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## **FINAL REPORT**

FOUNDATION INVESTIGATION  
FOR HIGH MAST LIGHTS  
G.W.P. 302-89-00  
HIGHWAY 417 FROM EAGLESON  
ROAD TO MOODIE DRIVE  
OTTAWA, ON

Totten Sims Hubicki

PROJECT NO. NO11674  
GEOCRES NO. 31G5-205

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# **PROJECT NO. NO11674**

**FINAL REPORT –  
FOUNDATION INVESTIGATION**

**TO**

**Totten Sims Hubicki  
300 Water Street  
Whitby, Ontario  
L1N 9J2**

**ON**

**Foundation Investigation for  
High Mast Lights  
G.W.P. 302-89-00  
  
Highway 417 from Eagleson  
Road to Moodie Drive  
  
District 42, Ottawa  
  
Ministry of Transportation  
Ontario  
  
Geocres No. 31G5-205**

---

**November 2006**

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FOUNDATION INVESTIGATION REPORT  
for  
G.W.P. 302-89-00  
High Mast Light Foundations  
Highway 417 from Eagleson Road to Moodie Drive  
Ottawa, Ontario  
District 42, Ottawa

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## 1.0 INTRODUCTION

This report was prepared for the design and construction of 38 High Mast Lights proposed along Highway 417 from Eagleson Road to Moodie Drive. This section of the report presents factual results of a foundation investigation carried out for the proposed High Mast Light locations identified as Pole Numbers P1 through P33 and P42, P43, P45, P46, and P47.

This foundation investigation was carried out in general accordance with Jacques Whitford Scope Changes 4 and 5 to G.W.P. 302-89-00, as outlined in our Scope Change Requests dated October 25, 2004, and January 6, 2006. Authorization to proceed was provided by the Ministry of Transportation of Ontario (MTO) under an agreement with Totten Sims Hubicki, the Prime Consultant for this project.

This report has been prepared specifically and solely for the project described herein. It contains factual information pertaining to the subsurface conditions which was obtained as part of this investigation.

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## 2.0 SITE DESCRIPTION AND GEOLOGY

The subject site is within the limits of MTO Group Work Project G.W.P. 302-89-00 to upgrade 14.6 km of Highway 417, between Highway 7 and Highway 416, from a 4-lane freeway to an 8-lane freeway. Within the limits of the proposed widening new High Mast Lights are proposed. The proposed High Mast Light locations P1 through P29, and P32 and P33 are within the centre median of Highway 417. The proposed High Mast Light locations P30 and P31 are located between the ramps at the Moodie Drive interchange. The proposed High Mast Light locations P42, P43, P45, P46 and P47 are located between the ramps at the Eagleson Road interchange. The site location and the proposed High Mast Light locations are shown on the Drawing No.'s NO11674-1 through NO11674-4, provided in Appendix A.

The project lies within the physiographic region known as the Ottawa Valley Clay Flats. Ontario Geological Survey Map P.2715 "Physiography of Southern Ontario" (Chapman and Putnam) indicates that this area consists of clay plains interrupted by ridges of rock or sand. The previous Jacques Whitford Pavement Design Report indicates that portions of this section of Highway 417 is constructed within rock cuts.

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### 3.0 INVESTIGATION PROCEDURE

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#### 3.1 Field Investigation

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A borehole drilling and laboratory testing program was carried out for the project to investigate the subsurface conditions at the site. The drilling was carried out using a track-mounted CME-75 drill rig. The drilling investigation was carried out between January 16 and March 1, 2006.

A total of thirty-eight (38) boreholes, designated as 06-1 through 06-33, 06-42, 06-43, 06-45, 06-46 and 06-47, were drilled as part of the field investigation. The boreholes were drilled at or as near as possible to the proposed locations of the High Mast Lights.

The boreholes were advanced within the overburden using hollow stem augers. The subsurface conditions were identified in the field by Jacques Whitford Limited (JW) personnel from samples obtained while carrying out Standard Penetration Tests (SPT) (ASTM D1586) at regular intervals. SPT's were carried out at 0.76 m intervals within the upper 5.0 m of overburden and carried out at 3.0 m intervals below 5.0 m. Occasionally the density and granular nature of the subsurface deposits caused the equipment to block resulting in gaps between samples. In-situ vane shear testing was carried out to determine the undrained shear strength and remoulded shear strength of cohesive soils. The vane tests were typically carried out between SPT samples such that either a vane test or split spoon sample was collected at 1.5 m intervals. Bedrock was cored using NQ-sized coring equipment. The Rock Quality Designation (RQD) and Rock Core Recovery (REC) values were measured in the field.

Standpipes were installed within all the boreholes with the exception of Borehole 06-31.

The recovered soil samples were stored in moisture proof containers and the recovered rock core samples were stored in core boxes. All recovered samples were returned to our laboratory.

Prior to completing the investigation, the boreholes were backfilled with auger cuttings and grouted with a cement/bentonite mix in accordance with MOE Regulation 903.

### 3.2 Survey

Borehole locations were established in the field by Jacques Whitford with a Trimble Pathfinder Pro XRS Global Position System using northing and easting locations provided by Totten Sims Hubicki. The ground surface elevations at the borehole locations were surveyed relative to three benchmarks. Table 3.1 summarizes the approximate locations and elevations of the benchmarks used as part of the geotechnical investigation.

**Table 3.1: Geodetic Benchmarks**

<b>Benchmark</b>	<b>Approximate Location</b>	<b>Geodetic Elevation (m)</b>
BM 403	Station 13+703, north shoulder of the WBL of the 417	97.302
BM 617	Eagleson Bridge Structure, median of Eagleson road	98.654
GBM 88-U-891	West side of Moodie Drive	74.392

### 3.3 Laboratory Testing

All samples returned to the laboratory were subjected to detailed visual classification by a geotechnical engineer. Routine testing, consisting of moisture content testing, Atterberg limits, grain size distribution analysis and unconfined compressive strength was carried out on representative samples. Six representative soil samples were submitted for pH, sulphate and resistivity testing to assess the potential for corrosion of buried steel and the potential for sulphate attack on buried concrete.

The grain size distribution test results are provided on Figure No.'s 1 to 9 in Appendix B. The Atterberg limit test results are provided on Figure No.'s 10 and 11.

No complex testing was deemed to be necessary based on the soil conditions.

All soil samples will be stored for a period of one year after issuance of the final version of the foundation investigation report. Unless otherwise directed, the stored samples will be disposed of after this period.

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## 4.0 SUBSURFACE CONDITIONS

---

### 4.1 Subsurface Profile

The subsurface conditions observed in the boreholes are presented in detail on the Records of Boreholes provided in Appendix B. An explanation of the symbols and terms used to describe the Records of Boreholes is also provided. In general, the subsurface profile beneath the proposed Highway 417 alignment, within the limits of the current High Mast Light project, may be described as follows:

- A bowl shaped bedrock surface filled with a deep clay deposit near the Eagleson Road Interchange.
- East of the Eagleson Road Interchange the ground surface rises and the High Mast Light alignment extends through a short section of shallow rock fill and through a sandstone rock cut approximately 1.1 km in length.
- East of the sandstone rock cut, the alignment is within a deep fill (broken down sandstone rockfill) overlying clay, till, and sand deposits.
- East of the deep fill, near the Moodie Drive Interchange, the overburden consist principally of a deep clay deposit.

Borehole locations are indicated on Drawing No.'s NO11674-1 through NO11674-4 in Appendix A.

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#### 4.1.1 Fill: Sand, Trace to Some Gravel, Cobbles and Boulders

Fill was encountered beneath the surficial topsoil layer within Boreholes 06-11 through 06-28. The encountered fill consists of sand with variable amounts of gravel and frequent sandstone cobbles and boulders. The fill material is generally thin within the portion of the alignment extending through the sandstone rock cut where it appears to have been placed as a levelling material and is thicker adjacent to the rock cut where it consists of embankment fill material up to 9 m in height. The fill appears to consist of broken down sandstone obtained from the adjacent rock cut.

The thickness of the fill at the borehole locations varied between 0.4 m and 9.1 m. The SPT 'N' values ranged from 8 to greater than 50. Based on the SPT 'N' values the consistency of the fill was generally compact to dense with intermittent loose layers.

The moisture content of the 8 samples of fill tested ranged from 5% to 9%. A grain size analysis of a sample of fill from borehole 06-24 indicated that it contained 51% gravel, 43% sand, and 6% silt sized particles. The results of the grain size distribution test is shown on Figure No. 4 in Appendix B.



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#### 4.1.2 Silty Clay

A layer of silty clay was observed in all the borehole with the exception of 06-11 through 06-20, 06-23 and 06-25. The silty clay was fully penetrated at boreholes 06-1, 06-2, 06-7, 06-21, 06-26, and 06-32 where the deposit thickness ranged from 1.8 m to 9.0 m. At the remaining locations, the boreholes were terminated within the silty clay deposit at depths ranging from 9.5 m to 15.9 m.

In situ field vane tests carried out in the silty clay indicated undrained shear strengths between 17 kPa and 106 kPa. West of the rock cut, the undrained shear strength of the deeper silty clay (below the stiffer weathered portion) generally ranged between 30 and 45 kPa and the sensitivity ranged from 2 to 9 with an average of 5. This material can generally be described as a sensitive clay. East of the rock cut, the undrained shear strength of the deeper silty clay ranged between 40 and 80 kPa and the sensitivity ranged from 4 to 22 with an average of approximately 10, indicating that the deposit is typically extra-sensitive.

The moisture content of the 72 samples tested ranged between 21% and 69%. Atterberg Limits testing was carried out on 20 samples of silty clay, the results are presented on Figure No.'s 10 and 11 in Appendix B and indicate Liquid Limits between 14 and 74 and Plastic Limits between 10 and 26.

Grain size analysis carried out on 14 samples tested indicated that it contained 0% to 2% gravel, 0% to 22% sand, 41% and 80% silt and 6% to 59% clay sized particles. The results of the grain size distribution tests are shown on the Figure No.'s 6 through 9 in Appendix B.

---

#### 4.1.3 Silty Sand, Trace Clay to Sandy Silt, Some Clay, Trace Gravel

A layer of silty sand, trace clay to sandy silt, some clay and trace gravel was observed in boreholes 06-4, 06-6, 06-9, 06-10, 6-23, 06-42, and 06-43. The thickness of this deposit varied between 0.5 to 3.7 m.

SPT 'N' values measured within the silty sand to sandy silt materials generally ranged from 1 to 19, indicating a loose to compact material.

The moisture content of the three samples tested ranged from 24% to 37%. Grain size analysis tests indicated from 0% to 7% gravel, 37% to 82% sand and 18% to 56% silt and clay sized particles. The results of the grain size distribution tests is shown on Figure No. 1 in Appendix B.

#### 4.1.4 Sand, With Gravel, Some Silt, Trace Clay to Silt, Some Sand, Trace Clay (TILL)

A deposit of till was encountered within boreholes 06-1, 06-7, 06-21, 06-25, 06-26, 06-27, and 06-32. The till contains variable amounts sand, gravel, silt and clay. The thickness of this deposit varied between 0.3 m and 5.5 m.

SPT 'N' values measured within the till layer ranged from 16 to greater than 50, suggesting a compact to very dense state.

The moisture content of the 5 samples tested ranged from 6% to 29%. Grain size analysis of four samples indicated that this deposit contained 0% to 22% gravel, 30% to 82% sand and 18% to 57% silt and clay sized particles. The results of the grain size distribution tests are shown on Figures No.'s 1, 2, 3 and 5 in Appendix B.

#### 4.1.5 Bedrock

Bedrock was encountered within Boreholes 06-1, 06-2, 06-7, and 06-11 through 06-21. The bedrock may be described as follows:

- Boreholes 06-1 and 06-7      Paragneiss
- Borehole 06-2                      Quartzite over Paragneiss
- Boreholes 06-11 to 06-21      Sandstone

Within boreholes 06-11 to 06-20 an inferred layer of very poor (very severely fractured) sandstone bedrock was encountered. This layer of bedrock was penetrated by the hollow stem augers and has been inferred as a fractured zone of bedrock or rock shatter zone formed as part of the initial Highway 417 construction.

The bedrock core recoveries ranged from 0% to 100%. Rock Quality Designation (RQD) values ranged from 0% to 100%, indicating a very poor to excellent rock quality.

A description of the state of weathering, fracture spacing, bedding widths, and bedding inclination is provided on the individual Record of Boreholes, as well as compiled within a single table titled "Rock Core Description" which is provided in Appendix B.

Typically the rock types encountered may be described as follows:

- |            |  |
|------------|--|
| Paragneiss | - light grey to dark greenish grey,  |
|            | - very poor to excellent,  |
|            | - slightly to highly weathered, very close to moderately spaced fractures, dipping from 0 to 10 degrees. |
| Quartzite  | - white,   |
|            | - good to excellent,   |
|            | - fresh, moderately spaced fractures, with dips of 0 to 5 degrees.                                       |

- Sandstone
- buff to light grey with iron staining at the weathered fractures,
  - very poor to excellent,
  - fresh to moderately weathered, very close to moderately spaced fractures, dipping from 0 to 15 degrees.

Table 4.1 summarizes the results of unconfined compressive strength tests carried out on several samples of bedrock.

**Table 4.1: Summary of Unconfined Compressive Strength Test Results**

Borehole	Approximate Depth of Sample Tested	Bedrock Type	Unconfined Compressive Strength (MPa)
BH06-7	3.8	Paragneiss	99.0
BH06-7	5.3	Paragneiss	109.1
BH06-12	4.0	Sandstone	93.8
BH06-12	5.1	Sandstone	84.6
BH06-12	6.6	Sandstone	94.7
BH06-15	1.9	Sandstone	85.2

## 4.2 Groundwater

Groundwater levels were measured in the standpipes on March 7, 2006. The water levels are indicated on the Borehole Records in Appendix B and are also summarized in Table 4.2.

