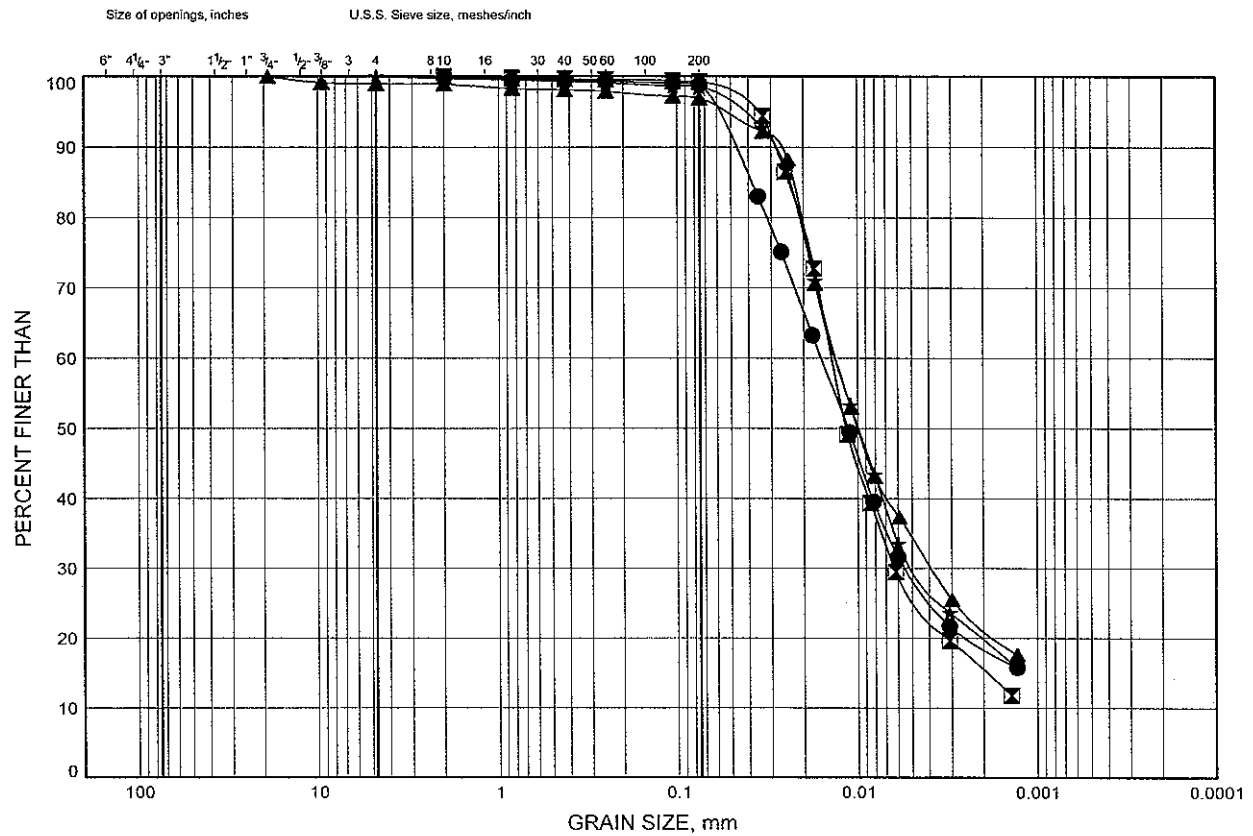
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-70

## SILT

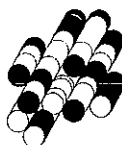


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WN2	2.5	179.1
⊠	WN3	4.0	178.1
▲	WS1	4.7	178.0
★	WS2	4.7	178.4

Date July 2010

Project 1-09-4135



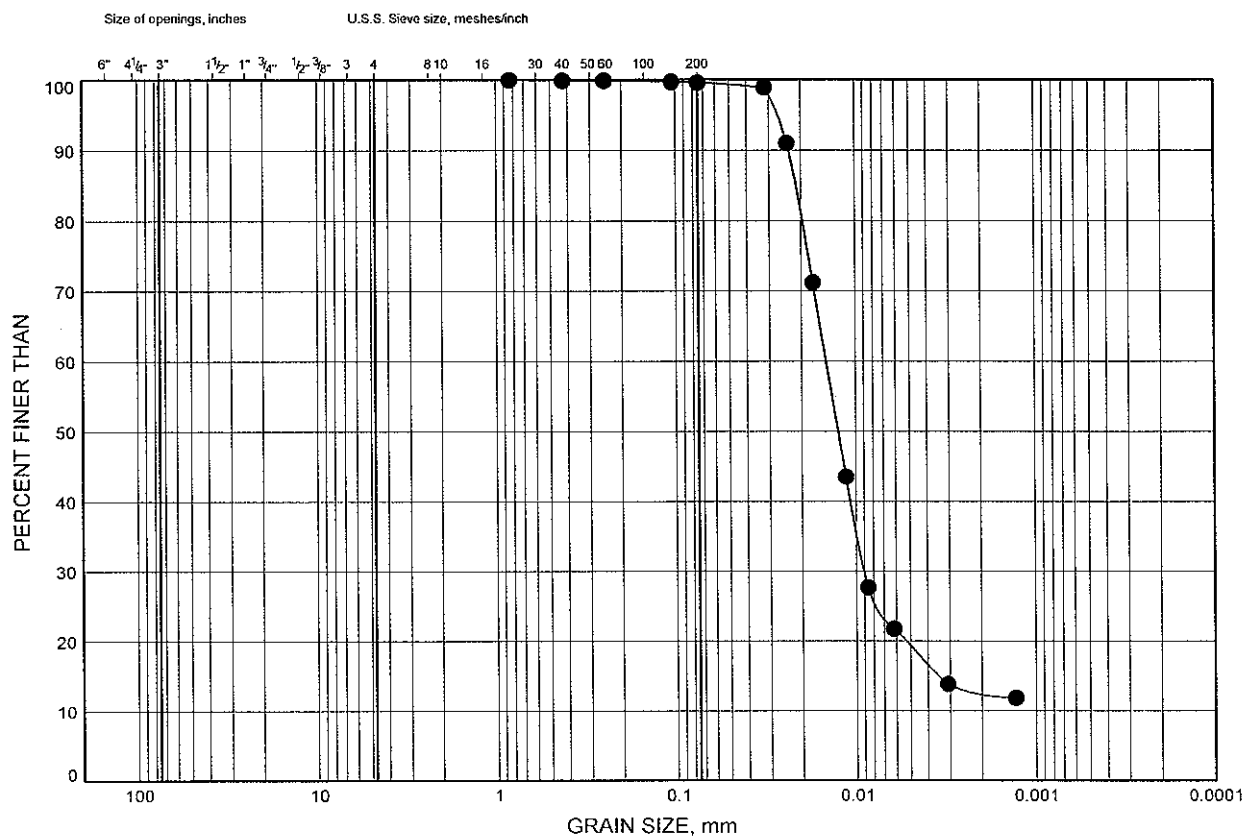
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-71

## CLAYEY SILT

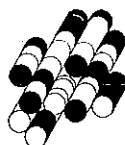


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+835Rt	6.3	176.6

Date July 2010

Project 1-09-4135



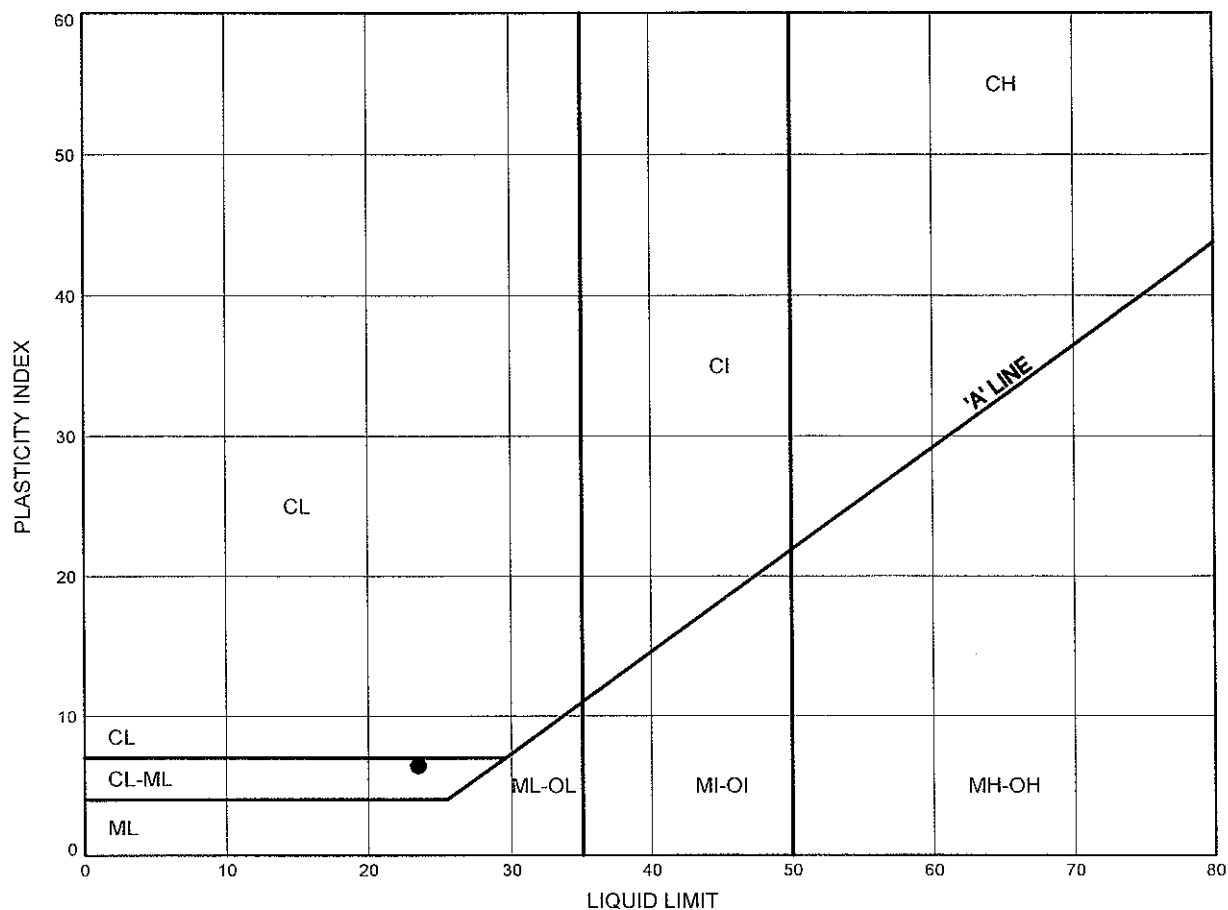
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-72

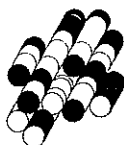
## CLAYEY SILT



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+835Rt	6.3	176.6

Date July 2010

Project 1-09-4135



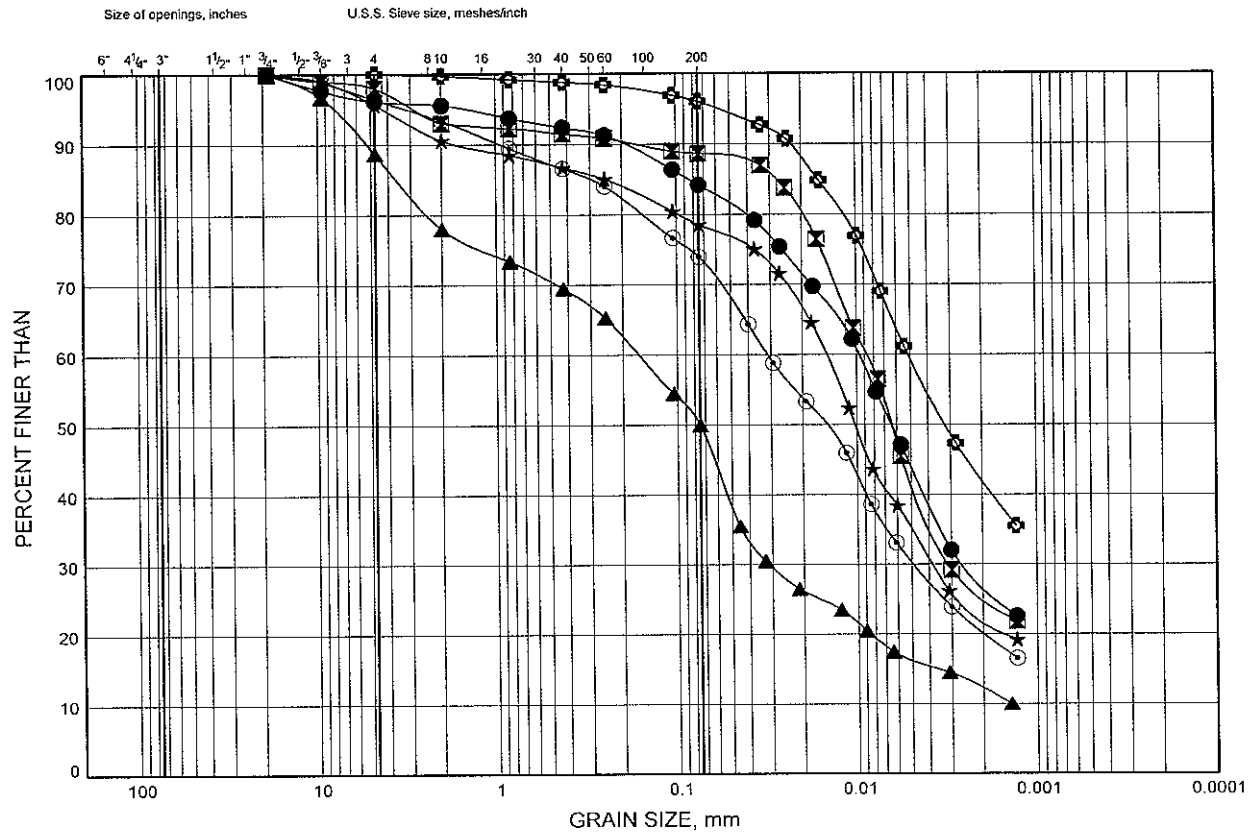
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-73

## SILTY CLAY TO CLAYEY SILT TILL



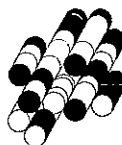
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	TN1	15.4	168.1
⊠	TN2	15.4	168.8
▲	TN2	26.1	158.1
★	TN3	17.0	167.1
⊙	TN4	17.0	167.0
⊛	TN4	27.6	156.4

Date July 2010

Project 1-09-4135



Prep'd DB

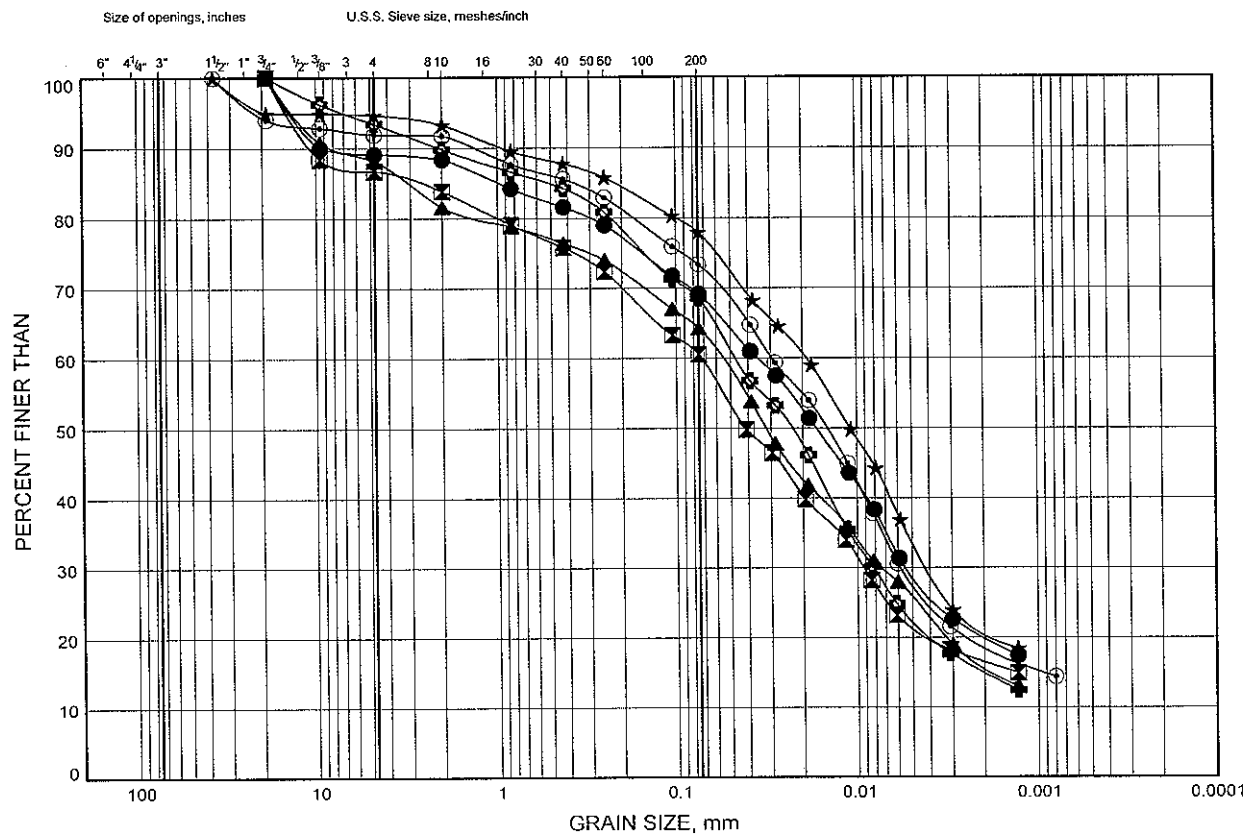
Chkd. MP



# GRAIN SIZE DISTRIBUTION

FIGURE B4-74

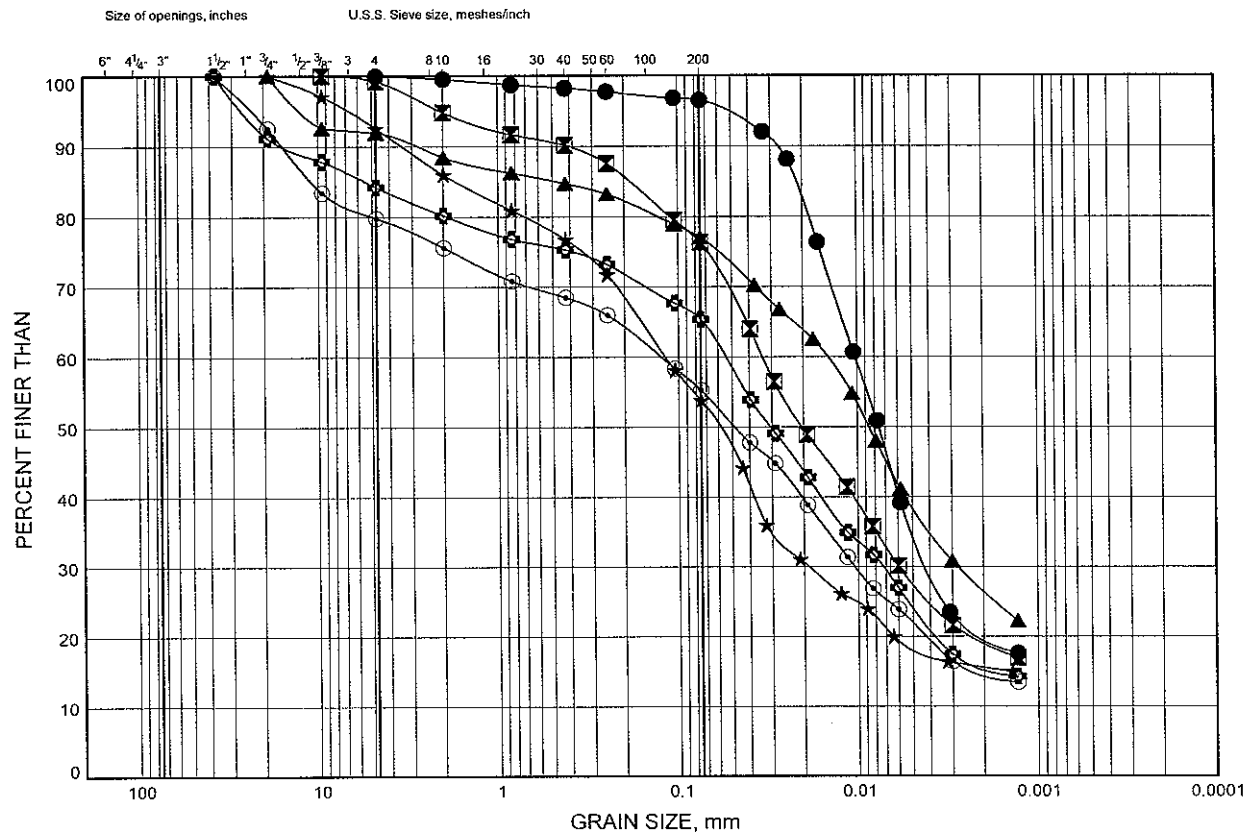
## SILTY CLAY TO CLAYEY SILT TILL



# GRAIN SIZE DISTRIBUTION

FIGURE B4-75

## SILTY CLAY TO CLAYEY SILT TILL



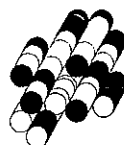
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	SBL 12+485Lt	13.9	168.1
⊠	TS1	26.1	156.5
▲	TS2	15.4	167.9
★	TS2	23.1	160.2
⊙	TS3	18.5	164.0
⊛	TS4	15.4	167.0

Date July 2010

Project 1-09-4135



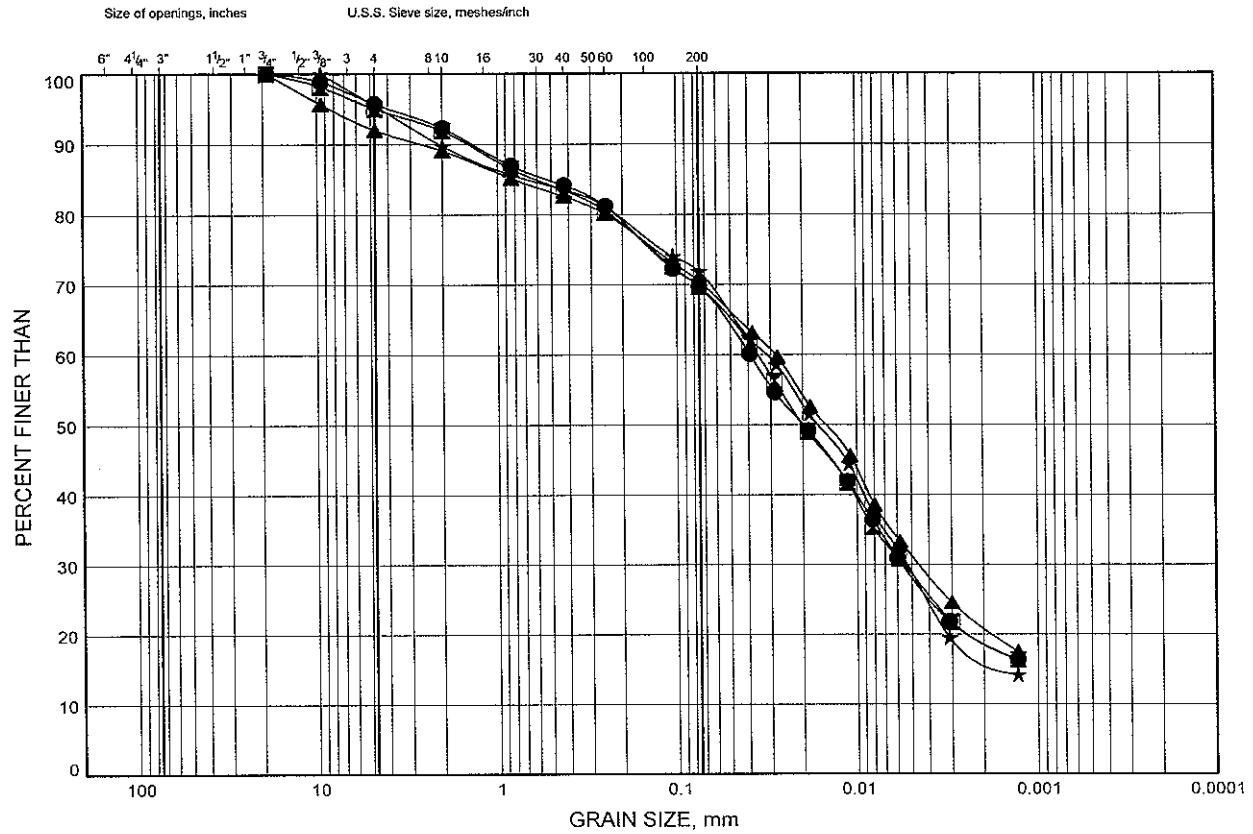
Prep'd DB

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# GRAIN SIZE DISTRIBUTION

FIGURE B4-76

## SILTY CLAY TO CLAYEY SILT TILL



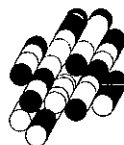
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	SBL 12+485Rt	13.9	167.9
⊠	SBL 12+525CL	13.9	167.9
▲	SBL 12+525CL	15.4	166.4
★	WS1	15.4	167.3

