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**FOUNDATION INVESTIGATION REPORT
OVERHEAD SIGNS
HIGHWAY 410
FROM 500 M NORTH OF BOVAIRD DRIVE
TO MAYFIELD ROAD
W.P. 101-00-00**

Submitted to:

URS Canada Inc.
75 Commerce Valley Drive East
Thornhill, Ontario
L3T 7N9

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by URS Canada Inc. (URS) on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the following components associated with the Phase 2 extension of Highway 410 from Sandalwood Parkway to Mayfield Road, in Brampton, Ontario:

- Underpass structures at Countryside Drive and Mayfield Road;
- New structural culverts;
- High fill embankments along Highway 410, on Mayfield Road and Countryside Drive, and on the Mayfield Road interchange ramps;
- High mast light poles; and
- Overhead signs.

This report addresses the foundations for eight overhead signs that are to be constructed along Highway 410, between 500 m north of Bovaird Drive and Mayfield Road, as shown in the table below. A foundation investigation has been carried out to determine the subsurface conditions at these locations.

	<i>Sign Number</i>	<i>Station</i>	<i>Approximate Location</i>
Hwy 410 NBL	1	18+100	850 m north of Bovaird Dr.
	2	18+550	500 m south of Sandalwood Pkwy.
	3	20+590	160 m north of Countryside Dr.
	4	20+970	540 m north of Countryside Dr.
Hwy 410 SBL	5	17+764	500 m north of Bovaird Dr.
	6	18+200	950 m north of Bovaird Drive
	7	19+770	720 m south of Countryside Dr.
	8	20+200	230 m south of Countryside Dr.

The terms of reference for the scope of work are outlined in Golder's Proposal No. P01-1228, dated August, 2000. Changes to the scope of work for the foundation engineering component are outlined in Golder's letter dated November 13, 2003, February 12, 2004, and June 14, 2004.

2.0 SITE DESCRIPTION

The Highway 410 extension is located about 400 m to 500 m east of the existing Heart Lake Road. The overhead signs will be installed along the new Highway 410 alignment from about 500 m north of Bovaird Drive to about 540 m north of Countryside Drive, predominantly through farmland. The surface topography in the area is relatively flat to slightly undulating, and in general slopes gradually and fairly uniformly to the south, toward Lake Ontario.

From 500 m north of Bovaird Drive to Mayfield Road, the ground surface generally rises from about Elevation 244 m to 254 m. A relatively deep swamp is located in the low-lying area (ground surface between about Elevations 248 m and 250 m) immediately south of Mayfield Road; this swamp extends toward the north/northeast, passing under the existing Mayfield Road embankment. Another small swamp is present about 200 m to 300 m south of Mayfield Road; in this area, the general ground surface is at about Elevation 254 m, and the ground surface within the swamp is at about Elevation 251 m to 252 m.

3.0 INVESTIGATION PROCEDURES

A borehole investigation was carried out for the proposed overhead sign locations in February and March 2005. Eight boreholes (Boreholes OHS-1 to OHS-8) were advanced in the vicinity of the sign locations, between approximately 500 m north of Bovaird Drive and 540 m north of Countryside Drive.

Boreholes OHS-1 to OHS-8 were drilled using a track-mounted drill rig supplied and operated by DBW Drilling Ltd. of Toronto, Ontario. These boreholes were extended to 9.8 m depth using solid-stem augers, with soil samples obtained at 0.75 m and 1.5 m intervals of depth using a 50 mm outside diameter split-spoon samplers driven with an automatic hammer, in accordance with the Standard Penetration Test (SPT) procedure. The water level in the open boreholes was observed throughout the drilling operations. Following completion, the boreholes were backfilled to ground surface using bentonite pellets.

The field work was supervised on a full-time basis by a member of Golder's staff who located the boreholes in the field, directed the drilling, sampling, and in situ testing operations, and logged the boreholes. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga for testing. Index and classification tests (water content determinations, Atterberg limit tests, and grain size distribution analyses) were carried out on selected soil samples.