**Table 4.2: Summary of Groundwater Levels**

Borehole Location	March 7, 2006 Depth to Groundwater (m)	Ground Surface Elevation (m)	Groundwater Elevation (m)
06-1	4.74	94.30	89.56
06-2	3.27	93.92	90.65
06-3	0.86	93.01	92.15
06-4	7.30	93.41	86.11
06-5	2.08	92.79	90.71
06-6	6.37	91.26	84.89
06-7	blocked	-	-
06-8	blocked	-	-
06-9	0.63	94.05	93.42
06-10	0.87	95.11	94.24
06-11	0.87	97.58	96.71
06-12	3.34	100.63	97.29
06-13	1.39	104.10	102.71
06-14	1.42	107.05	105.63
06-15	0.89	109.75	108.86
06-16	0.85	110.20	109.35
06-17	1.19	109.01	107.82

Table 4.2: Summary of Groundwater Levels

Borehole Location	March 7, 2006 Depth to Groundwater (m)	Ground Surface Elevation (m)	Groundwater Elevation (m)
06-18	1.11	105.65	104.54
06-19	0.69	102.05	101.36
06-20	1.89	97.98	96.09
06-21	2.97	95.51	92.54
06-22	4.96	93.99	89.03
06-23	9.60	91.44	81.84
06-24	8.62	86.71	78.09
06-25	4.07	81.79	77.72
06-26	2.20	77.64	75.44
06-27	1.85	73.83	71.98
06-28	1.38	71.63	70.25
06-29	0.57	70.10	69.53
06-30	blocked	-	-
06-32	0.67	69.24	68.57
06-33	1.55	68.34	66.79
06-42	6.30	93.84	87.54
06-43	5.37	94.54	89.17
06-45	standpipe sank		
06-46	1.25	92.34	91.09
06-47	2.59	93.92	91.33

Fluctuations in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated.

## 5.0 CLOSURE

A subsurface investigation is a limited sampling of a site. The subsurface conditions given herein are based on information gathered at the specific borehole locations. Should any conditions at the site be encountered which differ from those at the borehole locations, we request that we be notified immediately in order to assess the additional information.

Yours very truly,

**JACQUES WHITFORD LIMITED**



Christopher McGrath, B.Eng.



Paul Carnaffan, M.Eng., P.Eng.



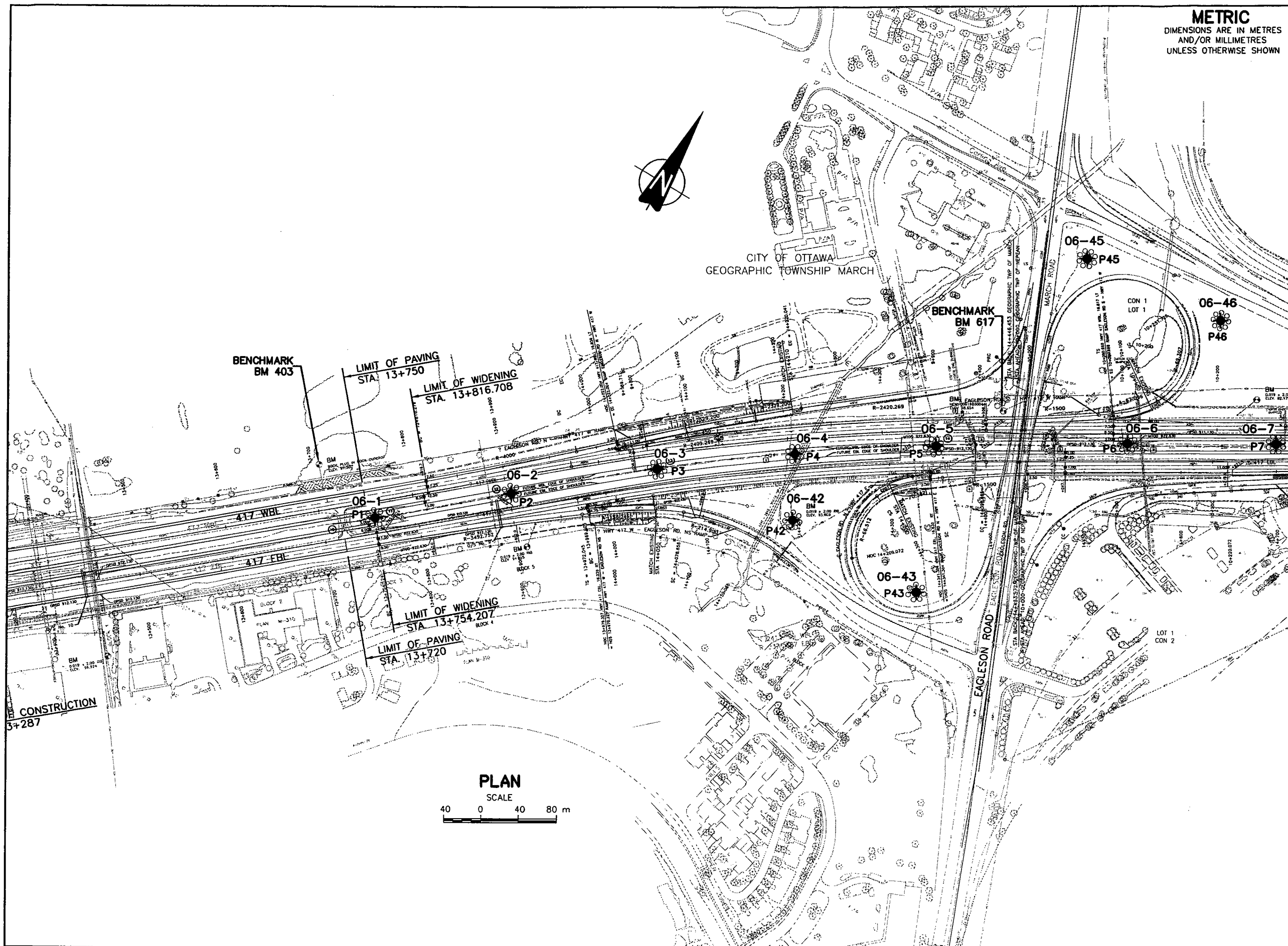
J.G.A. Raymond Haché, M.Sc., P.Eng., PMP  
Principal and Senior Service Director,  
Designated Principal MTO Foundation Contact



P:\2006\10000\11674 - Hwy 417 Widening\High Mast Lights\Final Report - Investigation Section - High Mast Lights Nov 2006.doc

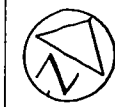
# **APPENDIX A**

## Borehole Location Plans



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

**CONT No**  
**GWP No 302-89-00**



**HWY 417, HML INVESTIGATION**  
STATION  
**BORE HOLE LOCATIONS**

**SHEET**  
**1**



**LEGEND**

- Bore Hole
- ⊙ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & 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
- Piezometer
- ⊙ High Mast Light

No	ELEVATION	COORDINATES	
		NORTH	EAST
06-1	94.08	5 019 821.5	352 401.7
06-2	93.68	5 019 917.9	352 513.5
06-3	92.69	5 020 017.8	352 632.1
06-4	93.24	5 020 113.4	352 760.2
06-5	92.58	5 020 185.0	352 869.7
06-6	91.02	5 020 288.2	353 039.8
06-7	91.27	5 020 365.9	353 173.8

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Farm 100.

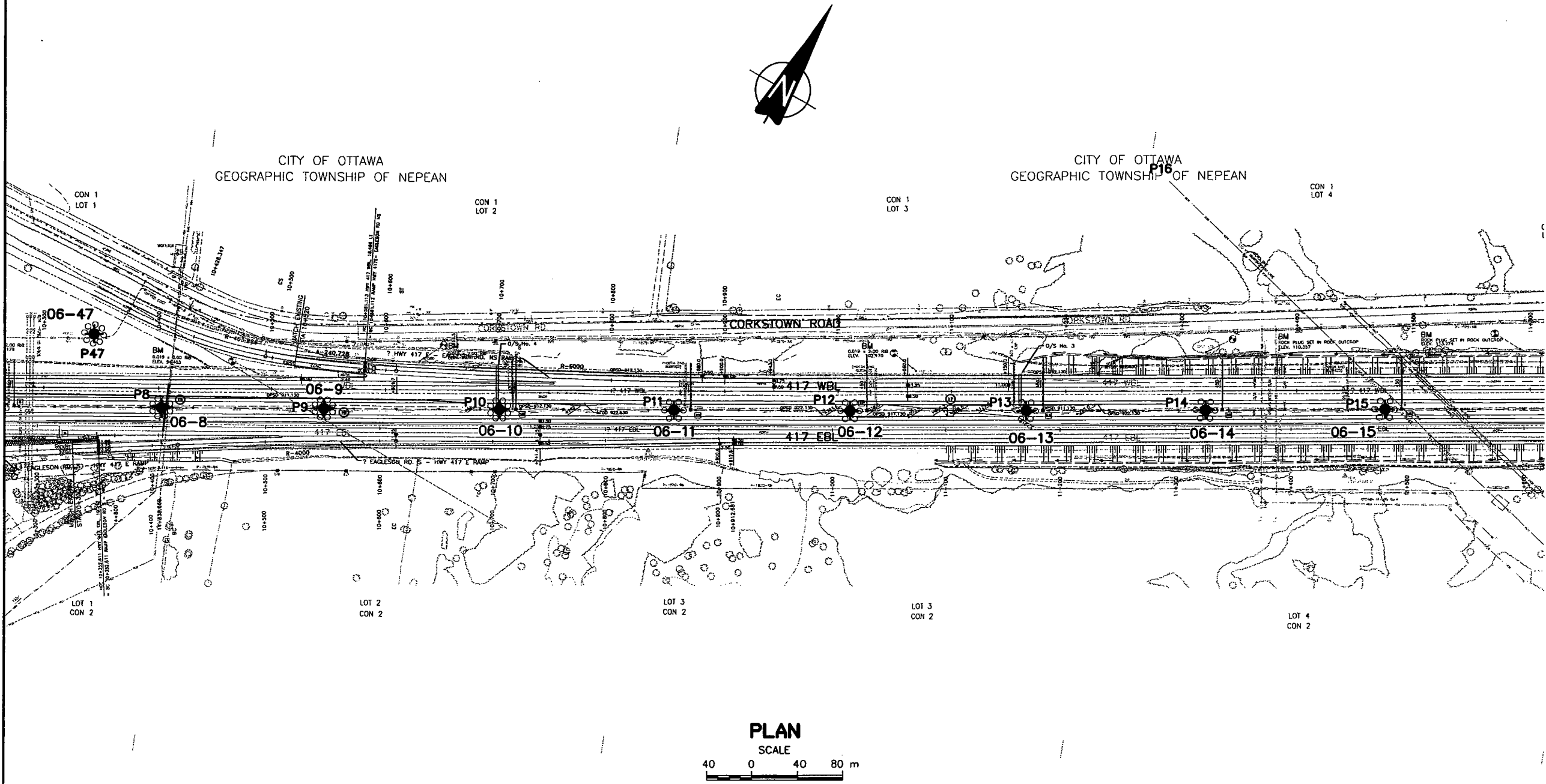
REVISIONS		DATE		DESCRIPTION
GEOCRE'S No				
HWY No 417				DIST
SUBWD CM	CHECKED	DATE 2006-04-21	SITE	
DRAWN GBB	CHECKED			DWG NO11674-1

CONT No  
GWP No 302-89-00



HWY 417, HML INVESTIGATION  
STATION  
BORE HOLE LOCATIONS

SHEET  
2



## LEGEND

Bore Hole

Dynamic Cone Penetration Test (Cone)

Bore Hole & 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

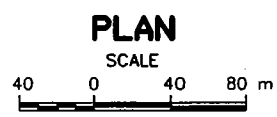
WL in Piezometer

Piezometer


High Mast Light

## COORDINATES

No	ELEVATION	NORTH	EAST
06-8	92.40	5 020 436.2	353.297.2
06-9	93.79	5 020 508.3	353 420.4
06-10	94.97	5 020 586.7	353 554.1
06-11	97.67	5 020 665.0	353 687.8
06-12	100.45	5 020 743.4	353 821.6
06-13	103.88	5 020 821.8	353 955.3
06-14	106.92	5 020 900.1	354 089.0
06-15	109.51	5 020 978.5	354 222.8



NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REVISIONS			
--	--		
DATE	BY	DESCRIPTION	
GEOCRE'S No			
HWY No 417		DIST	
SUBM'D CM	CHECKED	DATE 2006-04-21	SITE
DRAWN GBB	CHECKED	APPROVED 	DWG NO11674-2