Date July 2010

Project 1-09-4135



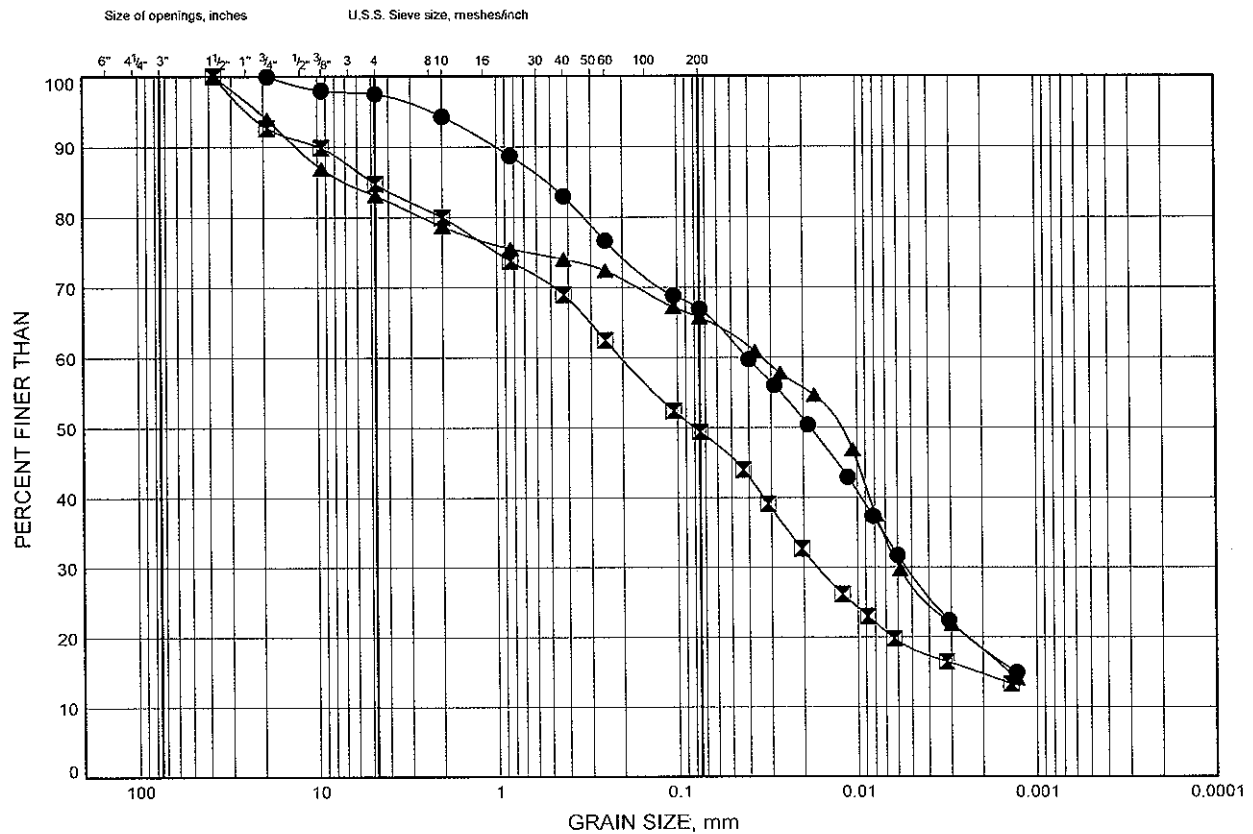
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-77

## SILTY CLAY TO CLAYEY SILT TILL



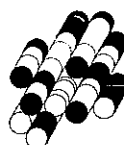
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	WS1	21.5	161.2
⊠	WS2	21.5	161.6
▲	WS4	15.4	167.3

Date July 2010

Project 1-09-4135



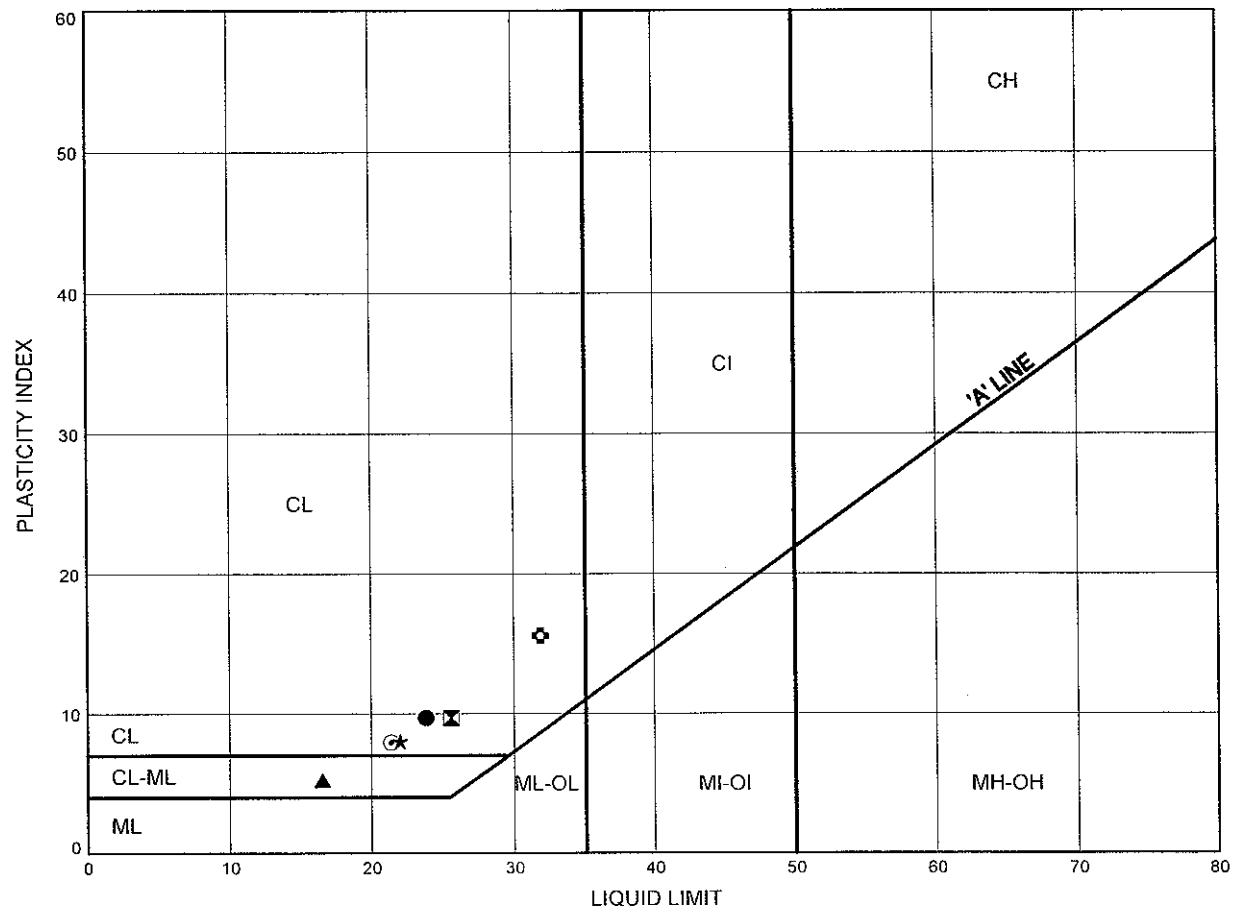
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-78

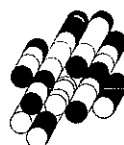
## SILTY CLAY TO CLAYEY SILT TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TN1	15.4	168.1
⊠	TN2	15.4	168.8
▲	TN2	26.1	158.1
★	TN3	17.0	167.1
⊙	TN4	17.0	167.0
⊕	TN4	27.6	156.4

Date July 2010

Project 1-09-4135



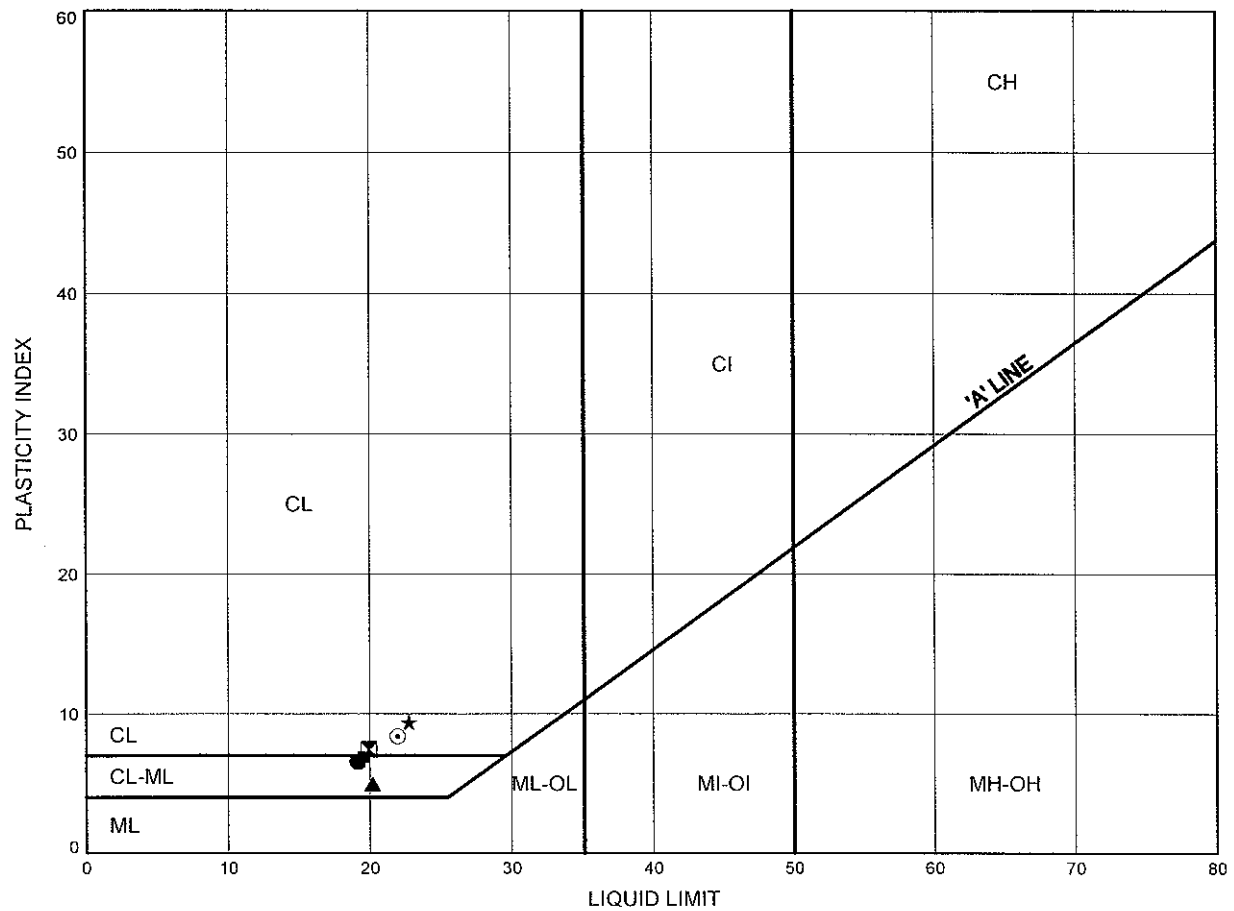
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-79

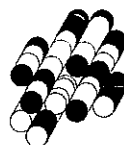
## SILTY CLAY TO CLAYEY SILT TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	NBL 12+525Lt	15.4	167.4
⊠	NBL 12+595Rt	13.9	167.7
▲	TS1	17.0	165.6
★	WN1	15.4	167.7
⊙	WN2	13.9	167.7
⊛	WN3	15.4	166.7

Date July 2010

Project 1-09-4135



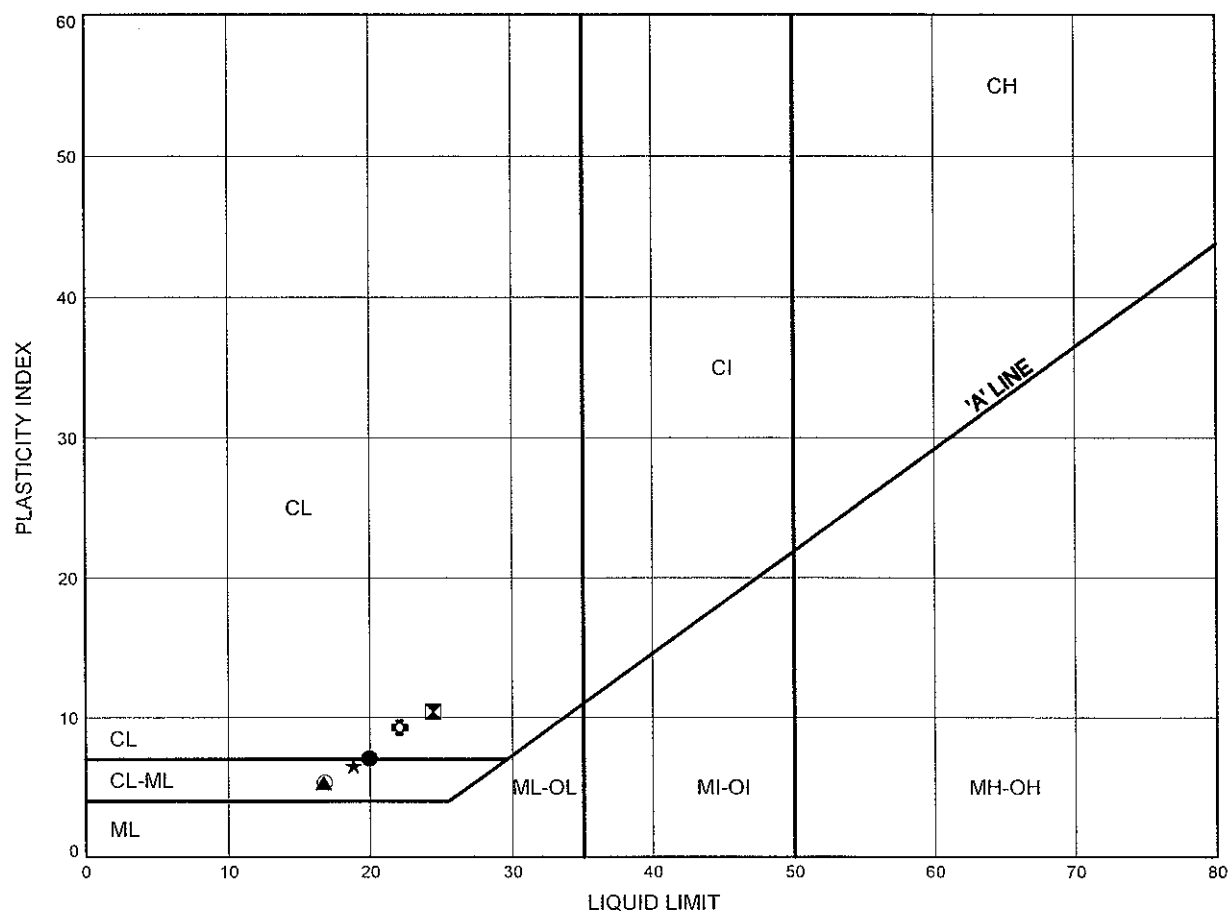
Prep'd DB

Chkd. MP

# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-80

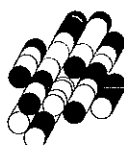
## SILTY CLAY TO CLAYEY SILT TILL



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TS1	26.1	156.5
⊠	TS2	15.4	167.9
▲	TS2	23.1	160.2
★	TS3	18.5	164.0
⊙	TS3	23.1	159.4
⊕	TS3	26.1	156.4

Date July 2010

Project 1-09-4135



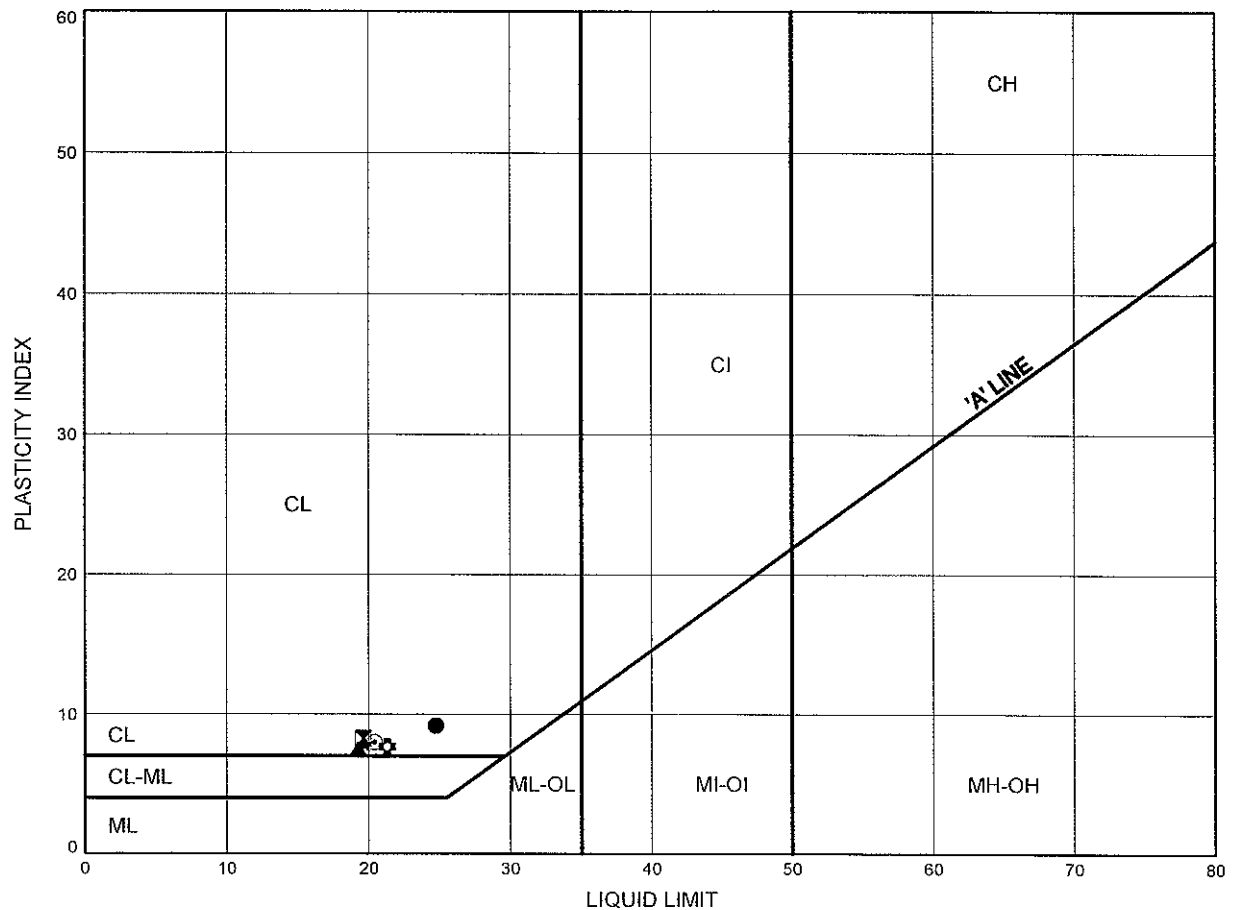
Prep'd DB

Chkd. MP

# 

FIGURE B4-81

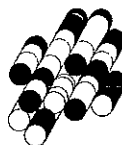
### 



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	SBL 12+485Lt	13.9	168.1
⊠	SBL 12+485Rt	13.9	167.9
▲	SBL 12+525CL	13.9	167.9
★	SBL 12+525CL	15.4	166.4
⊙	TS4	15.4	167.0
⊞	WS1	15.4	167.3

Date July 2010

Project 1-09-4135



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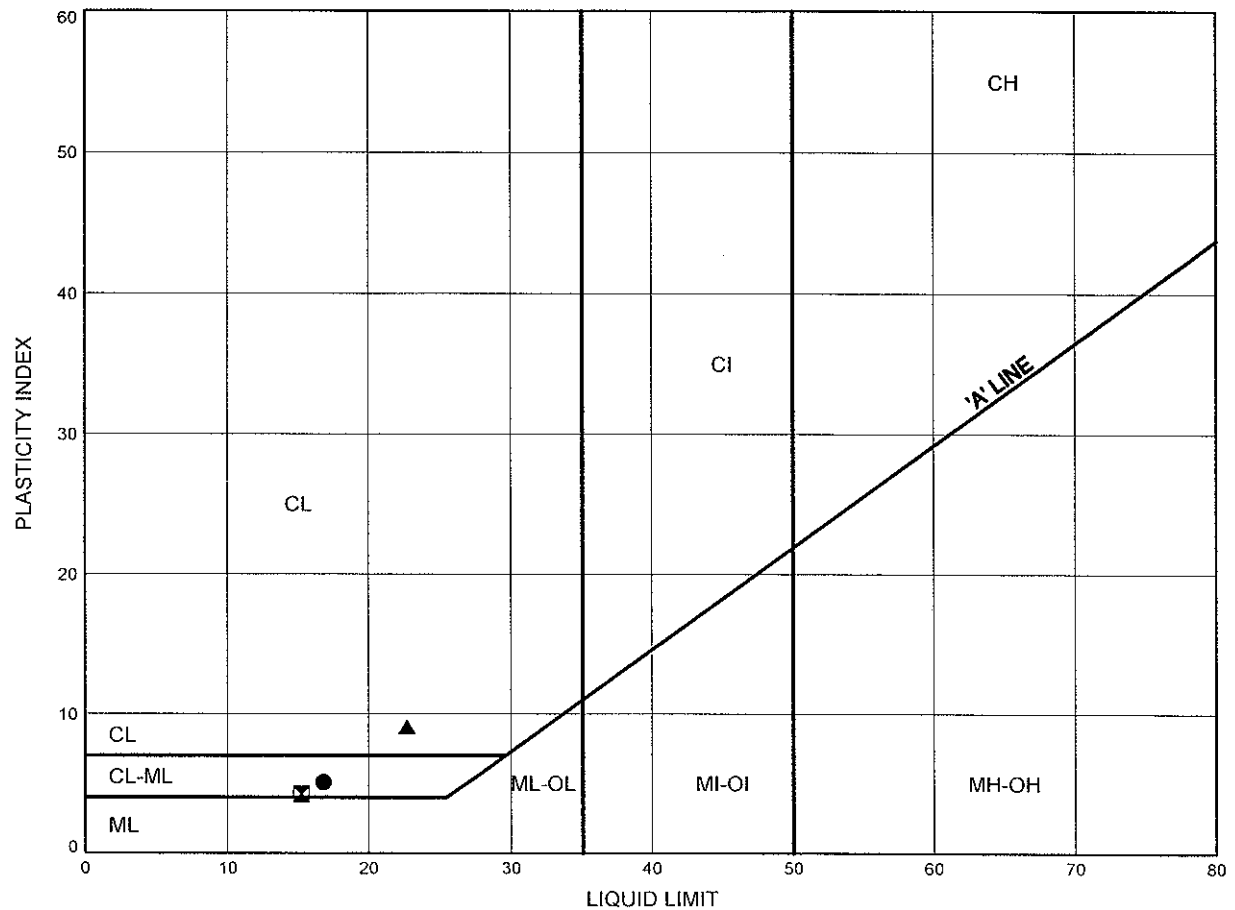
Chkd. MP



# ATTERBERG LIMITS TEST RESULTS

FIGURE B4-82

## SILTY CLAY TO CLAYEY SILT TILL

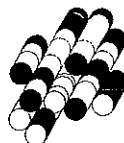


SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	WS1	21.5	161.2
⊠	WS2	21.5	161.6
▲	WS4	15.4	167.3

ALTR 1-09-4135 SITE4.GPJ 07/07/10

Date July 2010

Project 1-09-4135



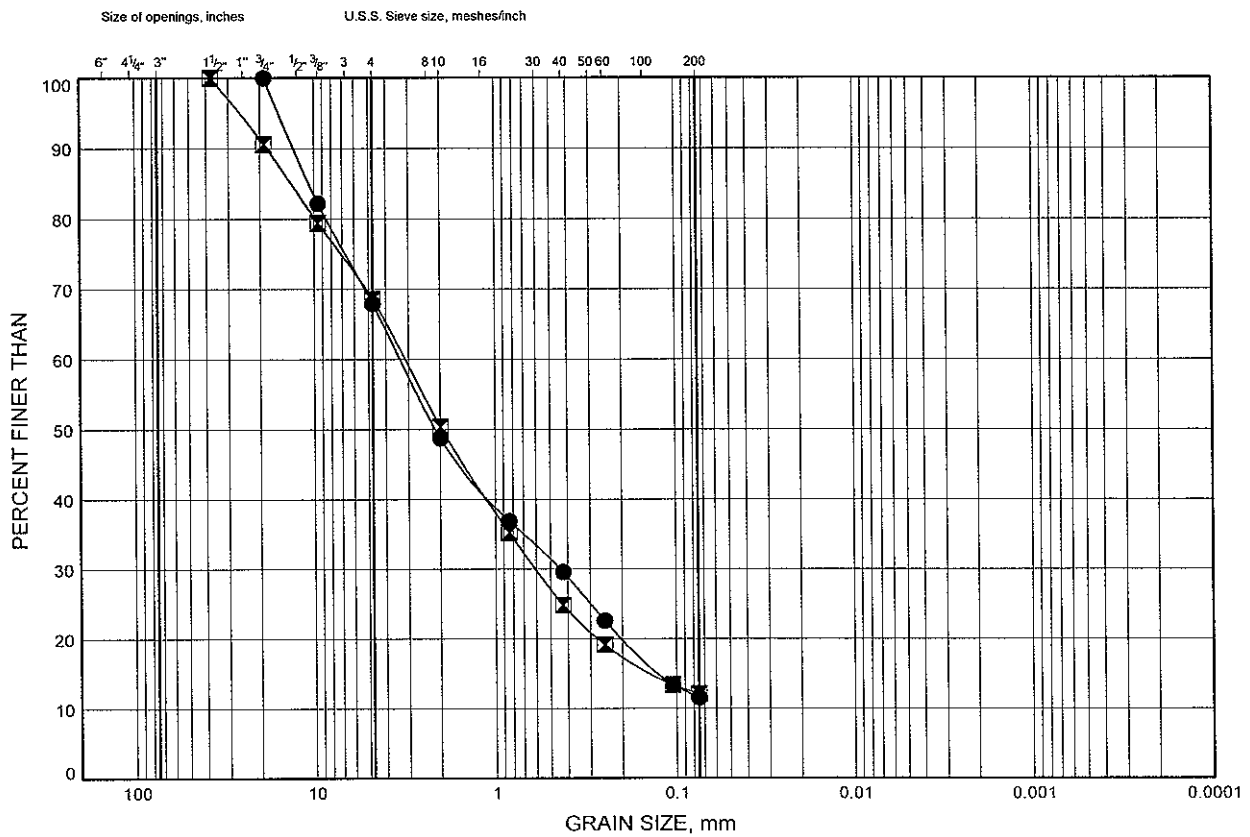
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-83

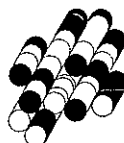
## SAND



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

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TS1	21.4	161.2
⊠	TS2	21.5	161.8

