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**FOUNDATION INVESTIGATION REPORT
HIGH MAST LIGHTS
HIGHWAY 410
FROM 800 M SOUTH OF COUNTRYSIDE DRIVE
TO 400 M NORTH OF MAYFIELD ROAD
W.P. 101-00-00**

Submitted to:

URS Canada Inc.
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DISTRIBUTION:

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February 2006

001-1159-5



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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 twenty-two high mast light poles that are to be constructed along Highway 410, between approximately 800 m south of Countryside Drive and 400 m north of Mayfield Road (the “Phase 2” extension). Foundation investigations have been carried out by Golder between 2001 and 2004 as part of the assignment to determine the subsurface conditions within the limits of the Phase 2 extension. Use has also been made of two boreholes (Boreholes 129 and 34) that were advanced as part of the Highway 410 feasibility study and the Phase 1 design work, respectively; the records of these boreholes were obtained from the following reports:

- Borehole 129: *Supplementary Foundation Feasibility Investigation, Proposed Highway 410 Extension, Bovaird Drive to Highway 10, W.P. 22-79-00*, prepared by Golder Associates Ltd., dated April 1999.
- Borehole 34: *Foundation Investigation Report, Proposed High Mast Lighting, Proposed Highway 410 Extension from Bovaird Drive to Sandalwood Parkway, Brampton, Ontario, W.P. 130-99-00*, prepared by Shaheen & Peaker Ltd., dated February 2000 (GEOCREs No. 30M12-244).

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 Phase 2 portion of the Highway 410 alignment extends from about 800 m south of Countryside Drive to about 400 m north of Mayfield Road, 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 south of Countryside Drive to Mayfield Road, the ground surface generally rises from about Elevation 247 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.

A localized topographic high, associated with an esker ridge, is present to the northwest of Mayfield Road. The ground surface rises from approximately Elevation 251 m to 254 m immediately north of Mayfield Road, to about Elevation 266 m at the highest point along the proposed Highway 410 alignment.

3.0 INVESTIGATION PROCEDURES

Borehole investigations have been carried out by Golder between 2001 and 2004 for the extension of Highway 410 between approximately Stations 19+550 (about 800 m south of Countryside Drive) and 21+100 (about 400 m north of Mayfield Road). The following boreholes have been used in the preparation of this report:

- Boreholes C-3 and C-04-2, which were advanced for the proposed Countryside Drive underpass structure;
- Boreholes C1-1, C1-2, E-6, and SWM-1, which were advanced for a proposed structural culvert, high fill embankment and stormwater management pond, all located between Countryside Drive and Mayfield Road;
- Boreholes 03-05, 03-06, 03-10 and WS-5, which were advanced for proposed structural culverts and/or high fill embankments at the Mayfield Road interchange;
- Boreholes HML-1 to HML-4, which were located to provide additional coverage beyond that obtained from boreholes that were advanced for specific structures or high fill embankments (as noted above).

In addition, use has been made of the following two boreholes from previous investigations related to the Highway 410 extension project:

- Borehole 129, which was advanced for an alternative alignment of Mayfield Road as part of a feasibility study in 1999 (*Supplementary Foundation Feasibility Investigation, Proposed Highway 410 Extension, Bovaird Drive to Highway 10, W.P. 22-79-00*, prepared by Golder Associates Ltd., dated April 1999).
- Borehole 34, which was drilled in 1999 as part of the Phase 1 work on the Highway 410 extension project (*Foundation Investigation Report, Proposed High Mast Lighting, Proposed Highway 410 Extension from Bovaird Drive to Sandalwood Parkway, Brampton, Ontario, W.P. 130-99-00*, prepared by Shaheen & Peaker Ltd., dated February 2000, GEOCREs No. 30M12-244).