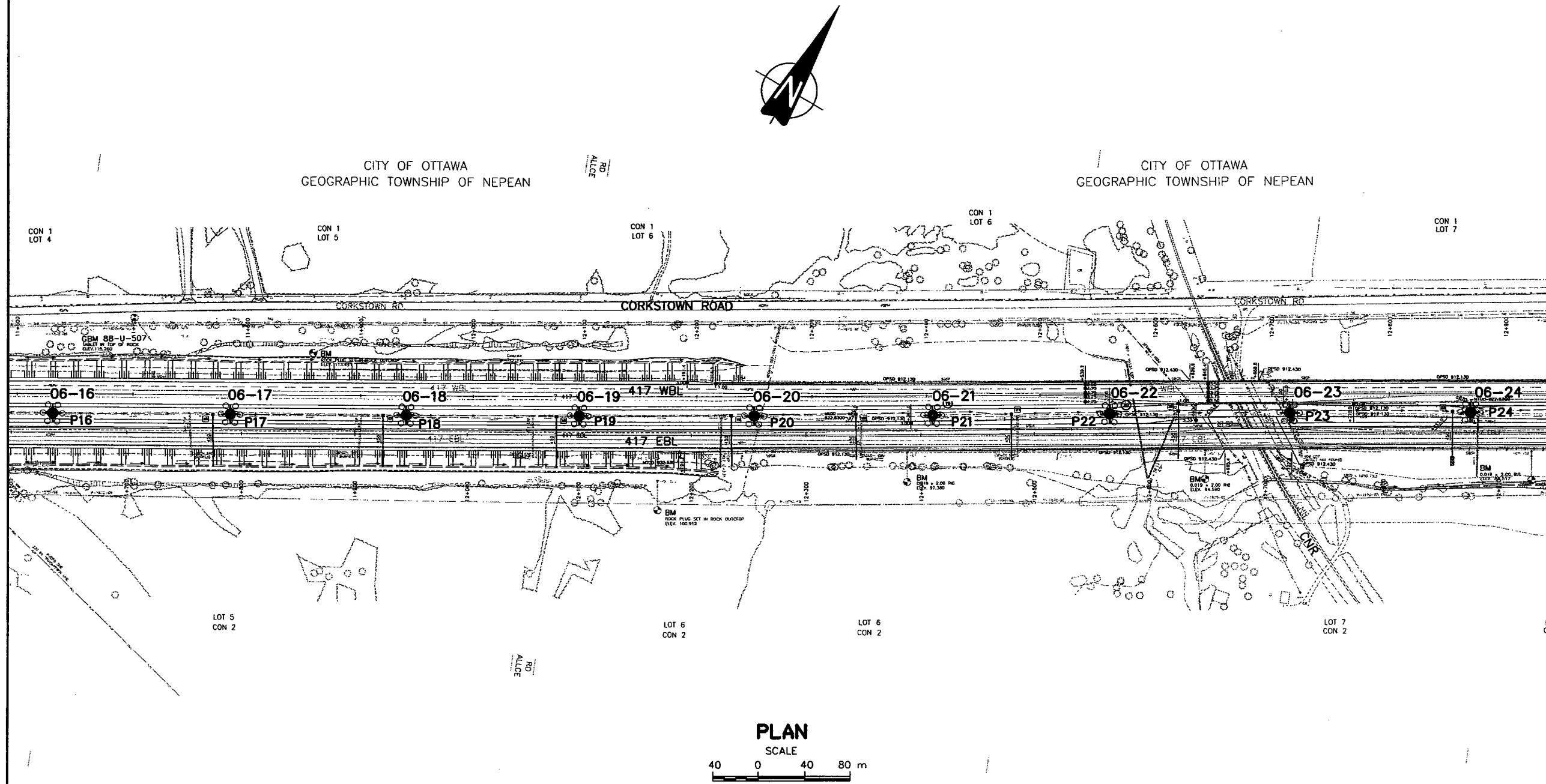


CONT No  
GWP No 302-89-00



HWY 417, HML INVESTIGATION  
STATION  
BORE HOLE LOCATIONS

SHEET  
3



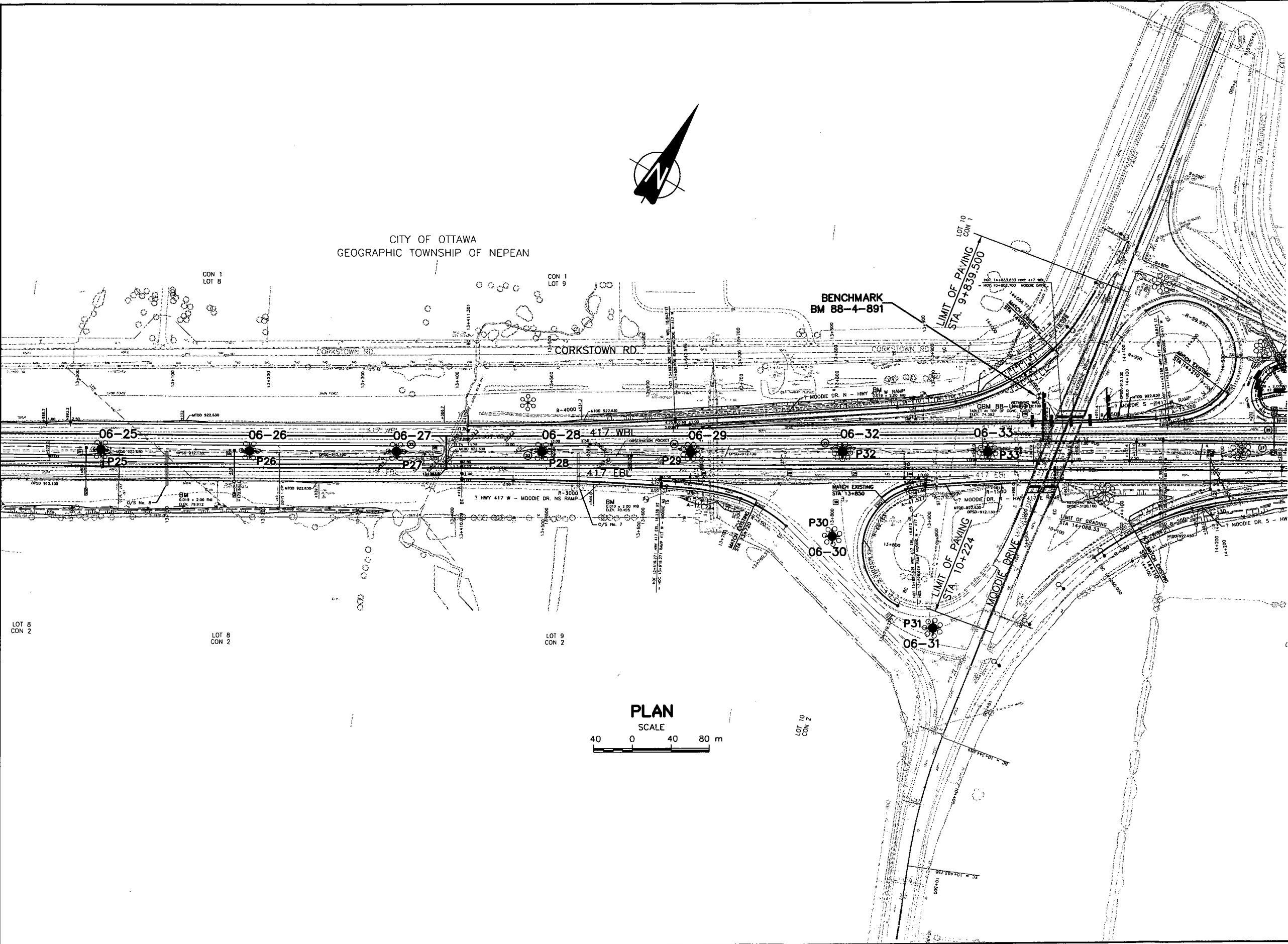
LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & 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
- Piezometer
- High Mast Light

No	ELEVATION	COORDINATES	
		NORTH	EAST
06-16	110.09	5 021 056.8	354 356.5
06-17	108.83	5 021 135.2	354 490.2
06-18	105.60	5 021 213.6	354 624.1
06-19	101.92	5 021 291.9	354 757.7
06-20	97.83	5 021 370.8	354 891.3
06-21	95.38	5 021 449.8	355 024.5
06-22	93.82	5 021 528.9	355 157.8
06-23	91.50	5 021 607.6	355 291.4
06-24	86.48	5 021 685.8	355 425.2

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REVISIONS			
DATE	BY	DESCRIPTION	
GEOCRES No			
HWY No 417			DIST
SUBM'D CM	CHECKED	DATE 2006-04-21	SITE
DRAWN GBB	CHECKED	APPROVED	DWG NO11674-3



CONT No  
GWP No 302-89-00

HIGHWAY 417 WIDENING  
STATION  
BORE HOLE LOCATIONS

SHEET  
4

LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Test (Cone)		
	Bore Hole & 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		
	Piezometer		
	High Mast Light		
		COORDINATES	
No	ELEVATION	NORTH	EAST
06-25	81.63	5 021 763.5	355 559.4
06-26	77.21	5 021 841.2	355 693.5
06-27	73.42	5 021 919.4	355 827.3
06-28	70.89	5 021 997.5	355 960.4
06-29	69.62	5 022 075.6	356 094.3
06-30	69.98	5 022 074.6	356 268.5
06-31	70.13	5 022 043.8	356 407.6
06-32	68.68	5 022 156.7	356 232.9
06-33	67.81	5 022 231.9	356 362.8

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REVISIONS			
DATE	BY	DESCRIPTION	
GEOCRES No			
HWY No 417	CHECKED	DATE 2006-11-21	DIST
SUBM'D CM	CHECKED	APPROVED	SITE
DRAWN GBB	CHECKED		DWG NO11674-4

## **APPENDIX B**

Symbols and Terms Used on Borehole Records

Borehole Records

Rock Core Descriptions

Grain Size Distribution Test Results

Atterberg Limit Test Results

# SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

## SOIL DESCRIPTION

### Terminology describing common soil genesis:

<i>Topsoil</i>	- mixture of soil and humus capable of supporting vegetative growth
<i>Peat</i>	- mixture of visible and invisible fragments of decayed organic matter
<i>Till</i>	- unstratified glacial deposit which may range from clay to boulders
<i>Fill</i>	- material below the surface identified as placed by humans (excluding buried services)

### Terminology describing soil structure:

<i>Desiccated</i>	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	- having cracks, and hence a blocky structure
<i>Varved</i>	- composed of regular alternating layers of silt and clay
<i>Stratified</i>	- composed of alternating successions of different soil types, e.g. silt and sand
<i>Layer</i>	- > 75 mm in thickness
<i>Seam</i>	- 2 mm to 75 mm in thickness
<i>Parting</i>	- < 2 mm in thickness

### Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488). The classification excludes particles larger than 76 mm (3 inches). The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

### Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

<i>Trace, or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>Frequent</i>	> 20%

### Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test N-Value (also known as N-Index). A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
<i>Very Loose</i>	<4
<i>Loose</i>	4-10
<i>Compact</i>	10-30
<i>Dense</i>	30-50
<i>Very Dense</i>	>50

### Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests.

Consistency	Undrained Shear Strength	
	kips/sq.ft.	kPa
<i>Very Soft</i>	<0.25	<12.5
<i>Soft</i>	0.25 - 0.5	12.5 - 25
<i>Firm</i>	0.5 - 1.0	25 - 50
<i>Stiff</i>	1.0 - 2.0	50 - 100
<i>Very Stiff</i>	2.0 - 4.0	100 - 200
<i>Hard</i>	>4.0	>200

## ROCK DESCRIPTION

### Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	<i>Very Poor</i>
25-50	<i>Poor</i>
50-75	<i>Fair</i>
75-90	<i>Good</i>
90-100	<i>Excellent</i>

Rock quality classification is based on a modified core recovery percentage (RQD) in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on NW core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from *in situ* fractures. The terminology describing rock mass quality based on RQD is subjective and is underlain by the presumption that sound strong rock is of higher engineering value than fractured weak rock.

### Terminology describing rock mass:

Spacing (mm)	Joint Classification	Bedding, Laminations, Bands
> 6000	<i>Extremely Wide</i>	-
2000-6000	<i>Very Wide</i>	<i>Very Thick</i>
600-2000	<i>Wide</i>	<i>Thick</i>
200-600	<i>Moderate</i>	<i>Medium</i>
60-200	<i>Close</i>	<i>Thin</i>
20-60	<i>Very Close</i>	<i>Very Thin</i>
<20	<i>Extremely Close</i>	<i>Laminated</i>
<6	-	<i>Thinly Laminated</i>

### Terminology describing rock strength:

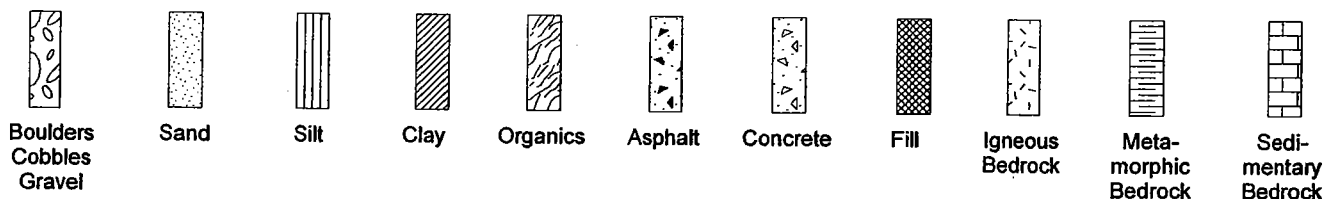
Strength Classification	Unconfined Compressive Strength (MPa)
<i>Extremely Weak</i>	< 1
<i>Very Weak</i>	1 – 5
<i>Weak</i>	5 – 25
<i>Medium Strong</i>	25 – 50
<i>Strong</i>	50 – 100
<i>Very Strong</i>	100 – 250
<i>Extremely Strong</i>	> 250

### Terminology describing rock weathering:

Term	Description
<i>Fresh</i>	No visible signs of rock weathering. Slight discolouration along major discontinuities
<i>Slightly Weathered</i>	Discolouration indicates weathering of rock on discontinuity surfaces. All the rock material may be discoloured.
<i>Moderately Weathered</i>	Less than half the rock is decomposed and/or disintegrated into soil.
<i>Highly Weathered</i>	More than half the rock is decomposed and/or disintegrated into soil.
<i>Completely Weathered</i>	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.

## STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



## SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

## WATER LEVEL MEASUREMENT



measured in standpipe,  
piezometer, or well



inferred

## RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

## N-VALUE / RQD





Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N value corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log. RQD is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery.

## DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to A size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (305 mm) into the soil. The DCPT is used as a probe to assess soil variability. Soil type may be inferred from adjacent boreholes and test pits.

## OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G <sub>s</sub>	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q <sub>u</sub>	Unconfined compression
I <sub>p</sub>	Point Load Index (I <sub>p</sub> on Borehole Record equals I <sub>p</sub> (50) in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer



**METRIC**

MTD 11674M~1.GPJ ON\_MOT.GDT 26/04/06

[illegible]

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

# RECORD OF BOREHOLE No 06-02

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 21.02.06 - 21.02.06 CHECKED BY PC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	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>		
								20 40 60 80 100						
									○ UNCONFINED   × FIELD VANE					
									● QUICK TRIAXIAL   × LAB VANE					
93.9	Grass													GR SA SI CL
93.6	80 mm TOPSOIL													
93.1	Silty CLAY, stiff, greyish brown (CH)													
			1	SS	5		93							
			2	SS	3		92						58.1	
			3	SS	2		91							
							90							
90.1	Silty CLAY, some sand, firm, grey (CL)		4	SS	1		90							0 14 44 42
89.2	Silty SAND with gravel and boulders: TILL (SM)		5	NQ			89							
88.7	BEDROCK						88							TCR = 100% SCR = 100% RQD = 97%
87.2	Quartzite		6	NQ			87							TCR = 98% SCR = 71% RQD = 71%
86.7	Paragneiss		7	NQ			86							TCR = 98% SCR = 71% RQD = 71%
85.6	End of Borehole		8	NQ										
8.3	Standpipe Installed													

MTD 11674M-1.GPJ ON\_MOT.GDT 27/04/06

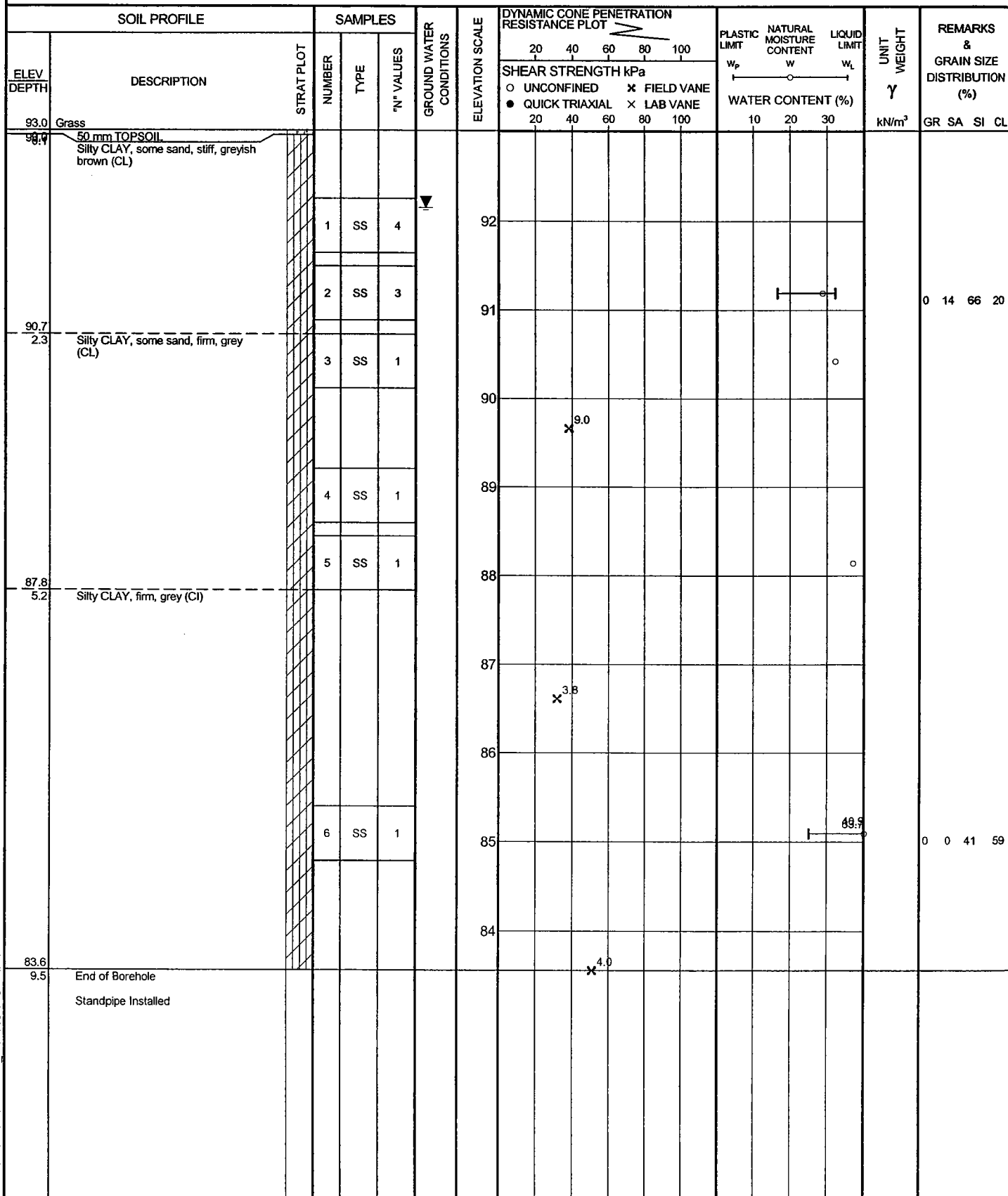


# RECORD OF BOREHOLE No 06-03

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 22.02.06 - 22.02.06 CHECKED BY PC



MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-04

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 20.02.06 - 20.02.06 CHECKED BY AC

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										
93.4	Grass							20 40 60 80 100								
92.9	100 mm TOPSOIL							20 40 60 80 100								
0.1	Silty CLAY, stiff, greyish brown (CH)															
91.9			1	SS	9		93									
1.5	Silty SAND, compact, brown (SM)		2	SS	19		92									
91.1																
2.3	Silty CLAY, with sand seams, firm to very stiff, brown (CI)		3	SS	6		91									
			4	SS	4		90									
			5	SS	2		89									
							88									
							87									
85.8							86									
7.6	Silty CLAY, firm, dark grey (CH)		6	SS	1		85									
84.0							84									
9.5	End of Borehole															
	Standpipe Installed															

MTO 11674M-1.GPJ ON MOT.GDT 28/04/06



## 1 OF 1

**METRIC**

W.P.	<u>GWP 302-89-00</u>	LOCATION	<u>Highway 417 - Eagleson Road to Moodie Drive</u>	ORIGINATED BY	<u>JF</u>
DIST	<u>42</u>	HWY	<u>417</u>	BOREHOLE TYPE	<u>HS Augers, Split Spoons</u>
DATUM	<u>Geodetic</u>	DATE	<u>16.02.06 - 16.02.06</u>	COMPILED BY	<u>JF</u>
				CHECKED BY	<u>PC</u>

[illegible]

MTD 11674M~1.GPJ ON\_MOT.GDT 26/04/06

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

# RECORD OF BOREHOLE No 06-07

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
DATUM Geodetic DATE 15.02.06 - 15.02.06 CHECKED BY PC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)	10 20 30		
91.5	Grass													
0.0	Silty CLAY, firm, brown (CH)													
			1	SS	2									
			2	SS	1									
			3	SS	1									
88.4														
3.1	Sandy SILT, some gravel, trace clay, dense, brown (TILL) (ML)		4	SS	50									13 28 59
88.1														
3.4	BEDROCK													
	Paragneiss													
	Dark grey to black, fair to good, fresh to slightly weathered, very close to moderately close spaced fractures (dip in primary 0-10 degrees, dip in secondary 60 degrees)		5	NQ										TCR = 85% SCR = 63% RQD = 63%
			6	NQ										TCR = 100% SCR = 74% RQD = 62%
84.8														
6.7	End of Borehole													

MTO 11674M-1.GPJ ON MOT.GDT 26/04/06



# RECORD OF BOREHOLE No 06-09

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 14.02.06 - 14.02.06 CHECKED BY PC

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							× LAB VANE	
94.1	Grass						20	40	60	80	100	10	20	30	GR SA SI CL			
0.0	Silty SAND, loose, greyish brown to grey (SM)		1	SS	6													
92.5	Silty CLAY, some sand, firm, grey to dark grey (CL)		2	SS	1										0 15 48 37			
1.6			3	SS	1													
	- with white shells from 3.0 to 7.0 m		4	SS	1													
			5	SS	1													
			6	SS	1													
	- dark grey to black below 6.0 m		7	SS	1													
83.1	End of Borehole																	
11.0	Standpipe Installed																	

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-10

1 OF 2

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing COMPILED BY JF  
 DATUM Geodetic DATE 06.02.14 - 06.02.14 CHECKED BY PL

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 (%)					
95.1	Grass													
98.9 0.1	100 mm TOPSOIL Silty CLAY, with sand, stiff, greyish brown to grey (CI)		1	SS	6									
93.1			2	SS	3									
2.0	Sandy SILT, some clay, trace gravel, very loose to compact, grey (CL)		3	SS	2									
			4	SS	19									
	- Sand Seam		5	SS	1									
90.5 4.6	Silty CLAY, soft, grey (CI)		6	SS	1									
			7	SS	1									
			8	SS	1									
	- tried MTO vane - vane sank under weight of rods													

MTO 11674M-1.GPJ ON MOT.GDT 06/11/27

Continued Next Page

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




# RECORD OF BOREHOLE No 06-10

2 OF 2



METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing COMPILED BY JF  
 DATUM Geodetic DATE 06.02.14 - 06.02.14 CHECKED BY PC

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/m³	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
							20	40	60	80	100	10	20	30			
79.3	Silty CLAY, soft, grey (CL)		9	SS	1											2 22 49 27	
15.9	End of Borehole Standpipe Installed		10	SS	1												

## 1 OF 1

## METRIC

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			WATER CONTENT (%)		
97.6	Grass						SHEAR STRENGTH kPa ○ UNCONFINED      × FIELD VANE ● QUICK TRIAXIAL    × LAB VANE 20    40    60    80    100	10    20    30				

[illegible]

MTD 11674M-1.GPJ ON MOT.GDT 26/04/06


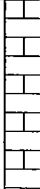
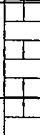

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-12

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 13.02.06 - 13.02.06 CHECKED BY PC

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						
100.6	Grass							20	40	60	80	100		
100.6 0.1	100 mm TOPSOIL Sand with sandstone boulders, light brown: FILL (SP)		1	SS	75/ 150mm									
98.9														
1.7	BEDROCK  Limestone  Grey, very poor, fresh (inferred overblast zone)		2	NQ										
97.4														
3.2	BEDROCK  Limestone  Grey, very poor, fresh, closely spaced fractures (dip 45 degrees)		3	NQ										
96.6														
4.0	BEDROCK  Sandstone  Buff to light grey with iron staining at weathered fractures, poor to fair, fresh to moderately weathered, very closely spaced fractures (dip 0-20 degrees)		4	NQ										
			5	NQ										
			6	NQ										
93.6														
7.1	End of Borehole  Standpipe Installed													

MTO 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-13

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 10.02.06 - 10.02.06 CHECKED BY PC

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									
104.1	Grass							20	40	60	80	100					GR SA SI CL
103.9	75 mm TOPSOIL																
103.3	Sand, some gravel, with sandstone boulders, light brown : FILL (SP)																
102.8	BEDROCK (Inferred)																
102.8	Sandstone																
102.8	Buff to light grey, very poor, slightly weathered (inferred overblast zone) / BEDROCK		1	NQ													TCR = 100% SCR = 76% RQD = 76%
102.8	Sandstone																
102.8	Buff to light grey with iron staining at weathered fractures, very poor to good, slightly weathered, close to moderately spaced fractures, very thin mudseams in fractures, laminated bedding (dip 0-10 degrees)		2	NQ													TCR = 100% SCR = 87% RQD = 70%
102.8																	
102.8			3	NQ													TCR = 98% SCR = 96% RQD = 0%
100.0																	
99.7	End of Borehole																
4.4	Standpipe Installed																

MTO 11674M-1.GPJ ON\_MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-14

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 10.02.06 - 10.02.06 CHECKED BY PC

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											
107.0	Grass							20	40	60	80	100							
106.9	75 mm TOPSOIL																		
106.5	Sand with gravel, some sandstone boulders, light brown: FILL (SP)																		
106.0	BEDROCK (Inferred)																		
1.0	Sandstone																		
	Light grey to buff, very poor, moderately weathered (inferred overblast zone) BEDROCK		1	NQ			106												TCR = 100% SCR = 94% RQD = 89%
	Sandstone																		
	Light grey to buff with iron staining at weathered fractures, good to excellent, moderately weathered, very close to moderately spaced fractures (dip 5-10 degrees)		2	NQ			105												TCR = 100% SCR = 96% RQD = 83%
							104												
			3	NQ			103												TCR = 100% SCR = 91% RQD = 91%
102.3	End of Borehole																		
4.8	Standpipe Installed																		

MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-15

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 10.02.06 - 10.02.06 CHECKED BY PC

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							20	40	60	80	100	
								QUICK TRIAXIAL	LAB VANE													
109.7	Grass																					
108.9	75 mm TOPSOIL Sand with sandstone boulders, light brown: FILL (SP)																					
108.7	BEDROCK (Inferred)																					
108.0	Sandstone																					
108.0	Buff, very poor, fresh to slightly weathered, (inferred overblast zone) / BEDROCK		1	NQ											TCR = 100% SCR = 100% RQD = 0%							
107.7	Sandstone																					
	Buff to dark grey with minor iron staining at weathered fractures, good to excellent, fresh to slightly weathered, very close to moderately spaced fractures (dip 0-10 degrees)		2	NQ											TCR = 100% SCR = 72% RQD = 72%							
			3	NQ											TCR = 100% SCR = 100% RQD = 91%							
105.0	End of Borehole																					
4.8	Standpipe Installed																					