Date July 2010  
Project 1-09-4135

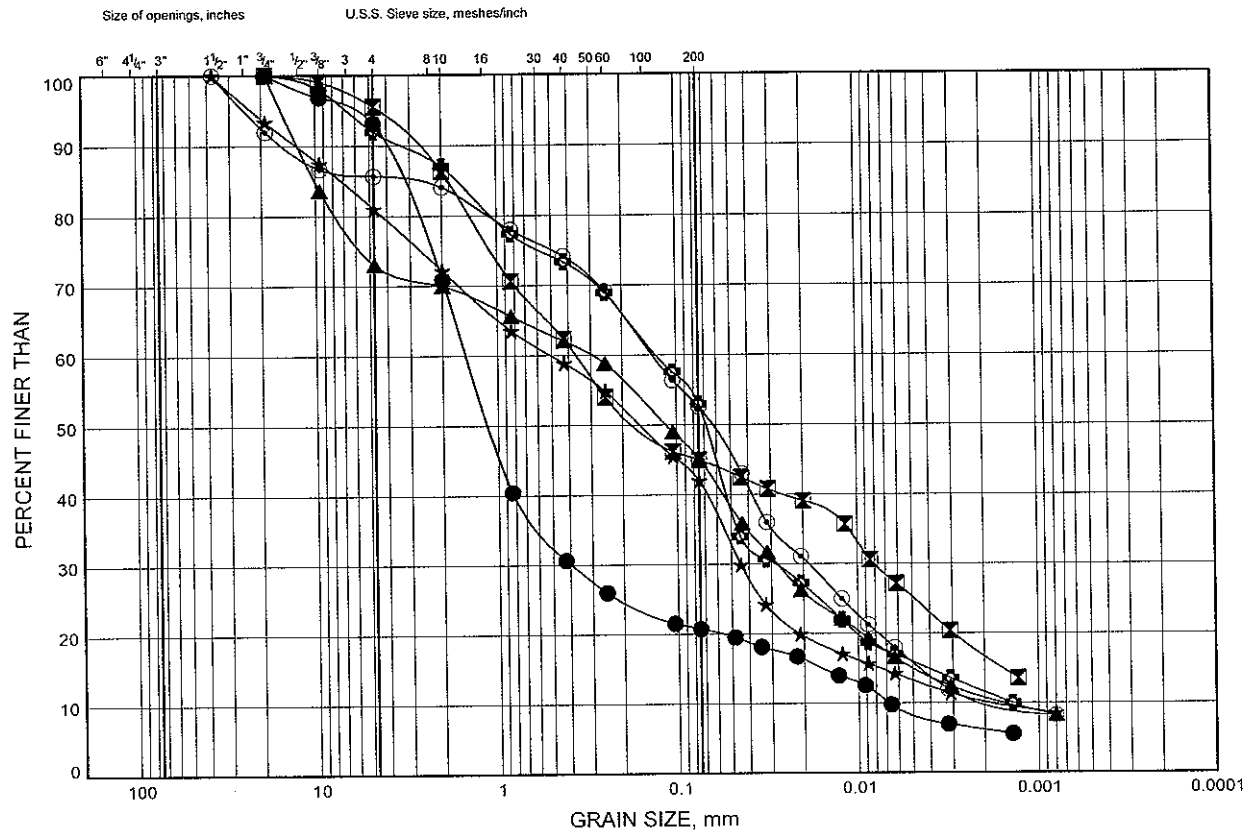


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Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-84

## SANDY SILT TO SILTY SAND TILL



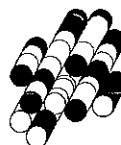
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL BOREHOLE DEPTH (m) ELEVATION (m)

●	TN1	20.0	163.5
⊠	TN1	24.6	158.9
▲	TN4	21.5	162.5
★	TN4	29.2	154.8
⊙	WN1	18.5	164.6
⊛	WN1	24.6	158.5

Date July 2010

Project 1-09-4135



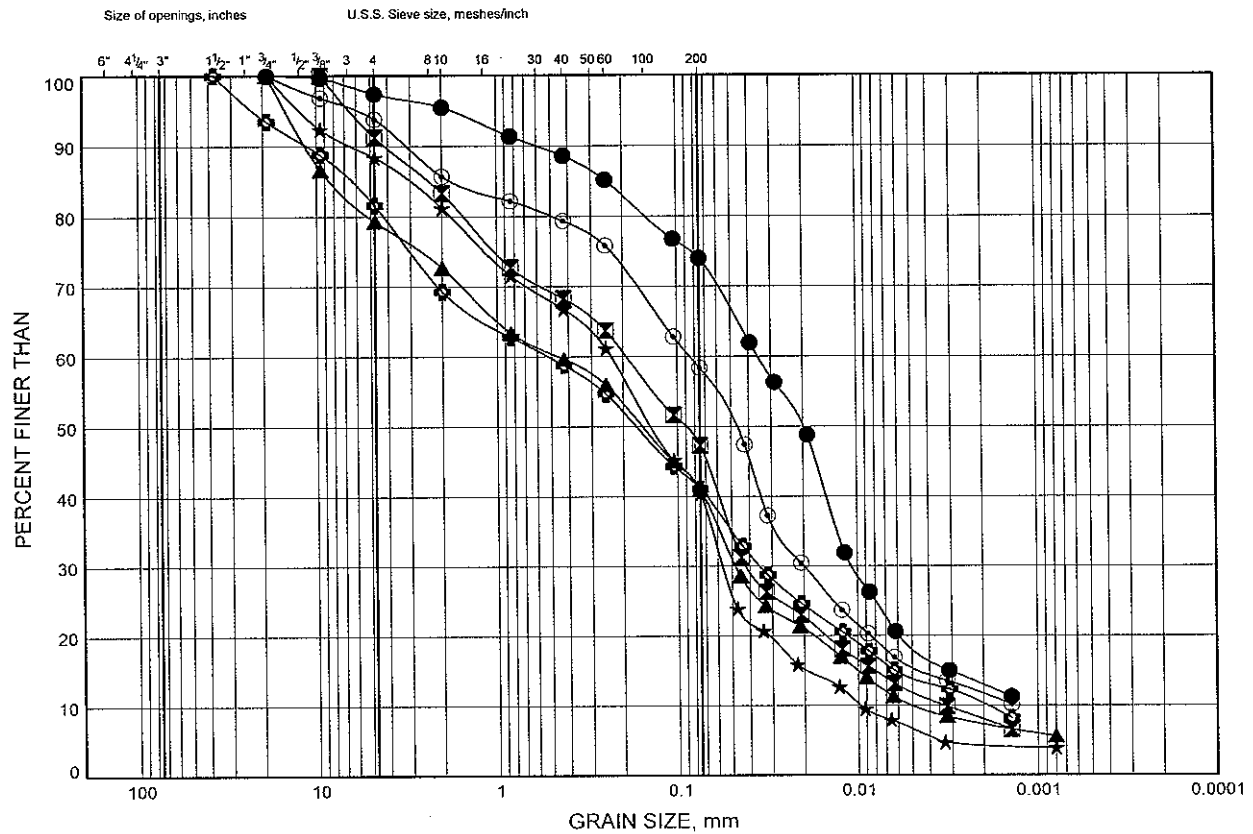
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-85

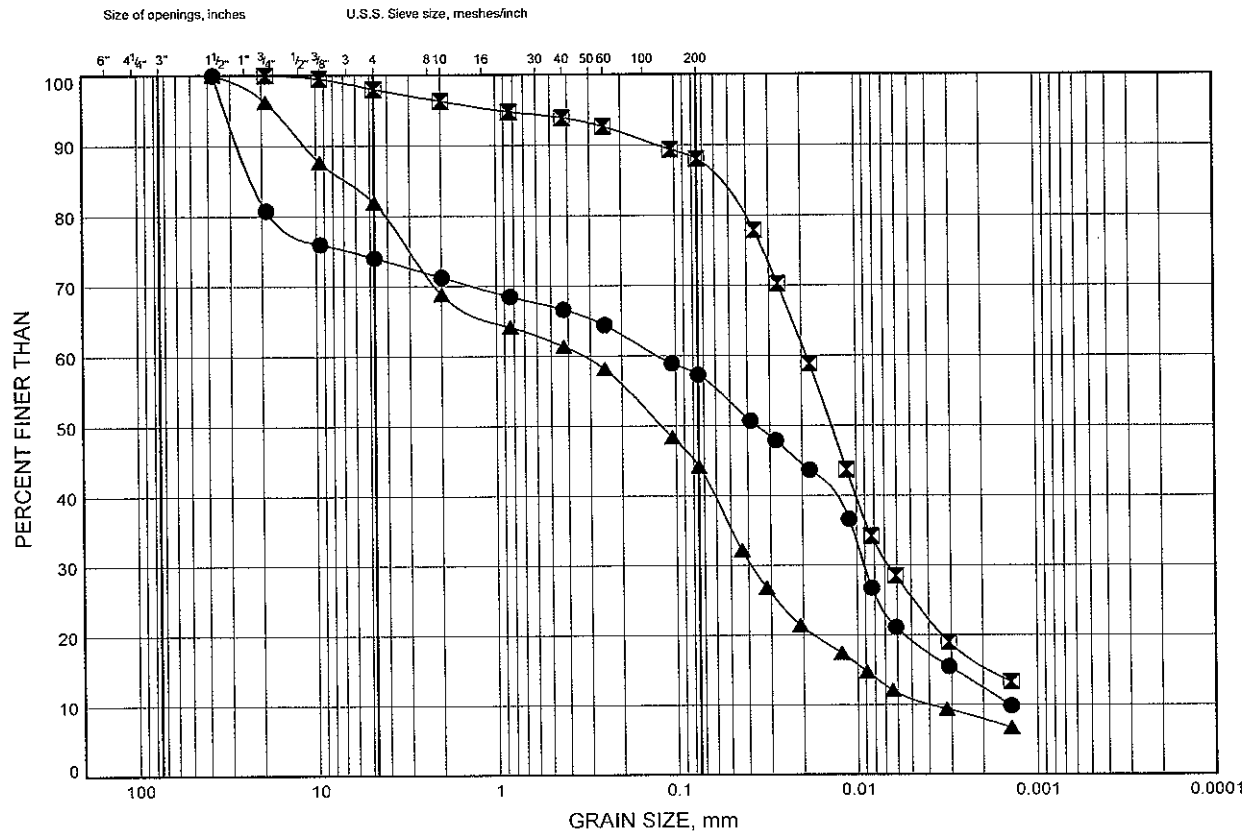
## SANDY SILT TO SILTY SAND TILL



# GRAIN SIZE DISTRIBUTION

FIGURE B4-86

## SANDY SILT TO SILTY SAND TILL



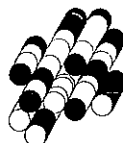
COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL    BOREHOLE    DEPTH (m)    ELEVATION (m)

●	WS2	18.5	164.6
⊠	WS3	18.5	164.5
▲	WS4	23.1	159.6

Date July 2010

Project 1-09-4135



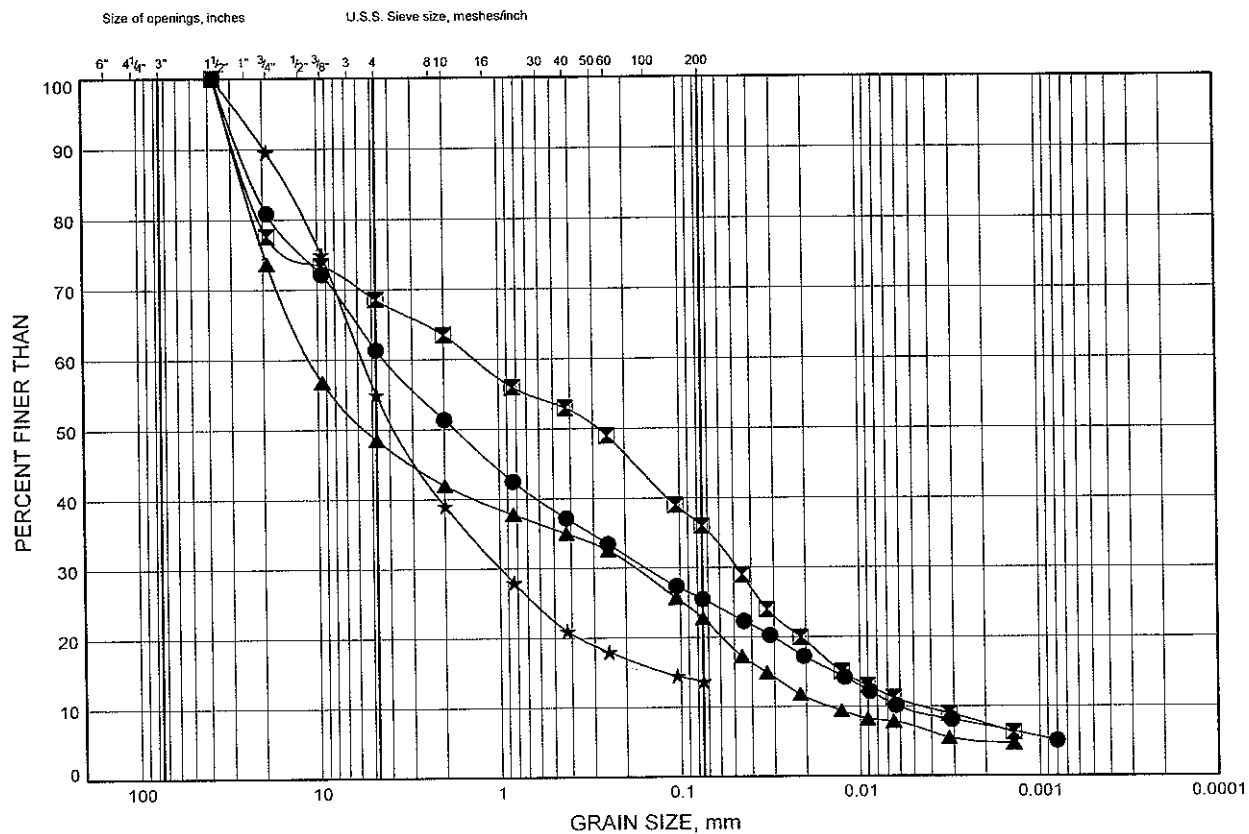
Prep'd DB

Chkd. MP

# GRAIN SIZE DISTRIBUTION

FIGURE B4-87

## SANDY GRAVEL TO SAND AND GRAVEL TILL

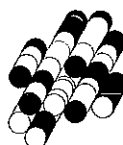


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	TN2	29.2	155.0
⊠	TN3	29.2	154.9
▲	TS3	27.6	154.9
★	TS4	27.5	154.9

Date July 2010

Project 1-09-4135



Prep'd DB

Chkd. MP

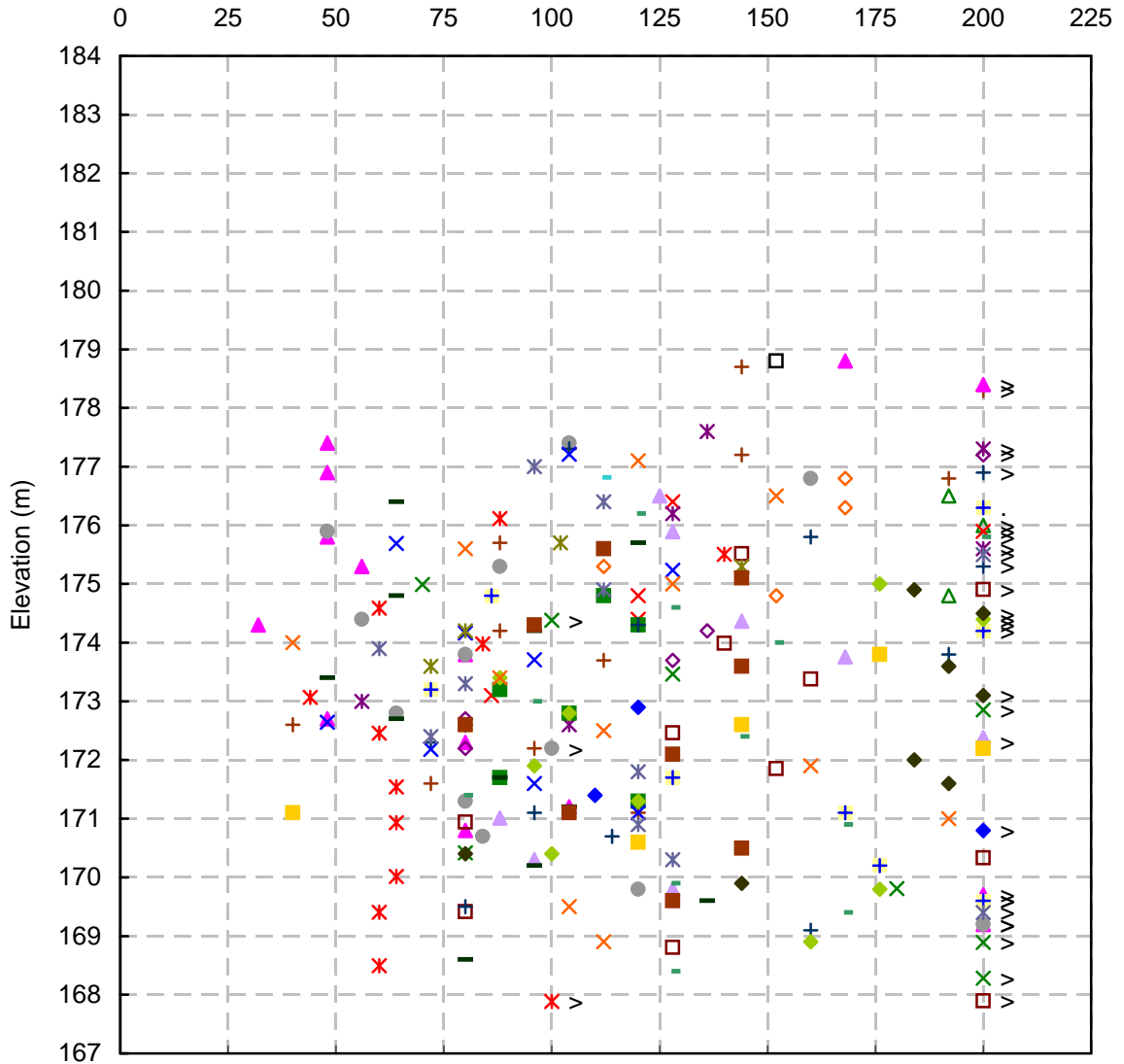
# CORRECTED UNDRAINED SHEAR STRENGTH

FIGURE B4-88

HWY 406 TWINNING - NBL

Silty Clay

Corrected Cu (kPa)



□ NBL 12+075 CL	◇ NBL 12+150 LT	△ NBL 12+150 RT	× NBL 12+225 CL	× NBL 12+300 LT
+ NBL 12+300 RT	■ NBL 12+375 LT	◆ NBL 12+440 RT	△ NBL 12+525 LT	× NBL 12+525 RT
× NBL 12+595 RT	+ NBL 12+645 LT	□ NBL 12+645 RT	△ NBL 12+695 LT	+ NBL 12+750 RT
◇ NBL 12+835 LT	△ NBL 12+835 RT	× NBL 12+910 CL	× NBL 12+985 LT	△ NBL 12+985 RT
◆ TN1	■ TN2	× TN3	× TN4	— WN1
— WN2	◆ WN3	■ WN4		

## Field Shear Vane Correction

Morris & Williams (1994)

( $\mu = 1.18 \text{ EXP}(-0.08 \text{ Ip}) + 0.57$ )

## Applied Correction Factors

0.85 (Elev.>179m)

1.00 (Elev.<179m)

Project No. : 1-09-4135

Date : September, 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA

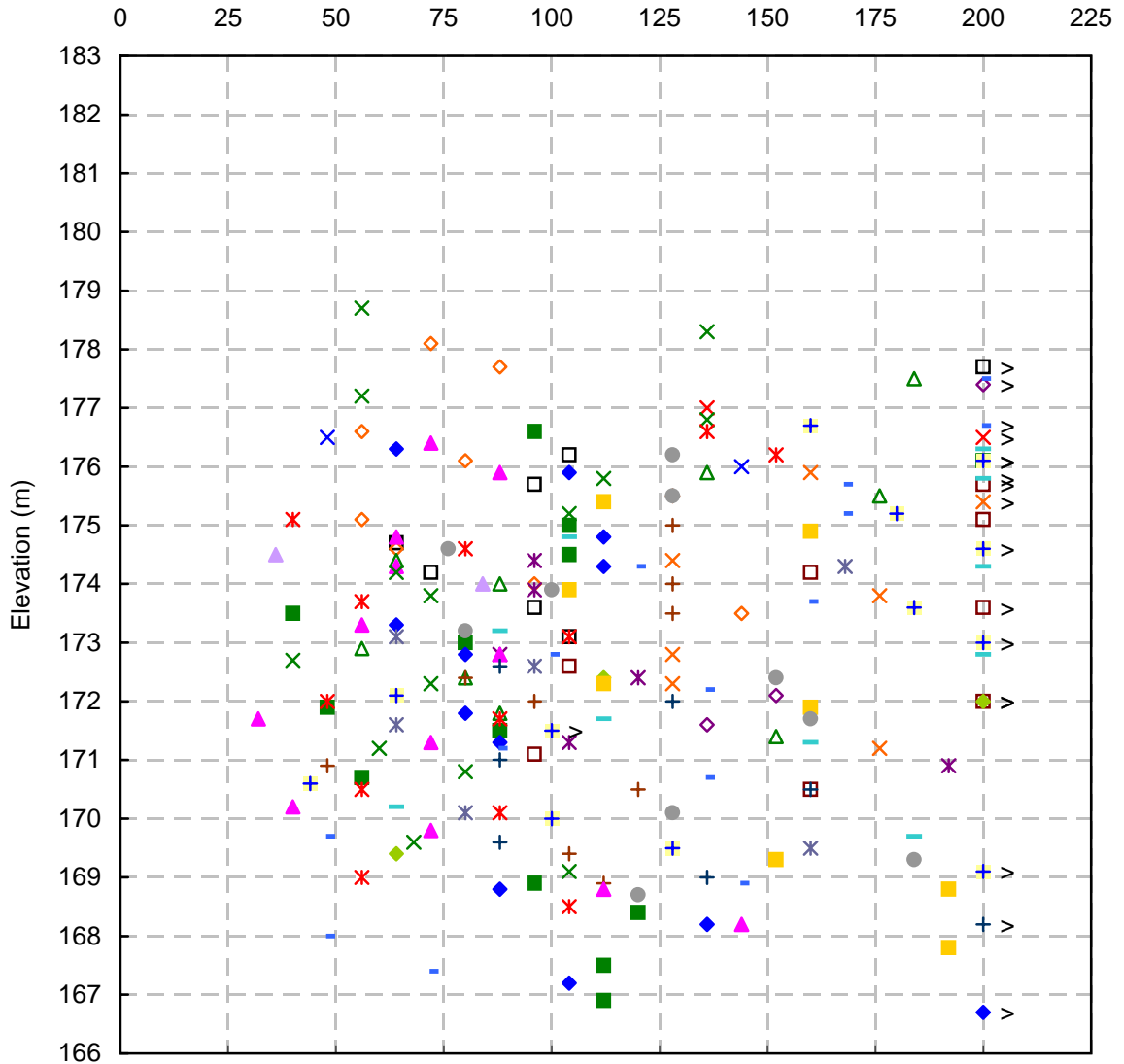
# CORRECTED UNDRAINED SHEAR STRENGTH

FIGURE B4-89

HWY 406 TWINNING - SBL

Silty Clay

Corrected Cu (kPa)



## Field Shear Vane Correction

Morris & Williams (1994)

$$(\mu = 1.18 \text{ EXP}(-0.08 \text{ Ip}) + 0.57)$$

## Applied Correction Factors

0.80 (Elev.>179m)

1.00 (Elev.<179m)

Project No. : 1-09-4135

Date : September, 2010



**Terraprobe Inc.**

Prepared By : HW

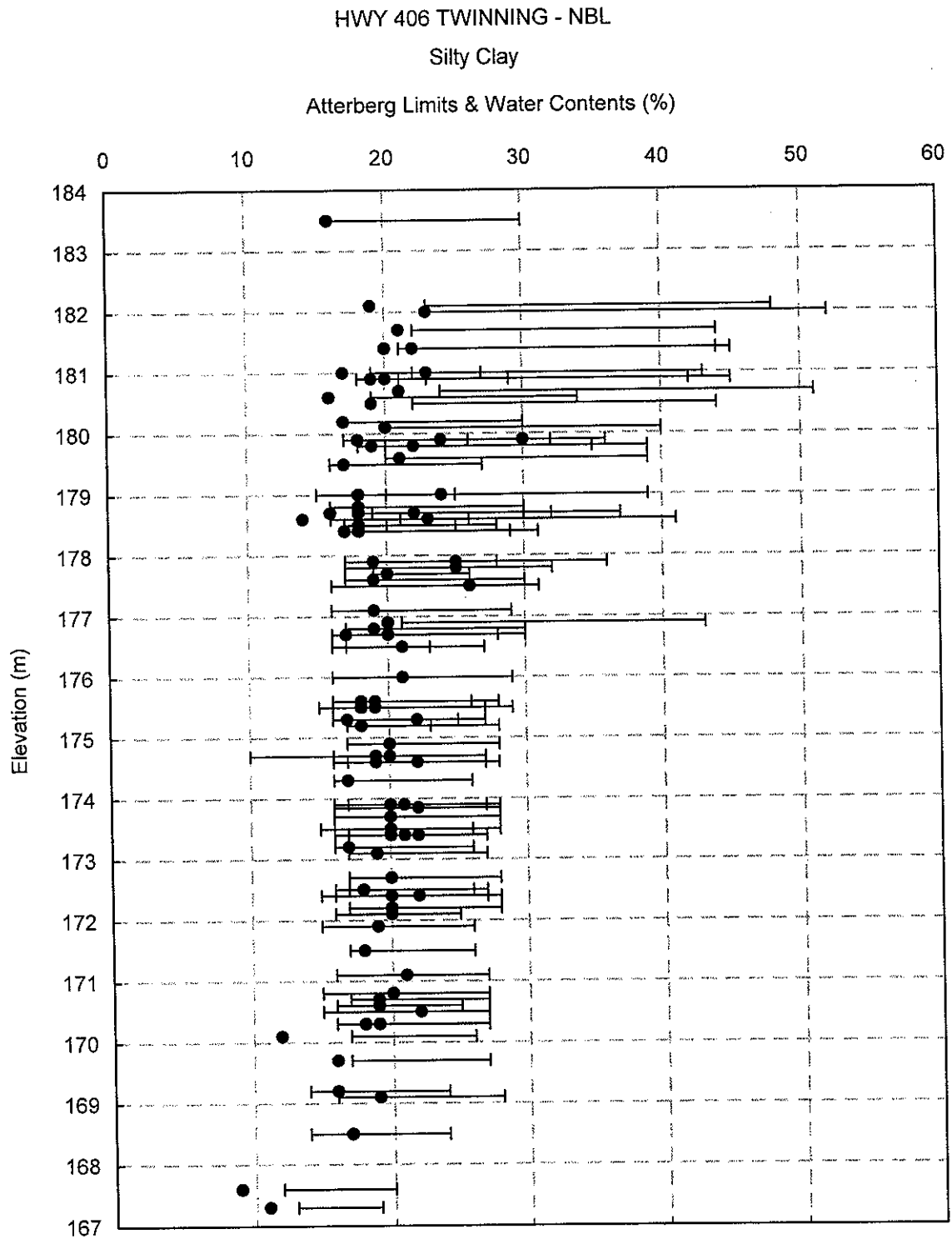
Checked By : RA



# ATTERBERG LIMITS AND WATER CONTENTS

FIGURE B4-90

C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Soil Parameter Estimation-NBL Combined.xls