The borehole locations were established by Golder relative to points staked along the alignment by Callon Dietz, Ontario Land Surveyors, of London, Ontario, and the ground surface elevations at these locations were determined using the topographic mapping for this project. The borehole locations (MTM NAD83 northing and easting coordinates) and the ground surface elevations referenced to geodetic datum are shown on Drawing 1 contained in this report, and are summarized in the following table:

<i>Borehole Number</i>	<i>MTM NAD83 Northing (m)</i>	<i>MTM NAD83 Easting (m)</i>	<i>Ground Surface Elevation (m)</i>
OHS-1	4,843,614.1	283,035.8	244.2
OHS-2	4,843,953.9	282,729.8	244.0
OHS-3	4,845,559.3	281,481.4	252.2
OHS-4	4,845,892.1	281,305.6	249.9
OHS-5	4,843,299.9	283,169.1	243.9
OHS-6	4,843,664.7	282,933.8	245.9
OHS-7	4,844,833.5	281,904.6	245.2
OHS-8	4,845,200.4	281,659.3	251.6

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geological Conditions

This portion of the Highway 410 extension is located in the physiographic region known as the Peel Plain, which covers the central portions of York, Peel and Halton Regions, as delineated in *The Physiography of Southern Ontario*¹. The surface topography of the Peel Plain is relatively flat, and slopes gradually and fairly uniformly towards Lake Ontario.

The soils within the Peel Plain physiographic region are characterized by relatively thick deposits of clayey silt till to silty clay till, that are overlain by lacustrine deposits (the “Peel ponds” deposits) consisting of relatively thin, localized accumulations of sand, silt and clay; organic deposits may also be present in low-lying areas. The glacial till deposits are underlain by shale bedrock of the Georgian Bay Formation; in this formation, the shale is interbedded with limestone, siltstone, sandstone and dolostone layers.

4.2 Site Stratigraphy

The detailed subsurface soil and groundwater conditions encountered in the boreholes and the results of in situ and laboratory testing are given on the Record of Borehole sheets and on Figures 1 and 2 following the text of this report. The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. Subsoil conditions will vary between and beyond the borehole locations.

The predominant soil deposit encountered along this portion of the Highway 410 extension is a clayey silt till. In the boreholes advanced as part of this investigation, the till is overlain by fill or topsoil and, at one location (Borehole OHS-7) by a surficial silty sand deposit. A more detailed description of the subsurface conditions encountered in the boreholes is provided in the following sections.

4.2.1 Fill

Fill was encountered immediately below the ground surface in Boreholes OHS-1, OHS-2, OHS-5 and OHS-6, associated with the general grading for Highway 410 that was already in place south of Sandalwood Parkway at the time of the investigation. Fill was also encountered below approximately 200 mm of topsoil in Borehole OHS-3, located just north of Countryside Drive. The fill is between 0.8 m and 2.3 m in thickness in these boreholes.

¹ Chapman, L.J. and D.F. Putnam. *The Physiography of Southern Ontario*, Ontario Geological Survey Special Volume 2, Third Edition, 1984. Accompanied by Map P.2715, Scale 1:600,000.

The fill material generally consists of clayey silt containing some sand and trace gravel; topsoil seams were observed within the fill in Borehole OHS-1. The measured Standard Penetration Test (SPT) “N” values within the fill range from 6 to 71 blows per 0.3 m of penetration, but are typically between about 6 and 30 blows per 0.3 m of penetration, indicating that the fill has a firm to hard consistency.

4.2.2 Topsoil

Topsoil was encountered immediately below the ground surface in Boreholes OHS-3, OHS-4, OHS-7 and OHS-8, and immediately below the fill in Borehole OHS-2. At these locations, the topsoil is about 100 mm to 600 mm in thickness.

