

**FOUNDATION INVESTIGATION REPORT  
WIDENING OF KING STREET OVERPASS AT HIGHWAY 8  
NORTHBOUND STRUCTURE  
KITCHENER, ONTARIO  
G.W.P. 277-97-00, SITE: 33-214W**

**Geocres Number: 40P8-145**

**Report to**

**Morrison Hershfield Limited**

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

August 20, 2007  
File: 19-479-38

H:\19\479\38 Hwy 8\Reports & Memos\King St WBL\King  
NBL FINAL FIR.doc

## TABLE OF CONTENTS

### PART 1: FACTUAL INFORMATION

1	INTRODUCTION .....	1
2	SITE DESCRIPTION .....	1
3	SITE INVESTIGATION AND FIELD TESTING .....	2
3.1	Current Investigation .....	2
3.2	Previous Investigation.....	3
4	LABORATORY TESTING .....	3
5	DESCRIPTION OF SUBSURFACE CONDITIONS .....	3
5.1	Asphaltic Concrete.....	3
5.2	Sand and Gravel Fill .....	3
5.3	Silty Sand to Sand and Gravel .....	4
5.4	Upper Heterogeneous Till (Silt and Sand to Clayey Silt) .....	4
5.5	Silty Clay Till.....	5
5.6	Lower Heterogeneous Till (Silt and Sand to Clayey Sandy Silt).....	5
5.7	Water Levels .....	6
6	MISCELLANEOUS .....	7

### Appendices

Appendix A	Record of Borehole Sheets
Appendix B	Laboratory Test Results
Appendix C	Borehole Locations and Soil Strata Drawings

**FOUNDATION INVESTIGATION REPORT**  
**WIDENING OF KING STREET OVERPASS AT HIGHWAY 8**  
**NORTHBOUND STRUCTURE**  
**KITCHENER, ONTARIO**  
**G.W.P. 277-97-00, SITE: 33-214W**

**Geocres Number: 40P8-145**

**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted at the northbound lane structure of the King Street East overpass at Highway 8 in Kitchener, Ontario. The existing structure was constructed in 1987, consists of a two-span girder bridge on an approximate 40-degree skew, and currently carries two lanes of through traffic plus a ramp speed change lane. The proposed project involves widening of the structure towards the median to accommodate an additional lane of traffic.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile and cross-sections, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained in the course of the investigation.

Thurber carried out the investigation as a sub-consultant to Morrison Hershfield Limited, under the Ministry of Transportation Ontario (MTO) Agreement Number 3005-E-0035.

**2 SITE DESCRIPTION**

The site is located on Highway 8 in Kitchener, Ontario, between the Grand River to the north and Sportsworld Drive to the south. The lands to the east of the site are generally vacant and a small residential subdivision exists to the west. Lands along King Street East to the west of Highway 8 have been developed for commercial and retail use.

The topography is typically rolling. Drainage at the site is generally towards the Grand River, which flows westerly within a deep valley located approximately 1 km to the north of the overpass. Vegetation consists of grass and small shrubs, with mature trees present in the southeast quadrant of the interchange.

The general site area is located within the physiographic region known as Waterloo Hills, characterized by ridges of sandy till and kames or kame moraines, with outwash sands occupying the intervening hollows.

### 3 SITE INVESTIGATION AND FIELD TESTING

#### 3.1 Current Investigation

The site investigation and field testing for this project were carried out between May 8 and 27, 2006 and consisted of drilling and sampling nine boreholes at the site, including boreholes drilled concurrently for investigation at the southbound structure. Boreholes 06-15 to 06-23 (excluding 06-18 and 06-19) were drilled within the Highway 8 median in line with the existing abutments and pier, and were terminated at depths of 20.1 to 27.7 m. Boreholes 06-14 and 06-24 were drilled to 11.1 m depth in the approaches approximately 20 m from the abutments.

The approximate borehole locations are shown on the Borehole Locations and Soil Strata Drawing in Appendix C. The coordinates and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendix A.

Prior to commencement of drilling, utility clearances were obtained for all borehole locations. Road occupancy and lane closure permits were also obtained.

Hollow stem augers were used to advance the boreholes. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The inspector logged the boreholes, visually examined the recovered samples, and transported them to Thurber's laboratory for further examination and testing.

Standpipe piezometers, consisting of 19 mm PVC pipes with slotted tip, were installed in selected boreholes to monitor groundwater levels. The completion details are shown in Table 3.1. The remaining boreholes were grouted in accordance with the abandonment requirements of MOE Reg. 903.

**Table 3.1 – Piezometer Installation Details**

Piezometer Location	Tip (Sand Filter) Details			Backfill
	Depth	Elevation	Stratum	
06-15	20.0 – 21.8	282.3 – 280.5	Clayey Silt and Sand Till	Bentonite and grout to 0.3 m, concrete to surface
06-23	25.3 – 27.1	278.2 – 276.4	Silt and Sand Till	Bentonite and grout to 0.3 m, concrete to surface

### **3.2 Previous Investigation**

A foundation investigation was carried out for the existing overpass structures in 1980 (Foundation Investigation for Freeport Drive Overpass, W.P. 31-76-04/05, Site Nos. 33-214A/B, Mar 1982). The Record of Borehole sheets for that investigation are included in Appendix A, and the approximate borehole locations are indicated on the drawing in Appendix C. The work was carried out prior to construction of the King Street cut and the overpass structure, and will not be referenced further in the current report.

## **4 LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendix A. Approximately 25% of the recovered samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures contained in Appendix B.

## **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets in Appendix A and on the Borehole Locations and Soil Strata Drawing in Appendix C. 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 terms, the site was found to be underlain by sand and gravel fill overlying, in succession, native sand and gravel, a layer of heterogeneous silt and sand to clayey silt till, a thick deposit of silty clay till, and a second layer of sand and silt to clayey sandy silt till.

More detailed descriptions of the individual strata are presented below.

### **5.1 Asphaltic Concrete**

The boreholes were drilled through the pavement structure on King Street or the shoulder of Highway 8. The asphaltic concrete layer varied in thickness from 50 to 190 mm in the boreholes.

### **5.2 Sand and Gravel Fill**

Sand and gravel fill was encountered below the asphalt in all boreholes. The fill extended to depths of 0.8 to 2.6 m (elevation 300.3 to 302.4 m) in Boreholes 06-15 to 06-23, and to 1.5 m depth (elevation 307.9 and 309.6 m) in Boreholes 06-14 and 06-24.

SPT N-values ranged from 50 blows/0.3 m penetration to 50 blows/0.125 m in the fill, indicating a very dense relative density. N-values greater than 50 blows/0.15 m may reflect the presence of cobbles or boulders in the fill. Grain size distribution results for the

fill are presented on the Record of Borehole sheets and Figure B1 of Appendix B. The silt content in the tested samples ranged from 6 to 11%. Moisture contents in this material ranged from 2% to 5%.

### 5.3 Silty Sand to Sand and Gravel

Native deposits of brown silty sand, sand, and sand and gravel were encountered below the granular fill in all boreholes. In Boreholes 06-15 to 06-23 drilled on King Street, the upper boundary of this material was encountered at depths of 0.8 to 2.6 m (elevation 300.3 to 302.4 m), and the lower boundary was encountered at depths of 2.3 to 4.6 m (elevation 298.9 to 300.6 m). In Borehole 06-24 drilled from Highway 8, the upper and lower boundaries were encountered at depths of 1.5 and 9.1 m (elevation 309.6 and 302.0 m), respectively. Borehole 06-14 encountered native sand and gravel at 1.5 m depth (elevation 307.9 m) and was terminated in this material at 11.1 m depth (elevation 298.3 m).

SPT N-values in the silty sand to sand and gravel generally ranged from 24 blows/0.3 m penetration to 50 blows/0.15 m, indicating a compact to very dense relative density. N-values greater than 50 blows/0.15 m may reflect the presence of cobbles or boulders. A loose to compact condition was indicated by N-values of 6 to 14 blows/0.3 m obtained between 0.9 and 2.3 m depth (elevation 302.0 and 300.6 m) in Borehole 06-17, between 3.0 and 4.6 m depth (elevation 300.5 and 298.9 m) in Borehole 06-23, and between 4.5 and 7.5 m depth (elevation 306.6 and 303.6 m) in Borehole 06-24.

Grain size distribution results for the silty sand to sand and gravel are presented on the Record of Borehole sheets and Figure B2 of Appendix B. The fines content (silt and clay) in the tested samples ranged from 13 to 34%. Moisture contents in this material ranged from 2% to 15%, typically less than 10%.

### 5.4 Upper Heterogeneous Till (Silt and Sand to Clayey Silt)

A brown heterogeneous till deposit varying in gradation from cohesionless silt and sand, some clay to clayey, to cohesive clayey silt, some sand to sandy, was encountered below the silty sand to sand and gravel deposit. The results of sieve and hydrometer analyses conducted on samples of this unit, presented on the Record of Borehole Sheets and Figure B3 of Appendix B, indicate the following particle size distribution:

Gravel	1 – 5 %
Sand	30 – 41 %
Silt	44 – 56 %
Clay	11 – 16 %

The thickness of this till deposit in Boreholes 06-15 to 06-23 ranged from 1.5 to 3.0 m. The upper boundary was encountered at 2.3 m depth (elevation 300.0 to 300.6 m) adjacent to the existing northbound lanes structure, at depths of 3.7 to 4.6 m (elevation 298.9 to 299.7 m) adjacent to the southbound lane structure, and at 3.0 m (elevation 300.2 m) in

Borehole 06-20 drilled along the highway centreline. The lower boundary was encountered at depths of 3.8 to 4.6 m (elevation 297.7 to 299.1 m) adjacent to the northbound lanes, at depths of 6.1 to 7.6 m (elevation 295.9 to 297.4 m) adjacent to the southbound lanes, and at 5.5 m (elevation 297.7 m) at the centreline.

Borehole 06-24 drilled at the south approach encountered the till at 9.1 m depth (elevation 302.0 m) and was terminated in this unit at 11.1 m (elevation 300.0 m).

SPT N-values obtained in the till deposit ranged from 31 blows/0.3 m to 50 blows/0.15 m penetration, indicating a hard or dense to very dense condition. Moisture contents from this deposit ranged from 5 to 19%.

A pocket of silt was encountered within the till unit at 3.8 m depth in Borehole 06-15. The results of a grain size analysis conducted on the silt are shown on Figure B2, Appendix B.

Although not encountered in the boreholes, glacial till may contain cobbles and large boulders.

### **5.5 Silty Clay Till**

The upper heterogeneous till layer is underlain by a thick deposit of brown to grey silty clay till. The silty clay till deposit ranges in thickness from 10.7 to 14.5 m, and has upper and lower boundaries at depths of 3.8 to 7.6 m (elevation 295.9 to 299.1 m) and 16.8 to 21.3 m (elevation 282.2 to 286.7 m), respectively.