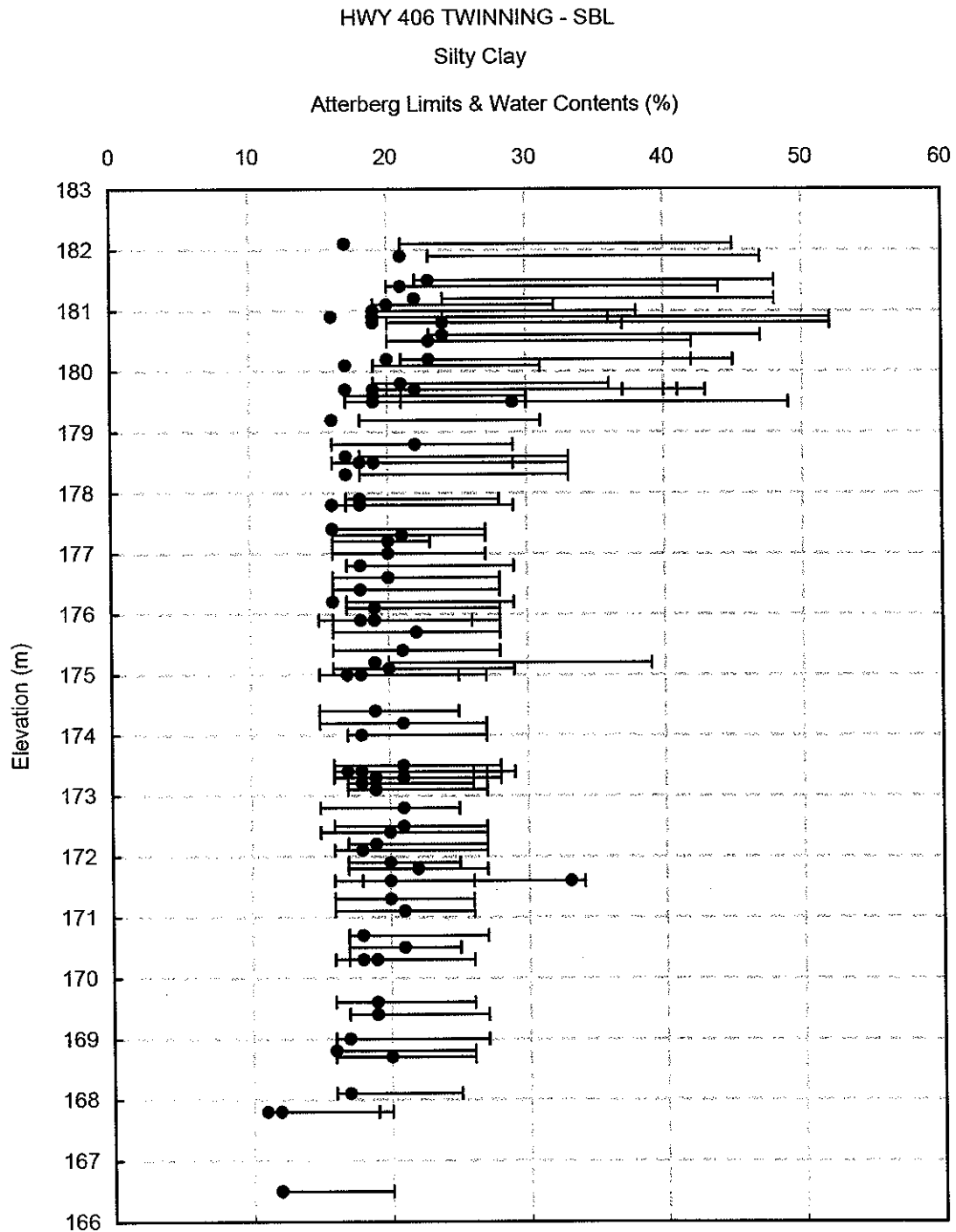
Project No. : 1-09-4135  
Date : July, 2010



Prepared By : HW  
Checked By : RA

# ATTERBERG LIMITS AND WATER CONTENTS

FIGURE B4-91



Project No. : 1-09-4135

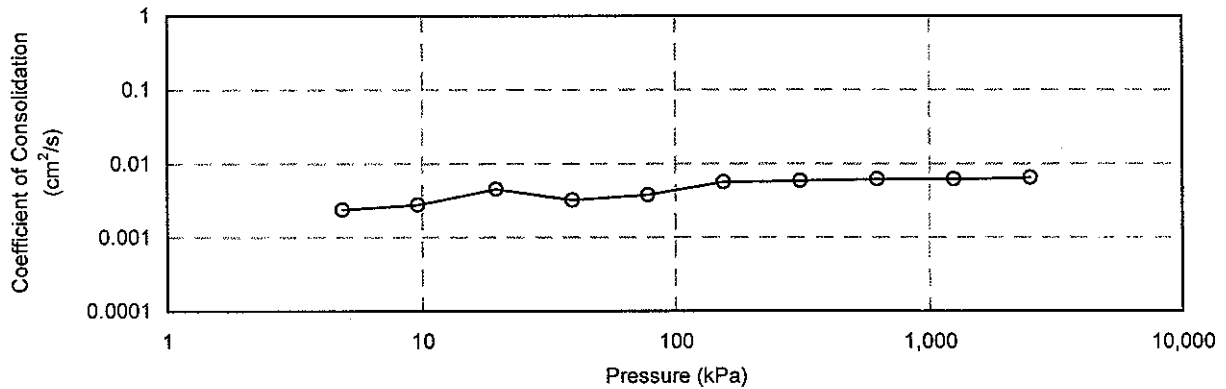
Date : July, 2010



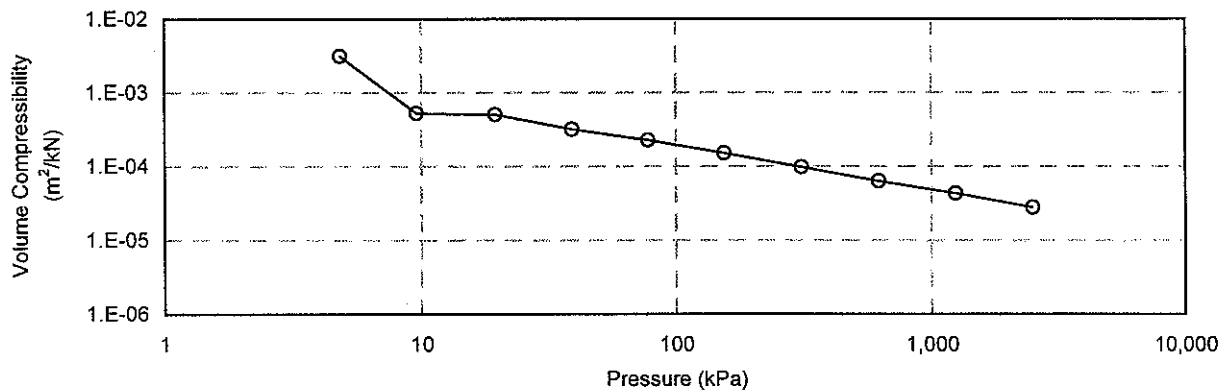
Prepared By : HW

Checked By : RA

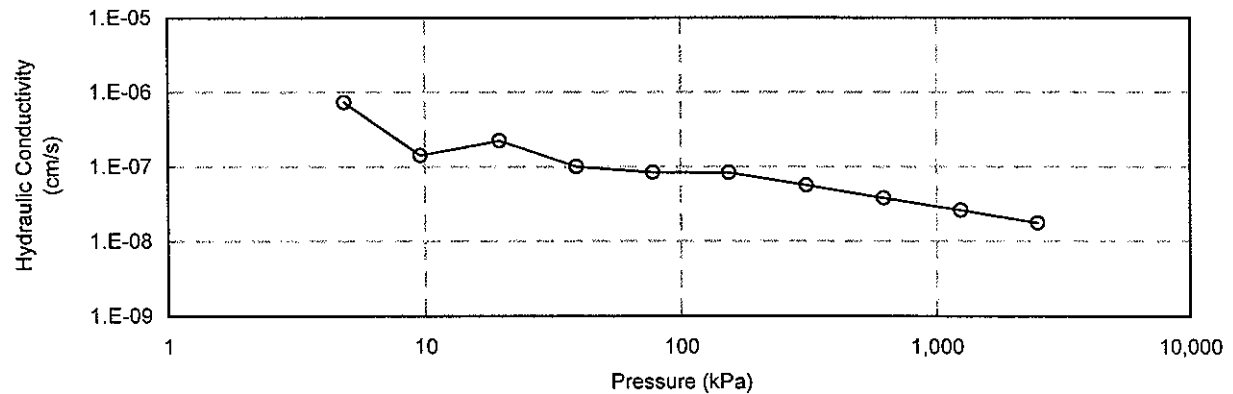
CONSOLIDATION TEST  
Cv vs Pressure  
NBL 12+375 LT, TW9



CONSOLIDATION TEST  
mv vs Pressure  
NBL 12+375 LT, TW9



CONSOLIDATION TEST  
k vs Pressure  
NBL 12+375 LT, TW9



C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Consolidation Results-TN.xls

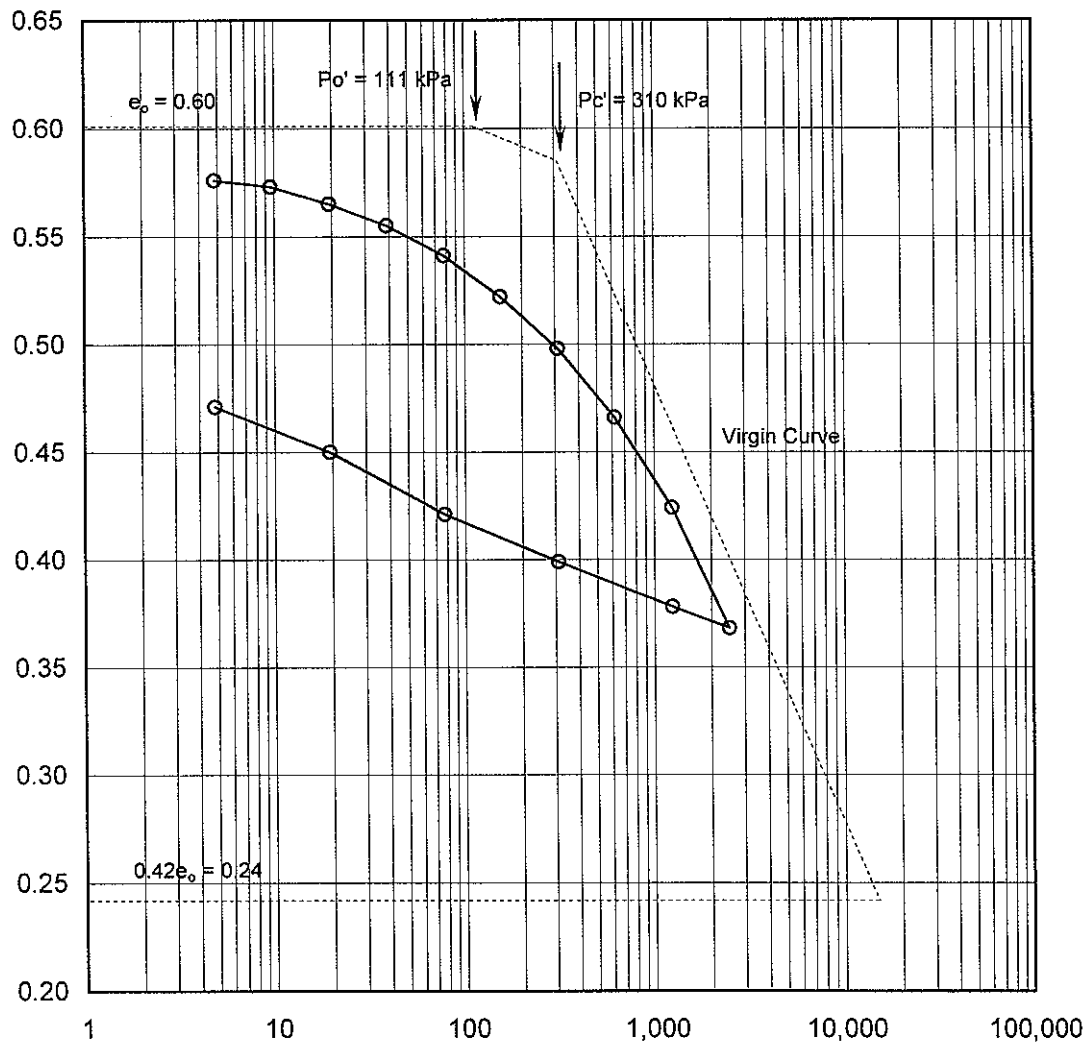
Project No. : 1-09-4135  
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

CONSOLIDATION TEST  
e vs Pressure  
NBL 12+375 LT, TW9



Soil Type : Silty Clay

$e_o =$	0.60	$\omega_L =$	28%	$Po' =$	111 kPa
$\omega =$	21%	$\omega_P =$	16%	$Pc' =$	310 kPa
$\gamma =$	20.6 kN/m <sup>3</sup>	$PI =$	12%	$Cc =$	0.204
$G_s =$	2.77			$Cr =$	0.036

Project No. : 1-09-4135  
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Consolidation Results-TN.xls

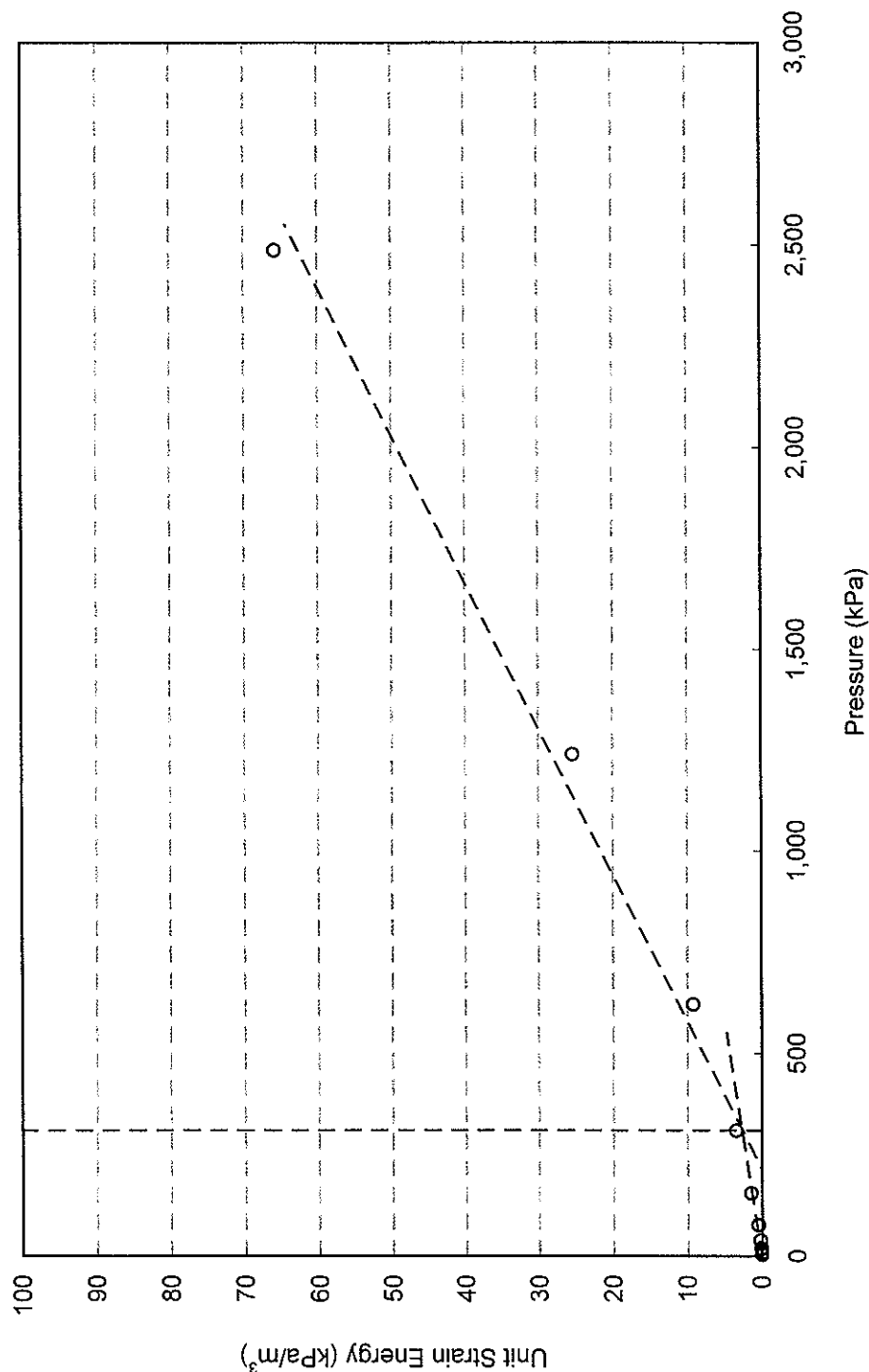
# HWY 406 TWINNING - TRILLIUM RAILWAY NORTH

FIGURE B4-94

## CONSOLIDATION TEST

Unit Strain Energy vs Pressure

NBL 12+375 LT, TW9



$P_c = 310 \text{ kPa}$

Project No. : 1-09-4135

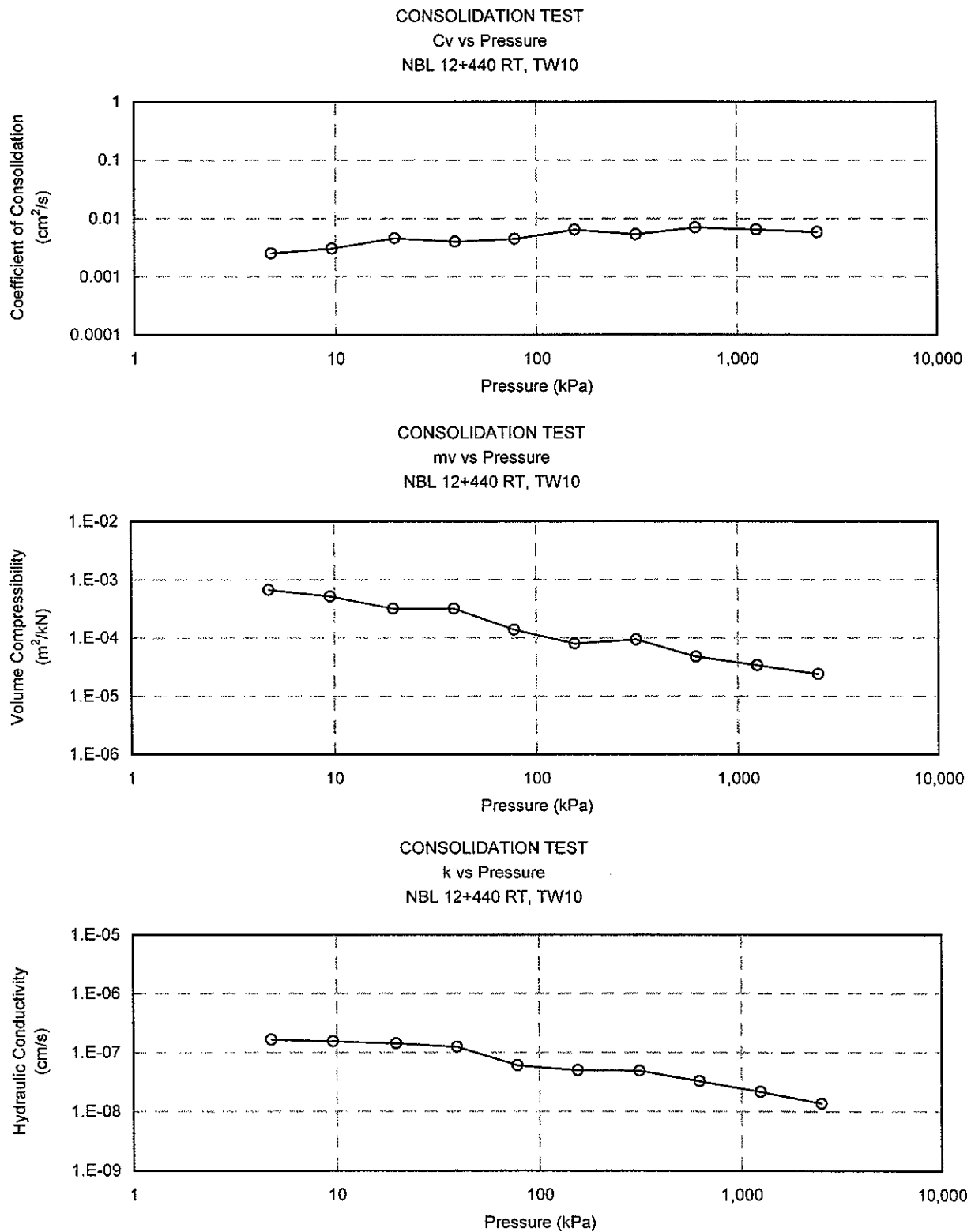
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



Project No. : 1-09-4135  
Date : July 2010



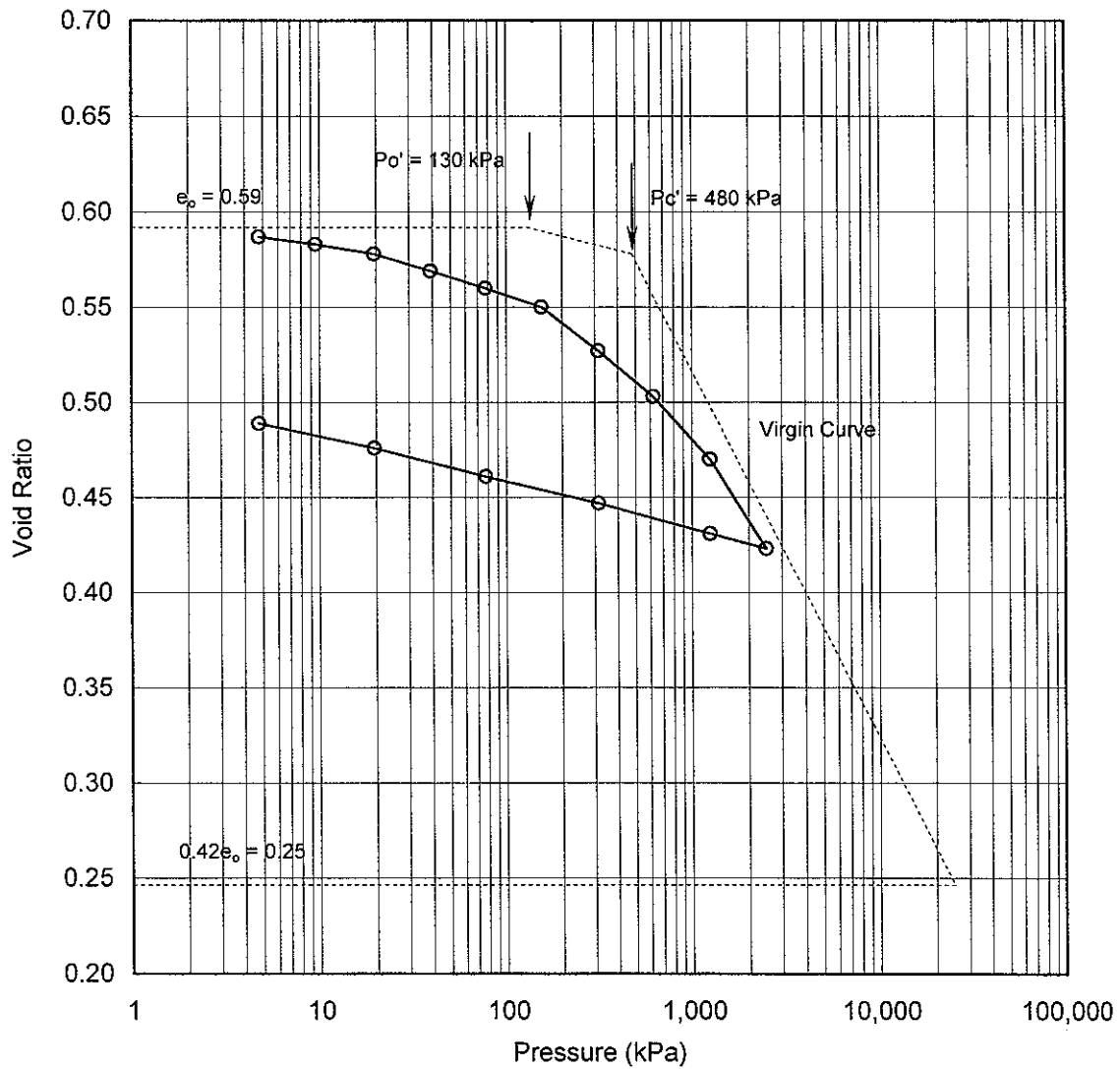
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

## CONSOLIDATION TEST

e vs Pressure

NBL 12+440 RT, TW10



Soil Type : Silty Clay

$e_o =$	0.59	$\omega_L =$	25%	$P_o' =$	130 kPa
$\omega =$	21%	$\omega_p =$	15%	$P_c' =$	480 kPa
$\gamma =$	20.7 kN/m <sup>3</sup>	PI =	10%	Cc =	0.193
Gs =	2.79			Cr =	0.025

Project No. : 1-09-4135

Date : July 2010

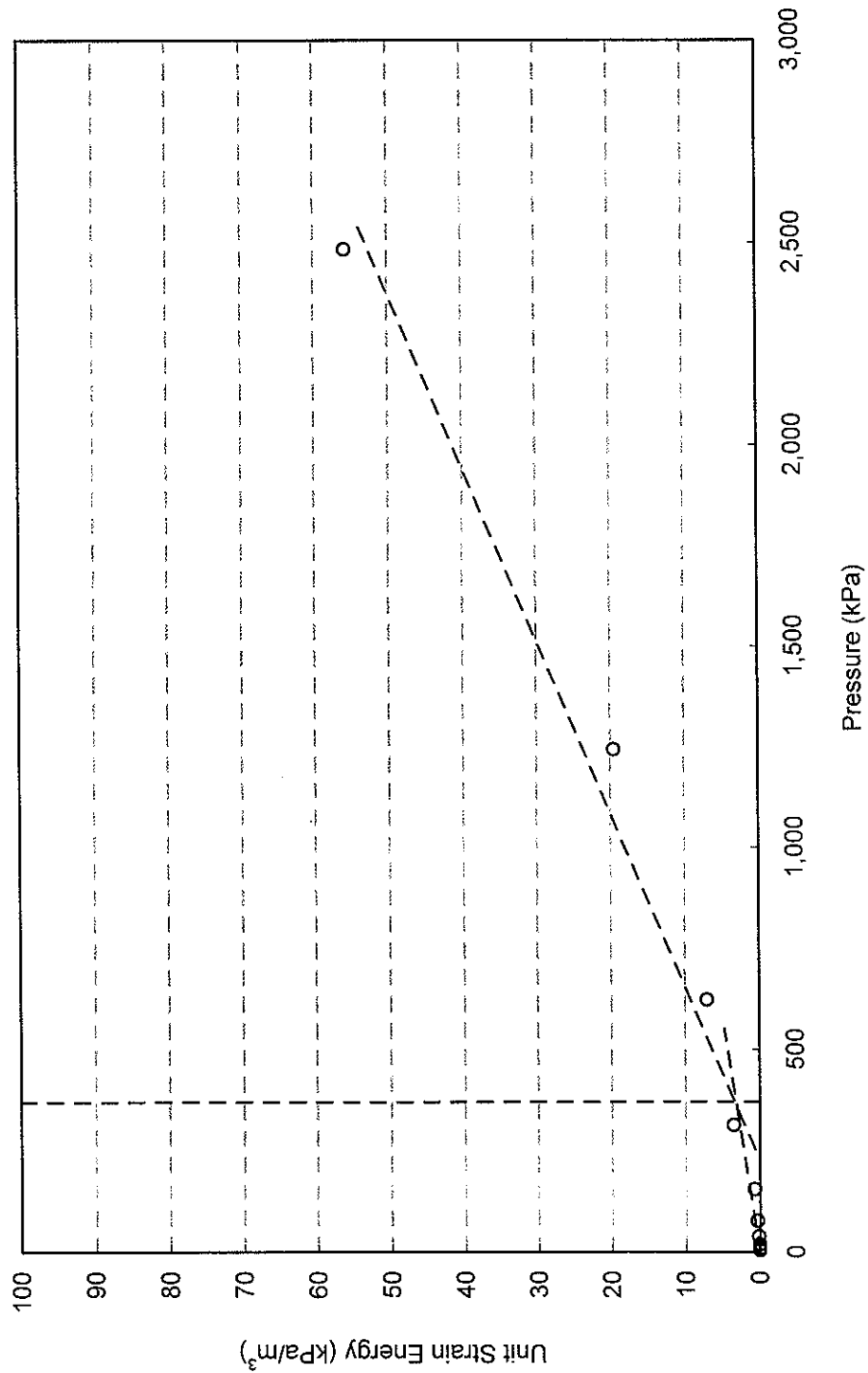


Terraprobe Inc.