The 2001 to 2004 boreholes were drilled using bombardier-mounted drill rigs supplied and operated by Geo-Environmental Drilling Inc. of Milton, Ontario, Walker Drilling of Utopia, Ontario and Groundworks Drilling Inc. of Etobicoke, Ontario. The boreholes were advanced using either hollow stem or solid stem augers, as indicated on the individual borehole records. Samples of the overburden were obtained at 0.75 m and 1.50 m intervals of depth using 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, and a total of three piezometers were installed in the boreholes that are included in this report.

The field work was supervised on a full-time basis by members 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 and ground surface elevations were established by Golder relative to points staked along the alignment and at proposed structure locations by Callon Dietz, Ontario Land Surveyors, of London, Ontario. It should be noted that the locations of some of the boreholes completed in 2001 were not accurately surveyed due to the work stoppage in July 2001; the location coordinates of the boreholes completed as part of the 2001 investigations are, therefore, considered accurate to within approximately 5 m. The borehole locations (MTM NAD83 northing and easting coordinates) and the ground surface elevations referenced to geodetic datum are shown on Drawings 1 to 3 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>
03-05	4846299.8	280567.1	261.8
03-06	4846339.2	280524.1	263.9
03-10	4846410.5	280841.9	248.9
C1-1 (2001)	4845701.9	281416.7	247.3
C1-2 (2001)	4845766.4	281339.0	249.7
C-3	4845373.6	281574.2	249.7
C-04-2	4845411.2	281553.5	250.8
E-6 (2001)	4845906.1	281281.7	250.4
HML-1 (2001)	4845015.7	281788.6	248.3
HML-2 (2001)	4845992.8	281231.8	249.5
HML-3 (2001)	4846211.6	281029.2	250.3
HML-4 (2001)	4846329.1	280306.9	266.3
SWM-1	4846299.3	280946.6	251.5
WS-5	4846255.2	280811.7	254.2
34 (1999)	4844632	282082	246.6
129 (1999)	4846359.7	280669.1	259.0

It is noted that Borehole 129, which was completed as part of the 1999 feasibility study in the Mayfield Road area, was surveyed using the NAD83 UTM datum (as shown on the borehole record contained in Appendix A). These coordinates have been converted to the NAD83 MTM system for presentation in this report.

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, on Figures 1 to 6, and in Appendices A and B. 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. Localized variations occur along the alignment, as follows:

- From Countryside Drive to Mayfield Road (excluding the swamp areas), the glacial till deposit is overlain by a shallow surficial deposit of generally firm to stiff clayey silt to silty clay. At some locations within this area, cohesionless surficial soils (silty sand to sandy silt) are also present.
- In the two swampy areas south of Mayfield Road, the glacial till is overlain by organic deposits. In the smaller swamp, about 0.8 m of organic soil has been encountered in the two boreholes included in this report. In the larger swamp, up to several metres of peat and organic soils are present, underlain by silty clay and silty sand to sandy silt deposits, in turn overlying the glacial till deposit.

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.

- To the north of Mayfield Road, the glacial till is underlain by a deposit of generally very dense silty sand to sandy silt, associated with the esker ridge in this area.

A more detailed description of the subsurface conditions encountered in the boreholes is provided in the following sections.

4.2.1 Fill

Between 0.2 m and 3.8 m of fill material was encountered in the immediate vicinity of the existing Countryside Drive and Mayfield Road embankments, as well as to the north of Mayfield Road where some reworking of the native soils was observed (as in Boreholes 03-05 and 03-06). The fill materials generally consist of clayey silt containing trace to some sand, trace gravel, and trace organic matter. The measured Standard Penetration Test (SPT) “N” values range from 4 to 20 blows per 0.3 m of penetration, indicating that the fill has a variable, firm to very stiff consistency.