4.2.3 Surficial Silty Sand

A 2.5 m thick surficial silty sand layer was encountered below the topsoil in Borehole OHS-7, which is located between Sandalwood Parkway and Countryside Drive. The silty sand contains trace gravel as well as clayey silt layers/seams. The measured SPT “N” values within this deposit range from 6 to 14 blows per 0.3 m of penetration, indicating that the silty sand has a loose to compact relative density.

4.2.4 Clayey Silt Till

A glacial till deposit was encountered below the existing fill or topsoil and, where present, the surficial silty sand deposit; in the boreholes, the surface of the till was encountered between 0.2 m and 3.1 m depth. The till typically consists of clayey silt containing trace to some sand and gravel, cobbles were also observed within the fill during drilling, as noted on the borehole records. The results of grain size distribution tests conducted on three samples of the till are shown on Figure 1.

Atterberg limit testing was conducted on eight selected samples of the till, and measured plastic limits of 9 to 15 per cent, liquid limits of 17 to 27 per cent, and corresponding plasticity indices of 3 to 16 (but typically 6 to 16) per cent. The results, presented on Figure 2, confirm that the tested samples represent a clayey silt of low plasticity, however, one sample is a non-plastic silt till. Natural water contents measured on samples of the till varied from 6 to 25 per cent, typically at or below the material’s plastic limit.

The measured SPT “N” values in the till generally range from 14 to greater than 100 blows per 0.3 m of penetration, indicative of a stiff to hard consistency. However, in Borehole OHS-7, SPT “N” values of 7 blows per 0.3 m of penetration were measured in the upper portion of the till, indicating that this portion of the till has a firm consistency.

4.2.5 Sandy Silt to Silt Interlayer in Till

A layer of sandy silt to silt was encountered at the base of Borehole OHS-3, and based on the results from other boreholes advanced as part of investigations for the Phase 2 extension of Highway 410, this is interpreted to represent an interlayer within the till deposit. The sandy silt to silt layer was encountered at 7.6 m depth and is at least 2.2 m in thickness; the borehole was terminated within this layer.

Two SPT “N” values of 27 and 36 blows per 0.3 m of penetration were measured within the sandy silt to silt, indicating that this interlayer has a compact to dense relative density.

4.3 Groundwater Conditions

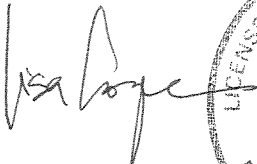
The majority of the boreholes were dry upon completion of drilling. However, wet conditions were observed in Boreholes OHS-2 and OHS-7 (where a water-bearing surficial silty sand deposit was encountered), as noted on the borehole records.

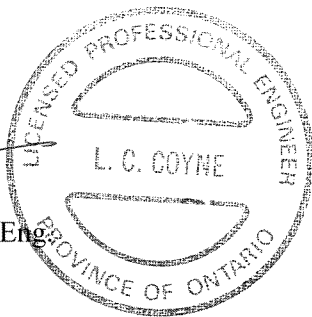
Although no piezometers were installed within the boreholes advanced as part of this investigation, piezometers have been installed in other boreholes associated with the Phase 1 and Phase 2 portions of the Highway 410 extension. In the area extending from 500 m north of Bovaird Drive to north of Countryside Drive, the water level typically is typically between 2 m and 3 m below the ground surface. It should be noted that groundwater levels are expected to fluctuate seasonally, and should be expected to rise during wet periods of the year.


5.0 CLOSURE

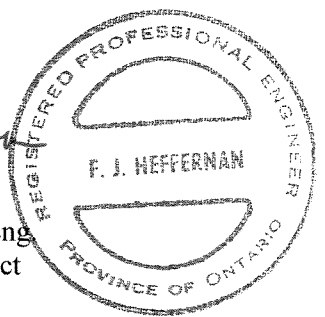
This Foundation Investigation Report was prepared by Ms. Karyn Gallant and reviewed by Ms. Lisa Coyne, P.Eng., an Associate and Geotechnical Engineer with Golder. Mr. Fintan Heffernan, a Designated MTO Contact for Golder, conducted an independent review of the report.