Prepared By : HW

Checked By : RA

CONSOLIDATION TEST  
Unit Strain Energy vs Pressure  
NBL 12+440 RT, TW10



Project No. : 1-09-4135

Date : July 2010



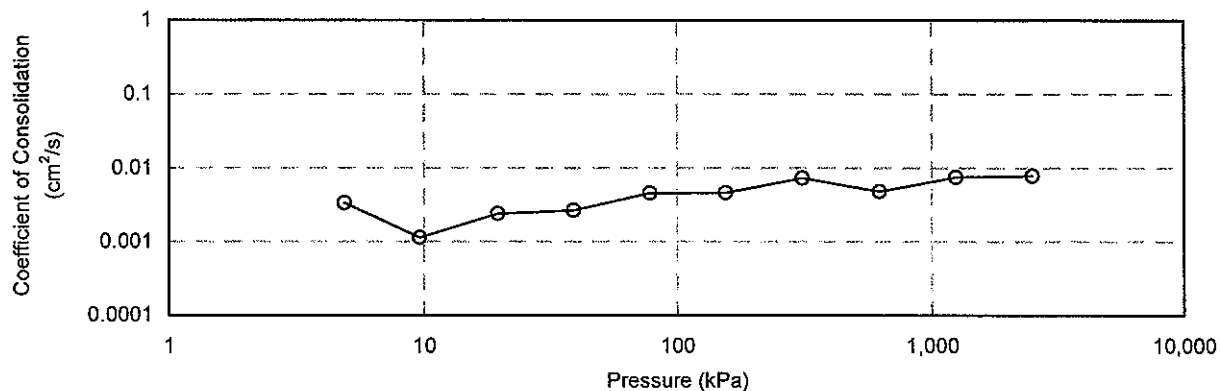
**Terraprobe Inc.**

Prepared By : HW

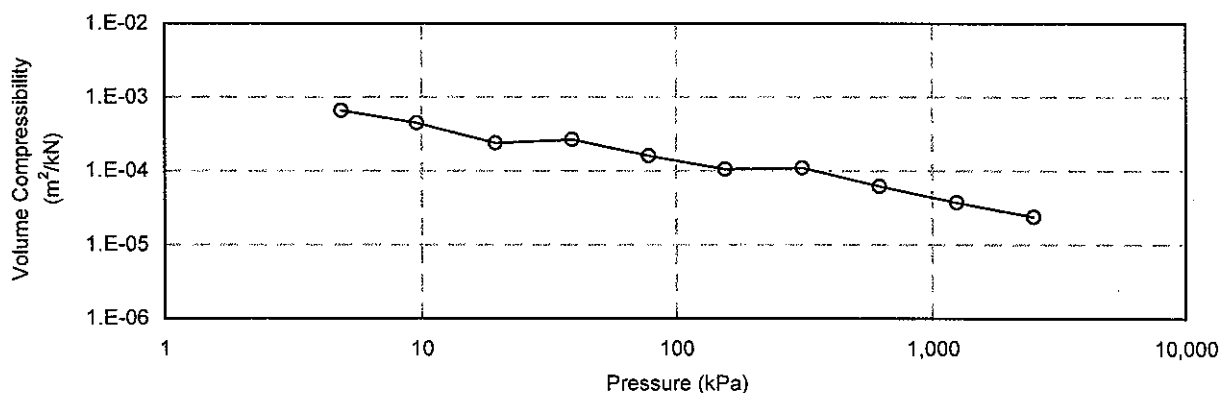
Checked By : RA



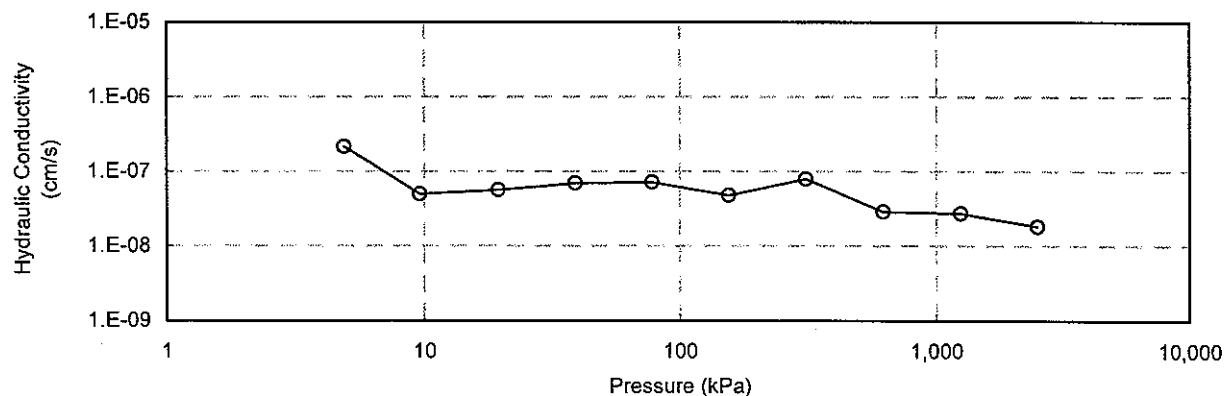
CONSOLIDATION TEST  
Cv vs Pressure  
NBL 12+695 LT, TW11



CONSOLIDATION TEST  
mv vs Pressure  
NBL 12+695 LT, TW11



CONSOLIDATION TEST  
k vs Pressure  
NBL 12+695 LT, TW11



Project No. : 1-09-4135  
Date : July 2010



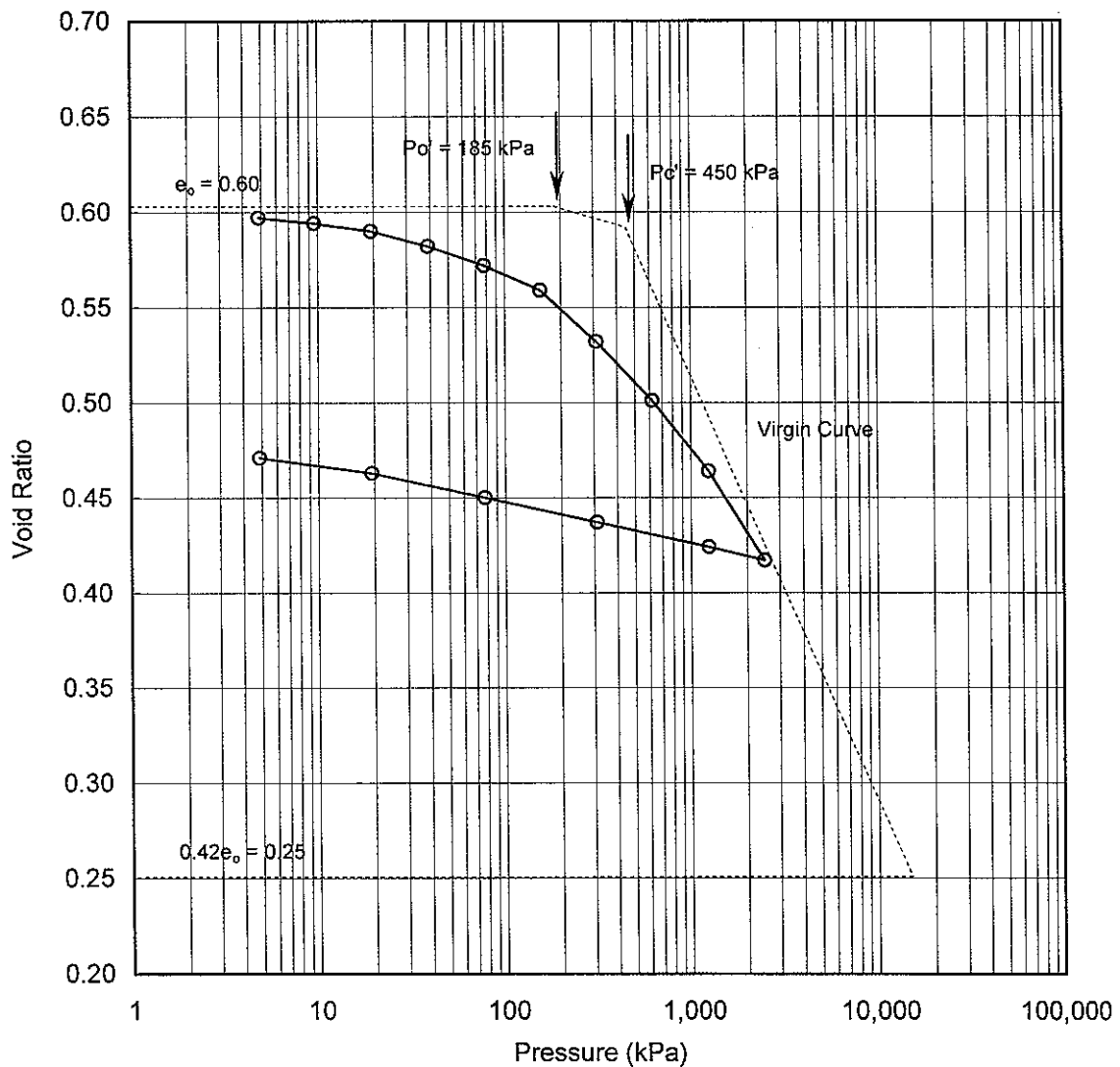
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

## CONSOLIDATION TEST

e vs Pressure

NBL 12+695 LT, TW11



Soil Type : Silty Clay

$e_o =$	0.60	$\omega_L =$	25%	$P_o' =$	185 kPa
$\omega =$	22%	$\omega_P =$	15%	$P_c' =$	450 kPa
$\gamma =$	20.6 kN/m <sup>3</sup>	PI =	10%	Cc =	0.224
Gs =	2.76			Cr =	0.028

Project No. : 1-09-4135  
Date : September 2010



Terraprobe Inc.

Prepared By : HW  
Checked By : RA

C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Consolidation Results-WN.xls

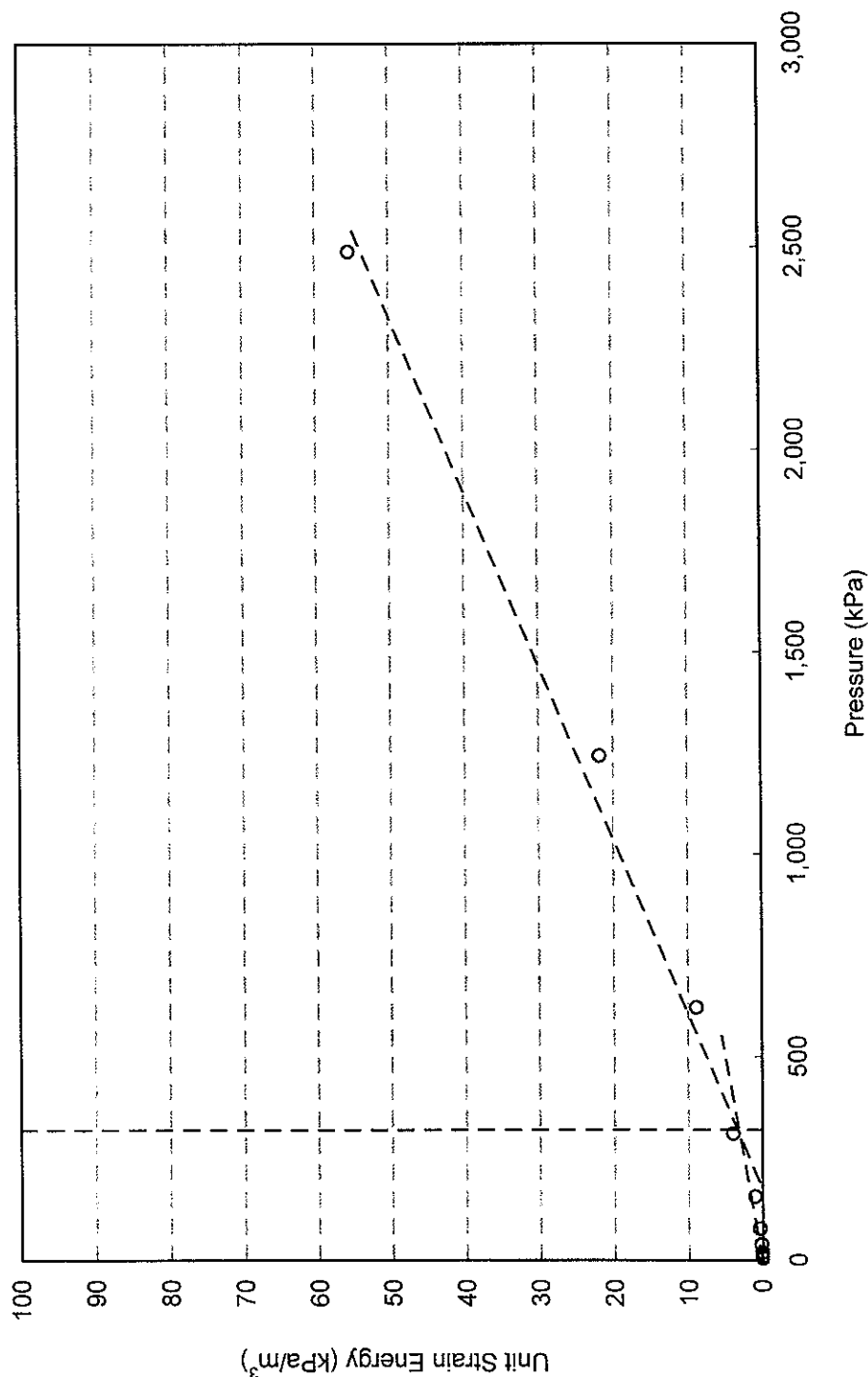
# HWY 406 TWINNING - WOODLAWN OVERPASS (NBL)

FIGURE B4-100

## CONSOLIDATION TEST

Unit Strain Energy vs Pressure

NBL 12+695 LT, TW11



Project No. : 1-09-4135

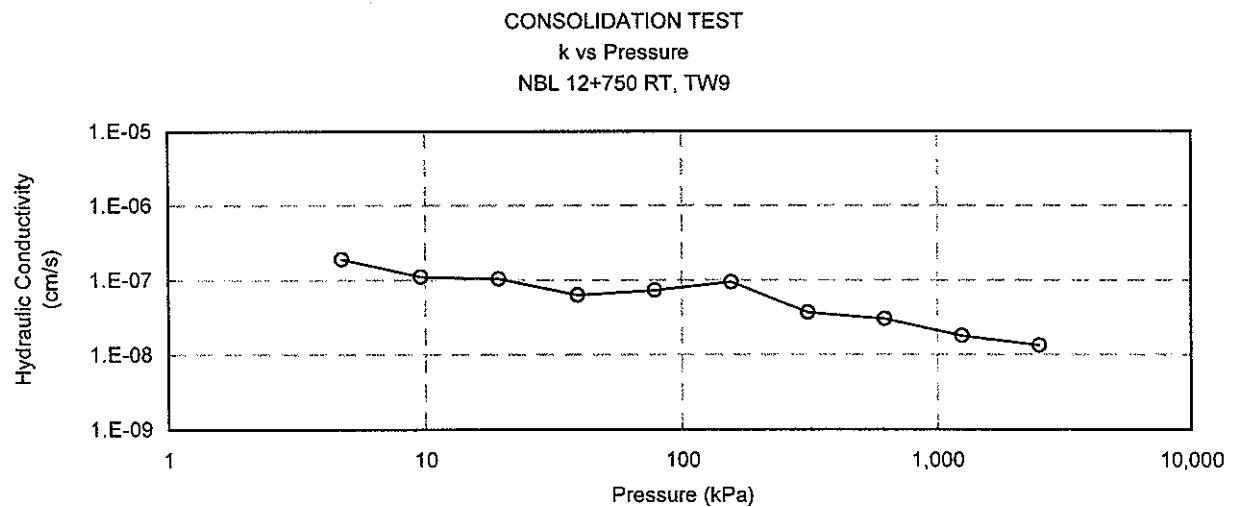
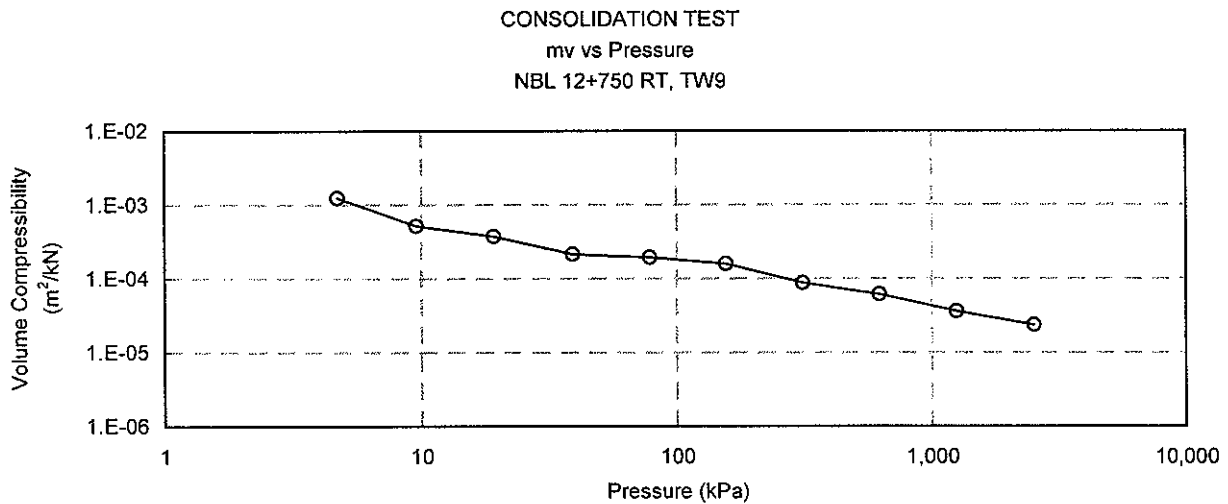
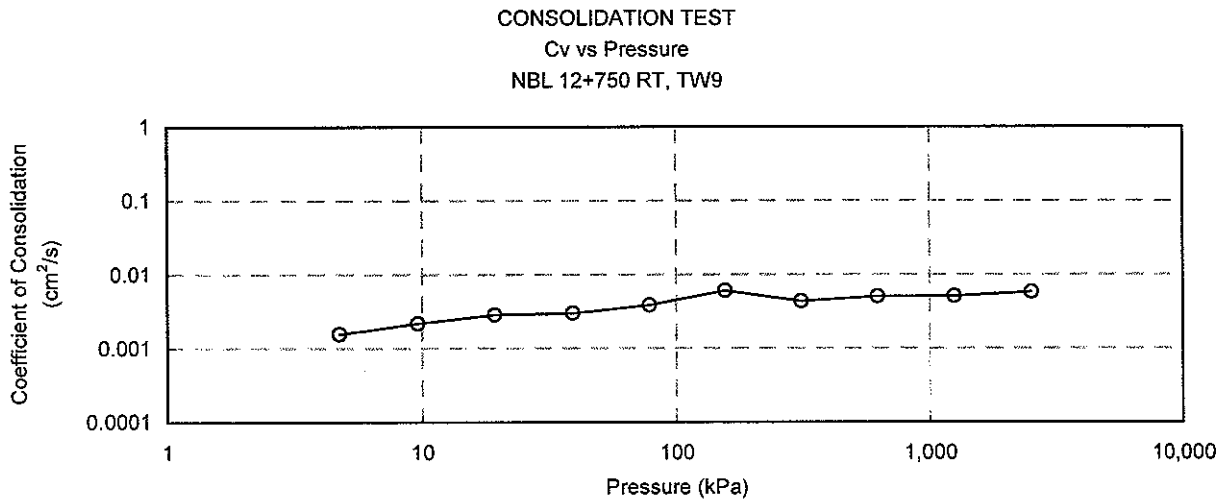
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Consolidation Results-WNL.xls

Project No. : 1-09-4135  
Date : July 2010



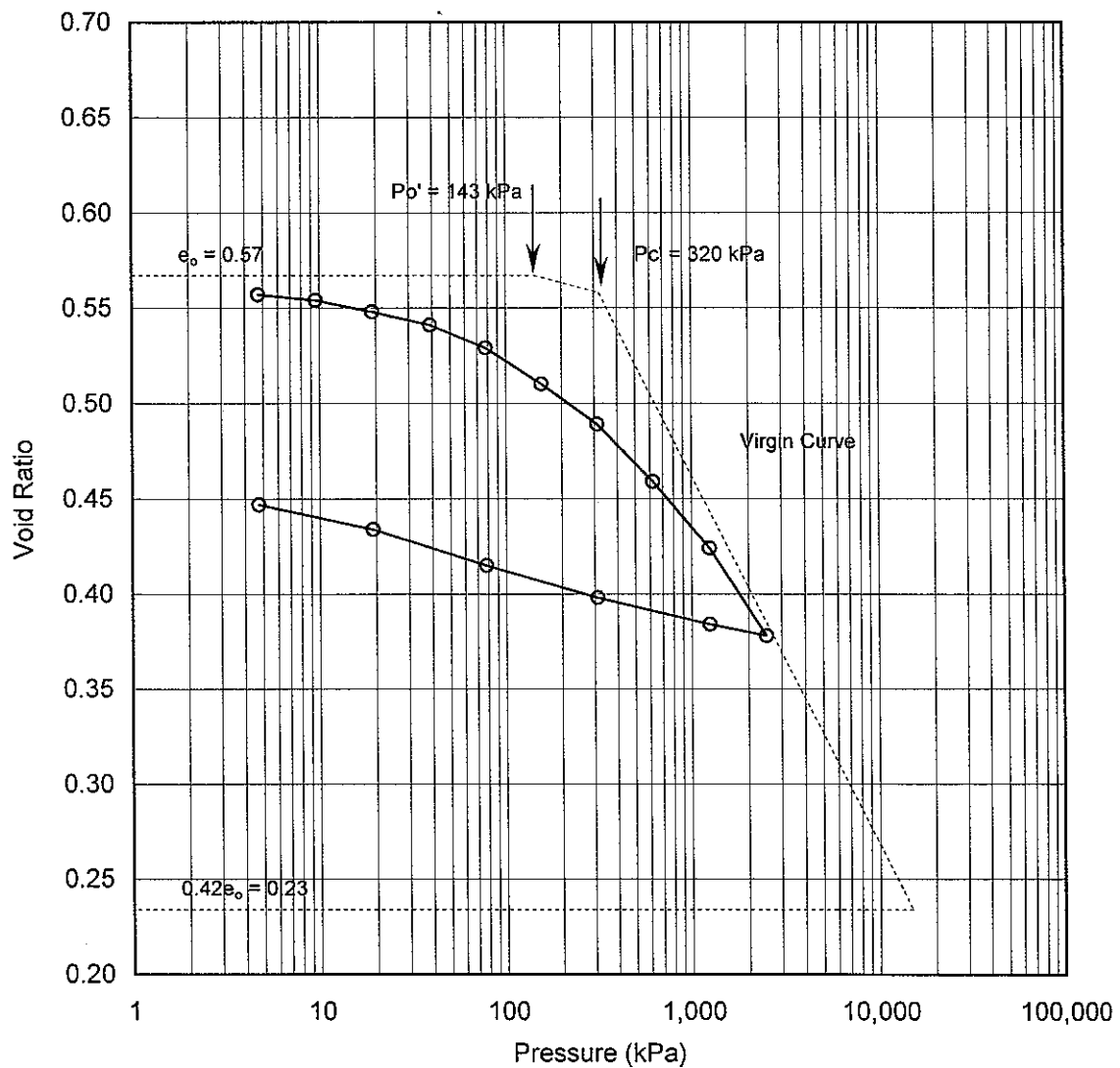
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

## CONSOLIDATION TEST

e vs Pressure

NBL 12+750 RT, TW9



Soil Type : Silty Clay

$e_o =$	0.57	$\omega_L =$	27%	$P_o' =$	143 kPa
$\omega =$	21%	$\omega_P =$	17%	$P_c' =$	320 kPa
$\gamma =$	20.8 kN/m <sup>3</sup>	PI =	10%	Cc =	0.194
Gs =	2.74			Cr =	0.026

Project No. : 1-09-4135  
 Date : September 2010



Terraprobe Inc.