Standard Penetration Tests conducted in this deposit typically yielded N-values ranging from 30 to 102 blows/0.3 m penetration, indicating a hard consistency. In Boreholes 06-16 to 06-21, N-values of 20 to 25 blows/0.3 m were obtained at depths of 13.7 to 16.8 m, indicating a very stiff zone. Moisture contents generally ranged from 11 to 22%, with higher values of up to 42% measured in the very stiff zones.

Samples from this deposit were subjected to grain size distribution and Atterberg Limits tests. The results of the grain size analyses are reported on the Record of Borehole Sheets and plotted in Figures B4 and B5 of Appendix B. The Atterbergs Limits, plotted on Figure B7, indicate that the silt clay till has a low to medium plasticity.

Although not encountered in the boreholes, glacial till may contain cobbles and large boulders.

### **5.6 Lower Heterogeneous Till (Silt and Sand to Clayey Sandy Silt)**

A second deposit of heterogeneous till was encountered below the silty clay till at depths of 16.8 to 21.3 m (elevation 282.2 to 286.7 m). This deposit varies in gradation from cohesionless silt and sand, some clay, to cohesive clayey sandy silt. The results of sieve and hydrometer analyses conducted on samples of this unit, presented on the Record of

Borehole Sheets and Figure B6 of Appendix B, indicate the following particle size distribution:

Gravel	0 – 3 %
Sand	31 – 48 %
Silt	42 – 48 %
Clay	8 – 22 %

SPT N-values obtained in this till deposit were greater than 100 blows/0.3 m penetration, indicating a hard or very dense condition. Moisture contents ranged from 5 to 15%, with one value of 21%. The boreholes were terminated in the till deposit at depths of 20.1 to 27.7 m (elevation 275.8 to 283.4 m).

Although not encountered in the boreholes, glacial till may contain cobbles and large boulders.

## 5.7 Water Levels

Upon completion of drilling, water was measured at depths of 7.0 to 18.9 m in open Boreholes 06-15, 06-17, 06-20 and 06-23. In addition, wet conditions and/or a wet split spoon sampler were observed at various depths in the majority of the boreholes during drilling. These observations are believed to reflect the presence of groundwater contained within lenses or pockets of more permeable sands and silts within the heterogeneous tills of overall lower permeability. Water also appears to be perched within the fill locally (such as in Borehole 06-17).

Standpipe piezometers were installed in Boreholes 06-15 and 06-23 to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.1, along with the measurements in the boreholes upon completion of drilling.

**Table 5.1 – Measured Groundwater Levels**

Borehole	Date	Water Level (m)		Comment
		Depth	Elevation	
06-15	19-May-2006	18.9	283.4	In open borehole
	19-May-2006	Dry	-	In piezometer
	08-Aug-2006	19.2	283.1	In piezometer
06-17	15-May-2006	7.0	295.9	In open borehole
06-20	11-May-2006	18.9	284.3	In open borehole
06-23	10-May-2006	18.9	284.6	In open borehole
	10-May-2006	20.6	282.9	In piezometer
	18-May-2006	19.9	283.6	In piezometer
	08-Aug-2006	21.2	282.3	In piezometer

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

encountered at higher levels in pockets or zones of more permeable sands and silts within the heterogeneous tills, or within the fill locally.

## 6 MISCELLANEOUS

Thurber Engineering Ltd. selected the borehole locations in the field relative to existing site features with consideration of access restraints, terrain conditions, and utility locations. Callon Dietz Inc., retained by Morrison Hershfield, subsequently established the co-ordinates and ground surface elevations at the staked borehole locations.

All-Terrain Drilling of Waterloo supplied and operated the drilling and sampling equipment used for the investigation. Full time supervision of the field activities, including obtaining utility clearances, was carried out by Mr. George Azzopardi and Mr. Kenneth Hui of Thurber.

Interpretation of the field data and preparation of the investigation report were conducted by Mr. Murray Anderson, P.Eng. Overall supervision of the field program and review of the report was provided by Mr. Alastair Gorman, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.  
Murray R. Anderson, P.Eng., M.Eng.  
Senior Geotechnical Engineer



Alastair E. Gorman, P.Eng., M.Sc.  
Senior Foundations Engineer



P.K. Chatterji, P.Eng., Ph.D.  
Review Principal



## **Appendix A**

### **Record of Borehole Sheets**

## SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

### 1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

### 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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



### 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

### 5. LEGEND FOR RECORDS OF BOREHOLES

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

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

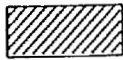



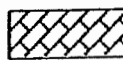
 Water Level  
 Shear Strength Determination by Pocket Penetrometer

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

# UNIFIED SOILS CLASSIFICATION

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

## EXPLANATION OF ROCK LOGGING TERMS

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

DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

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



# RECORD OF BOREHOLE No 06-14

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 713.1 E 231 485.9 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 27.05.06 - 27.05.06 CHECKED BY MRA

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		
309.4														
0.0	ASPHALT (100 mm)													
0.1	SAND and GRAVEL, trace to some silt Very Dense Brown Dry (FILL)		1	SS	85		309							
			2	SS	50/ .150									
307.9							308							
1.5	SAND and GRAVEL, some silt Very Dense to Dense Brown Dry		3	SS	50/ .150									
			4	SS	76		306							
			5	SS	43		305							
			6	SS	36		303							
			7	SS	35		302							
			8	SS	41		301							
							300							

Continued Next Page

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

20  
15 5  
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-14

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 713.1 E 231 485.9 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 27.05.06 - 27.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <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			
298.3			9	SS	35		299										Sampler wet
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

ONTMT4S 7938-2.GPJ 08/01/07

# RECORD OF BOREHOLE No 06-15

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 728.1 E 231 500.9 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 18.05.06 - 19.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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		
302.3														
0.0	ASPHALT: (75 mm)													
0.1	SAND and GRAVEL, trace silt, occasional cobbles Very Dense Brown (FILL)		1	SS	50/ .150		302							
			2	SS	50/ .150									
300.8							301							53 40 8 (SI+CL)
1.5	Silty SAND, trace gravel Compact Brown (SM)		3	SS	27									
300.0							300							
2.3	Clayey SILT, some sand to sandy, trace gravel Hard Brown (TILL)  occasional wet sand seams		4	SS	64									
			5	SS	38		299							Sampler wet
	pocket of silt, some clay		6	SS	100									
297.7							298							0 2 85 13
4.6	Silty CLAY, trace to some sand, trace gravel Hard Brown (TILL)		7	SS	88		297							
			8	SS	53		296							
							295							
			9	SS	74		294							
							293							
			10	SS	54									

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

G.W.P.	277-97-00	LOCATION	King Street Overpass N 4 808 728.1 E 231 500.9	ORIGINATED BY	GA
HWY	8	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	2006-05-18 - 2006-05-19	CHECKED BY	MRA

[illegible]

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

ONTMT4S 7938-2.GPJ 5/25/07

# RECORD OF BOREHOLE No 06-15

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 728.1 E 231 500.9 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2006-05-18 - 2006-05-19 CHECKED BY MRA

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					
	Continued From Previous Page		17	SS	106								
						282							
						281							
280.5			18	SS	104								
21.8	END OF BOREHOLE AT 21.79 m. BOREHOLE OPEN TO 21.79 m AND WATER LEVEL AT 18.90 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 19.05.06 dry - 08.08.06 19.22 283.08												

# RECORD OF BOREHOLE No 06-16

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 720.6 E 231 518.7 ORIGINATED BY KH  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 17.05.06 - 17.05.06 CHECKED BY MRA

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		
302.9	ASPHALT: (50 mm)		1	SS	50/									
0.1	SAND and GRAVEL, trace silt				.125									
	Very Dense													
	Brown													
	Moist													
302.1	(FILL)													
0.8	Silty SAND, some gravel		2	SS	67		302							
	Very Dense to Compact													
	Brown													
	Dry													
			3	SS	29		301							
300.6														
2.3	SILT and SAND, some clay to clayey,		4	SS	64		300							3 41 44 12
	trace gravel, trace limestone fragments													
	Hard													
	Brown													
	(TILL)													
			5	SS	45		299							
			6	SS	62		298							
298.3							297							
4.6	Silty CLAY, trace sand		7	SS	55		296							
	Hard													
	Grey													
	Moist													
	(TILL)													
			8	SS	76		295							0 3 61 37
			9	SS	39		294							
			10	SS	54		293							

Continued Next Page

+ 3, X 3: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-16

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 720.6 E 231 518.7 ORIGINATED BY KH  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2006-05-17 - 2006-05-17 CHECKED BY MRA

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						
	Continued From Previous Page							20 40 60 80 100						
			11	SS	51		292							0 4 46 50
							291							
			12	SS	37		290							
							289							
			13	SS	30		288							
							287							
			14	SS	21		286							
							285							
			15	SS	23		284							
							283							
285.4							282							
17.5	SILT and SAND, some clay, trace gravel, trace limestone fragments Very Dense Grey (TILL)		16	SS	50/ .150									2 44 44 10

Continued Next Page

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

METRIC

G.W.P.	<u>277-97-00</u>	LOCATION	<u>King Street Overpass N 4 808 720.6 E 231 518.7</u>	ORIGINATED BY	<u>KH</u>
HWY	<u>8</u>	BOREHOLE TYPE	<u>Hollow Stem Augers</u>	COMPILED BY	<u>WM</u>
DATUM	<u>Geodetic</u>	DATE	<u>2006-05-17 - 2006-05-17</u>	CHECKED BY	<u>MRA</u>

[illegible]

# RECORD OF BOREHOLE No 06-17

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 715.6 E 231 533.5 ORIGINATED BY KH/GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 12.05.06 - 15.05.06 CHECKED BY MRA

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		
302.9	ASPHALT: (75mm)													
0.0	SAND and GRAVEL, trace silt													
0.1	Very Dense		1	SS	95									
	Brown													
	Moist													
302.0	(FILL)													
0.9	SAND, fine grained, some silt		2	SS	26		302							
	Compact to Loose													
	Brown													
	Moist		3	SS	6		301							Sampler wet
300.6														
2.3	SILT and SAND, some clay, trace		4	SS	31		300							4 41 44 11
	gravel													
	Dense to Very Dense													
	Brown		5	SS	61									
	Moist													
	(TILL)													
299.1														
3.8	Silty CLAY, trace sand		6	SS	82		299							
	Hard													
	Grey		7	SS	92		298							0 2 60 38
	(TILL)													
							297							
			8	SS	52									
							296							
			9	SS	58		295							
							294							
			10	SS	78									
							293							

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-17

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 715.6 E 231 533.5 ORIGINATED BY KH/GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 12.05.06 - 15.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y 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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
			11	SS	43		292							
			12	SS	52		291							
			13	SS	24		289							
			14	SS	22		288							
			15	SS	30		286							
284.6 18.3	SILT and SAND, some clay, trace gravel Very Dense Brown Moist to Wet (SM)		16	SS	105		284							
							283							

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

ONTMT4S 7938-2.GPJ 08/01/07

Water level at  
6.1m before  
continuing drilling  
after 3 days.