MTO 11674M-1-GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-16

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 10.02.06 - 10.02.06 CHECKED BY AC

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											
110.2	Grass							20	40	60	80	100							
110.0	75 mm TOPSOIL						110												
109.6	Sand with gravel, some sandstone boulders, light brown: FILL (SP)																		
109.6	BEDROCK (Inferred)																		
109.1	Sandstone																		
109.1	Light grey to buff, very poor, fresh to slightly weathered (inferred overblast zone)		1	NQ			109												TCR = 100% SCR = 76% RQD = 70%
109.1	BEDROCK																		
109.1	Sandstone																		
109.1	Light grey to buff with minor iron staining at weathered fractures, fair to excellent, fresh to slightly weathered, close to moderately spaced joints (dip 0-10 degrees)		2	NQ			108												TCR = 100% SCR = 100% RQD = 95%
109.1																			
109.1							107												
109.1																			
109.1			3	NQ			106												TCR = 100% SCR = 100% RQD = 84%
105.8	End of Borehole																		
4.4	Standpipe Installed																		

MTD 11674M-1.GPJ ON\_MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-17

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 09.02.06 - 09.02.06 CHECKED BY PC

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														
109.0	Grass							20	40	60	80	100										
108.9	75 mm TOPSOIL																					
108.6	Sand with sandstone boulders, light brown: FILL (SP)																					
0.4	BEDROCK (Inferred)																					
	Sandstone																					
	Light to dark grey, very poor, fresh (inferred overblast zone)		1	NQ			108										TCR = 100% SCR = 59% RQD = 16%					
107.3	BEDROCK																					
1.7	Sandstone																					
	Light to dark grey with minor iron staining at weathered fractures, very poor to excellent, fresh, very close to moderately spaced fractures, very thin to thin bedding (dip 0-10 degrees)		2	NQ			107										TCR = 98% SCR = 98% RQD = 92%					
							106															
			3	NQ													TCR = 100% SCR = 100% RQD = 98%					
104.8	End of Borehole						105															
4.2	Standpipe Installed																					

MTO 11674M-1.GPJ ON MOT.GDT 26/04/06















































# RECORD OF BOREHOLE No 06-18

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 09.02.06 - 09.02.06 CHECKED BY PC

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									
105.7	Grass							20	40	60	80	100					
0.0	Sand with sandstone boulders, light brown: FILL																
105.2	BEDROCK (Inferred)																
0.5																	
104.7	Sandstone																
0.9	Light grey, very poor, fresh to slightly weathered (inferred overblast zone) / BEDROCK		1	NQ													TCR = 100% SCR = 64% RQD = 43%
	Sandstone																
	Light grey with minor iron staining at weathered fractures, fair to good, fresh to slightly weathered, close to moderately spaced fractures, very thin to thin bedding (dip 0-5 degrees)		2	NQ													TCR = 100% SCR = 100% RQD = 81%
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
																	
101.5	End of Borehole																TCR = 100% SCR = 100% RQD = 72%
4.1	Standpipe Installed																

MT0 11674M-1.GPJ ON MOT.GDT 28/04/06

**METRIC**[illegible]

MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

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

# RECORD OF BOREHOLE No 06-20

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 08.02.06 - 08.02.06 CHECKED BY PC

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					
98.0	Grass																
98.0 0.1	75 mm TOPSOIL Sand, some gravel, with sandstone boulders, light brown: FILL (SP)																
97.0	BEDROCK (Inferred)						97										
	Sandstone																
	Light grey to buff, very poor, slightly to moderately weathered (Inferred overblast zone)																
96.0	BEDROCK						96										
	Sandstone																
	Light grey to buff with moderate iron staining at weathered fracture, fair to excellent, slightly to moderately weathered, close to moderately spaced fractures, thin bedding, very thin shale interbeds (dip 0-10 degrees)		1	NQ			95										TCR = 85% SCR = 85% RQD = 72%
			2	NQ			94										TCR = 98% SCR = 98% RQD = 91%
			3	NQ			93										TCR = 91% SCR = 91% RQD = 86%
92.5	End of Borehole																
5.4	Standpipe Installed																


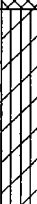



MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-21

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 08.02.06 - 08.02.06 CHECKED BY PC

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/m³	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							
95.5 0.0	Grass  Sand with gravel, some sandstone boulders, light brown: FILL (SP)														
			1	SS	31										
91.1 4.4	Silty CLAY, stiff, greyish brown (CH)		2	SS	13										
89.3 6.2	Silty sand, some gravel, trace clay, compact, reddish brown: TILL (SM)		3	SS	5										
			4	SS	16										
86.7 8.8	BEDROCK  Sandstone  Pinkish grey with minor iron staining at weathered fractures, good to excellent, fresh to slightly weathered, close to moderately spaced fractures, thin bedding, very thin shale interbeds (dip 0-15 degrees)		5	NQ											
			6	NQ											
			7	NQ											
83.1 12.4	End of Borehole  Standpipe Installed														

MT0 11674M-1.GPJ ON MOT.GDT 27.04/06

# RECORD OF BOREHOLE No 06-22

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 06.02.06 - 06.02.06 CHECKED BY PC

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	× LAB VANE				
94.0	Grass					20	40	60	80	100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
93.9	50 mm TOPSOIL Clay, dark grey : FILL (CL)										WATER CONTENT (%)			
93.1														
0.9	Sand and gravel, with sandstone boulders, loose to dense, light brown: FILL (SP)													
			1	SS	20									
			2	SS	8									
			3	SS	35									
87.9														
6.1	Silty CLAY, stiff, greyish brown to grey (CH)		4	SS	3									
			5	SS	4									
			6	SS	3									
83.9														
10.1	End of Borehole  Standpipe Installed													

MT0 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-23

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
DIST 42 HWY 417 BOREHOLE TYPE HS Augers, SplitSpoons COMPILED BY JF  
DATUM Geodetic DATE 02.02.06 - 02.02.06 CHECKED BY PC

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	
							20	40	60	80	100		10	20	30	kN/m <sup>3</sup>	GR SA SI CL	
91.4	Grass																	
89.9	100 mm TOPSOIL																	
0.1	Sand and gravel with sandstone boulders, loose to compact, light brown: FILL (SP)		1	SS	28													
			2	SS	8													
			3	SS	8													
85.3																		
6.1	Silty SAND, loose to very dense, grey to brown (SM)		4	SS	4													
			5	SS	14													
			6	SS	66													
81.7																		
9.8	End of Borehole Standpipe Installed																	

MTO 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-24

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 26.01.06 - 27.01.06 CHECKED BY AC

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						
86.7	Grass						20	40	60	80	100	10	20	30	GR SA SI CL	
86.6	100 mm TOPSOIL															
86.5	Sand and gravel, trace silt, with cobbles and sandstone boulders, loose to dense, light brown: FILL (GP)															
			1	SS	20											
			2	SS	50/ 50mm											
			3	SS	18											
			4	SS	16											
			5	SS	9											
77.6			6	SS	21											
9.1	Silty CLAY, trace sand, very stiff, dark grey (CH)		7	SS	34											
76.6																
10.1	End of Borehole Standpipe Installed															

MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-25

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 31.01.06 - 01.02.06 CHECKED BY PC

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 (%)					
81.8 0.0	Grass Sand and gravel, with cobbles and sandstone boulders, dense, light brown: FILL (SP)													
			1	SS	50/ 75mm									
			2	SS	50									
77.8 4.0	Silt, some sand, trace clay, very dense, grey: TILL (ML)													
			3	SS	50/ 75mm									
			4	SS	51									
			5	SS	50/ 75mm									
			6	SS	50									
72.3 9.5	End of Borehole Standpipe Installed													

MTO 11674M-1.GPJ ON\_MOT.GDT 26/04/06



# RECORD OF BOREHOLE No 06-26

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, SplitSpoons COMPILED BY JF  
 DATUM Geodetic DATE 25.01.06 - 25.01.06 CHECKED BY PC

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						20	40
77.6	Grass																	
76.9	75 mm TOPSOIL						77											
	Sand and gravel, with cobbles and boulders, loose to dense, light brown: FILL (SP)		1	SS	50/75mm													
75.7			2	SS	8		76											
74.6	75 mm TOPSOIL layer																	
74.0	Silty CLAY, trace sand, stiff, greyish brown (CH)		3	SS	18		75											
			4	SS	13		74											
			5	SS	10		73											
			6	SS	6		72											
71.5							71											
6.1	Silty sand, some gravel, compact to dense, grey to brown : TILL (SM)		7	SS	29		70											
			8	SS	27		69											
68.3			9	SS	77/100mm													
9.4	End of Borehole																	
	Standpipe Installed																	

MT0 11674M-1.GPJ ON MOT.GDT 26/04/06



# RECORD OF BOREHOLE No 06-28

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY BF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 23.01.06 - 23.01.06 CHECKED BY PC

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				
								20 40 60 80 100				
								20 40 60 80 100				
71.6	Grass											
70.9	100 mm TOPSOIL											
0.1	Silty CLAY, stiff, brown (CH)											
			1	SS	6		71					
			2	SS	5		70					
			3	SS	3		69				46.8	
68.3	Silty CLAY, firm to stiff, grey (CH)						68	18.7				
3.4			4	SS	1		67	6.4			53.5	
							66					
			5	SS	2		65				49.2	
							64	12.0				
							63					
			6	SS	1		62				48.4	
61.6	End of Borehole							20.0				
10.1	Standpipe Installed											

MT0 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-29

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 23.01.06 - 23.01.06 CHECKED BY PC

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 (%)										
							20	40	60	80	100	10	20	30	GR SA SI CL		
70.1	Grass						70									0 3 36 61	
70.0	100 mm TOPSOIL						69										
0.1	Silty CLAY, stiff, greyish brown (CH)		1	SS	4		68										
			2	SS	1		67										
			3	SS	2		66										
							65										
66.8	Silty CLAY, firm to stiff, grey (CH)						67			9.2							
3.4							66										
							65			8.0							
							64										
			5	SS	1		63										
							62			7.1							
							61										
			6	SS	1												
60.0	End of Borehole																
10.1	Standpipe Installed									22.0							

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

# RECORD OF BOREHOLE No 06-30

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons, Casing, NQ Core COMPILED BY JF  
 DATUM Geodetic DATE 16.01.06 - 16.01.06 CHECKED BY PC

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							
70.0	Grass						20	40	60	80	100					
70.0	75 mm TOPSOIL															
68.4	Silty CLAY, stiff, greyish brown (CH)															
			1	SS	4		69							46.1		
			2	SS	4		68							55.4		
			3	SS	2		67							59.3		
			4	SS	2		66							60.3		
							65									
65.5	Silty CLAY, stiff, grey (CH)		5	SS	1		64							56.2		
							63									
			6	SS	2		62							41.7		
							61									
60.6	End of Borehole															
9.5	Standpipe Installed (blocked)															

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

MT0 11674M-1.GPJ ON MOT.GDT 26/04/06



1 OF 1

## METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
DATUM Geodetic DATE 24.01.06 - 24.01.06 CHECKED BY PC

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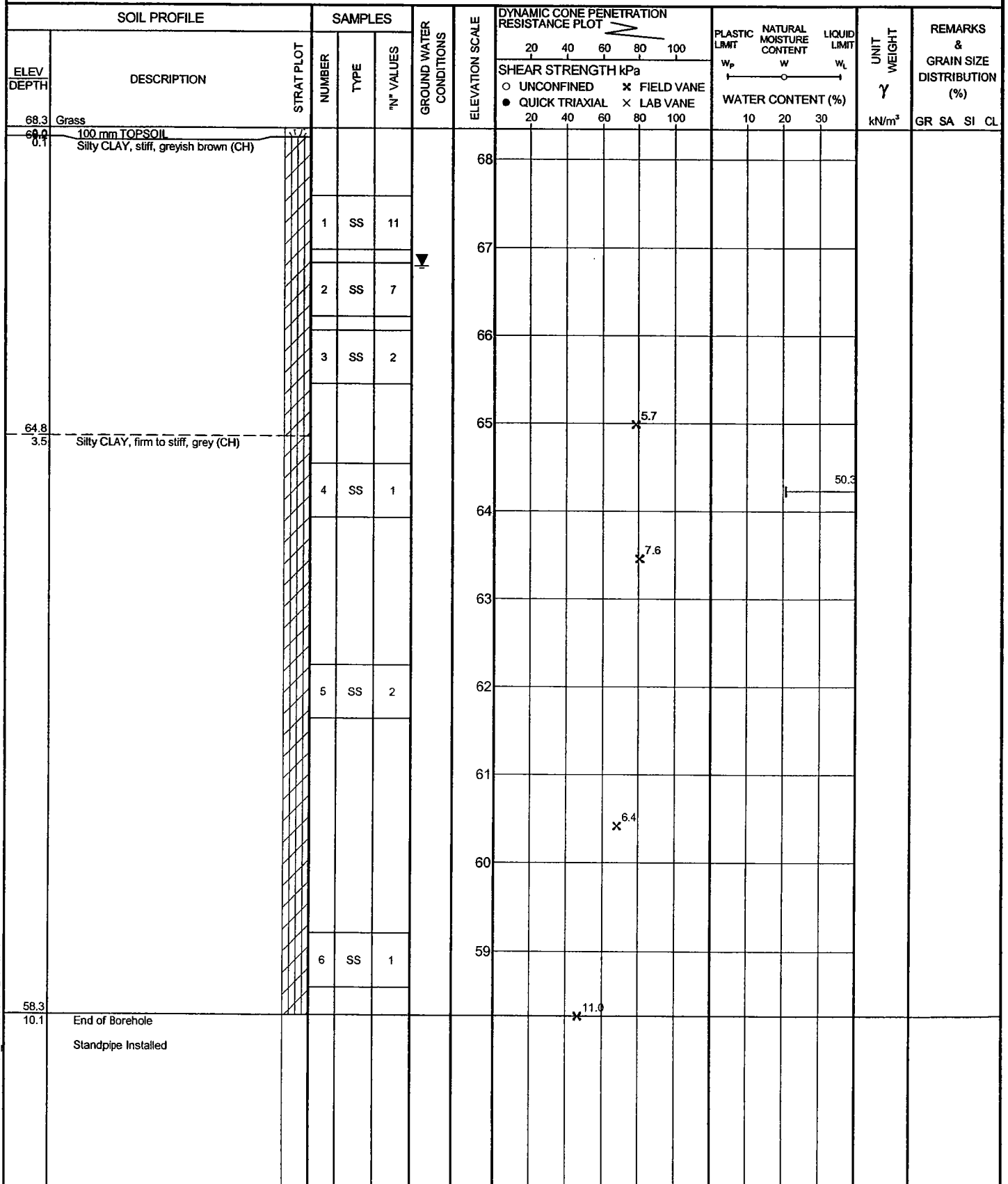
+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-33