4.2.2 Peat / Organic Soils

Peat and organic soils are present within the two swamp areas that are located south of Mayfield Road, as follows:

- A 4.6 m thickness of peat and organic silt was encountered in Borehole 03-10, located within the larger swamp immediately south of Mayfield Road; the thickness of the peat and organics varies throughout this swamp. The measured SPT “N” values within the peat and organic silt in this borehole vary from 0 (weight of hammer) to 2 blows per 0.3 m of penetration. One in situ vane test measured an undrained shear strength in excess of 100 kPa within the organic silt. The result of one Atterberg limit test conducted on a sample of the organic silt is shown on Figure 2.
- About 0.8 m of organic clayey silt to silty clay was encountered in Boreholes HML-3 and SWM-1, located in the smaller swamp between 200 m and 300 m south of Mayfield Road. Measured SPT “N” values within this layer of 2 and 3 blows per 0.3 m of penetration indicate a soft consistency.

4.2.3 Surficial Soils (Clayey Silt to Silty Clay, and Silty Sand to Sandy Silt)

In the majority of the boreholes located south of Mayfield Road and the Mayfield Road area swamps, a 0.6 m to 3.0 m thick layer of surficial soil was encountered atop the glacial till deposit. The surficial soils are typically comprised of clayey silt to silty clay containing trace to some sand and trace gravel, although surficial silty sand to sandy silt was also encountered in three of the boreholes. A grain size distribution test result for one selected sample of the clayey silt to silty clay material is shown on Figure 1.

Atterberg limit testing was conducted on one selected sample of the surficial soil. The result, presented on Figure 2, shows that this material is a clayey silt of low plasticity, based on a plastic limit of 15 per cent, a liquid limit of 24 per cent, and a plasticity index of about 9 per cent. These results are consistent with (but at the low end of the range of) other plasticity testing carried out on samples of the surficial clayey silt to silty clay from this area.

The measured SPT “N” values in the surficial clayey silt to silty clay range from 4 to 25 blows per 0.3 m of penetration, with an average of 13 blows per 0.3 m of penetration; these results indicate that the clayey silt to silty clay varies from firm to very stiff in consistency, but is typically stiff to very stiff. In the silty sand to sandy silt layers, SPT “N” values of 14 and 16 blows per 0.3 m of penetration were measured; these results indicate that the surficial silty sand to sandy silt has a compact relative density.

4.2.4 Glacial Till

Glacial till was encountered in all of the boreholes advanced during this investigation. South of Mayfield Road, the surface of the glacial till is typically encountered between 0.8 m and 2.4 m depth, where it is overlain by shallow surficial deposits (clayey silt to silty clay, or silty sand to sandy silt); however, within the Mayfield swamp, the till underlies the peat/organic soils at about 4.6 m depth, as encountered in Borehole 03-10 which is included in this report. North of Mayfield Road, the glacial till is present immediately below the topsoil (as in Borehole HML-4) or below about 1.8 m to 3.8 m of existing fill/reworked soil (as in Boreholes 03-05 and 03-06). Where the till was fully penetrated, in the immediate vicinity of Mayfield Road, the deposit varies in thickness from 2.8 m to 6.5 m; however, the till deposit is thicker to the south of Mayfield Road where all of the boreholes were terminated within the till.

The glacial till is typically comprised of clayey silt with some sand and trace to some gravel. However, in some locations the till grades to silty clay containing some sand and trace to some gravel, or sand and silt containing trace to some gravel and trace clay. In addition, interlayers of water-bearing cohesionless soil were observed within the glacial till in some of the boreholes. Figures 3A and 3B present the grain size distribution test results for ten selected samples of the glacial till and two selected samples of cohesionless interlayers within the till.

Atterberg limit testing was conducted on sixteen selected samples of the glacial till. The results, presented on Figures 4A and 4B, indicate that the till is typically a clayey silt of low plasticity, based on plastic limits of 12 to 18 per cent, liquid limits of 17 to 33 per cent, and plasticity indices of 6 to 16 per cent. One of the tested samples is a silty clay of intermediate plasticity (based on a measured plastic limit of 18 per cent, a liquid limit of 37 per cent, and a plasticity index of 19 per cent).