# RECORD OF BOREHOLE No 06-17

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 715.6 E 231 533.5 ORIGINATED BY KH/GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 12.05.06 - 15.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <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>		
			17	SS	110/ .300												
281.3							282										
21.6	END OF BOREHOLE AT 21.56 m. BOREHOLE OPEN TO 21.56 m AND WATER LEVEL AT 7.01 m UPON COMPLETION OF DRILLING. BOREHOLE GROUTED TO SURFACE.		18	SS	100/ .225												

# RECORD OF BOREHOLE No 06-20

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 706.1 E 231 537.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 10.05.06 - 11.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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		
303.2	ASPHALT: (50 mm)													
0.1	SAND and GRAVEL, some silt Very Dense to Dense Brown (FILL)		1	SS	57		303							32 58 11 (SI+CL)
302.4														
0.8	SAND, fine to medium grained, trace silt Compact to Dense Brown		2	SS	33		302							
			3	SS	26									
			4	SS	30		301							
300.2														
3.0	Clayey SILT and SAND, trace gravel Hard Brown (TILL)		5	SS	56		300							
			6	SS	100									
							299							
			7	SS	46									
							298							
297.7														
5.5	Silty CLAY, some sand, trace gravel Hard Brown (TILL)		8	SS	100		297							
							296							
			9	SS	82									
							295							
			10	SS	69		294							

Continued Next Page

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

20  
15  
10

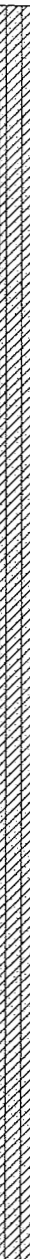

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-20

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 706.1 E 231 537.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 10.05.06 - 11.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			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							
							20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	WATER CONTENT (%)					
							20 40 60 80 100	20 40 60								
	Becoming Very Stiff		11	SS	65											
			12	SS	61											
			13	SS	32											
			14	SS	20											
			15	SS	24											
284.9	Clayey Sandy SILT, trace gravel Hard Brown (TILL)		16	SS	100											
18.3																

Becoming Very Stiff

Continued Next Page

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

# RECORD OF BOREHOLE No 06-20

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 706.1 E 231 537.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 10.05.06 - 11.05.06 CHECKED BY MRA

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		
			17	SS	115		283							1 31 48 19
281.7			18	SS	104/		282							
21.5	END OF BOREHOLE AT 21.49 m. BOREHOLE OPEN TO 21.49 m AND WATER LEVEL AT 18.90 m UPON COMPLETION OF DRILLING. BOREHOLE GROUTED TO SURFACE.				.150									

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	w <sub>p</sub>	w	w <sub>L</sub>			WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
302.9 0.0	<b>ASPHALT:</b> (50 mm)		1	SS	50/ .150							54 40 6 (SI+CL)		
0.1	<b>SAND and GRAVEL,</b> trace silt , trace clay, occasional cobbles Very Dense to Dense Brown Dry (FILL)													
302		2	SS	34										
301														
300.3 2.6	<b>SAND,</b> some gravel, some silt Dense Brown Moist		3	SS	38									
300														
299.2 3.7	<b>SILT and SAND,</b> some clay to clayey, trace gravel Hard Brown (TILL)		4	SS	104									
299														
298														
297														
296.8 6.1	<b>Silty CLAY,</b> trace sand Hard Brown (TILL)		5	SS	84									
296														
295			6	SS	61							0 1 60 3		
294			7	SS	74									

+ 3, × 3: Numbers refer to Sensitivity



## METRIC

[illegible]

END OF BOREHOLE AT 21.54 m.  
BOREHOLE OPEN TO 21.54 m AND  
DRY UPON COMPLETION.  
BOREHOLE GROUTED TO  
SURFACE.

# RECORD OF BOREHOLE No 06-22

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 702.3 E 231 525.8 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 15.05.06 - 16.05.06 CHECKED BY MRA

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						
303.5								20 40 60 80 100						
0.0	ASPHALT: (150 mm)							○ UNCONFINED + FIELD VANE						
0.2	SAND and GRAVEL, trace silt, occasional cobbles Very Dense to Dense Brown Moist (FILL)		1	SS	50/ .125		303	● QUICK TRIAXIAL × LAB VANE						
			2	SS	60			WATER CONTENT (%)						
							302	20 40 60 80 100						
			3	SS	40			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
301.2								W <sub>P</sub> W W <sub>L</sub>						
2.3	SAND, fine grained, trace gravel, trace silt Compact to Dense Brown Moist		4	SS	24		301							
			5	SS	36		300							
299.7														
3.8	Clayey Sandy SILT, trace gravel Hard Brown (TILL)		6	SS	80		299							5 31 48 16
			7	SS	50/ .150		298							
297.4														
6.1	Silty CLAY, trace sand Hard Brown (TILL)		8	SS	59		297							
							296							Sampler wet
			9	SS	100		295							
			10	SS	76		294							

Continued Next Page

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

20  
15  
10  
(%) STRAIN AT FAILURE

5 31 48 16  
Sampler wet

## METRIC

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					
								20 40 60 80 100 WATER CONTENT (%) 20 40 60					
			11	SS	46								0 8 50 42
			12	SS	45								
			13	SS	55								
			14	SS	40								0 0 37 63
286.7							287						
16.8	SILT and SAND, some clay Very Dense Brown (TILL)		15	SS	115								
							286						
			16	SS	101		285						
							284						

+ 3, x 3: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 06-22

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 702.3 E 231 525.8 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 15.05.06 - 16.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y 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		
283.4			17	SS	110									
20.1	END OF BOREHOLE AT 20.12 m. BOREHOLE OPEN TO 20.12 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.						283							

ONTMT4S 7938-2.GPJ 08/01/07

# RECORD OF BOREHOLE No 06-23

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 697.3 E 231 540.7 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 08.05.06 - 10.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
303.5							20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>		
0.0 0.1	ASPHALT: (50 mm) SAND and GRAVEL, trace silt Very Dense Brown Damp (FILL)		1	SS	52							
			2	SS	75							
	occasional cobbles											
301.7			3	SS	50/ .075							
1.8	SAND and GRAVEL, some silt Very Dense Brown Damp		4	SS	68							
300.5												
3.0	SAND, some silt, trace gravel Compact Brown Moist to Wet (SP)		5	SS	10							
			6	SS	13							
298.9												
4.6	Sandy SILT, some clay to clayey, trace gravel Hard Brown (TILL)		7	SS	38							
			8	SS	60							
295.9												
7.6	Silty CLAY, some sand Hard Brown (TILL)		9	SS	102							
			10	SS	74							

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

2000 PROFILE					DYNAMIC CONE PENETRATION				
--------------	--	--	--	--	--------------------------	--	--	--	--

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity

CONTMT4S 7938-2.GPJ 5/25/07

# RECORD OF BOREHOLE No 06-23

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 697.3 E 231 540.7 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2006-05-08 - 2006-05-10 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <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				WATER CONTENT (%) w <sub>p</sub> w w <sub>L</sub>															
Continued From Previous Page																											
282.2	SILT and SAND, trace to some clay, trace gravel Very Dense Brown Moist (TILL)		17	SS	100/ .075		283																				
282																											
281																											
280																											
279			18	SS	100/ .225												3 47 42 8										
278			19	SS	119		278																				
277																											
276	20	SS	108				276																				
27.7	<p>END OF BOREHOLE AT 27.74 m. BOREHOLE OPEN TO 27.13 m AND WATER LEVEL AT 18.90 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.</p> <p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH(m)</th> <th>ELEV.(m)</th> </tr> </thead> <tbody> <tr> <td>10.05.06</td> <td>20.64</td> <td>282.86</td> </tr> <tr> <td>18.05.06</td> <td>19.85</td> <td>283.65</td> </tr> <tr> <td>08.08.06</td> <td>21.23</td> <td>282.27</td> </tr> </tbody> </table>															DATE	DEPTH(m)	ELEV.(m)	10.05.06	20.64	282.86	18.05.06	19.85	283.65	08.08.06	21.23	282.27
DATE	DEPTH(m)	ELEV.(m)																									
10.05.06	20.64	282.86																									
18.05.06	19.85	283.65																									
08.08.06	21.23	282.27																									

ONTMT4S 7938-2.GPJ 5/25/07

# RECORD OF BOREHOLE No 06-24

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 714.5 E 231 550.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 24.05.06 - 24.05.06 CHECKED BY MRA

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		
311.1								SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
								WATER CONTENT (%)						
								20	40	60	80	100		
0.0	ASPHALT: (190 mm)													
0.2	SAND and GRAVEL crusher run limestone Very Dense Brown Dry (FILL)		1	SS	50/ .150		311							42 47 11 (SI+CL)
			2	SS	50		310							
309.6														
1.5	Silty SAND, trace gravel, trace clay Dense to Very Dense Brown Dry to Damp		3	SS	33		309							
							308							
			4	SS	60		307							
							306							
	Becoming Compact to Loose, some silt		5	SS	14		305							
							304							
			6	SS	8		303							
							302							
302.0														
9.1	SILT, some clay, some sand to sandy, trace gravel Very Dense Brown Dry (TILL)		8	SS	53									3 63 25 9

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-24

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 714.5 E 231 550.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 24.05.06 - 24.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y 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	20 40 60 80 100	W P W W L	20 40 60						
300.0			9	SS	102		301										
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

ONTMT4S 7938-2.GPJ 08/01/07

# RECORD OF BOREHOLE No 1

W P 31-76-04/05 LOCATION Co-ords. N 4 808 491; E 231 481 ORIGINATED BY BL  
 DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL  
 DATUM Geodetic DATE 80-02-12 CHECKED BY

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			VALUES	20					
308.9	Ground Level												
0.0	Sand and Gravel Traces of Silt and Clay  Compact to V. Dense		1	SS	22								
			2	SS	12								
			3	SS	14								
			4	SS	37								
			5	SS	41								
			6	SS	57								
302.8			7	SS	50/76 mm								
6.2	End of Borehole		8	SS	100/127 mm								

+3, x5; Numbers refer to  
Sensitivity

20  
15 + 5 (%) STRAIN AT FAILURE  
10



Ministry of  
Transportation and  
Communications

## RECORD OF BOREHOLE No 2

W P 31-76-04/05 LOCATION Co-ords. N 4 808 490; E 231 504 ORIGINATED BY BL  
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL  
DATUM Geodetic DATE 80-02-13 & 14 CHECKED BY