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KG/LCC/FJH/lcc

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LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

Consistency

	c_u, s_u	kPa	psf
Very soft		0 to 12	0 to 250
Soft		12 to 25	250 to 500
Firm		25 to 50	500 to 1,000
Stiff		50 to 100	1,000 to 2,000
Very stiff		100 to 200	2,000 to 4,000
Hard		over 200	over 4,000

Dynamic Cone Penetration Resistance; N_d :

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. General

π	3.1416
$\ln x$,	natural logarithm of x
\log_{10}	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ϵ	linear strain
ϵ_v	volumetric strain
η	coefficient of viscosity
ν	poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index $= (w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index $= (w - w_p) / I_p$
I_C	consistency index $= (w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction $= \tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 + \sigma_3)/2$ or $(\sigma'_1 + \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 + \sigma_3)$
S_t	sensitivity

- Notes:**
- 1 $\tau = c' + \sigma' \tan \phi'$
 - 2 shear strength $= (\text{compressive strength})/2$
 - * density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

PROJECT <u>001-1159-6</u>		RECORD OF BOREHOLE No OHS-1		1 OF 1 METRIC																		
W.P. <u>101-00-00</u>		LOCATION <u>N 4843614.1 ; E 283035.8</u>		ORIGINATED BY <u>PKS</u>																		
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>Power Auger CME 55, 159 mm O.D. Solid Stem Augers</u>		COMPILED BY <u>KG</u>																		
DATUM <u>Geodetic</u>		DATE <u>March 14, 2005</u>		CHECKED BY <u>LCC</u>																		
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa														
								<div style="display: flex; justify-content: space-between; font-size: small;"> 20 40 60 80 100 20 40 60 80 100 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED </div>														
244.2	GROUND SURFACE																					
0.0	Clayey Silt, some sand, trace gravel, containing topsoil seams (FILL) Stiff to hard Brown Moist		1	SS	67																	
			2	SS	15																	
			3	SS	30																	
241.9																						
2.3	Clayey Silt, some sand, trace gravel, containing cobbles (TILL) Very stiff to hard Brown to grey below 6.1 m depth Moist		4	SS	21																	
			5	SS	29																	
			6	SS	53																	
			7	SS	100																	
			8	SS	70/15																	
			9	SS	84																	
			10	SS	52																	
234.5																						
9.8	End of Borehole Note: 1. Borehole dry upon completion of drilling.																					

MIS-MTO 001 001-1159-6-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT 001-1159-6			RECORD OF BOREHOLE No OHS-2			1 OF 1 METRIC		
W.P. 101-00-00			LOCATION N 4843953.9 ; E 282729.8			ORIGINATED BY PKS		
DIST _____ HWY 410			BOREHOLE TYPE Power Auger CME 55, 159 mm O.D. Solid Stem Augers			COMPILED BY KG		
DATUM Geodetic			DATE March 14, 2005			CHECKED BY LCC		
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100
244.0	GROUND SURFACE							PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)
0.0	Clayey Silt, some sand, trace gravel (FILL) Very stiff to hard Brown Moist		1	SS	71		243	
242.6	Topsoil		2	SS	22		242	
1.5	Clayey Silt, some sand, trace gravel, containing cobbles (TILL) Stiff to hard Brown to grey below 4.3 m depth Moist to wet below 7.6 m depth		3	SS	15		241	
			4	SS	43		240	
			5	SS	35		239	
			6	SS	42		238	
			7	SS	44		237	
			8	SS	28		236	
			9	SS	30		235	
234.3	End of Borehole		10	SS	29			
9.8	Note: 1. Water level in open borehole at 8.5 m depth upon completion of drilling.							