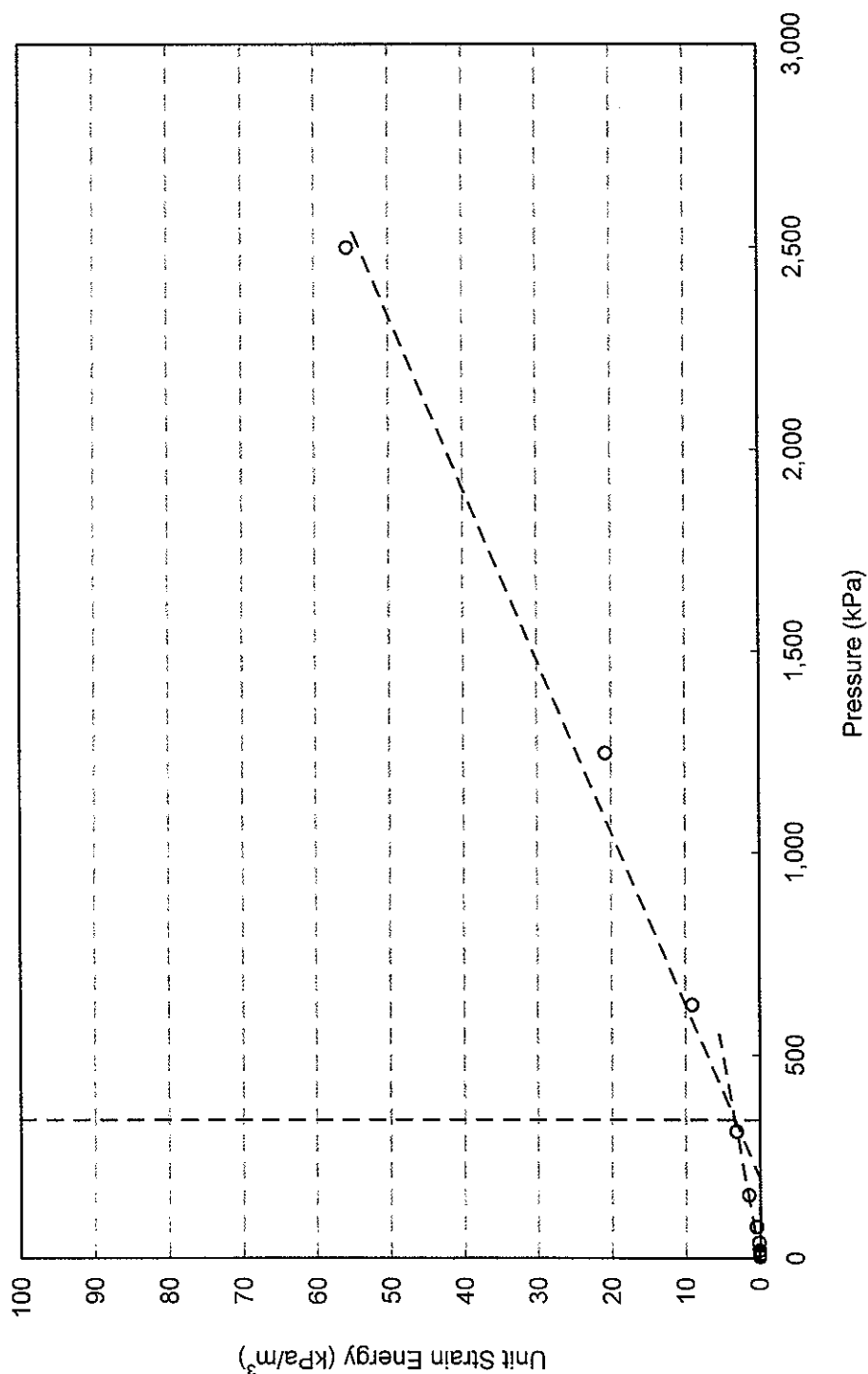
Prepared By : HW  
 Checked By : RA

C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Consolidation Results-WN.xls

# HWY 406 TWINNING - WOODLAWN OVERPASS (NBL)

FIGURE B4-103

## CONSOLIDATION TEST Unit Strain Energy vs Pressure NBL 12+750 RT, TW9



Project No. : 1-09-4135

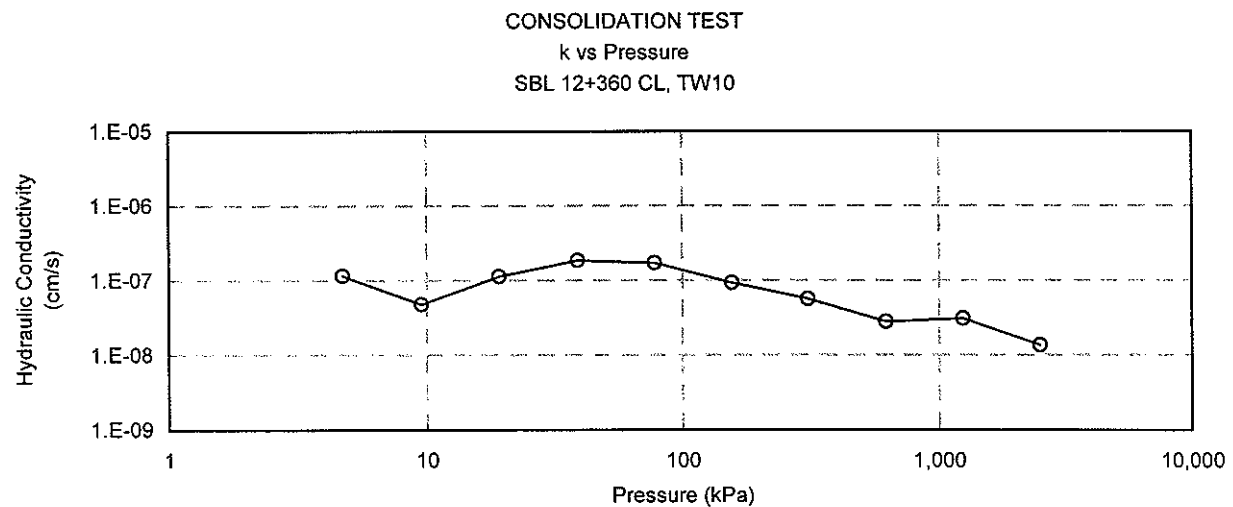
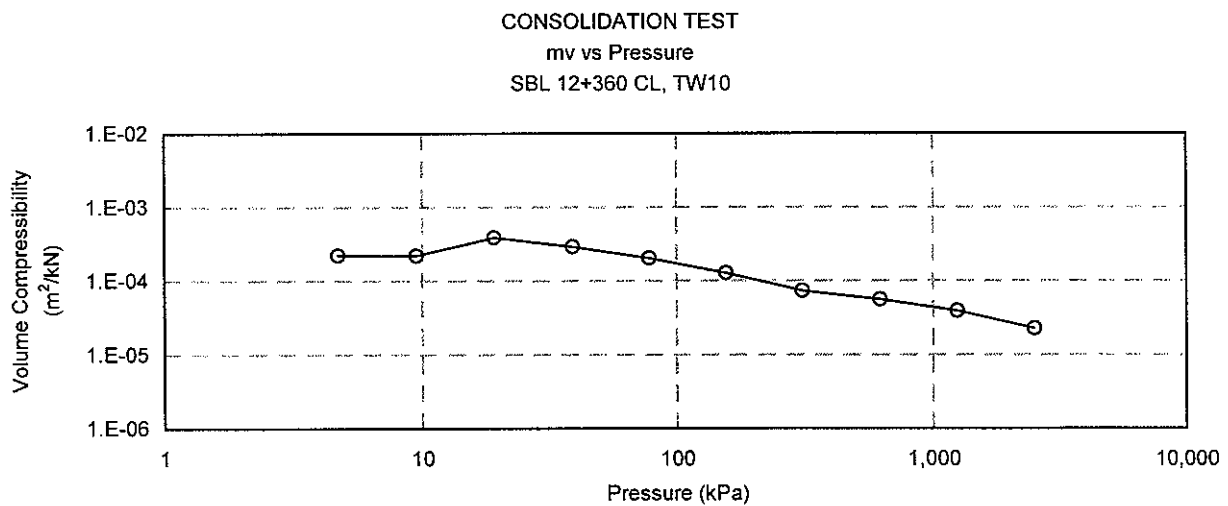
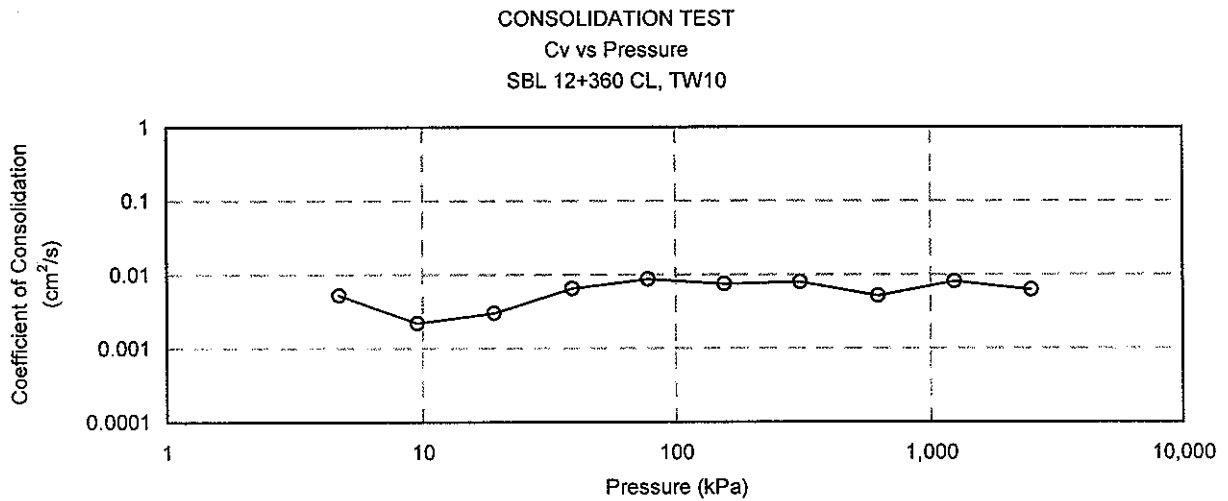
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



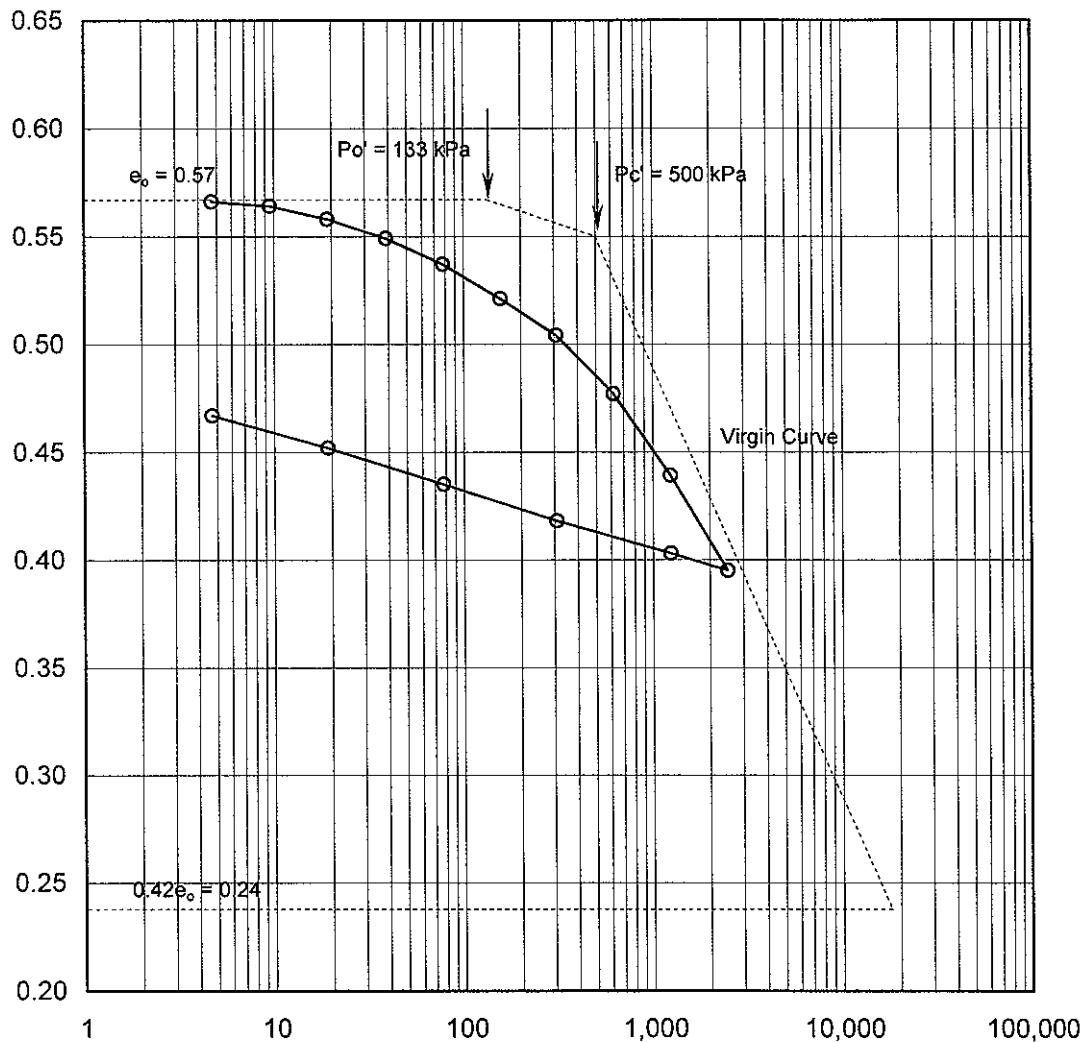
Project No. : 1-09-4135  
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

CONSOLIDATION TEST  
e vs Pressure  
SBL 12+360 CL, TW10



Soil Type : Silty Clay

$e_o =$	0.57	$\omega_L =$	25%	$P_o' =$	133 kPa
$\omega =$	21%	$\omega_p =$	17%	$P_c' =$	500 kPa
$\gamma =$	20.7 kN/m <sup>3</sup>	$Pl =$	8%	$C_c =$	0.201
$G_s =$	2.74			$Cr =$	0.030

Project No. : 1-09-4135  
Date : July 2010

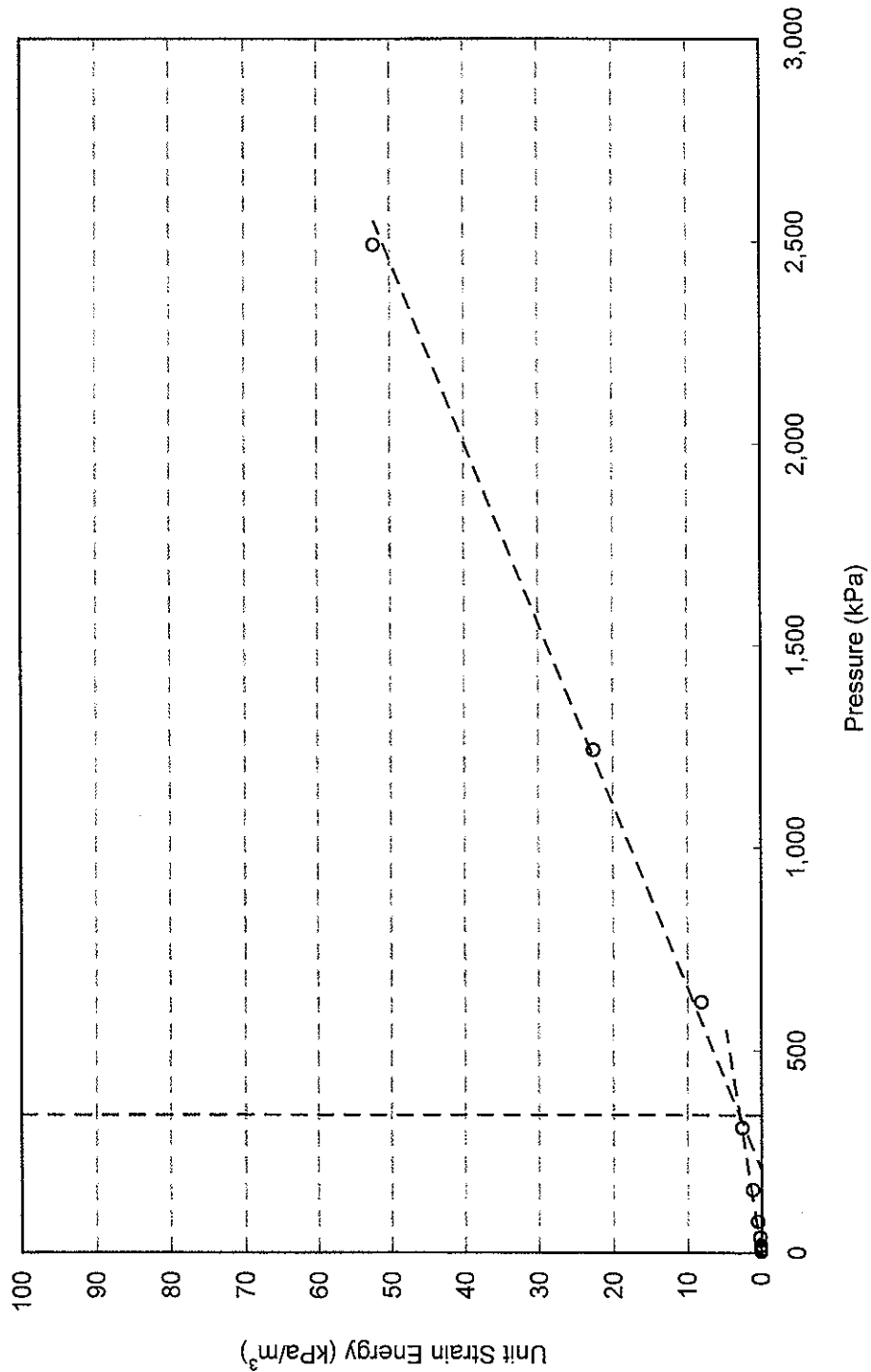


**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA



CONSOLIDATION TEST  
Unit Strain Energy vs Pressure  
SBL 12+360 CL, TW10



Project No. : 1-09-4135

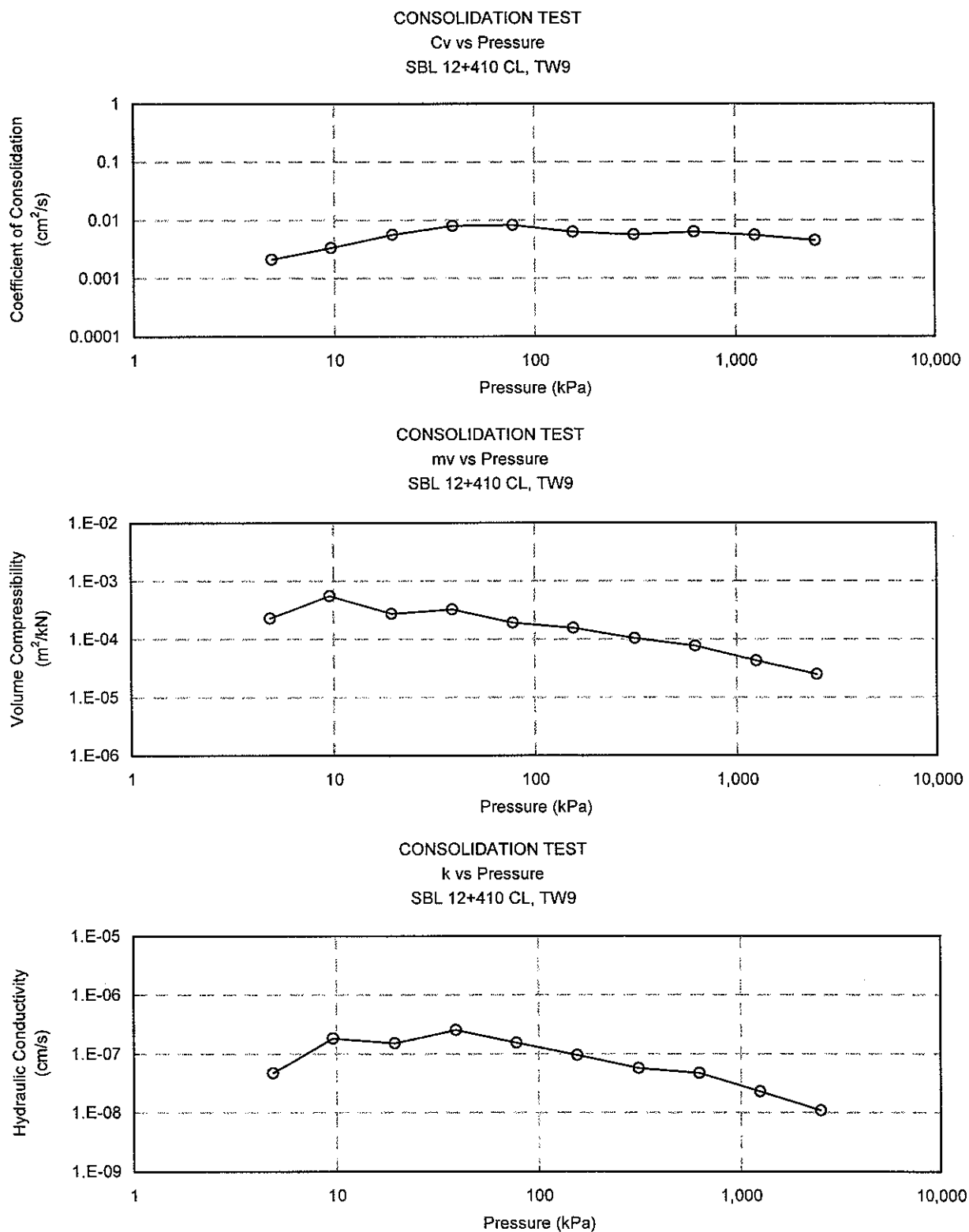
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW

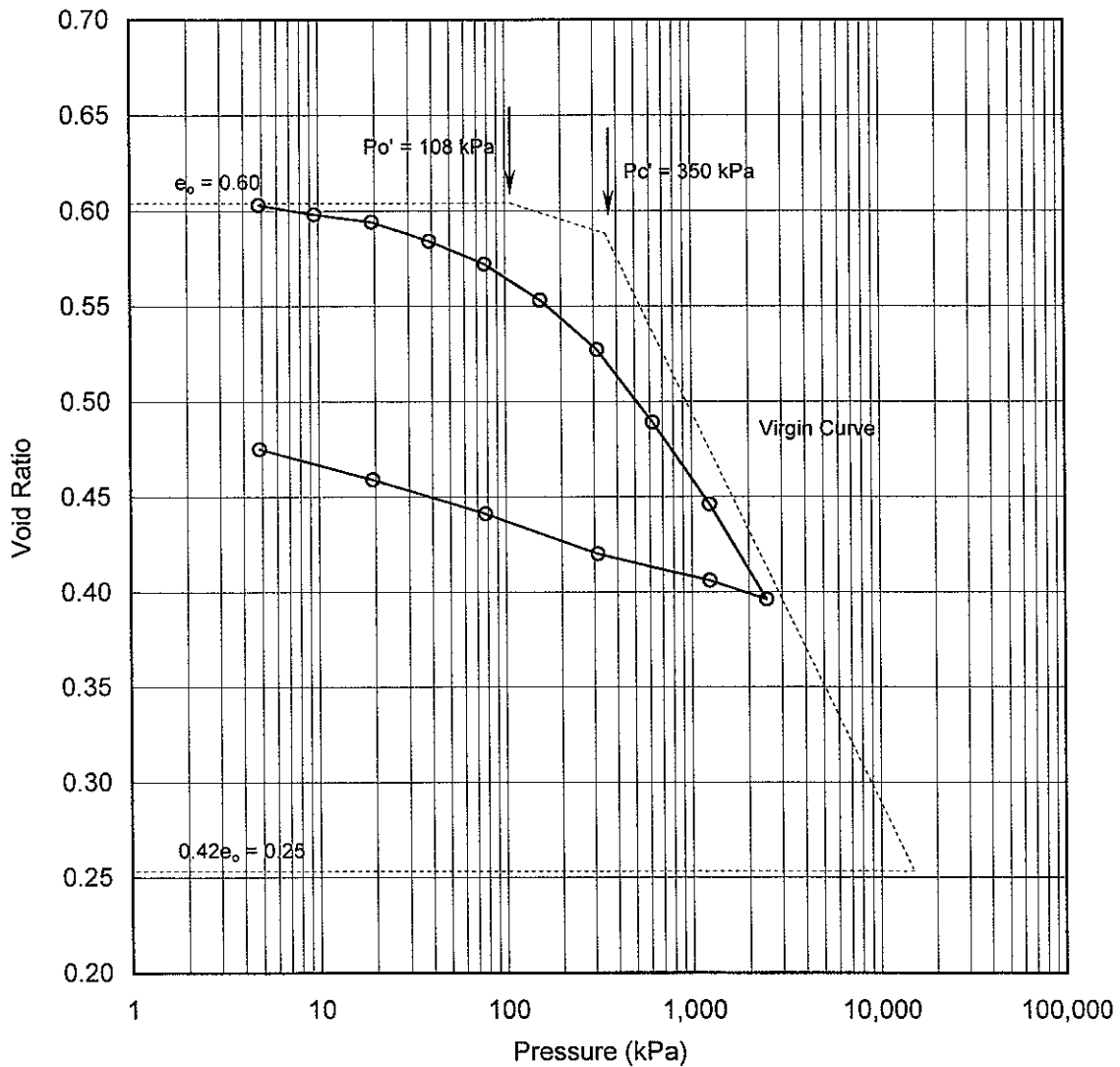
Checked By : RA



## CONSOLIDATION TEST

e vs Pressure

SBL 12+410 CL, TW9



Soil Type : Silty Clay

$e_o =$	0.60	$\omega_L =$	26%	$P_o' =$	108 kPa
$\omega =$	21%	$\omega_P =$	17%	$P_c' =$	350 kPa
$\gamma =$	20.4 kN/m <sup>3</sup>	PI =	9%	Cc =	0.205
Gs =	2.76			Cr =	0.031

Project No. : 1-09-4135

Date : July 2010

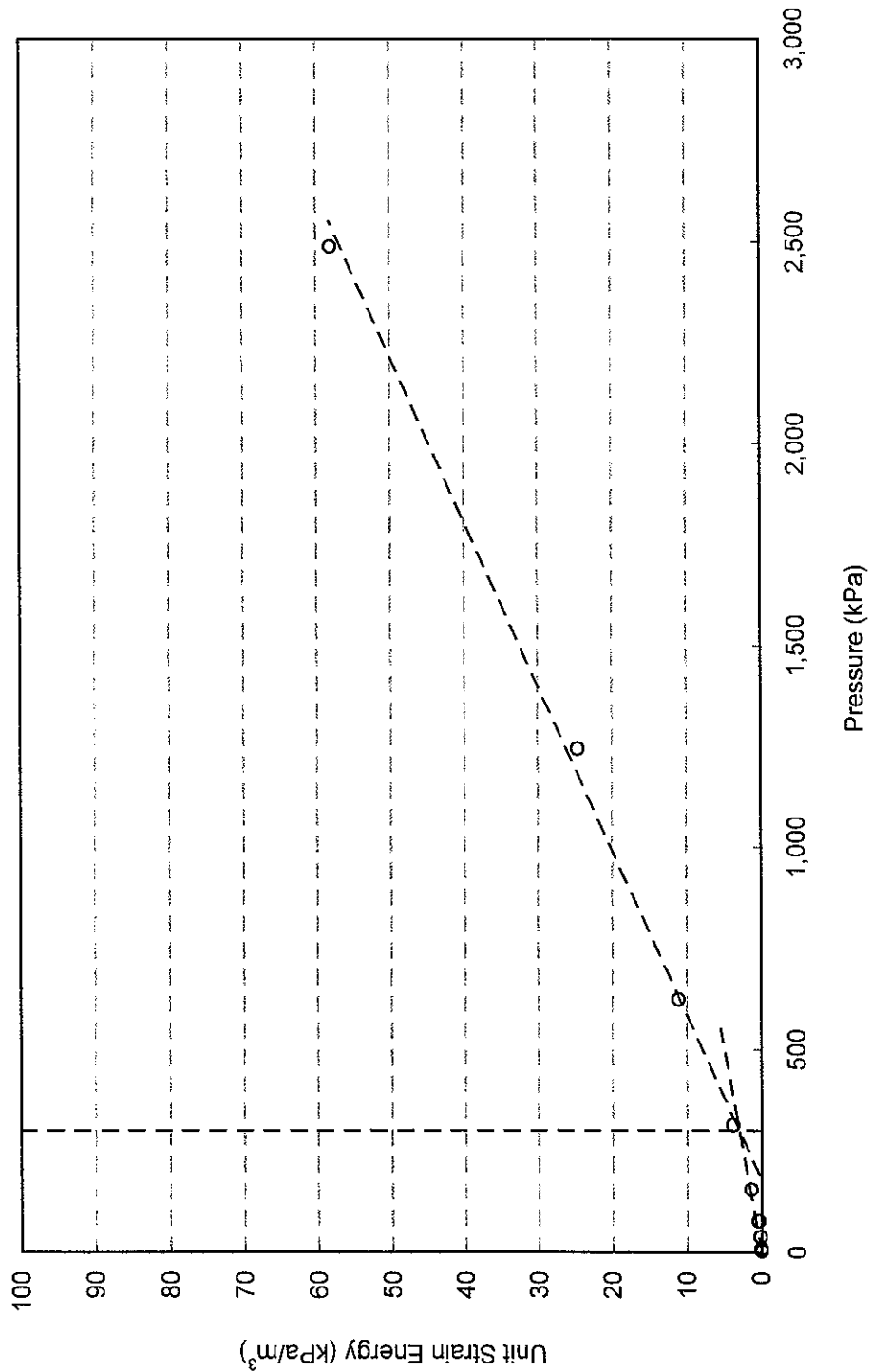


Terraprobe Inc.