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							WATER CONTENT (%) 10 20 30
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
308.5	Ground Level							Auger to 1.0 m						GR SA SI CL	
0.0	Sand and Gravel		1	SS	13		308							57 31 (12)	
	Traces of Silt and Clay		2	SS	96		306							41 49 (10)	
			3	SS	54										
			4	SS	47										
	Compact to Very Dense		5	SS	47										
			6	SS	63										
			7	SS	63										
			8	SS	114/	280 mm	302								
			9	SS	48										
			10	SS	39										
300.0							300								
8.5	Silty Clay		11	SS	100/	127 mm	298							0 0 59 41	
	(Plasticity: Low to Intermediate)		12	SS	146										
	Trace of Gravel		13	SS	166		296								
			14	SS	86										
	Very Stiff to Hard		15	SS	70		294								
			16	SS	104		292							0 6 49 45	
			17	SS	60		290								
			18	SS	34		288								
			19	SS	37										
			20	SS	28		286								
284.4															
24.1	Het. Mixture of Silty Clay Sand and Gravel		21	SS	92/	152 mm	284							14 51 30 5	
283.0	Hard. Glacial Till		22	SS	40/	0 mm									
25.5	End of Borehole														

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 3

W P 31-76-04 / n5 LOCATION Co-ords. N 4 808 487; E 231 542 ORIGINATED BY BL  
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL  
DATUM Geodetic DATE 80-02-15 80-02-18 to 20 CHECKED BY

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					
308.3	Ground Level											
0.0												
	Sand and Gravel		1	SS	11							
	Traces of Silt and Clay		2	SS	16							
			3	SS	39							
			4	SS	81							
			5	SS	39							
			6	SS	26							
	Compact to Dense		7	SS	36							
			8	SS	22							
			9	SS	89							
299.8			10	SS	154							
8.5												
	Silty Clay		11	SS	122							
	(Plasticity: Low to Intermediate)		12	SS	86							
			13	SS	64							
	Trace of Sand		14	SS	86							
			15	SS	50							
	Hard		16	SS	82							
			17	SS	46							
			18	SS	37							
			19	SS	35							
284.5			20	SS	30							
23.8												
	Heterogeneous Mixture of Silty Clay, Sand and Gravel		21	SS	1057	152 mm						
			22	SS	1377	152 mm						
	Hard											
	Glacial Till											
280.6			23	SS	1307	152 mm						
27.7	End of Borehole											

+3, x5: Numbers refer to  
Sensitivity

20  
15-0.5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 4

W P 31-76-04 /05 LOCATION Co-ords. N 4 808 491; E 231 477 ORIGINATED BY BL  
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL  
DATUM Geodetic DATE 80-02-21; 80-02-25 CHECKED BY

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					
308.9																	
0.0	Sand and Gravel																
	Traces of Silt and Clay																
	Very Dense		1	SS	131												
			2	SS	81												46 45 (9)
			3	SS	122	292 H											
			4	SS	51												45 46 (9)
			5	SS	85												
297.4																	
11.6	Silty Clay		6	SS	119												
	(Plasticity: Low to Intermediate)		7	SS	109												
	Some Sand		8	SS	91												
	Trace of Gravel		9	SS	76												
	Hard		10	SS	57												0 5 38 57
			11	SS	77												
			12	SS	31												
			13	SS	48												8 16 38 28
285.5																	
23.5	Heterogeneous Mixture of Silty Clay, Sand and Gravel		14	SS	124	76 mm											
	Hard		15	SS	100	152 mm											0 28 49 23
	Glacial Till																
281.4			16	SS	100	64 mm											
27.6	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15 x 5 (%) STRAIN AT FAILURE  
10



Ministry of  
Transportation and  
Communications  
Ontario

## RECORD OF BOREHOLE No 5

W P 31-76-04/05 LOCATION Co-ords. N 4 808 499; E 231 501 ORIGINATED BY BL  
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL  
DATUM Geodetic DATE 80-02-26 & 27 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
308.8 0.0	Ground Level										
0.0 299.6 8.2	Sand and Gravel  Some Silt  Trace of Clay   Loose to Dense		1	SS	9						0 77 (23)
			2	SS	18						
			3	SS	18						
			4	SS	4						
			5	SS	23						
			6	SS	22						
			7	SS	29						
			8	SS	20						
			9	SS	32						
			10	SS	33						
8.2 285.0 23.8	Silty Clay  (Plasticity: Low to Intermediate)  Some Sand   Hard		11	SS	55						4 60 (36)
			12	SS	82						
			13	SS	77						
			14	SS	52						
			15	SS	64						
			16	SS	67						
			17	SS	89						
			18	SS	39						
			19	SS	40						
			20	SS	58						
23.8 281.1 27.7	Heterogeneous Mixture of Clayey Silt Sand and Gravel  Hard  Glacial Till  End of Borehole		21	SS	172	254 mm					0 2 59 39
			22	SS	105	127 mm					
			23	SS	100	114 mm					
											0 0 26 74
											0 13 33 49
											12 30 46 12

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 6

W P 31-76-04/05 LOCATION Co-ords. N 4 808 459; E 231 550 ORIGINATED BY BL  
 DIST 3 HWY 88 BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL  
 DATUM Geodetic DATE 80-02-28 & 29 CHECKED BY

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	100					
308.5	Ground Level													
0.0														
	Sand and Gravel		1	SS	9		308	Auger to 1.0 m						
			2	SS	26									
	Traces of Silt and Clay		3	SS	60		306							46 40 12 2
			4	SS	61									
	Loose to Very Dense		5	SS	68		304							
			6	SS	98/	127 mm	302							
			7	SS	35		300							
300.0														
8.5														
	Silty Clay (Plasticity: Low to Intermediate)		8	SS	46		298							0 77 (23)
	Occ. Silty Sand Layers		9	SS	26									
	Trace of Sand		10	SS	50/	76 mm	296							
	Very Stiff to Hard		11	SS	145		294							
			12	SS	98		292							0 8 53 39
			13	SS	89		290							
			14	SS	99		288							
			15	SS	58		286							
			16	SS	40		284							
284.7			17	SS	34		282							0 1 24 75
23.8														
	Heterogeneous Mixture of silty clay Sand and Gravel		18	SS	155/	76 mm	284							16 25 44 15
	Hard		19	SS	100/	127 mm	282							
	Glacial Till													
280.9			20	SS	106/	146 mm								26 28 39 7
27.6	End of Borehole													

+3, x5: Numbers refer to 20  
Sensitivity 15-5 (%) STRAIN AT FAILURE  
10

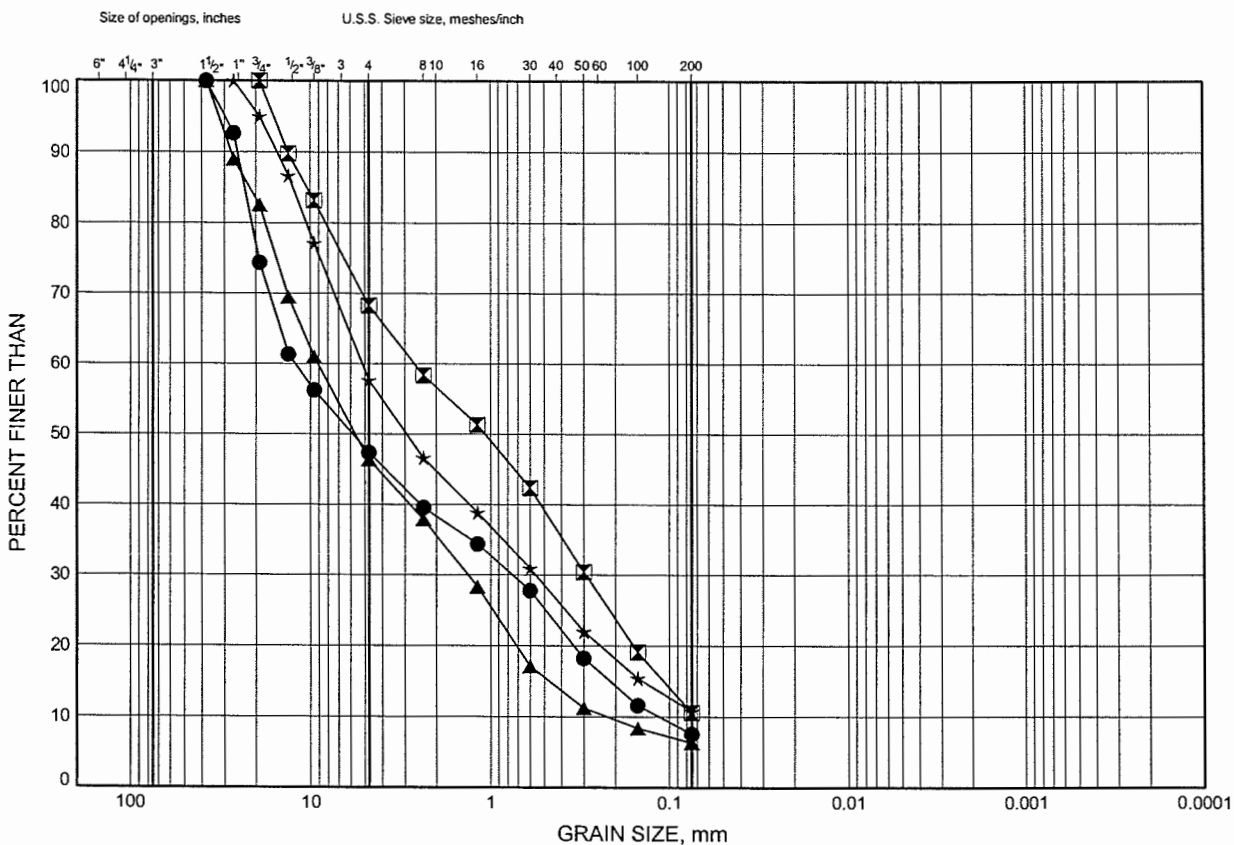
## **Appendix B**

### **Laboratory Test Results**

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B1

## SAND AND GRAVEL FILL, SAND FILL

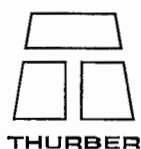


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-15	1.07	301.23
⊠	06-20	0.46	302.74
▲	06-21	1.83	301.07
★	06-24	0.53	310.57