MIS-MTO 001 001-1159-6-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT 001-1159-6			RECORD OF BOREHOLE No OHS-3			1 OF 1 METRIC					
W.P. 101-00-00			LOCATION N 4845559.3 ; E 281481.4			ORIGINATED BY PKS					
DIST _____ HWY 410			BOREHOLE TYPE Power Auger CME 55, 159 mm O.D. Solid Stem Augers			COMPILED BY KG					
DATUM Geodetic			DATE February 24, 2005			CHECKED BY LCC					
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
252.2	GROUND SURFACE										
0.0	Topsoil										
0.2	Clayey Silt, some sand, trace gravel (FILL) Firm to very stiff Brown Moist		1	SS	6		252				
			2	SS	26		251				
250.7											
1.5	Clayey Silt, some sand, trace gravel (TILL) Stiff to hard Brown to grey below 4.6 m depth Moist		3	SS	14		250				
			4	SS	32						
			5	SS	47		249				
			6	SS	82		248				
			7	SS	38		247				
			8	SS	34		246				
							245				
244.6											
7.6	Sandy Silt to Silt, trace gravel, trace clay, containing sand seams Compact to dense Grey Moist		9	SS	27		244				
							243				
242.5			10	SS	36						
9.8	End of Borehole										
	Note: 1. Borehole dry upon completion of drilling.										

MIS-MTO 001 001-1159-6-MTO.GPJ ON_MOT.GDT 12/2/06

MIS-MTO 001 001-1159-6-MTO.GPJ ON MOT.GDT 12/2/06


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

MIS-MTO 001 001-1159-6-MTO.GPJ ON MOT.GDT 12/2/06

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

PROJECT 001-1159-6			RECORD OF BOREHOLE No OHS-6			1 OF 1 METRIC											
W.P. 101-00-00			LOCATION N 4843664.7 ; E 282933.8			ORIGINATED BY PKS											
DIST _____ HWY 410			BOREHOLE TYPE Power Auger CME 55, 159 mm O.D. Solid Stem Augers			COMPILED BY KG											
DATUM Geodetic			DATE March 14, 2005			CHECKED BY LCC											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ	GR SA SI CL
								20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	10 20 30				
245.9	GROUND SURFACE																
0.0	Clayey Silt, some sand, trace gravel (FILL) Hard Brown Moist		1	SS	36												
245.1																	
0.8	Clayey Silt, some sand, trace gravel, containing cobbles (TILL) Very stiff to hard Brown to grey below 4.3 m depth Moist		2	SS	32		245										
			3	SS	42		244										
			4	SS	23		243										
			5	SS	35		242										
			6	SS	54		241										
			7	SS	84		240										
							239										
			8	SS	42		238										
			9	SS	62		237										
236.2	End of Borehole		10	SS	74												
9.8	Note: 1. Borehole dry upon completion of drilling.																

MIS-MTO 001 001-1159-6-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT 001-1159-6			RECORD OF BOREHOLE No OHS-7			1 OF 1 METRIC						
W.P. 101-00-00			LOCATION N 4844833.5 ; E 281904.6			ORIGINATED BY PKS						
DIST _____ HWY 410			BOREHOLE TYPE Power Auger CME 55, 159 mm O.D. Solid Stem Augers			COMPILED BY KG						
DATUM Geodetic			DATE February 24, 2005			CHECKED BY LCC						
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
245.2	GROUND SURFACE											
0.0	Clayey Topsoil, some sand Stiff Brown Moist		1	SS	16		245					5 14 44 37
244.6												
0.6	Silty Sand containing clayey silt interlayers, trace gravel Firm to stiff Brown Moist to wet below 2.1 m depth		2	SS	6		244					
			3	SS	11		243					
		4	SS	14		242						
242.2												
3.1	Clayey Silt, some sand, trace gravel (TILL) Firm to hard Grey Wet	5	SS	15		241						
		6	SS	7		240						
		7	SS	7		239						
		8	SS	16		238						
		9	SS	18		237						
		10	SS	30		236						
235.5	End of Borehole											
9.8	Note: 1. Water level in open borehole at 7.6 m depth upon completion of drilling.											