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 24.01.06 - 24.01.06 CHECKED BY PC



MT0 11674M-1.GPJ ON MOT.GDT 26/04/06





# RECORD OF BOREHOLE No 06-43

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodle Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, SplitSpoons COMPILED BY JF  
 DATUM Geodetic DATE 01.03.06 - 01.03.06 CHECKED BY PC

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	● QUICK TRIAXIAL						× FIELD VANE	× LAB VANE	WATER CONTENT (%)
94.5	Grass						20	40	60	80	100						
94.4	100 mm TOPSOIL																
94.1	Sandy silty CLAY, very stiff, brown (CL-ML)		1	SS	14												
93.1	Silty CLAY, stiff to very stiff, brown (CL-ML)		2	SS	6												
			3	SS	1												
90.7	Silty CLAY, firm, grey (CL)		4	SS	1												
			5	SS	1												
			6	SS	1												
84.8	End of Borehole																
9.8	Standpipe Installed																

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

MTD 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-45

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 27.02.06 - 27.02.06 CHECKED BY PC

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					
92.0	Grass																
90.9	75 mm TOPSOIL																
	Silty CLAY, firm to stiff, greyish brown (CH)																
			1	SS	10		91										
			2	SS	11		90										
			3	SS	4		89										
			4	SS	2		88										
87.4																	
4.6	Silty CLAY, some sand, firm, grey (CL)		5	SS	1		87										
							86										
			6	SS	1		84										
							83										
82.5																	
9.5	End of Borehole																

MTO 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-46

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 24.02.06 - 24.02.06 CHECKED BY PC

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						
								20 40 60 80 100						
92.3	Grass													
91.9	75 mm TOPSOIL													
91.1	Silty CLAY, stiff, greyish brown (CH)													
			1	SS	9		92							
							91							
			2	SS	9								43.4	
							90							
			3	SS	4								69.8	
							89							
			4	SS	1								53.1	
88.5														
3.8	Silty CLAY, firm, grey (CH)		5	SS	1								68.9	
							88							
							87							
							86							
86.2			6	SS	1									
6.1	Silty CLAY, firm, dark grey (CH)													
							85							
							84							
			7	SS	1		83						40.8	
82.6														
9.8	End of Borehole													
	Standpipe Installed													

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

MT0 11674M-1.GPJ ON MOT.GDT 26/04/06

# RECORD OF BOREHOLE No 06-47

1 OF 1

METRIC

W.P. GWP 302-89-00 LOCATION Highway 417 - Eagleson Road to Moodie Drive ORIGINATED BY JF  
 DIST 42 HWY 417 BOREHOLE TYPE HS Augers, Split Spoons COMPILED BY JF  
 DATUM Geodetic DATE 24.02.06 - 24.02.06 CHECKED BY PC

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 (%)					
93.9	Grass													
93.9 0.1	80 mm TOPSOIL Silty CLAY, stiff, greyish brown (CH)													
			1	SS	7									
			2	SS	4									
			3	SS	3									
90.9 3.1	Silty CLAY, firm, grey (CH)		4	SS	1									
			5	SS	1									
			6	SS	1									
84.5 9.5	End of Borehole Standpipe Installed													

MTO 11674M-1.GPJ ON MOT.GDT 26/04/06

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

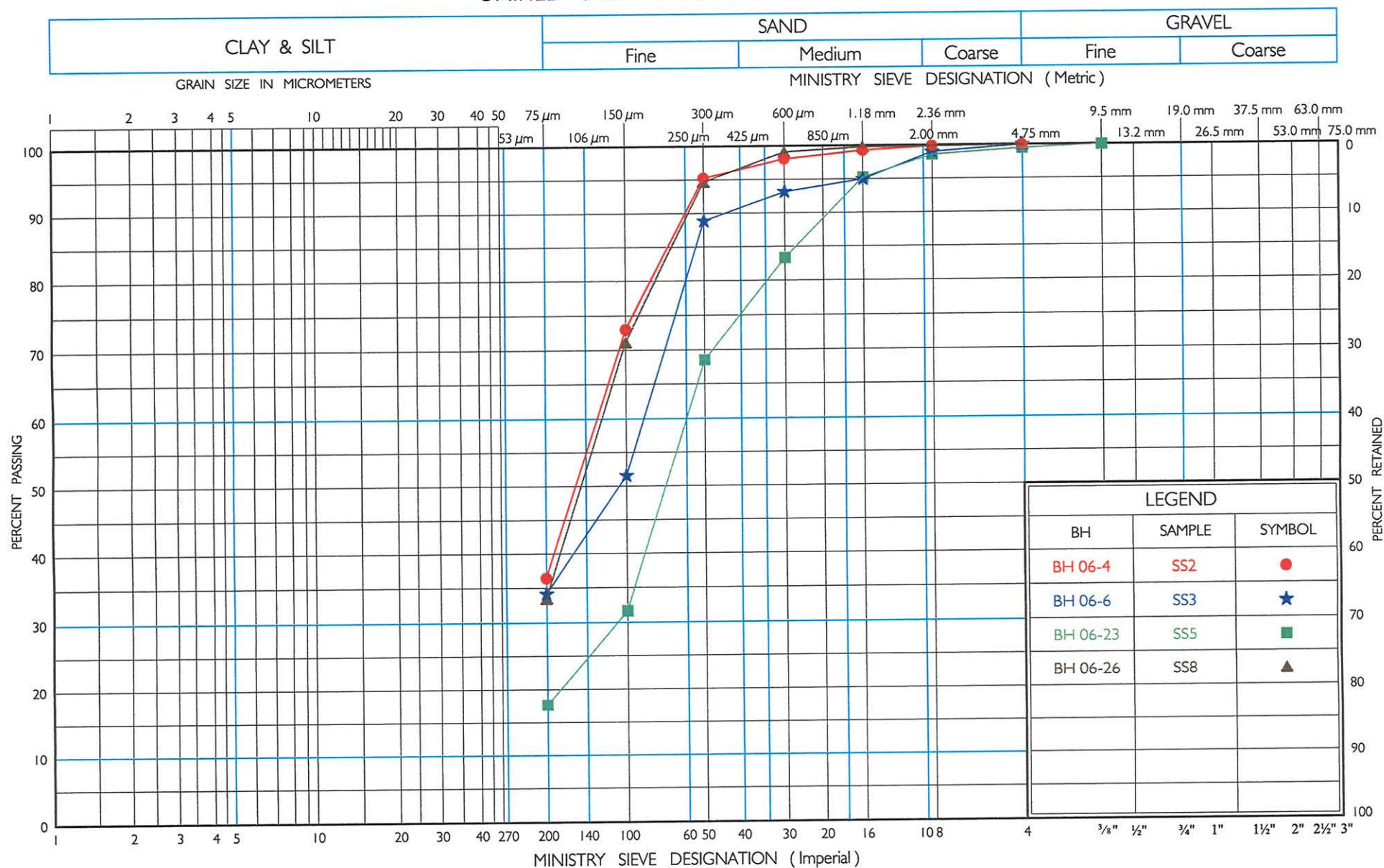
**Rock Core Description**  
**W.P. 302-89-00**

Borehole #	HML #	Sample #	Recovery (%)		R.Q.D. (%)	Description
			TCR	SCR		
06-1	P1	7	95	7	7	PARAGNEISS, light to dark greenish grey, very poor to fair, slightly to highly weathered, very thin to thin mudseams at some fractures, very close to close spaced fractures (dip = 10 to 40 degrees)
		8	93	93	0	
		9	100	84	50	
		10	100	36	36	
06-2	P2	6	100	100	97	QUARTZSITE, white, good to excellent, fresh, moderately spaced fractures, massive (dip = 0 to 5 degrees)
		7	98	71	71	QUARTZSITE, white, good to excellent, fresh, moderately spaced fractures, massive (dip = 0 to 5 degrees) over PARAGNEISS, dark greenish grey, good to excellent, moderately to highly weathered, extremely close to close spaced fractures (dip = 0 to 5 degrees)
		8	98	71	71	PARAGNEISS, dark greenish grey, good to excellent, moderately to highly weathered, extremely close to close spaced fractures (dip = 0 to 5 degrees)
06-7	P7	5	85	63	63	PARAGNEISS, dark grey to black, fair to good, fresh to slightly weathered, very close to moderately spaced fractures (dip in primary = 0 to 10, dip in secondary = 60 degrees)
		6	100	74	62	
06-11	P11	1	31	5	0	SANDSTONE, buff to light grey with iron staining at weathered fractures, good to excellent, moderately to highly weathered, close to moderately spaced fractures, very thin bedding, very thin shale interbeds (dip = 0 to 10 degrees)
		2	97	97	80	
		3	98	77	77	
		4	100	100	100	
06-12	P12	2	50	17	0	LIMESTONE, grey, very poor, fresh, closely spaced fractures (dip = 45 degrees)
		3	37	29	0	
		4	100	70	30	SANDSTONE, buff to light grey with iron staining at weathered fractures, poor to fair, fresh to moderately weathered, very closely spaced fractures (dip = 0 to 20 degrees)
		5	98	88	48	
		6	100	90	68	
06-13	P13	1	100	76	76	SANDSTONE, buff to light grey with iron staining at weathered fractures, very poor to good, slightly weathered, close to moderately spaced fractures, very thin mudseams in fractures, laminated bedding (dip = 0 to 10 degrees)
		2	100	87	70	
		3	98	96	0	
06-14	P14	1	100	94	89	SANDSTONE, buff to light grey with iron staining at weathered fractures, good to excellent, moderately weathered, very close to moderately spaced fractures (dip = 5 to 10 degrees)
		2	100	96	83	
		3	100	91	91	
06-15	P15	1	100	100	0	SANDSTONE, buff to dark grey with minor iron staining at weathered fractures, good to excellent, fresh to slightly weathered, very close to moderately spaced fractures (dip = 0 to 10 degrees)
		2	100	72	72	
		3	100	100	91	
06-16	P16	1	100	76	70	SANDSTONE, buff to light grey with minor iron staining at weathered fractures, fair to excellent, fresh to slightly weathered, close to moderately spaced joints (dip = 0 to 10 degrees)
		2	100	100	95	
		3	100	100	84	
06-17	P17	1	100	59	16	SANDSTONE, light to dark grey with minor iron staining at weathered fractures, very poor to excellent, fresh, very close to moderately spaced fractures, very thin to thin bedding (dip = 0 to 10 degrees)
		2	98	98	92	
		3	100	100	98	
06-18	P18	1	100	64	43	SANDSTONE, light grey with minor iron staining at weathered fractures, fair to good, fresh to slightly weathered, close to moderately spaced fractures, very thin to thin bedding (dip = 0 to 5 degrees)
		2	100	100	81	
		3	100	100	72	
06-19	P19	2	38	16	0	SANDSTONE, light grey with iron staining at weathered fractures, fair to good, fresh to slightly weathered, very close to closely spaced fractures, very thin shale interbeds (dip = 0 to 5 degrees)
		3	100	100	86	
		4	98	98	60	

**Rock Core Description**  
**W.P. 302-89-00**

Borehole #	HML #	Sample #	Recovery (%)		R.Q.D. (%)	Description
			TCR	SCR		
06-20	P20	1	85	85	72	SANDSTONE, light grey to buff with moderate Iron staining at weathered fractures, fair to excellent, slightly to moderately weathered, close to moderately spaced fractures, thin bedding, very thin shale interbeds (dip = 0 to 10 degrees)
		2	98	98	91	
		3	91	91	86	
06-21	P21	5	86	86	86	SANDSTONE, pinkish grey with minor Iron staining at weathered fractures, good to excellent, fresh to slightly weathered, close to moderately spaced fractures, thin bedding, very thin shale interbeds (dip = 0 to 15 degrees)
		6	97	95	80	
		7	100	100	98	
NOTE: TCR = Total Core Recovery SCR = Solid Core Recovery						