Date January 2007

Project 277-97-00



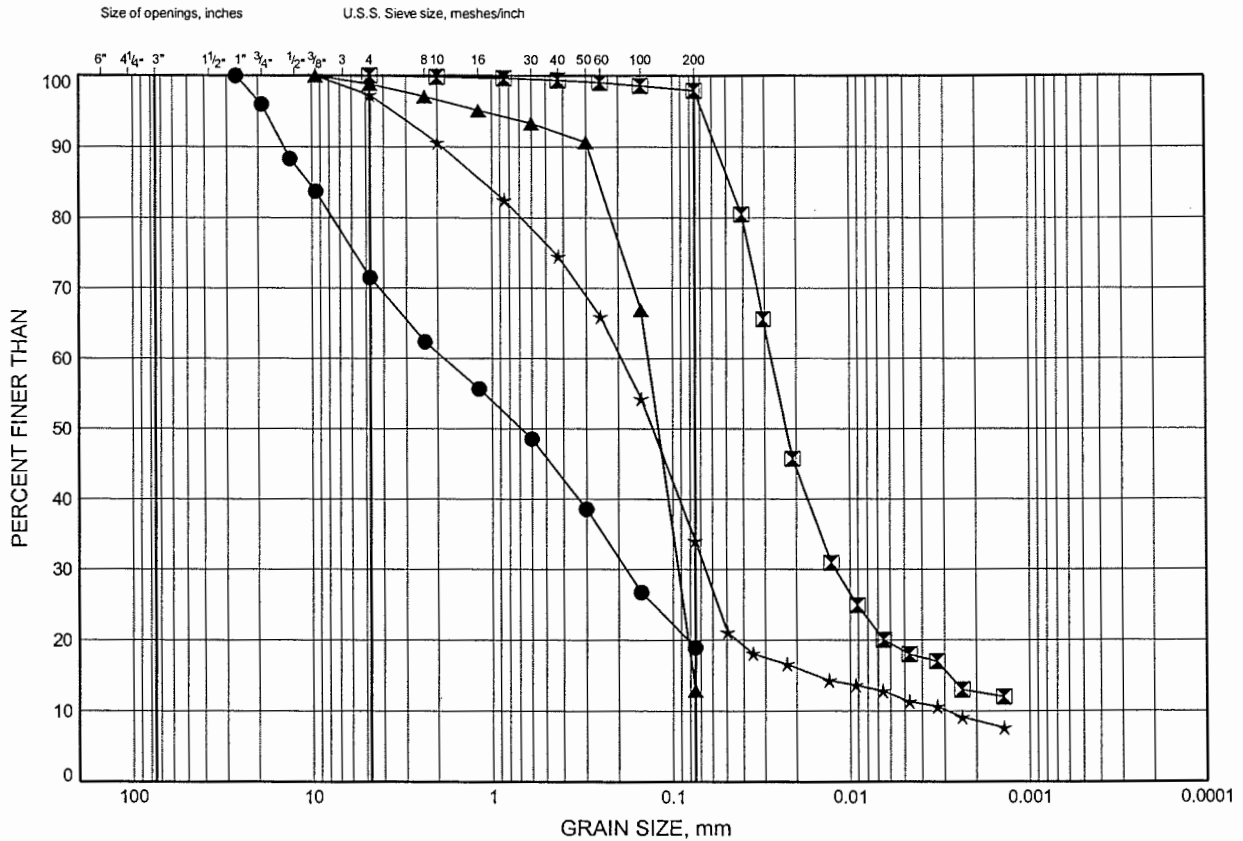
Prep'd MFA

Chkd. MRA

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B2

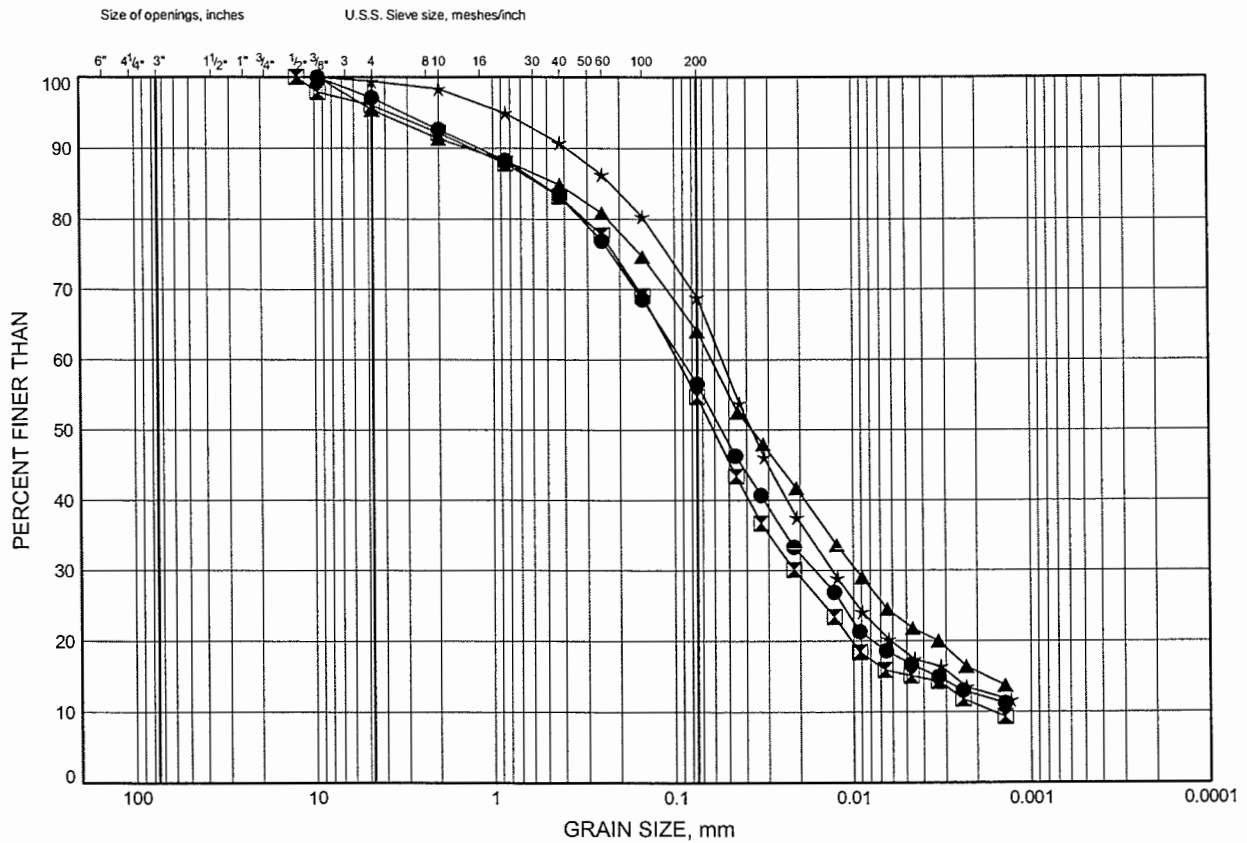
## SAND TO SAND AND GRAVEL, SILT



# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B3

## SILT AND SAND TO CLAYEY SANDY SILT (TILL)

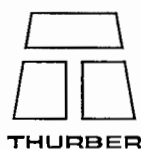


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-16	2.59	300.31
⊠	06-17	2.59	300.31
▲	06-22	4.80	298.70
★	06-23	6.32	297.17

Date January 2007

Project 277-97-00



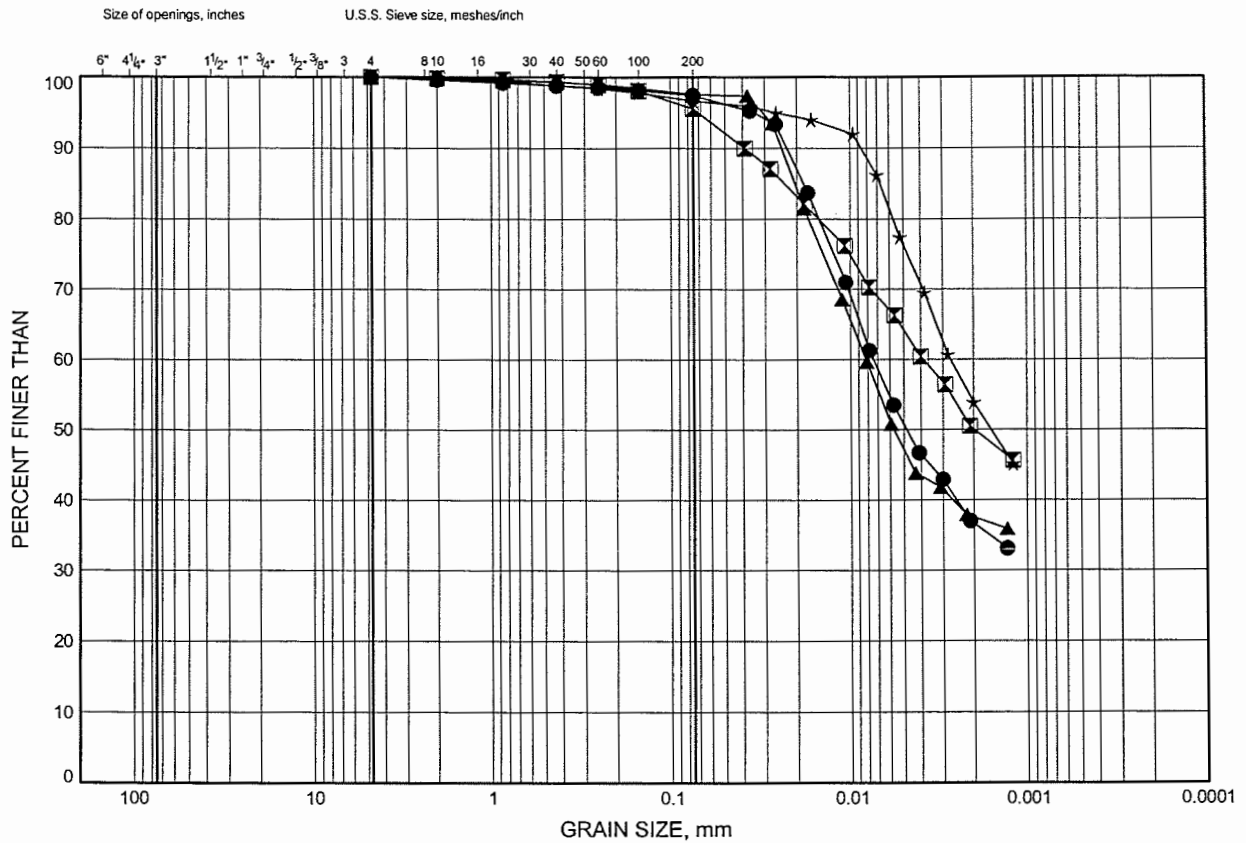
Prep'd MFA

Chkd. MRA

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B4

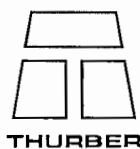
## SILTY CLAY TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-16	6.32	296.58
◻	06-16	10.90	292.00
▲	06-17	4.80	298.10
★	06-20	16.99	286.21