MIS-MTO 001 001-1159-6-MTO.GPJ ON_MOT.GDT 12/2/06

MIS-MTO 001 001-1159-6-MTO.GPJ ON MOT.GDT 12/2/06

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

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 101-00-00

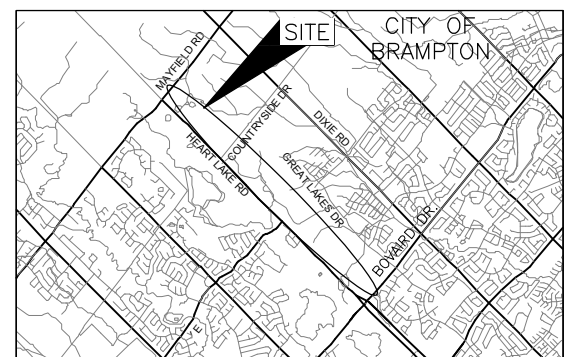


HIGHWAY 410
OVERHEAD SIGNS
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN

APPROX. SCALE

2.5km 0 2.5 km

LEGEND

Borehole - Current Investigation

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
OHS-1	244.2	4843614.1	283035.8
OHS-2	244.0	4843953.9	282729.8
OHS-3	252.2	4845559.3	281481.4
OHS-4	249.9	4845892.1	281305.6
OHS-5	243.9	4843299.9	283169.1
OHS-6	245.9	4843664.7	282933.8
OHS-7	245.2	4844833.5	281904.6
OHS-8	251.6	4845200.4	281659.3

NOTES

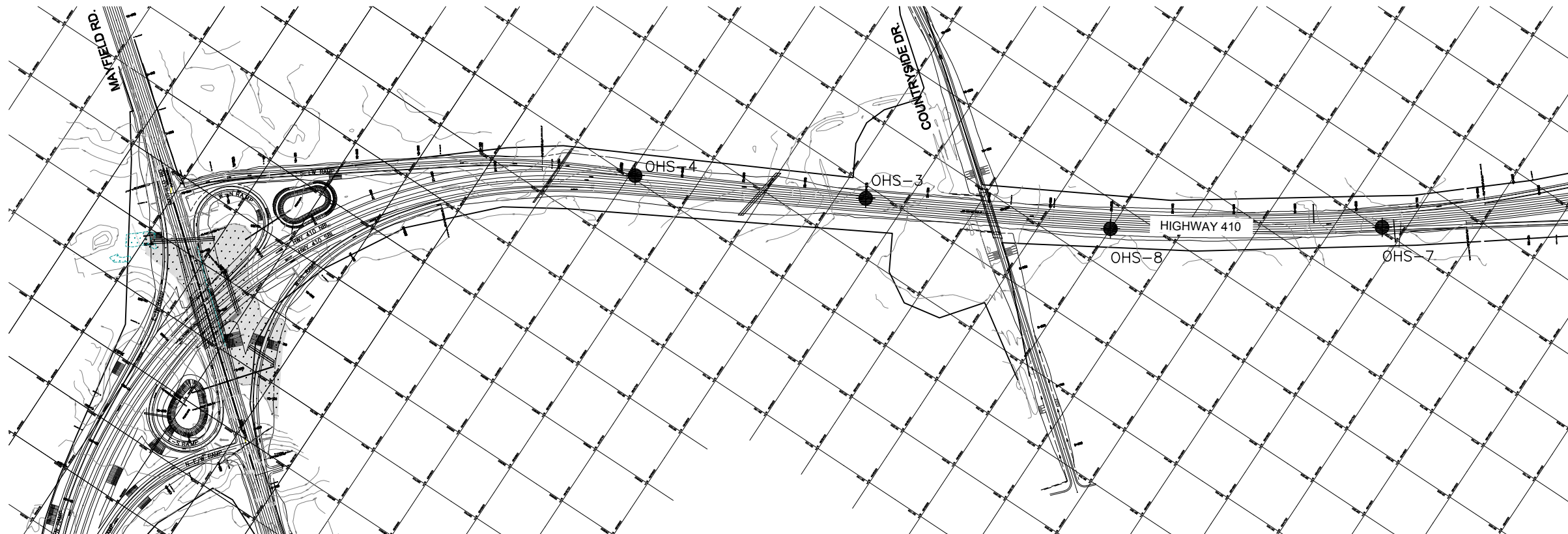
This drawing is for subsurface information only. The proposed works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