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

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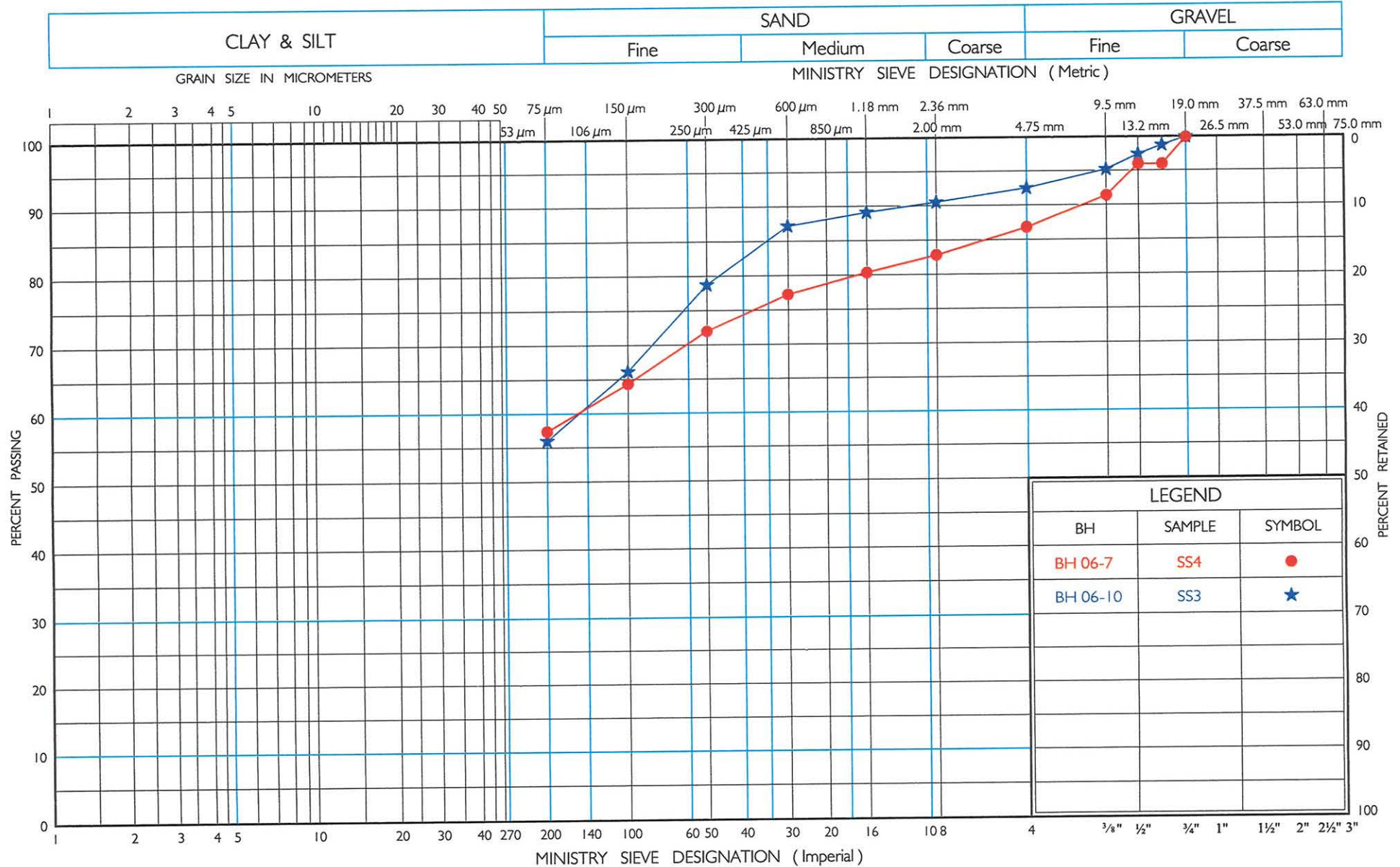
GRAIN SIZE DISTRIBUTION  
SILTY SAND, TRACE CLAY TO SAND, SOME SILT

FIG No I

W P 302-89-00



## UNIFIED SOIL CLASSIFICATION SYSTEM



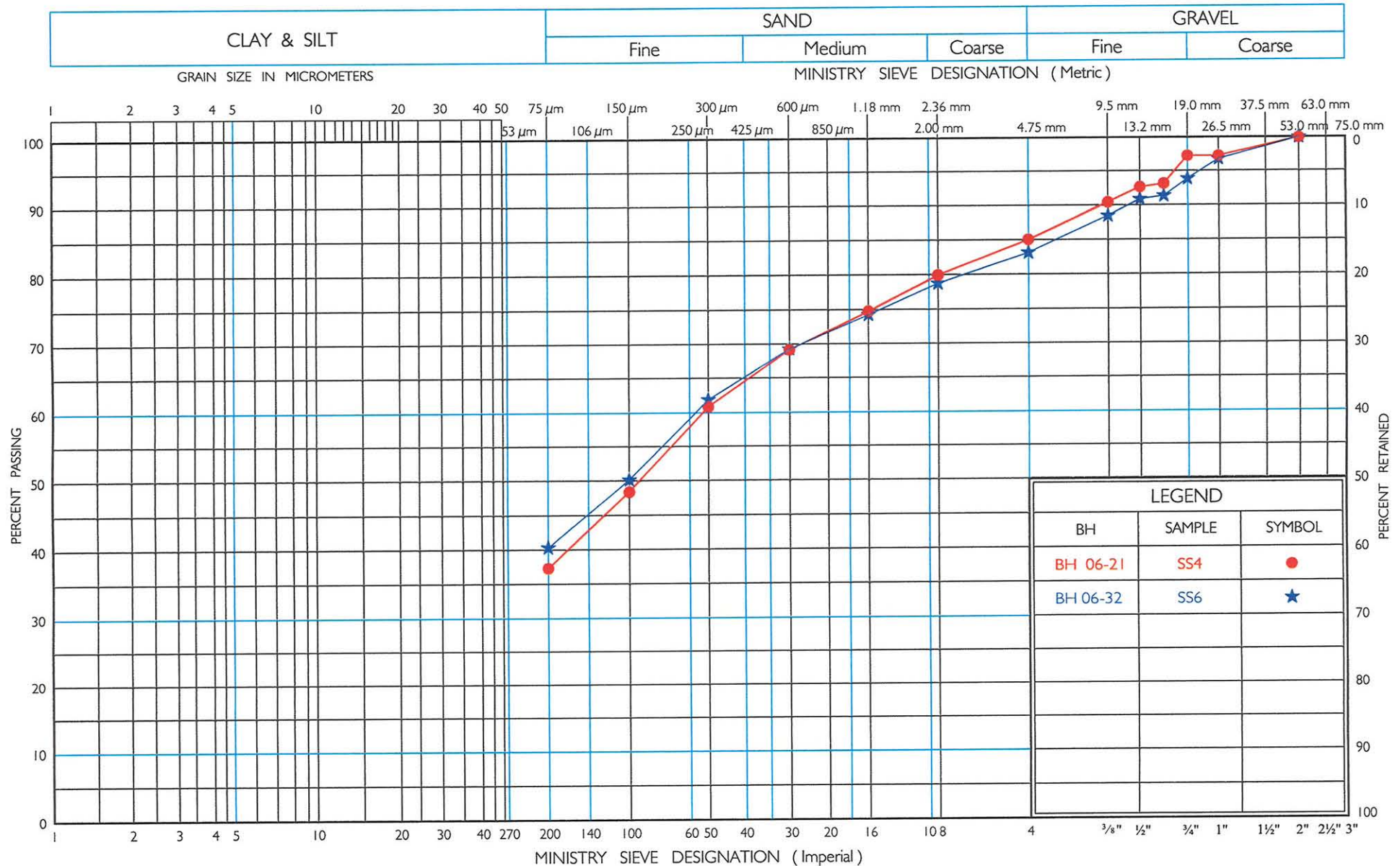
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GRAIN SIZE DISTRIBUTION  
SANDY SILT, SOME CLAY, TRACE TO SOME GRAVEL

FIG No 2

W P 302-89-00

## UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION  
SILTY SAND, SOME GRAVEL, TRACE CLAY

FIG No 3

W P 302-89-00



**GRAIN SIZE DISTRIBUTION CURVE**

**CLAY & SILT**

**SAND**

**GRAVEL**

**GRAIN SIZE IN MICROMETERS**

**MINISTRY SIEVE DESIGNATION (Metric)**

**MINISTRY SIEVE DESIGNATION (Imperial)**

**PERCENT RETAINED**

**LEGEND**

BH	SAMPLE	SYMBOL
BH 06-24	SS3	●

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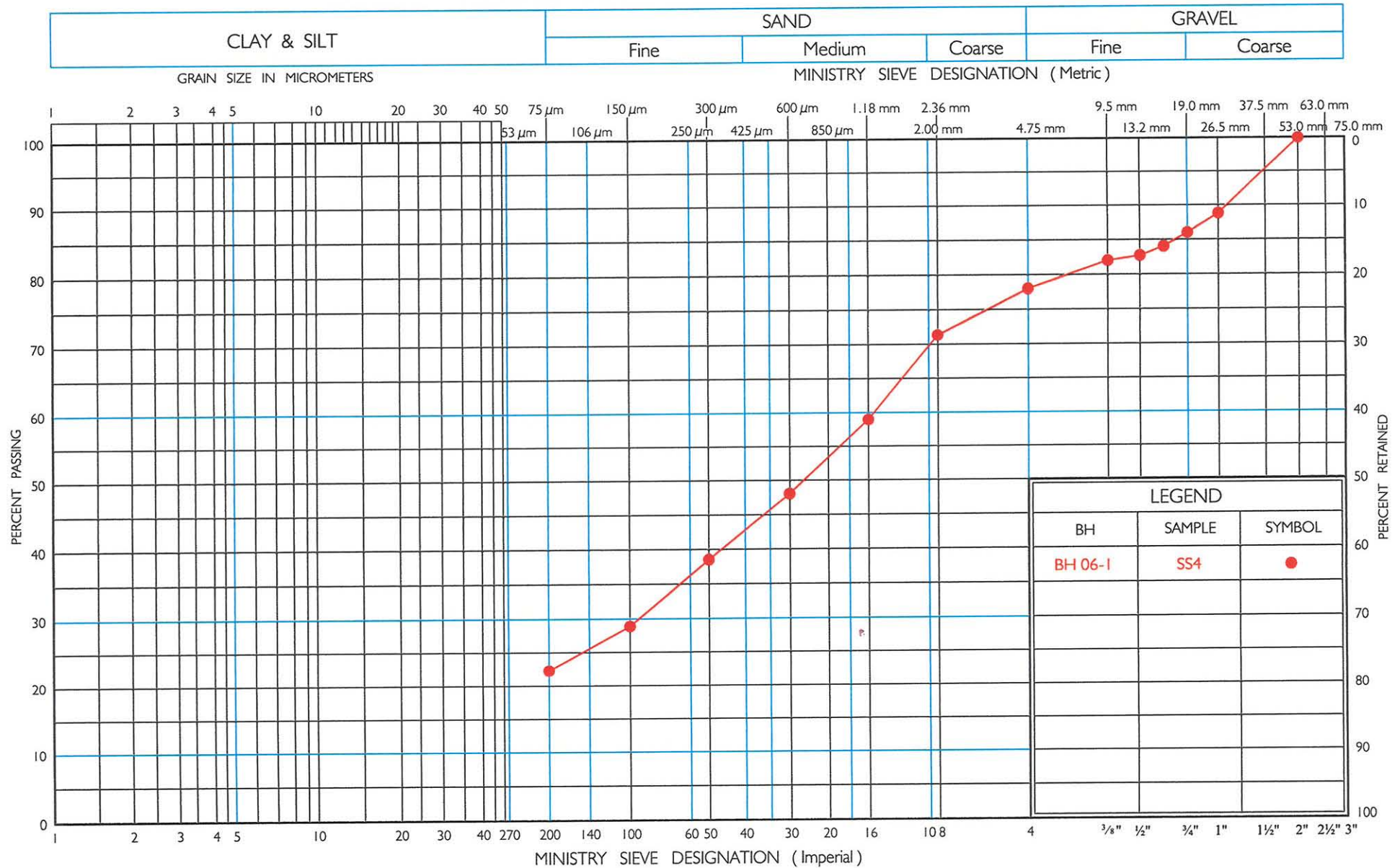
# GRAIN SIZE DISTRIBUTION

## SAND AND GRAVEL, TRACE SILT

FIG No 4

W P 302-89-00

## UNIFIED SOIL CLASSIFICATION SYSTEM

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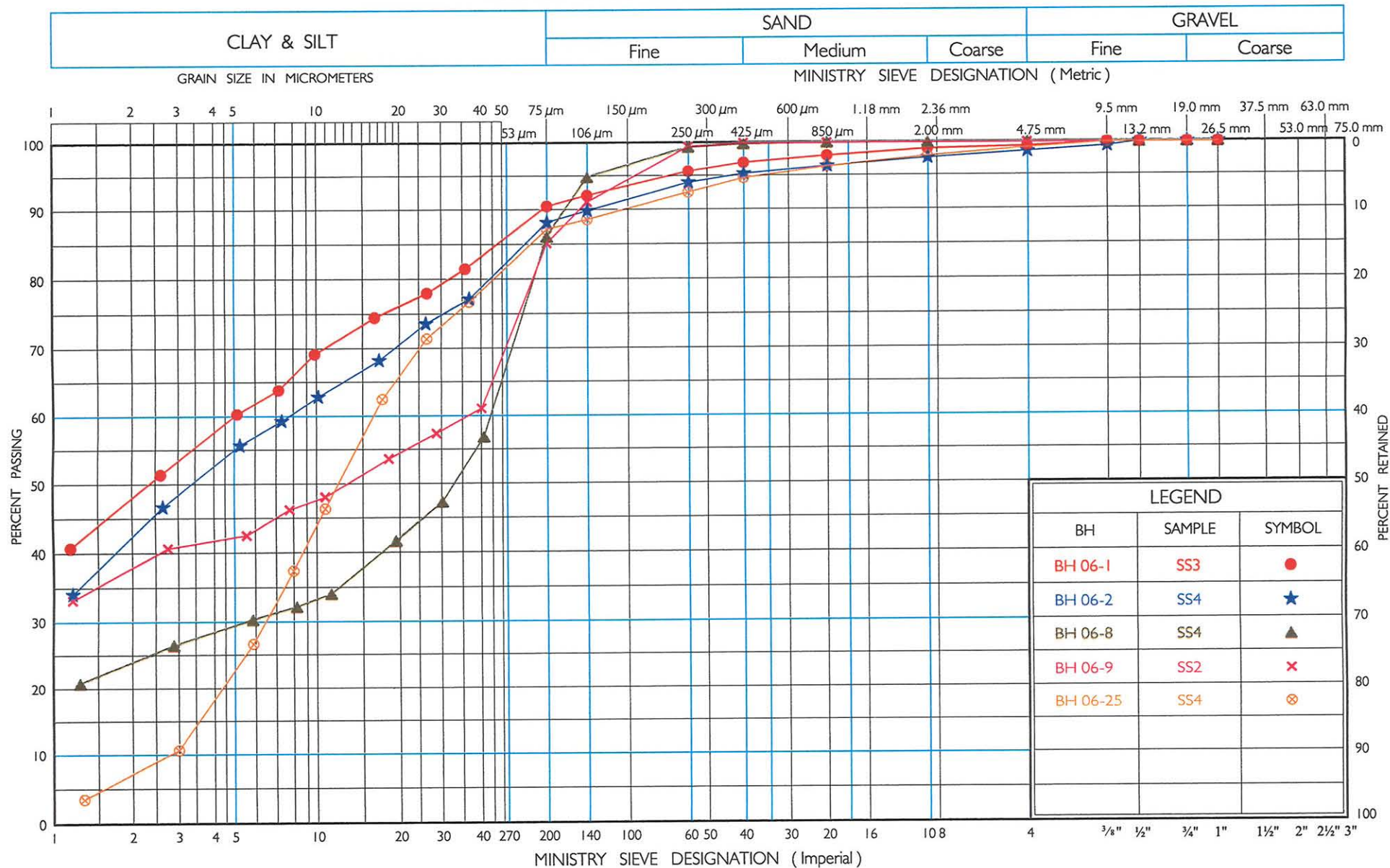
GRAIN SIZE DISTRIBUTION  
SAND WITH GRAVEL, SOME SILT, TRACE CLAY