Prepared By : HW

Checked By : RA

CONSOLIDATION TEST  
Unit Strain Energy vs Pressure  
SBL 12+410 CL, TW9



$P_c = 300 \text{ kPa}$

Project No. : 1-09-4135

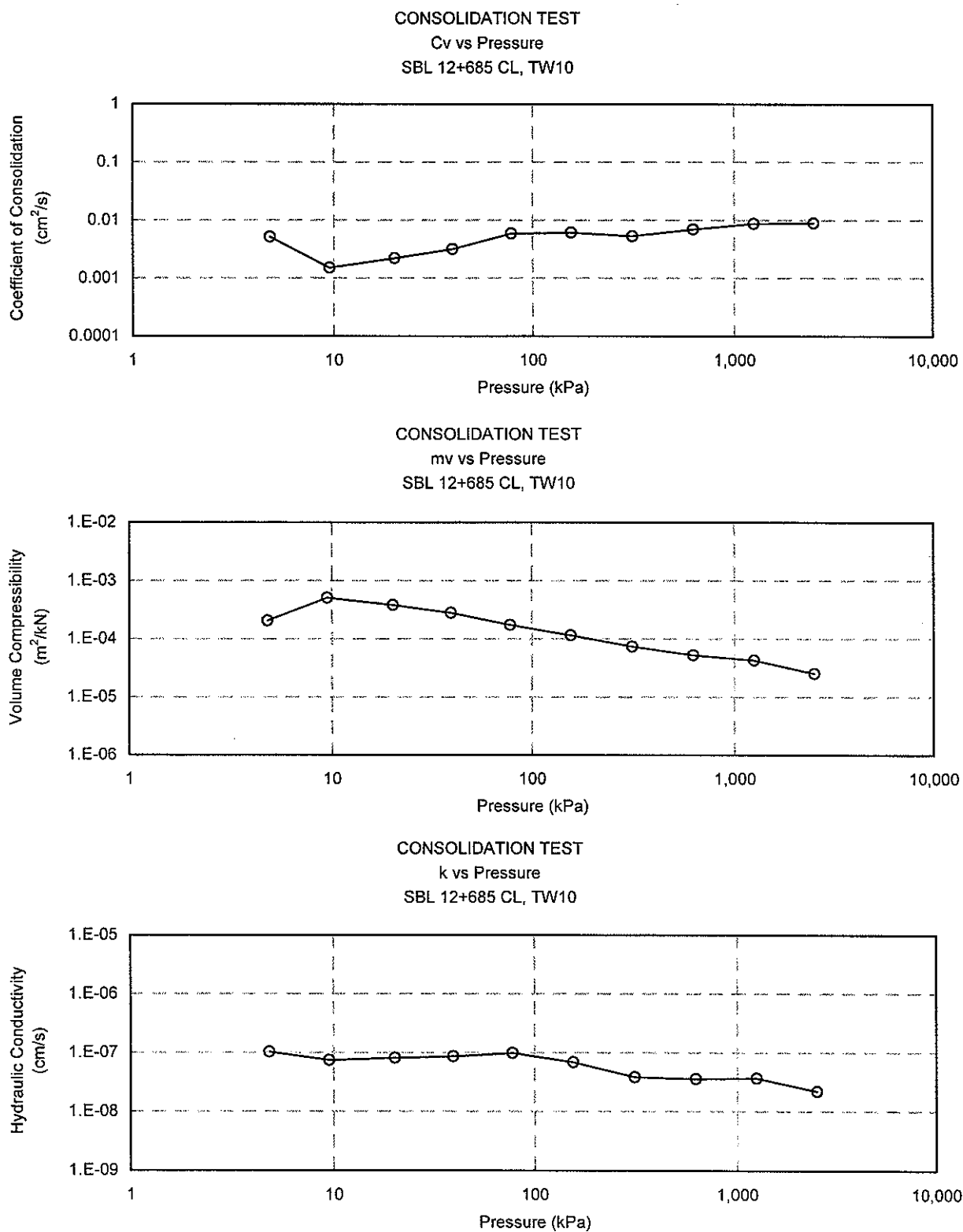
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



Project No. : 1-09-4135  
Date : July 2010



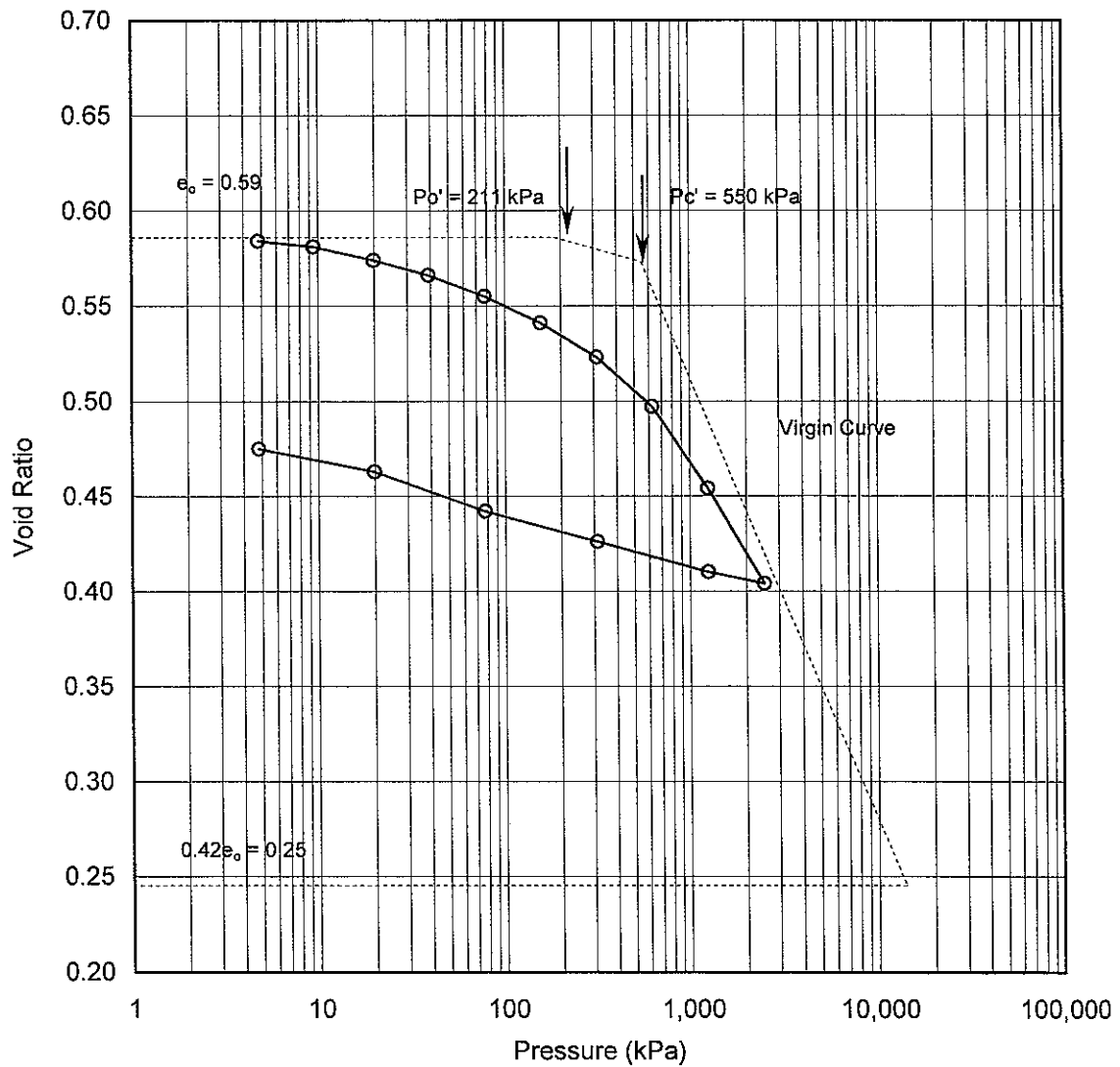
**Terraprobe Inc.**

Prepared By : HW  
Checked By : RA

## CONSOLIDATION TEST

e vs Pressure

SBL 12+685 CL, TW10



Soil Type : Silty Clay

$e_o =$	0.59	$\omega_L =$	27%	$Po' =$	211 kPa
$\omega =$	22%	$\omega_P =$	17%	$Pc' =$	550 kPa
$\gamma =$	20.7 kN/m <sup>3</sup>	$PI =$	10%	$Cc =$	0.233
$G_s =$	2.75			$Cr =$	0.027

Project No. : 1-09-4135  
 Date : September 2010



Terraprobe Inc.

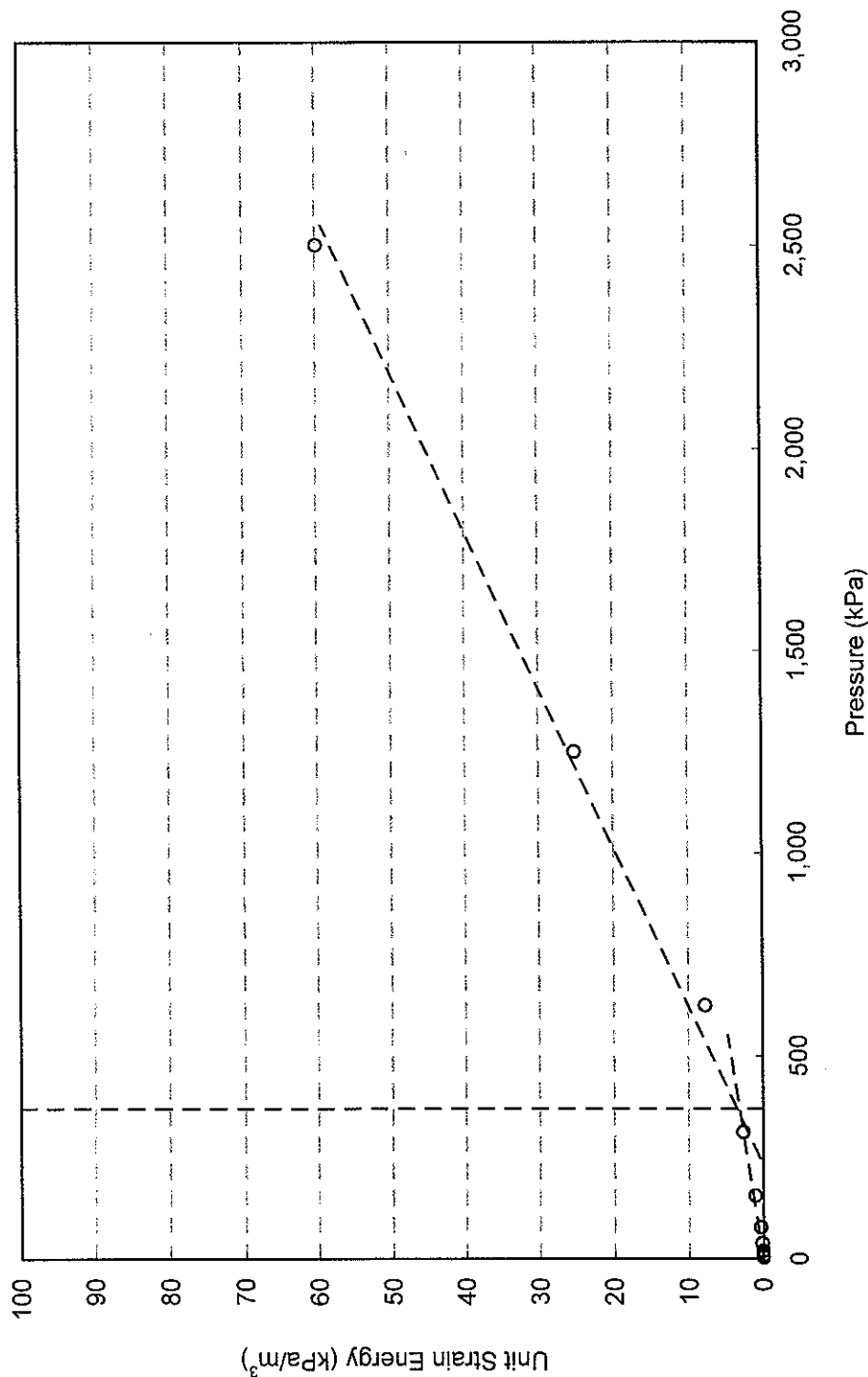
Prepared By : HW  
 Checked By : RA

C:\Documents and Settings\Admin\My Documents\Marc P\Projects 2009\Hwy 406 Expansion\1-09-4135 (Hwy 406 Foundations)\High Fills (Woodlawn)\1-09-4135 Consolidation Results-WS.xls

# HWY 406 TWINNING - WOODLAWN OVERPASS (SBL)

FIGURE B4-112

## CONSOLIDATION TEST Unit Strain Energy vs Pressure SBL 12+685 CL, TW10



$P_c = 370 \text{ kPa}$

Project No. : 1-09-4135

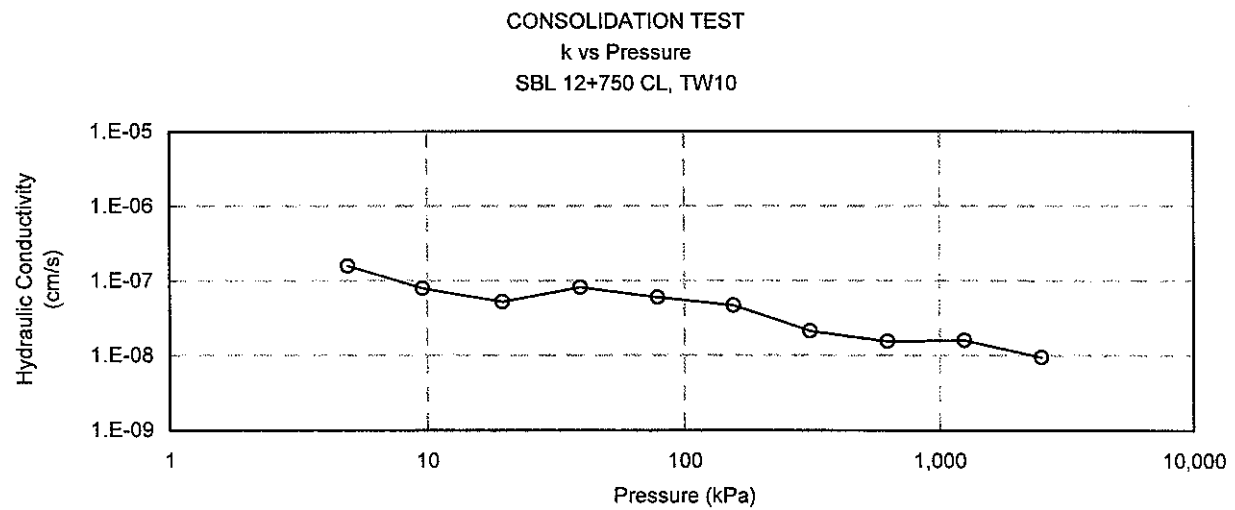
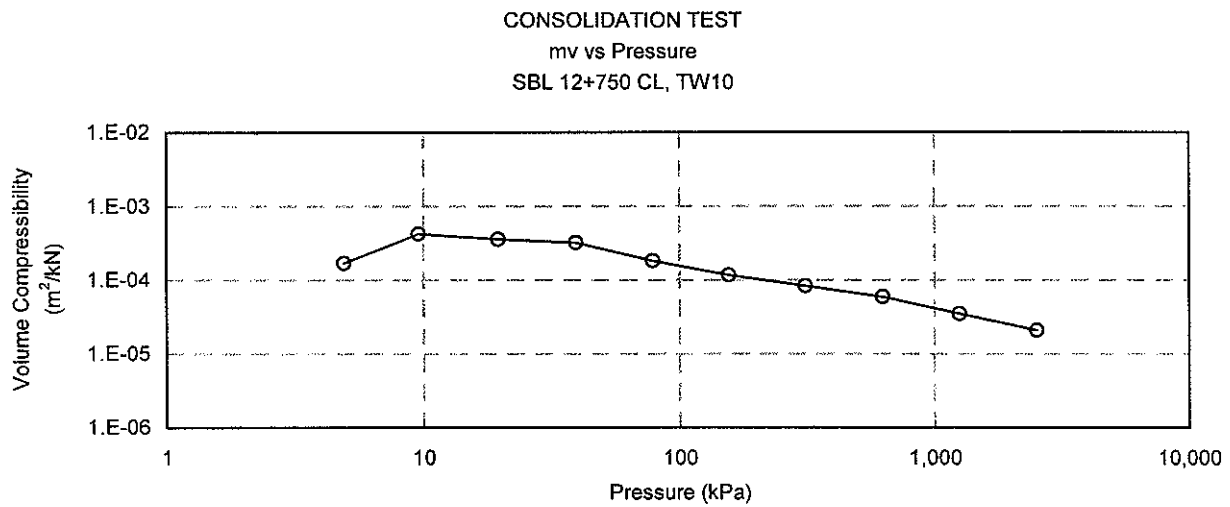
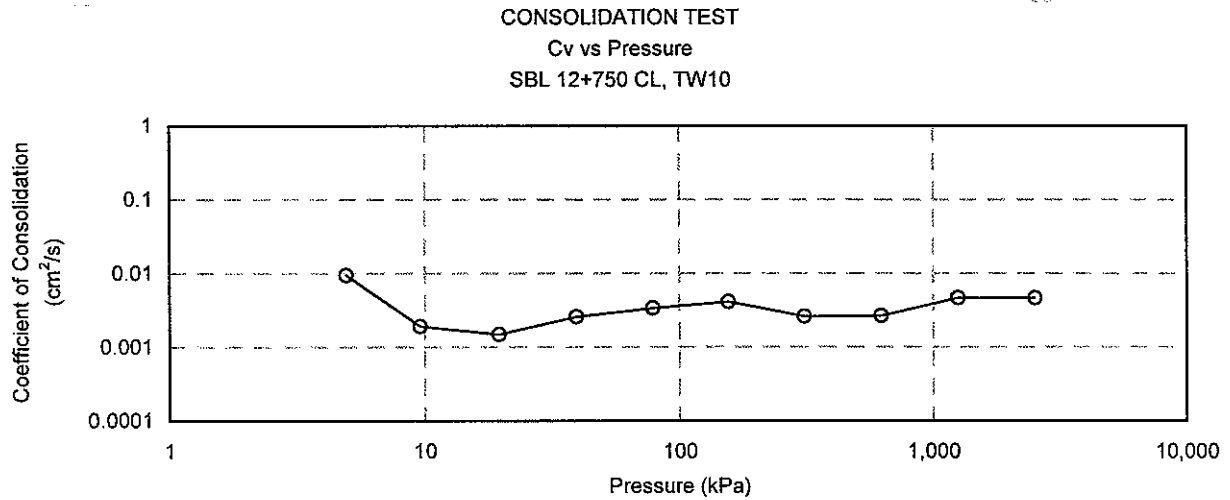
Date : July 2010



**Terraprobe Inc.**

Prepared By : HW

Checked By : RA



Project No. : 1-09-4135  
Date : July 2010



**Terraprobe Inc.**

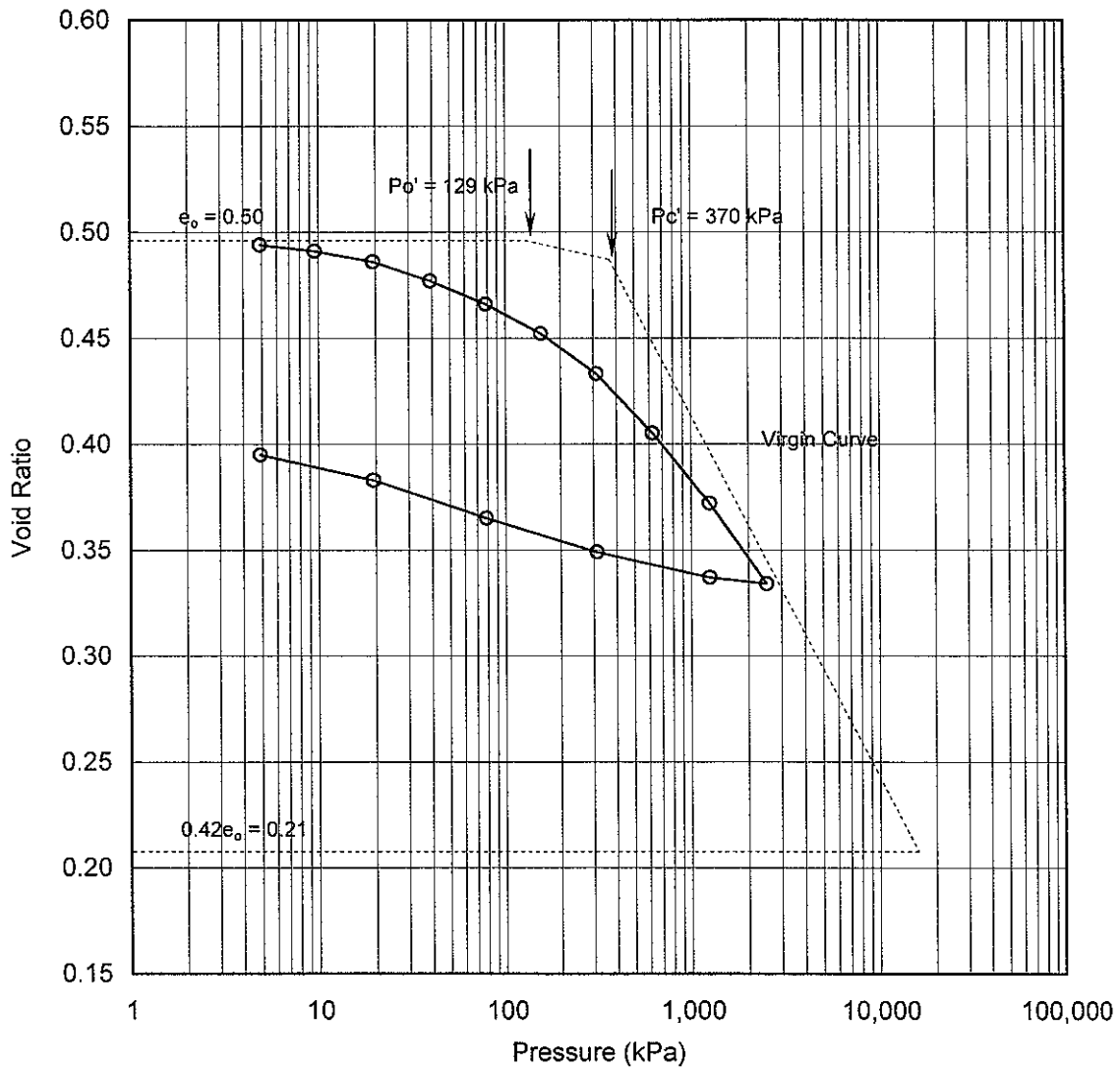
Prepared By : HW  
Checked By : RA



## CONSOLIDATION TEST

e vs Pressure

SBL 12+750 CL, TW10



Soil Type : Silty Clay

$e_o =$	0.50	$\omega_L =$	25%	$P_o' =$	129 kPa
$\omega =$	19%	$\omega_P =$	15%	$P_c' =$	370 kPa
$\gamma =$	21.1 kN/m <sup>3</sup>	PI =	10%	Cc =	0.171
Gs =	2.70			Cr =	0.020

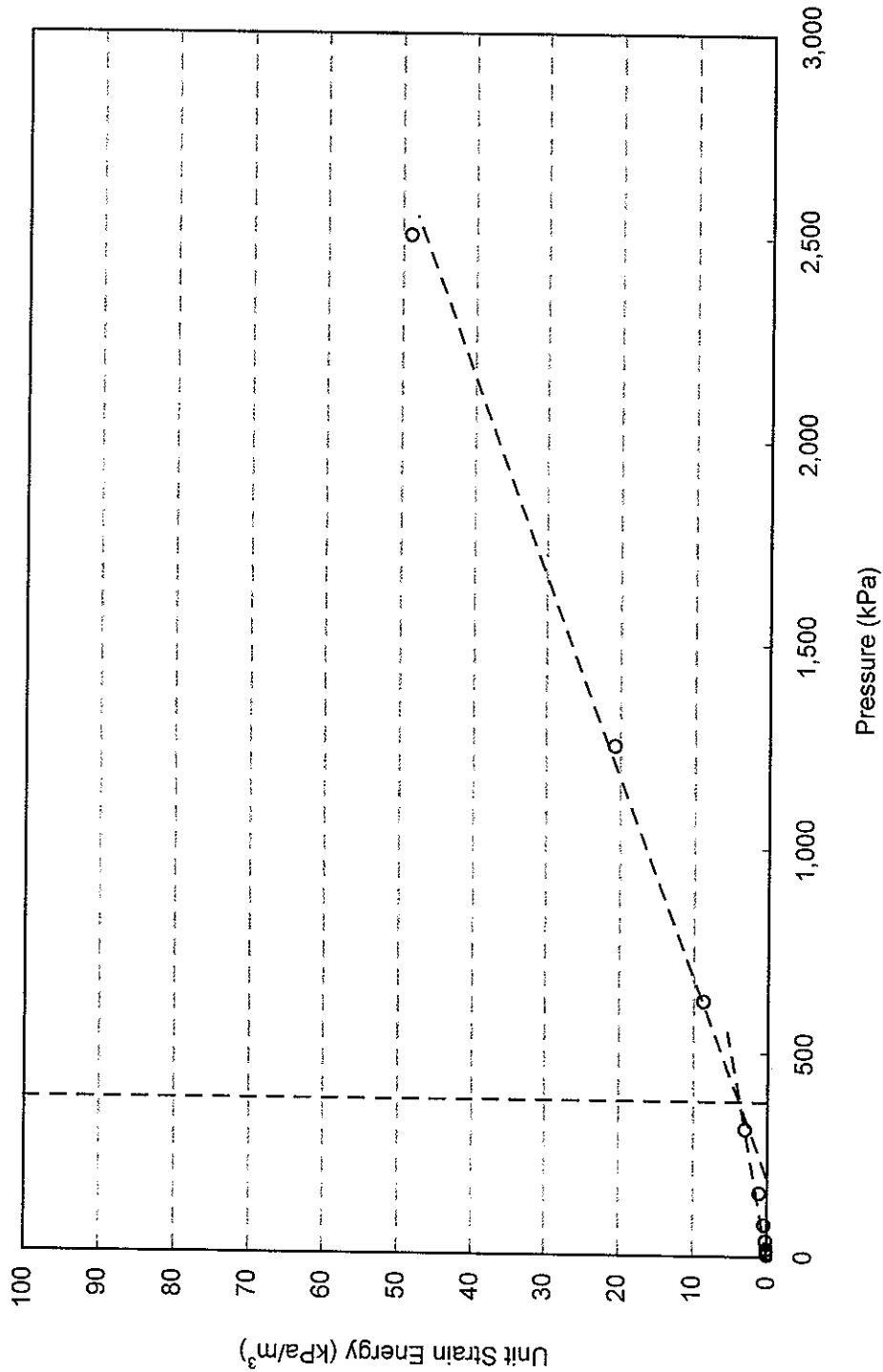
Project No. : 1-09-4135  
 Date : July 2010



Terraprobe Inc.