The measured SPT “N” values in the glacial till range from 8 to greater than 100 blows per 0.3 m of penetration, indicating that the till has a variable consistency. South of Mayfield Drive, the measured SPT “N” values typically range from 15 to 60 blows per 0.3 m of penetration, with an average of about 35 blows per 0.3 m of penetration; the glacial till in this area is generally very stiff to hard, although localized, near-surface zones of stiff soil are also present. North of Mayfield Drive, the glacial till is typically hard, based on SPT “N” values that are generally greater than 30 blows per 0.3 m of penetration, with an average of about 70 blows per 0.3 m of penetration.

4.2.5 Lower Sand to Sand and Silt

A deposit of sand to sand and silt was encountered below the glacial till deposit in the boreholes (03-05, 03-06, HML-4 and 129) that were advanced through the “esker ridge” located north of Mayfield Road; in these boreholes, the surface of this deposit was encountered between Elevations 252.8 m and 260.1 m. A sand to sand and silt deposit was also encountered underlying the glacial till in Boreholes 03-10 and WS-5, which are located in the immediate vicinity of the Mayfield swamp; in these boreholes, the surface of the deposit was encountered between Elevation 237.8 m and 247.2 m. The results of four grain size distribution tests conducted on selected samples of these deposits are shown on Figure 5.

In the “esker ridge” area north of Mayfield Road, the measured SPT “N” values within the lower sand to sand and silt deposit range from 39 to greater than 100 blows per 0.3 m of penetration, indicative of a dense to very dense relative density. Where this deposit was encountered in the vicinity of the Mayfield swamp (in Boreholes 03-10 and WS-5), SPT “N” values of 3 to 36 blows per 0.3 m of penetration were measured, indicative of a very loose to compact relative density; it is noted, however, that the lower sand to sand and silt deposit is below the water table in the vicinity of the Mayfield swamp, and the lower measured SPT “N” values in this area could be attributable to some disturbance due to water inflow to the borehole during sampling.

4.3 Groundwater Conditions

The groundwater conditions along this portion of the Highway 410 extension are summarized as follows:

- In the Mayfield swamp, immediately south of Mayfield Road, the groundwater level is at or above ground surface, at approximately Elevation 250 m.
- To the north/northwest of Mayfield Road in the vicinity of the esker ridge, the groundwater level is at about Elevation 250 m to 251 m (some 8 m to 14 m below ground surface), based on the results from the boreholes included in this report as well as other investigations in this area. This groundwater level is within the lower sand to sand and silt deposit.

- South of Mayfield Road, the water level declines along with the ground surface; the water level is typically between about 2 m and 3 m below the ground surface.

The following table summarizes the most recent water levels that have been measured in piezometers installed in the boreholes included in this report:

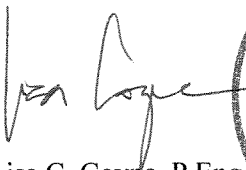
<i>Borehole No.</i>	<i>Borehole Location</i>	<i>Depth to Groundwater Level</i>	<i>Groundwater Elevation</i>	<i>Date of Measurement</i>
129 (1999)	North of Mayfield Road	7.8 m	251.2 m	January 21, 1999
03-10	South of Mayfield Road	0.8 m above surface	249.7 m	December 11, 2003
C1-1	Between Mayfield Road and Countryside Drive	1.9 m	245.5 m	February 19, 2004

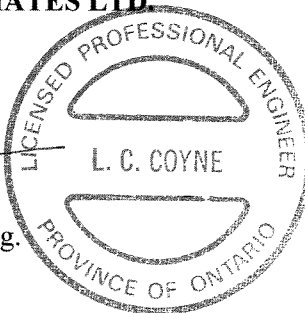
It should be noted that groundwater levels are expected to fluctuate seasonally, and should be expected to rise during wet periods of the year.