Date January 2007  
Project 277-97-00

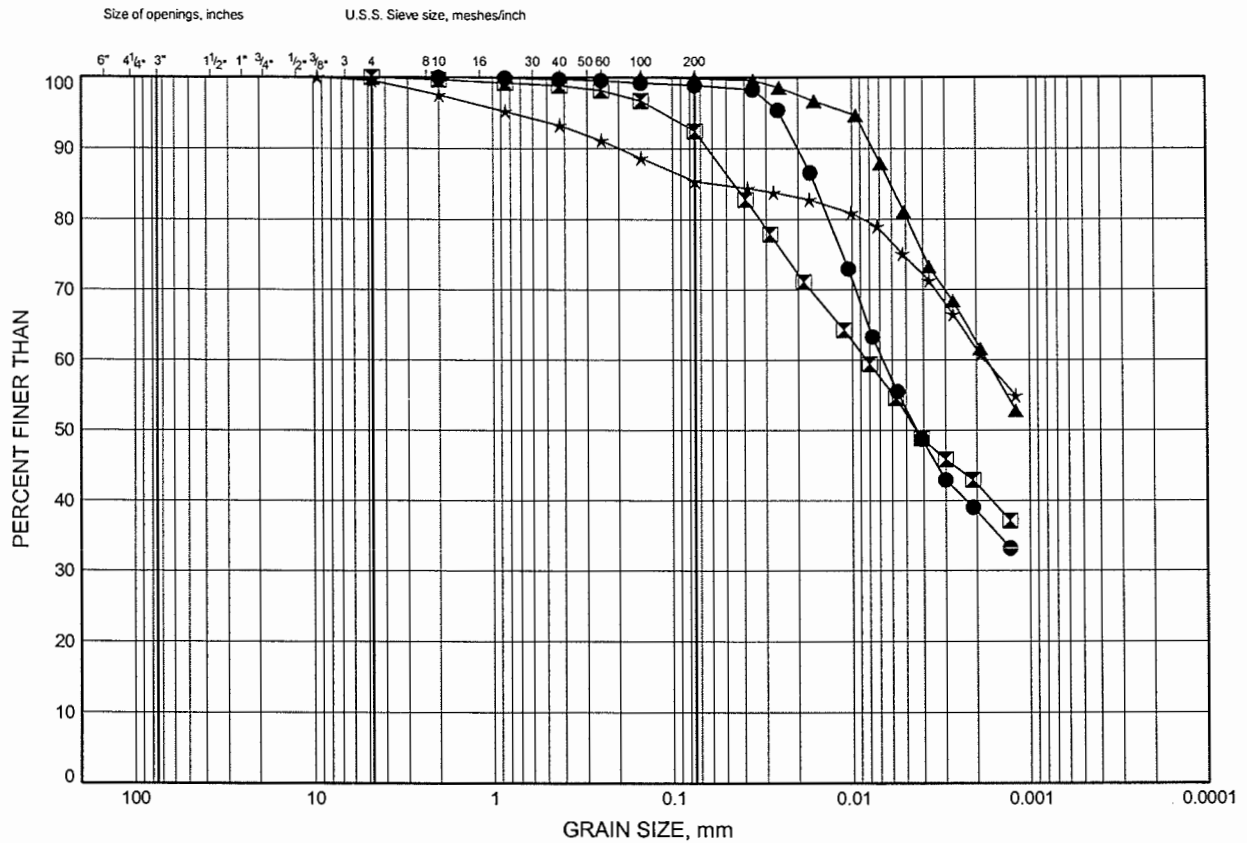


Prep'd MFA  
Chkd. MRA

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B5

## SILTY CLAY TILL

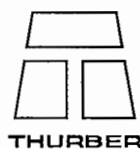


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-21	7.85	295.05
⊠	06-22	10.90	292.60
▲	06-22	15.47	288.03
★	06-23	18.52	284.98

Date January 2007

Project 277-97-00



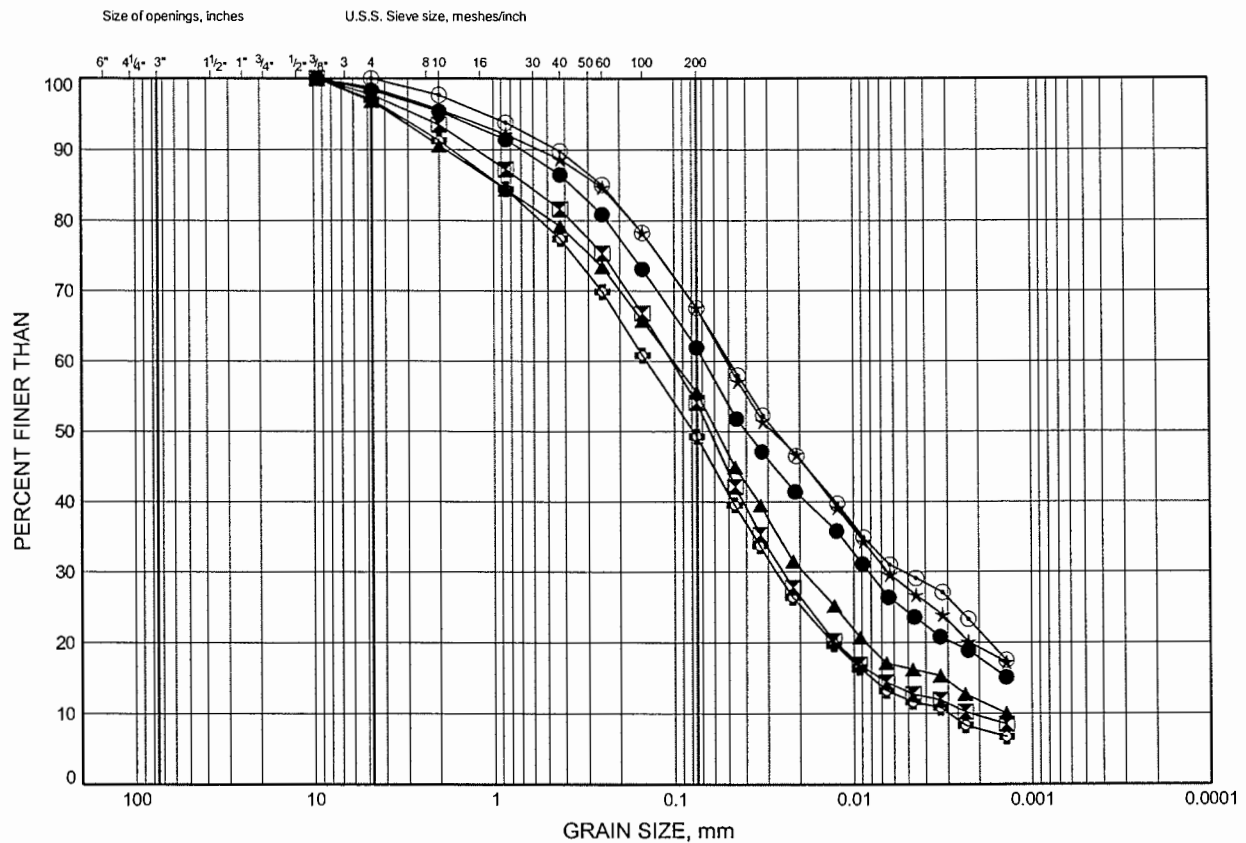
Prep'd MFA

Chkd. MRA

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B6

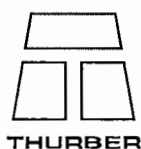
## SILT AND SAND TO CLAYEY SANDY SILT (TILL)



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-15	18.52	283.78
⊠	06-16	18.52	284.38
▲	06-17	20.04	282.86
★	06-20	20.04	283.16
⊙	06-21	20.04	282.86
⊛	06-23	24.61	278.89

Date January 2007  
Project 277-97-00

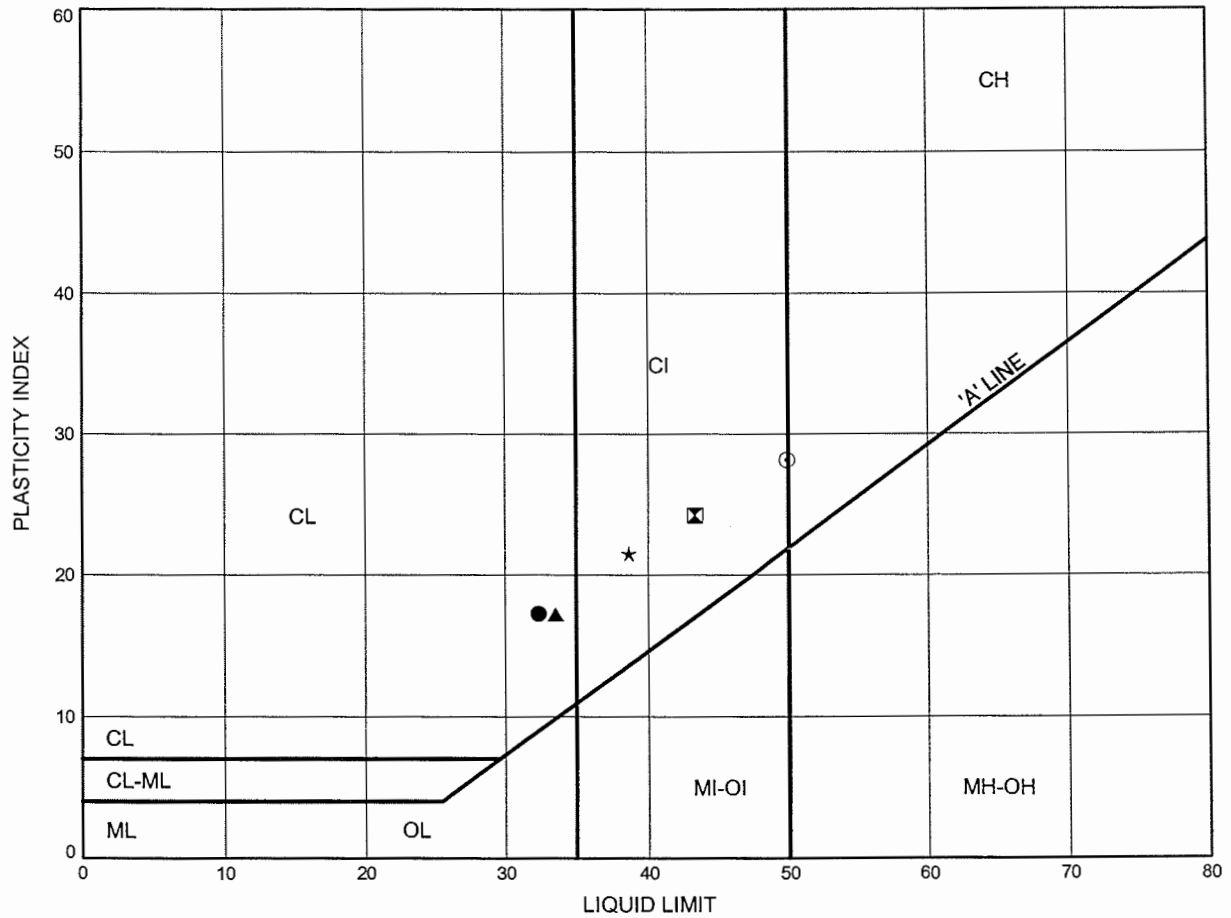


Prep'd MFA  
Chkd. MRA

Geotechnical Investigation  
**ATTERBERG LIMITS TEST RESULTS**

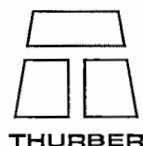
FIGURE B7

**SILTY CLAY TILL**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-17	4.80	298.10
⊠	06-20	16.99	286.21
▲	06-21	7.85	295.05
★	06-22	10.90	292.60
⊙	06-23	18.52	284.98