Prepared By : HW  
 Checked By : RA

CONSOLIDATION TEST  
Unit Strain Energy vs Pressure  
SBL 12+750 CL, TW10



$P_c = 380 \text{ kPa}$

Project No. : 1-09-4135

Date : July 2010



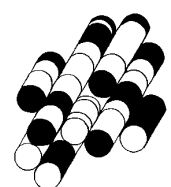
**Terraprobe Inc.**

Prepared By : HW

Checked By : RA

# C4

**TERRAPROBE INC.**

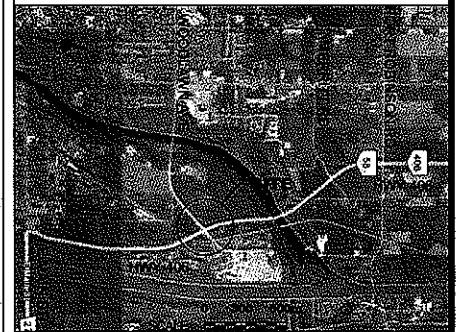


METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETERS  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 280-99-00





HIGHWAY 406 NBL & SBL  
BOREHOLE LOCATIONS AND SOIL STRATA

**Giffels Associates Limited**  
Consulting Engineers and Architects  
An IBI Group Company



### KEY PLAN

### LEGEND

- |   |                                       |
|---|---------------------------------------|
|    | Bore Hole                             |
|    | Dynamic Cone Penetration Test         |
|   | Bore Hole And Cone                    |
| 'N'   | Blows/0.3m (Std Pen Test, 475 J/blow) |
| CONE  | Blows/0.3m (60° Cone, 475 J/blow)     |
|   | WL at Time of Investigation           |
|   | WL in Piezometer (MAY. 2010)          |
|  | Piezometer                            |
| 90%   | Rock Quality Designation              |
| A/R   | Auger Refusal                         |

[illegible]

**NOTE**

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

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

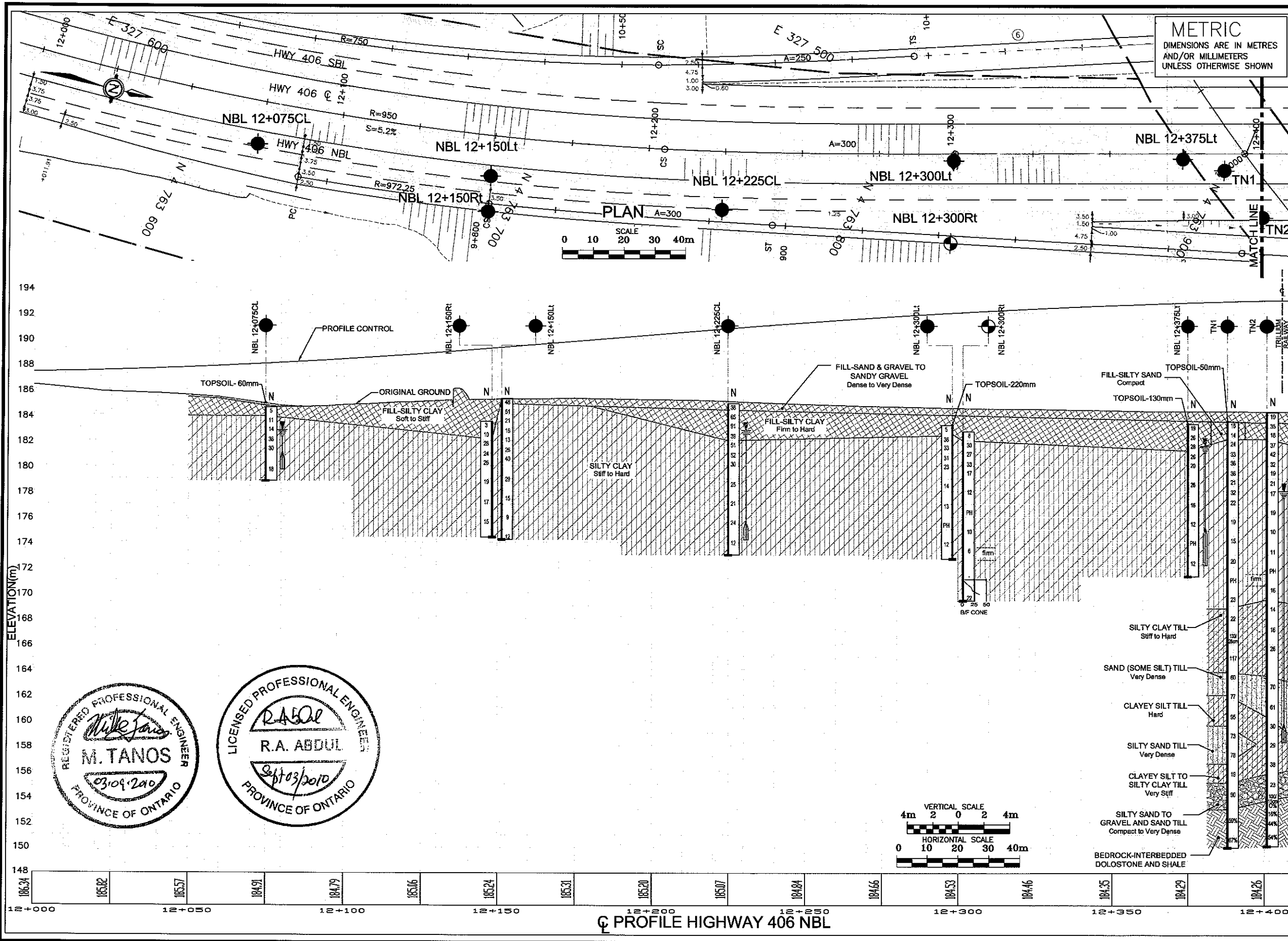
REVISIONS			
	DATE	BY	DESCRIPTION
DESIGN	R.A.	CODE	CHBDC2006
		LOAD	DATE SEPT. 2010
DRAWN	K.C.	CHK	R.A.
		STRUCT	GEOCRES 30M3-263

PLAN

40m 20 0 20 40m

SCALE





CONT No  
WP No 280-99-00

HIGHWAY 406 NBL  
BOREHOLE LOCATIONS AND SOIL STRATA

Giffels Associates Limited  
Consulting Engineers and Architects  
An IBI Group Company

**Terraprobe**  
Consulting Geotechnical & Environmental Engineering  
Construction Materials Engineering, Inspection & Testing

**KEY PLAN**

**LEGEND**

- Bore Hole
- Dynamic Cone Penetration Test
- Bore Hole And Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- WL at Time of Investigation
- WL in Piezometer (MAY, 2010)
- Piezometer
- 90% Rock Quality Designation
- A/R Auger Refusal

**COORDINATES**

No	ELEV.	NORTHING	EASTING
NBL 12+075CL	184.5	4 763 620.5	327 614.8
NBL 12+150Lt	185.3	4 763 692.1	327 588.2
NBL 12+150Rt	183.5	4 763 696.9	327 598.9
NBL 12+225CL	184.9	4 763 763.5	327 562.3
NBL 12+300Lt	183.1	4 763 822.6	327 512.4
NBL 12+300Rt	182.7	4 763 834.3	327 536.7
NBL 12+375Lt	183.3	4 763 888.1	327 476.6
TN1	183.5	4 763 901.9	327 473.4
TN2	184.2	4 763 920.1	327 481.1

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

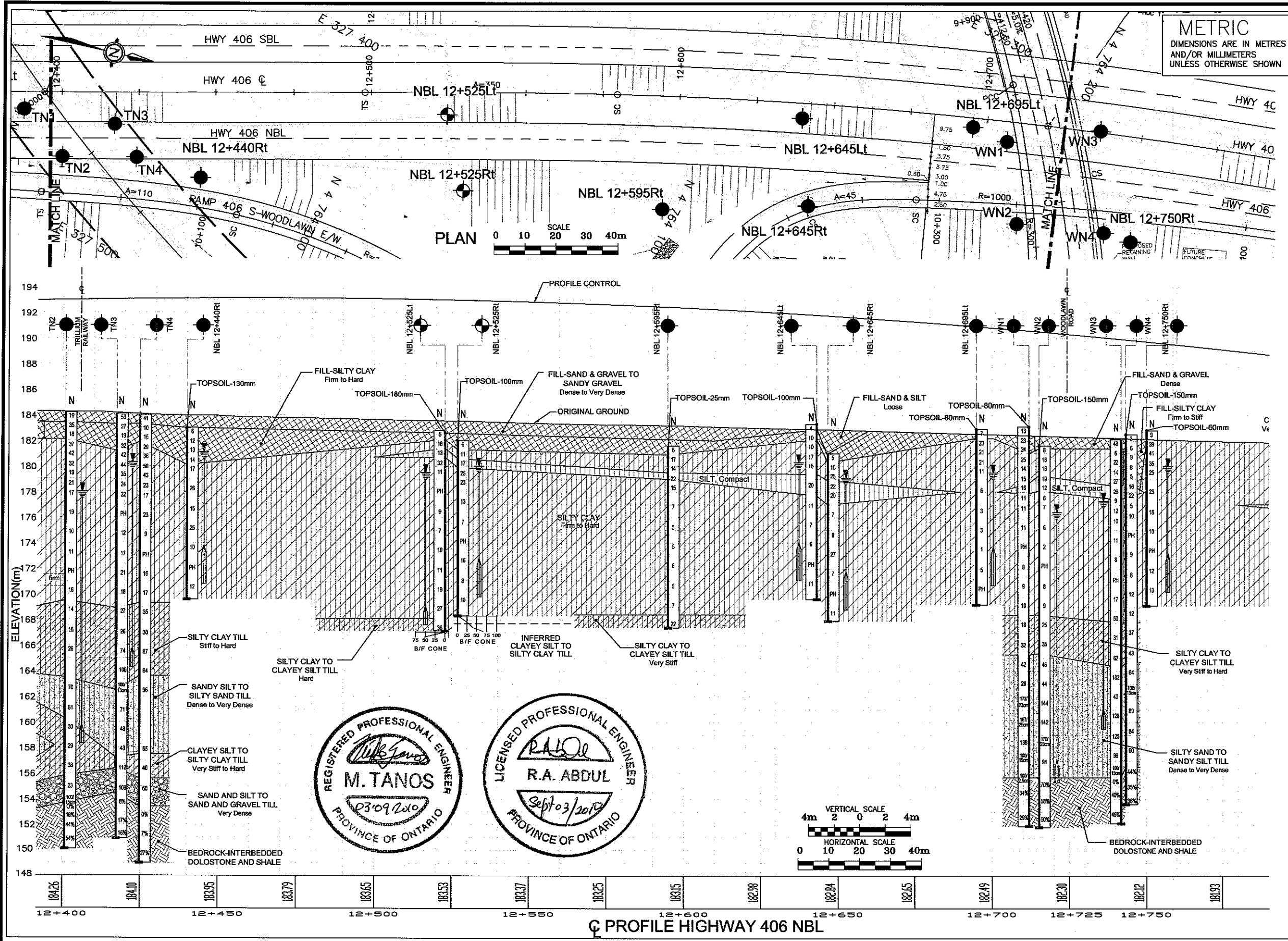
This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**REVISIONS**

DATE	BY	DESCRIPTION
DESIGN R.A.	CODE CHBDC2006	LOAD
DRAWN K.C.	CHK R.A.	STRUCT

**DESIGN R.A.**  
CODE CHBDC2006  
LOAD  
DATE SEPT. 2010

**DRAWN K.C.**  
CHK R.A.  
STRUCT  
GEODCS 30M3-263



CONT No  
WP No 280-99-00

HIGHWAY 406 NBL  
BOREHOLE LOCATIONS AND SOIL STRATA

Giffels Associates Limited  
Consulting Engineers and Architects  
An IBI Group Company

**Terraprobe**  
Consulting Geotechnical & Environmental Engineering  
Construction Materials Engineering, Inspection & Testing

KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test
- Bore Hole And Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60' Cone, 475 J/blow)
- WL at Time of Investigation
- WL in Piezometer (MAY, 2010)
- Piezometer
- 90% Rock Quality Designation
- A/R Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
NBL 12+440Rt	183.0	4 763 962.9	327 465.8
NBL 12+525Lt	182.8	4 764 023.2	327 410.0
NBL 12+525Rt	182.0	4 764 038.4	327 429.4
NBL 12+595Rt	181.6	4 764 099.0	327 404.2
NBL 12+645Lt	183.3	4 764 124.9	327 356.9
NBL 12+645Rt	181.0	4 764 140.0	327 381.0
NBL 12+695Lt	182.9	4 764 175.1	327 333.0
NBL 12+750Rt	182.8	4 764 237.5	327 341.9
TN2	184.2	4 763 920.1	327 481.1
TN3	184.1	4 763 930.0	327 463.7
TN4	184.0	4 763 941.4	327 469.8
WN1	183.1	4 764 187.0	327 332.0
WN2	181.6	4 764 202.3	327 364.1
WN3	182.1	4 764 212.0	327 314.7
WN4	182.5	4 764 228.4	327 343.4

NOTE

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REVISIONS

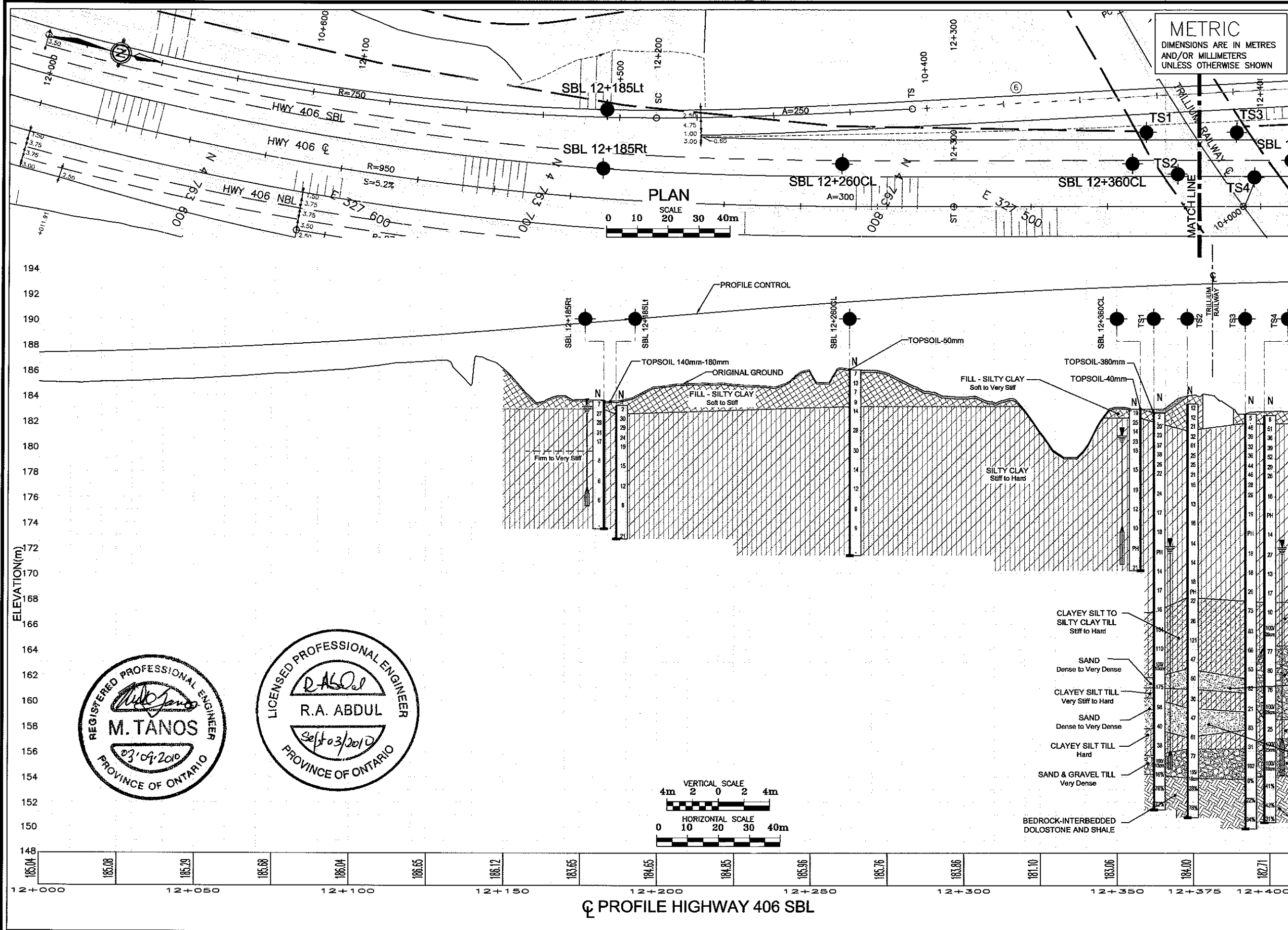
DATE	BY	DESCRIPTION
SEPT. 2010		

DESIGN	R.A.	CODE	CHB02006	LOAD	DATE	SEPT. 2010
DRAWN	K.C.	CHK	R.A.	STRUCT	GEOCES 30M3-263	

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CONT No  
WP No 280-99-00

HIGHWAY 406 SBL  
BOREHOLE LOCATIONS AND SOIL STRATA

Giffels Associates Limited  
Consulting Engineers and Architects  
An IBI Group Company

**Terraprobe**  
Consulting Geotechnical & Environmental Engineering  
Construction Materials Engineering, Inspection & Testing

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SHEET  
5 OF 7

KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test
- Bore Hole And Cone
- 'N'
- Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE
- Blows/0.3m (60' Cone, 475 J/blow)
- WL at Time of Investigation
- WL in Piezometer (MAY. 2010)
- Piezometer
- 90%
- A/R
- Rock Quality Designation
- Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
SBL 12+185Lt	183.2	4 763 707.6	327 535.6
SBL 12+185Rt	183.6	4 763 715.5	327 553.2
SBL 12+260CL	186.0	4 763 783.4	327 515.0
SBL 12+360CL	182.9	4 763 866.5	327 470.3
TS1	182.6	4 763 865.7	327 459.1
TS2	183.3	4 763 881.2	327 466.3
TS3	182.5	4 763 891.8	327 445.1
TS4	182.4	4 763 903.8	327 455.3

NOTE

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REVISIONS

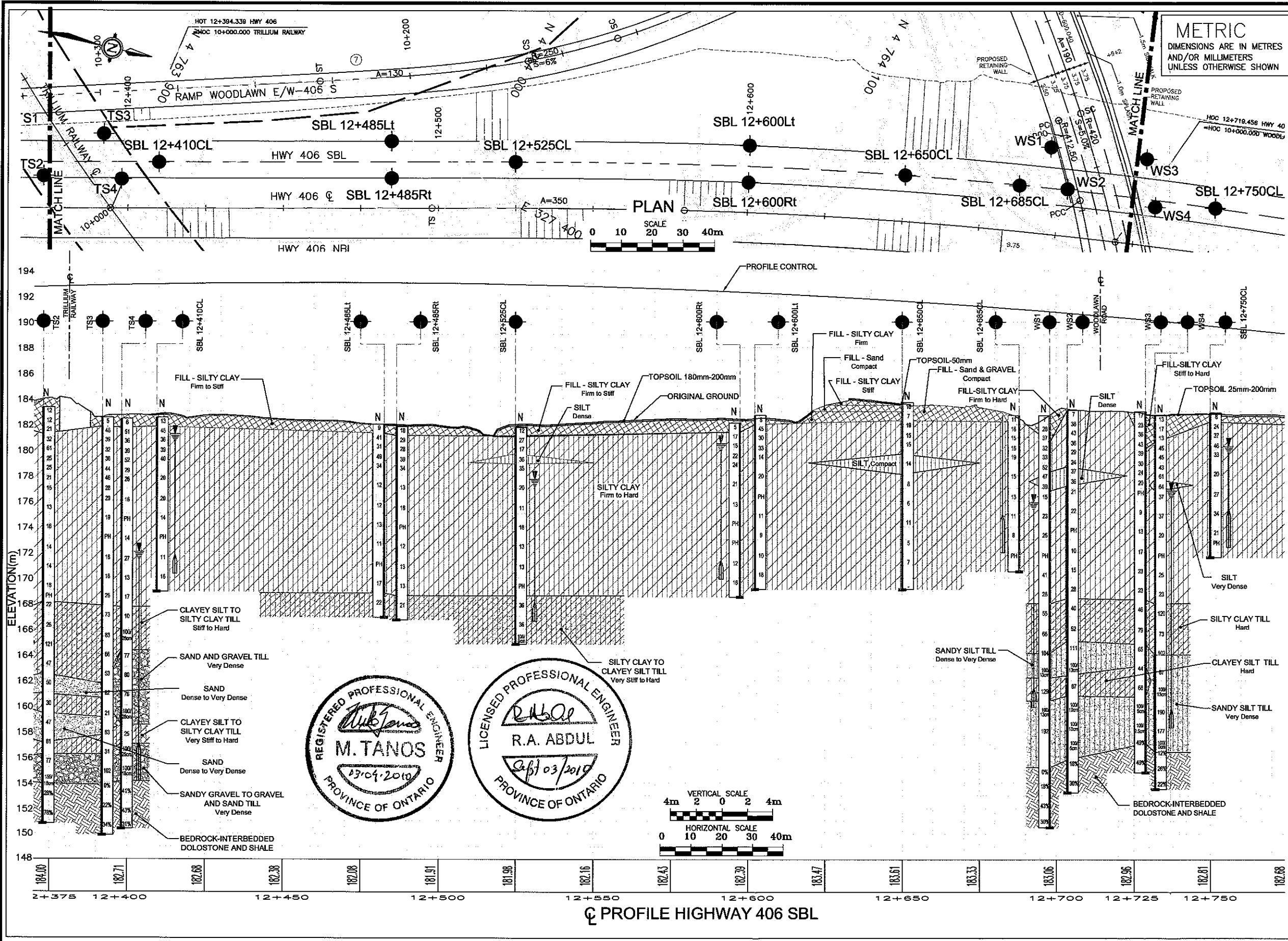
DATE	BY	DESCRIPTION
DESIGN R.A.	CODE CHBDC2006	LOAD
DRAWN K.C.	CHK R.A.	STRUCT

DATE SEPT. 2010

GEOCRE 30M3-263

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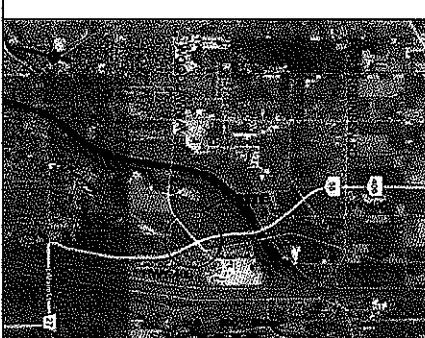




CONT No  
WP No 280-99-00

HIGHWAY 406 SBL  
BOREHOLE LOCATIONS AND SOIL STRATA

Giffels Associates Limited  
Consulting Engineers and Architects  
An IBI Group Company



KEY PLAN

- LEGEND
- Bore Hole
  - Dynamic Cone Penetration Test
  - Bore Hole And Cone
  - Blows/0.3m (Std Pen Test, 475 J/blow)
  - Blows/0.3m (60' Cone, 475 J/blow)
  - WL at Time of Investigation
  - WL in Piezometer (MAY, 2010)
  - Piezometer
  - 90% Rock Quality Designation
  - A/R Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
SBL 12+485Lt	182.0	4 763 974.6	327 403.3
SBL 12+485Rt	181.8	4 763 980.3	327 413.8
SBL 12+525CL	181.8	4 764 013.1	327 390.2
SBL 12+600Lt	182.7	4 764 077.3	327 349.6
SBL 12+600Rt	182.1	4 764 082.6	327 360.4
SBL 12+650CL	183.7	4 764 126.1	327 334.4
SBL 12+685CL	182.7	4 764 160.4	327 319.7
SBL 12+750CL	182.9	4 764 219.9	327 296.2
TS3	182.5	4 763 891.8	327 445.1
TS4	182.4	4 763 903.8	327 455.3
WS1	182.7	4 764 163.6	327 303.9
WS2	183.1	4 764 174.7	327 313.4
WS3	183.0	4 764 192.6	327 292.7
WS4	182.7	4 764 202.3	327 305.2

NOTE

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REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RA	CODE	CHBDC2006
LOAD	DATE	SEPT. 2010	
DRAWN	K.C	CHK	RA
STRUCT	GEOCR	30M3-263	