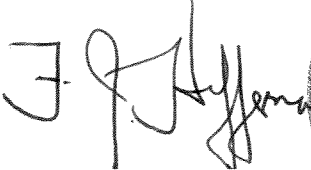
5.0 CLOSURE

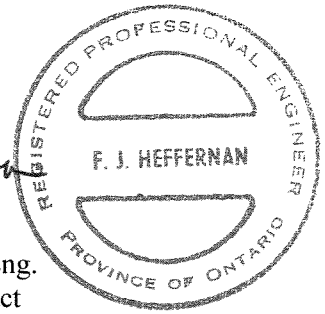
This Foundation Investigation Report was prepared by Ms. Lisa Coyne, P.Eng., an Associate and Geotechnical Engineer with Golder. Mr. Fintan Heffernan, a Designated MTO Contact for Golder, conducted an independent review of the report.

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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

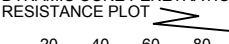

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction $= \tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress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

MIS-MTO 001 001-1159-4-MTO.GPJ ON MOT.GDT 12/2/06

Continued Next Page

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

PROJECT 001-1159-4			RECORD OF BOREHOLE No 03-05			2 OF 2 METRIC						
W.P. 101-00-00			LOCATION N 4846299.8 ; E 280567.1			ORIGINATED BY PKS / GPD						
DIST _____ HWY 410			BOREHOLE TYPE CME 55 Bombardier, 108 mm ID Hollow Stem Augers			COMPILED BY KG						
DATUM Geodetic			DATE November 13, 2003			CHECKED BY LCC						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT  SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	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	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
	--- CONTINUED FROM PREVIOUS PAGE ---											
	Sand and Silt to Sand, some silt, trace clay and gravel Dense to very dense Brown Dry to moist		11	SS	58		251					2 61 33 4
								250				
			12	SS	39							
			13	SS	51							
							248					
							247					
246.1			14	SS	55							
15.7	End of Borehole											
	Note: 1. Water level in open borehole at 12.2 m depth (Elev. 249.6 m) on completion of drilling.											

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

MIS-MTO 001 001-1159-4-MTO.GPJ ON MOT.GDT 12/2/06

PROJECT <u>001-1159-4</u>		RECORD OF BOREHOLE No 03-06		2 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4846339.2 ; E 280524.1</u>		ORIGINATED BY <u>GPD</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm ID Hollow Stem Augers</u>		COMPILED BY <u>KG</u>	
DATUM <u>Geodetic</u>		DATE <u>November 18, 2003</u>		CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	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 × REMOULDED					W _p	W	W _L		
								20	40	60	80	100	25	50	75		
	--- CONTINUED FROM PREVIOUS PAGE ---																
251.1	Sand, trace to some silt Very dense Brown Moist		11	SS	60		253										
							252										
12.8	Sand and Silt, trace to some clay, trace gravel Very dense Brown Moist						251										
			13	SS	78		250									2 55 34 9	
248.2							249										
			14	SS	67												
15.7	End of Borehole Note: 1. Open borehole dry on completion of drilling operations																

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

MIS-MTO 001 001-1159-4-MTO.GPJ ON MOT.GDT 12/2/06

PROJECT 001-1159-4		RECORD OF BOREHOLE No 03-10				2 OF 2 METRIC								
W.P. 101-00-00		LOCATION N 4846410.5 ; E 280841.9				ORIGINATED BY GPD								
DIST _____ HWY 410		BOREHOLE TYPE CME 55 Bombardier, 108 mm ID Hollow Stem Augers				COMPILED BY KG								
DATUM Geodetic		DATE November 20, 2003				CHECKED BY LCC								
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)	
	--- CONTINUED FROM PREVIOUS PAGE ---							20 40 60 80 100	20 40 60 80 100	25 50 75				
237.8	Clayey Silt with sand to some sand, trace gravel (TILL) Stiff to hard Grey Moist		10	SS	26		238							
11.1	Sand and Silt, trace clay and gravel Very loose to compact Grey Wet		11	SS	3		237							
							236							
							235							
							234							
233.7	Sand, trace gravel and silt Compact Brown Wet		12	SS	16									
233.2	End of Borehole													
15.7	Note: 1. Water level in piezometer at 0.8 m above ground surface (at Elev. 249.7 m) on Dec 11, 2003													