FIG No 5

W P 302-89-00



## UNIFIED SOIL CLASSIFICATION SYSTEM



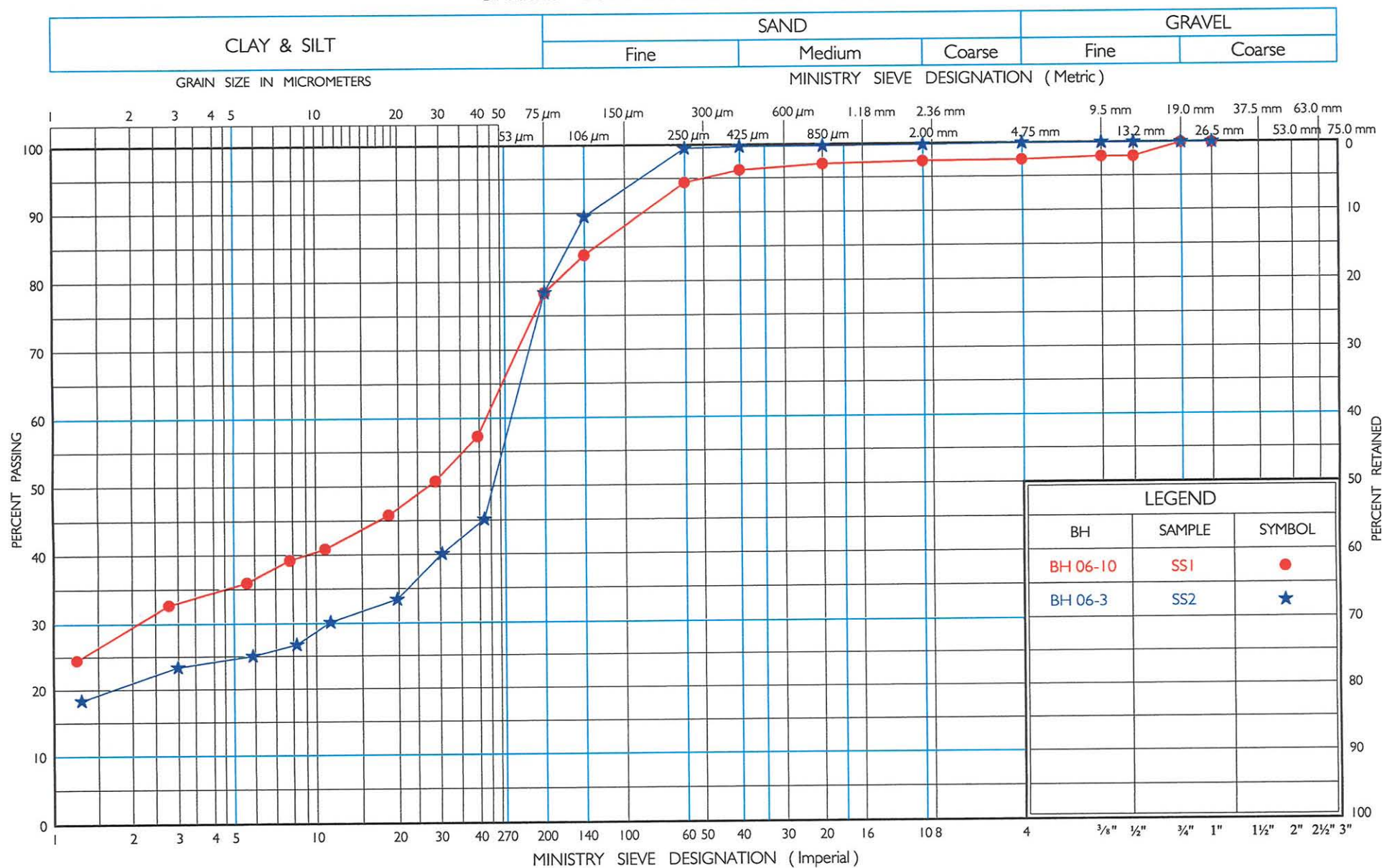
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GRAIN SIZE DISTRIBUTION  
SILTY CLAY, SOME SAND

FIG No 6

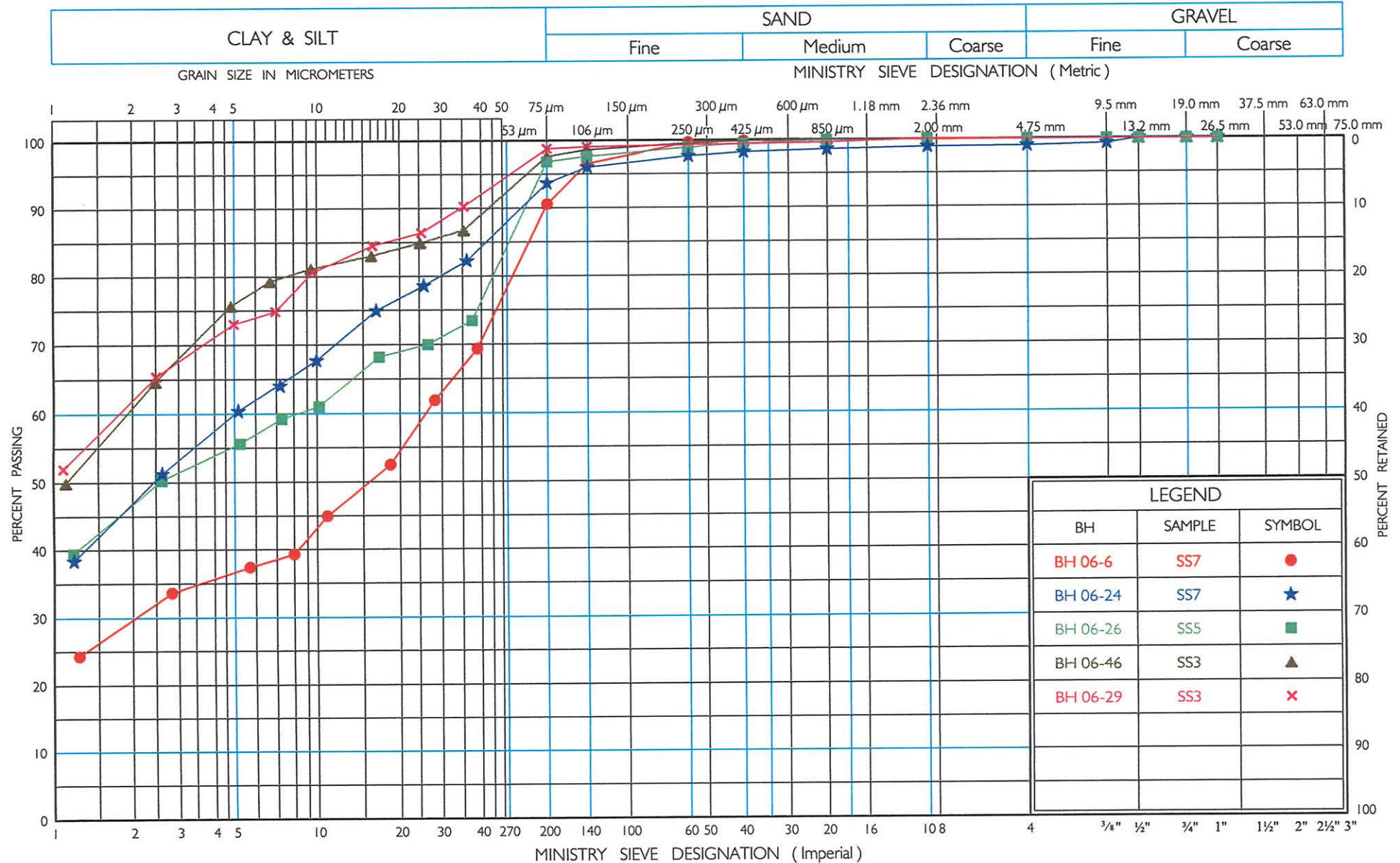
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## UNIFIED SOIL CLASSIFICATION SYSTEM





## UNIFIED SOIL CLASSIFICATION SYSTEM



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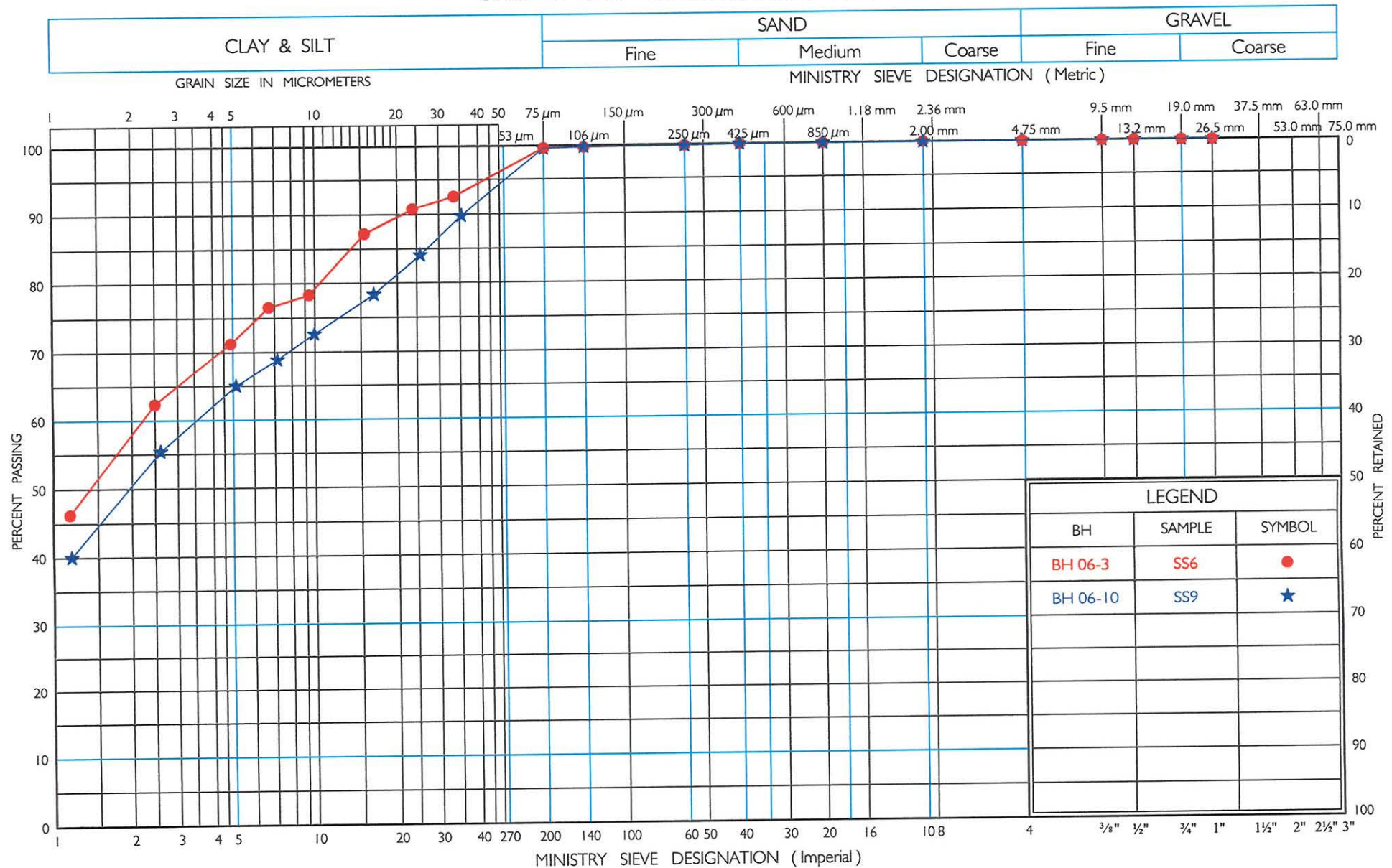
Ontario

GRAIN SIZE DISTRIBUTION  
SILTY CLAY, TRACE SAND

FIG No 8

W P 302-89-00

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GRAIN SIZE DISTRIBUTION  
SILTY CLAY

FIG No 9

W P 302-89-00