Date January 2007  
 Project 277-97-00



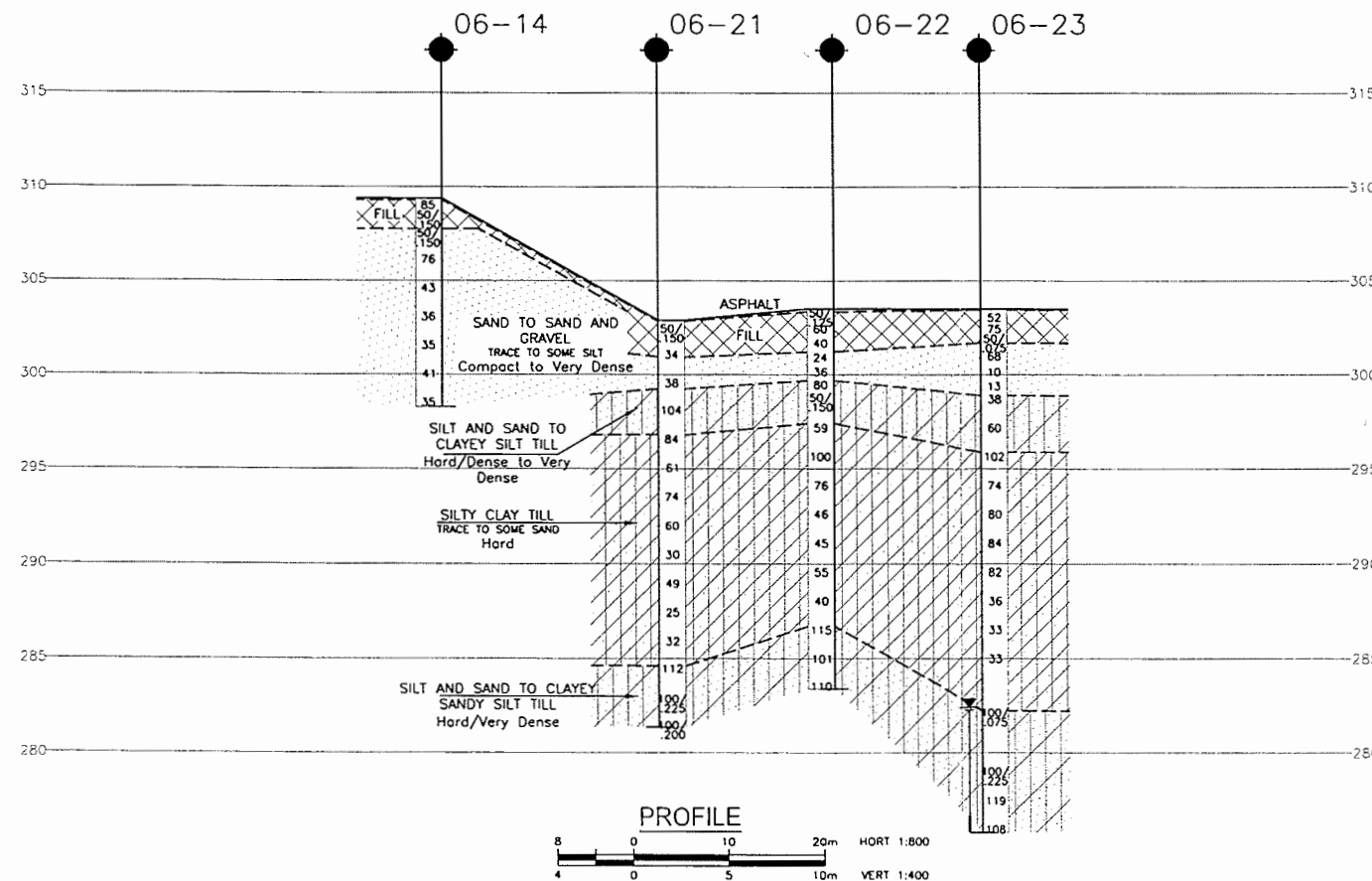
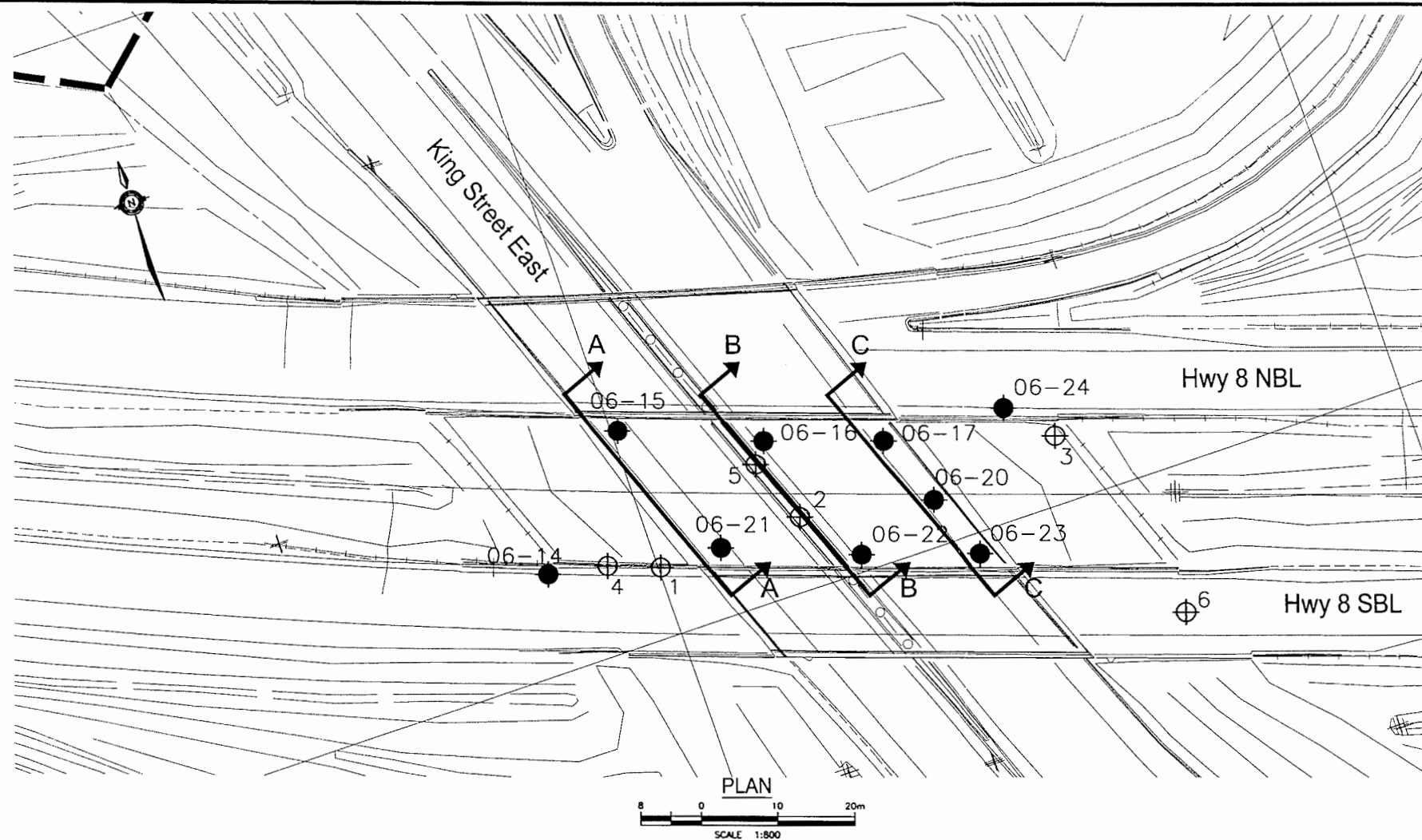
Prep'd MFA  
 Chkd. MRA

---

## **Appendix C**

### **Drawings**

#### **Borehole Locations and Soil Strata**



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

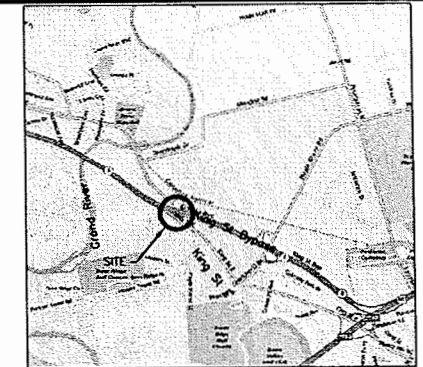
CONT No  
GWP No.277-97-00

KING STREET OVERPASS  
HWY 8 WIDENING  
KITCHENER  
BOREHOLE LOCATIONS AND SOIL STRATA



MORRISON  
HERSHFIELD

THURBER ENGINEERING LTD.  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



**KEYPLAN  
LEGEND**

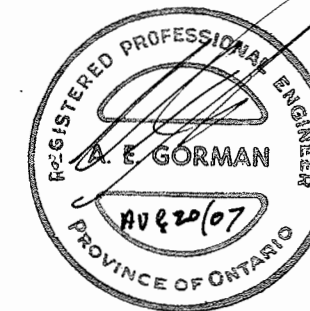
- BoreHole
- BoreHole and Cone
- BoreHole from Previous Investigation (Approximate)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
06-14	309.4	4 808 713.1	231 485.9
06-15	302.3	4 808 728.1	231 500.9
06-16	302.9	4 808 720.6	231 518.7
06-17	302.9	4 808 715.6	231 533.5
06-20	303.2	4 808 706.1	231 537.0
06-21	302.9	4 808 709.1	231 508.7
06-22	303.5	4 808 702.3	231 525.8
06-23	303.5	4 808 697.3	231 540.7
06-24	311.1	4 808 714.5	231 550.0