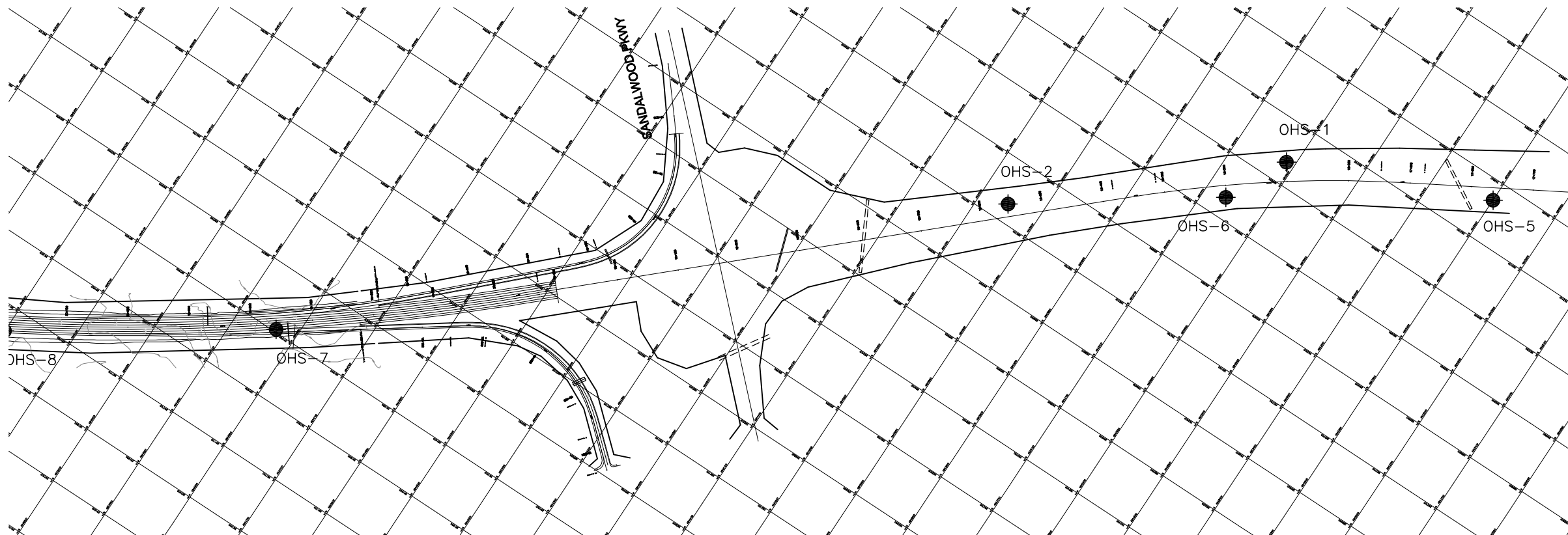
Culvert locations received in digital format from URS Canada Inc. (drawing file "01004 Hwy 410 plan-CV.dwg", received March 9, 2005) and swamp configuration received in digital format from URS Canada Inc. (drawing file "Mayfield_watermain_option.dwg", received March 9, 2005).

NO.	DATE	BY	REVISION
Geocres No.			
HWY. 410		PROJECT NO. 001-1159-6	
SUBM'D. KG		DATE: MAY 2005	SITE:
DRAWN: JFC/MSM		CHKD. KG	APPD. LCC
			DWG. 1



PLAN

80 0 80 160
SCALE METRES



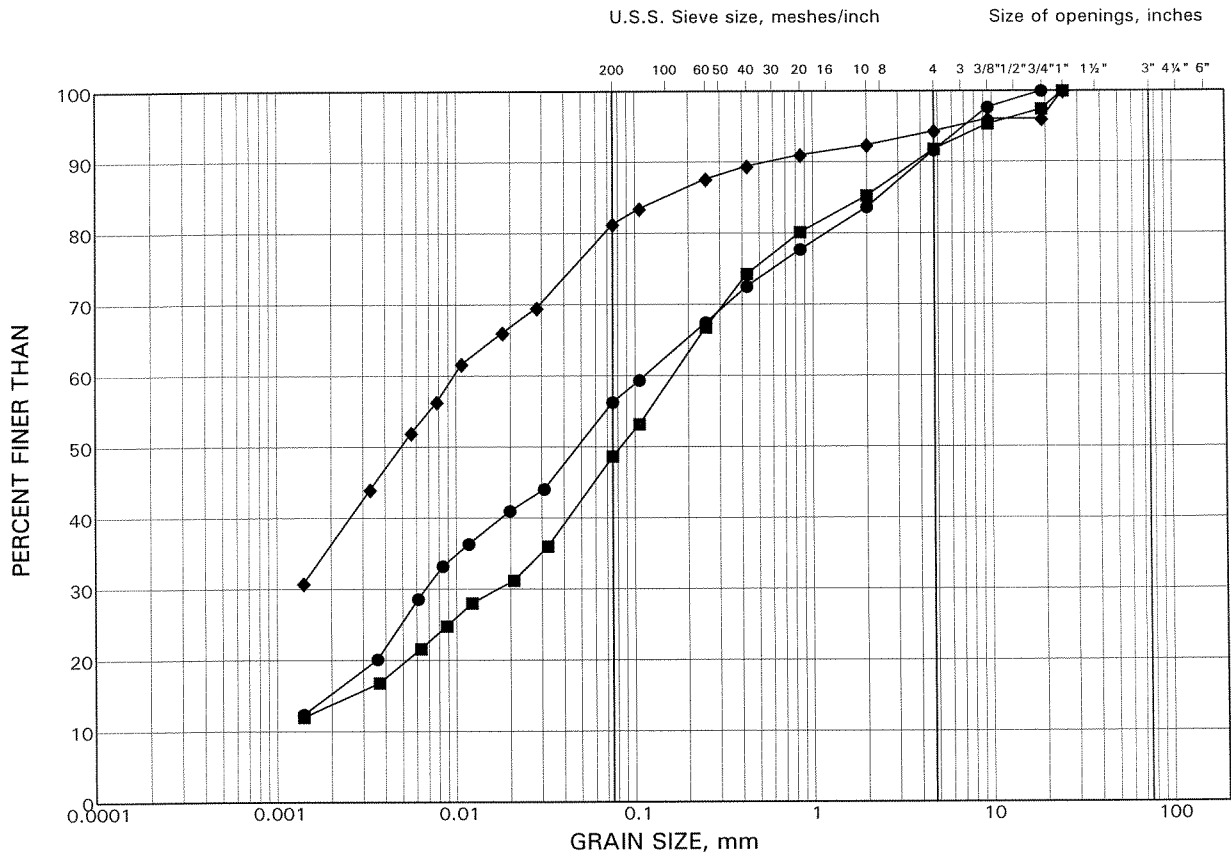
PLAN

80 0 80 160
SCALE METRES

GRAIN SIZE DISTRIBUTION TEST RESULTS

Clayey Silt Till

FIGURE 1



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	OHS-1	4	0.8-1.4
■	OHS-5	7	4.6-5.2
◆	OHS-7	6	3.8-4.4