**-NOTES-**

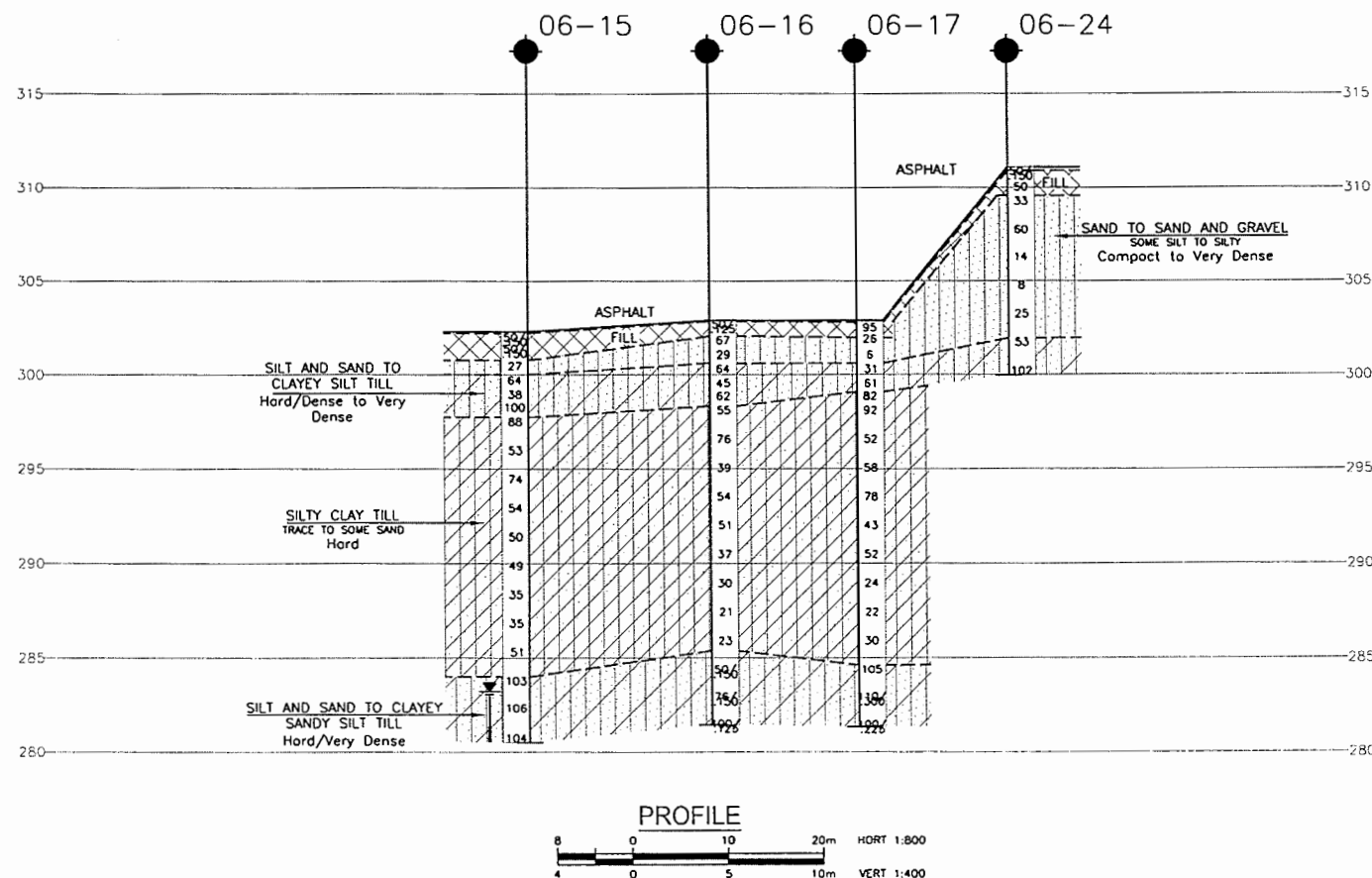
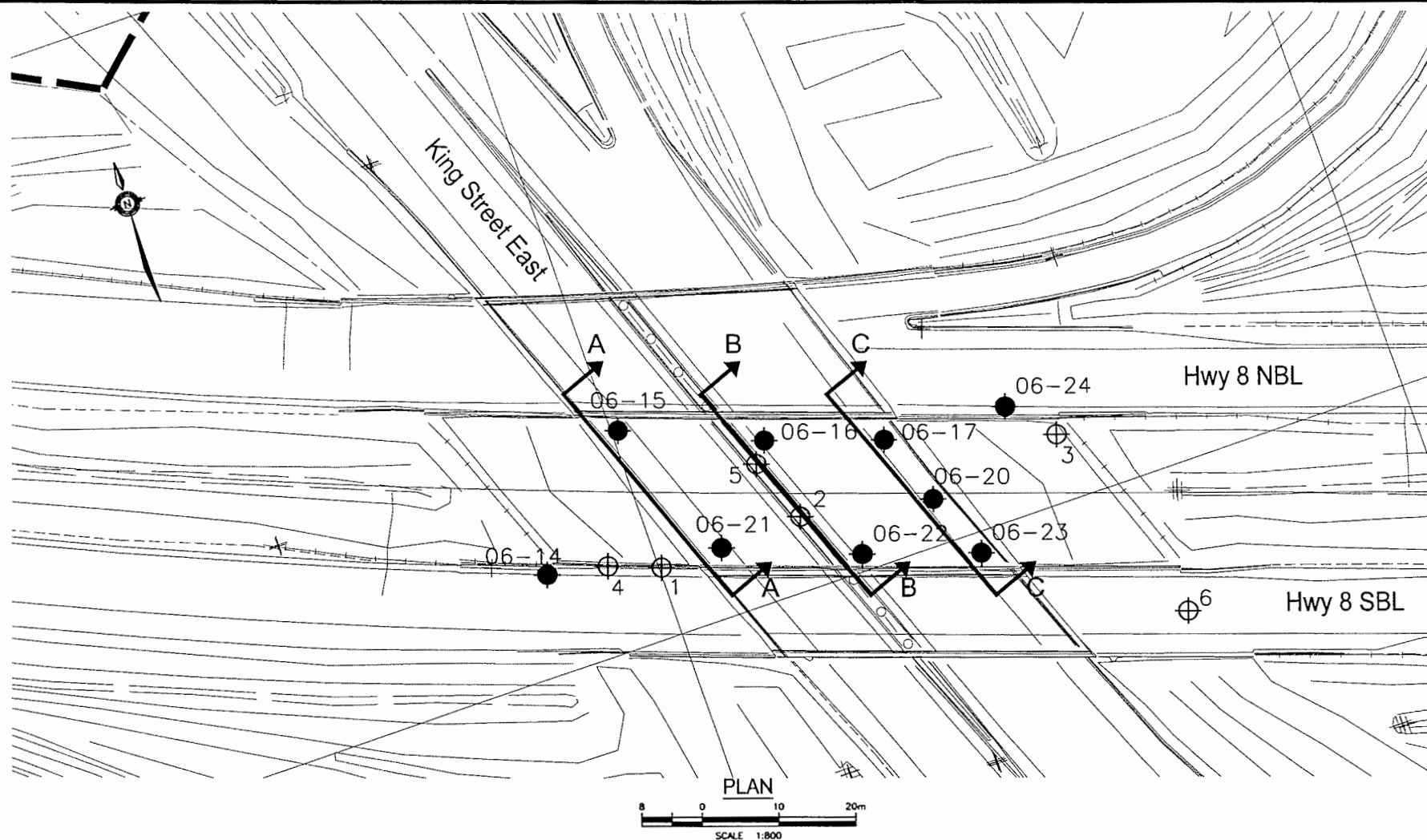
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 40P8-145



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK PKC	CODE
DRAWN	JHL	CHK PKC	SITE 33-214W
LOAD			STRUCT
DATE	JAN 2007		DWG 1



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

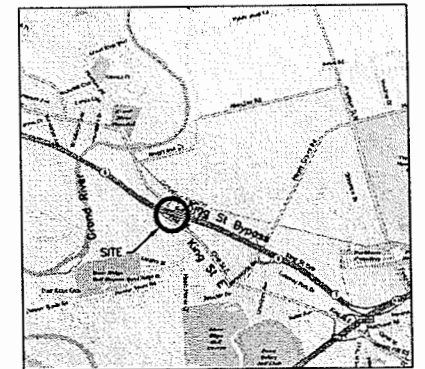
CONT No  
GWP No.277-97-00  
KING STREET OVERPASS  
HWY 8 WIDENING  
KITCHENER  
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET

MORRISON  
HERSHFIELD

THURBER ENGINEERING LTD.  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN  
LEGEND

- ◆ BoreHole
- ◆ BoreHole and Cone
- ⊕ BoreHole from Previous Investigation (Approximate)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- ↕ Water Level
- ↕ Head Artesian Water
- ↕ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
06-14	309.4	4 808 713.1	231 485.9
06-15	302.3	4 808 728.1	231 500.9
06-16	302.9	4 808 720.6	231 518.7
06-17	302.9	4 808 715.6	231 533.5
06-20	303.2	4 808 706.1	231 537.0
06-21	302.9	4 808 709.1	231 508.7
06-22	303.5	4 808 702.3	231 525.8
06-23	303.5	4 808 697.3	231 540.7
06-24	311.1	4 808 714.5	231 550.0

**NOTES-**

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

GEOCREs No. 40P8-145



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK PKC	CODE
DRAWN	JHL	CHK PKC	SITE 33-214W STRUCT DWG 2

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

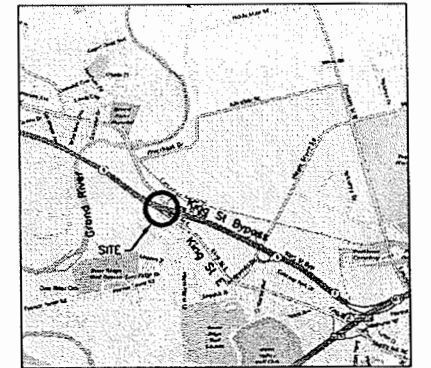
CONT No  
 GWP No.277-97-00

KING STREET OVERPASS  
 HWY 8 WIDENING  
 KITCHENER  
 BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

MORRISON  
 HERSHFIELD

THURBER ENGINEERING LTD.  
 GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN  
 LEGEND

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

NO	ELEVATION	NORTHING	EASTING
06-14	309.4	4 808 713.1	231 485.9
06-15	302.3	4 808 728.1	231 500.9
06-16	302.9	4 808 720.6	231 518.7
06-17	302.9	4 808 715.6	231 533.5
06-20	303.2	4 808 706.1	231 537.0
06-21	302.9	4 808 709.1	231 508.7
06-22	303.5	4 808 702.3	231 525.8
06-23	303.5	4 808 697.3	231 540.7
06-24	311.1	4 808 714.5	231 550.0

**-NOTES-**

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

GEOCREs No. 40P8-145

DATE	BY	DESCRIPTION
DESIGN	MRA	CHK PKC [CODE]
DRAWN	MFA	CHK PKC [SITE 33-214W] [STRUCT]
		[DWG 3]

REVISIONS

DATE JAN 2007  
 DWG 3

FILENAME: D:\Job Files\97479\38 Hwy 8\ED7938\KingStreet-2.dwg  
 PLOTDATE: Aug 14, 2007 - 2:17pm

DRAWING NOT TO BE SCALED  
 100 mm ON ORIGINAL DRAWING

SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

SECTION E-E

SECTION F-F

SECTION G-G

SECTION H-H

SECTION I-I

SECTION J-J

SECTION K-K

SECTION L-L

SECTION M-M

SECTION N-N

SECTION O-O

SECTION P-P

SECTION Q-Q

SECTION R-R

SECTION S-S

SECTION T-T

SECTION U-U

SECTION V-V

SECTION W-W

SECTION X-X

SECTION Y-Y

SECTION Z-Z

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW

SECTION XX-XX

SECTION YY-YY

SECTION ZZ-ZZ

SECTION AA-AA

SECTION BB-BB

SECTION CC-CC

SECTION DD-DD

SECTION EE-EE

SECTION FF-FF

SECTION GG-GG

SECTION HH-HH

SECTION II-II

SECTION JJ-JJ

SECTION KK-KK

SECTION LL-LL

SECTION MM-MM

SECTION NN-NN

SECTION OO-OO

SECTION PP-PP

SECTION QQ-QQ

SECTION RR-RR

SECTION SS-SS

SECTION TT-TT

SECTION UU-UU

SECTION VV-VV

SECTION WW-WW