MIS-MTO 001 001-1159-4-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT <u>001-1159-3</u>		RECORD OF BOREHOLE No C1-1		1 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845701.9 ; E 281416.7</u>		ORIGINATED BY <u>GD</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm Diameter Solid Stem Augers</u>		COMPILED BY <u>SP</u>	
DATUM <u>Geodetic</u>		DATE <u>May 11, 2001</u>		CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE CONTENT			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					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W _p W W _L				
247.3	Ground Surface						20	40	60	80	100						
247.1	Topsoil																
0.2	Clayey Silt, some sand, trace gravel Stiff Brown Moist		1	AS	-												
			2	SS	13												
245.8	Clayey Silt with sand to some sand, trace gravel (TILL) Very stiff to hard Brown becoming grey below 3.1 m depth Moist		3	SS	24												
1.5			4	SS	39								H				
			5	SS	22								H				
			6	SS	20												
			7	SS	22												
			8	SS	31												
			9	SS	33												

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

PROJECT <u>001-1159-3</u>	RECORD OF BOREHOLE No C1-1	2 OF 2	METRIC
W.P. <u>101-00-00</u>	LOCATION <u>N 4845701.9 ; E 281416.7</u>	ORIGINATED BY <u>GD</u>	
DIST <u> </u> HWY <u>410</u>	BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm Diameter Solid Stem Augers</u>	COMPILED BY <u>SP</u>	
DATUM <u>Geodetic</u>	DATE <u>May 11, 2001</u>	CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
								○ UNCONFINED + FIELD VANE					WATER CONTENT (%)				
--- CONTINUED FROM PREVIOUS PAGE ---							● QUICK TRIAXIAL × REMOULDED										
9.9	End of Borehole Notes: 1. Open borehole dry upon completion of drilling operations 2. Water level in piezometer at 1.9 m depth (Elev. 245.5 m) on February 19, 2004																

MIS-MTO 001 001-1159-3-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT 001-1159-3			RECORD OF BOREHOLE No C1-2			1 OF 1 METRIC											
W.P. 101-00-00			LOCATION N 4845766.4 ; E 281339.0			ORIGINATED BY GD											
DIST HWY 410			BOREHOLE TYPE CME 55 Bombardier, 108 mm Diameter Solid Stem Augers			COMPILED BY SP											
DATUM Geodetic			DATE May 11, 2001			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	25 50 75				
249.7	Ground Surface																
0.0	Topsoil																
249.5																	
0.2	Silty Sand, containing rootlets Brown Moist		1	AS	-												
248.9																	
0.8	Clayey Silt with sand to some sand, trace gravel (TILL) Very stiff to hard Brown becoming grey below 3.1 m depth Moist		2	SS	17												
			3	SS	25												
			4	SS	61												
			5	SS	37												
			6	SS	38												
			7	SS	35												
			8	SS	34												
			9	SS	34												
243.1	End of Borehole																
6.6	Note: 1. Open borehole dry upon completion of drilling operations																

PROJECT <u>001-1159-2</u>		RECORD OF BOREHOLE No C-3		1 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845373.6 ; E 281574.2</u>		ORIGINATED BY <u>SB</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm ID Hollow Stem Augers</u>		COMPILED BY <u>LCC</u>	
DATUM <u>Geodetic</u>		DATE <u>October 20, 2003</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										WATER CONTENT (%)		
249.7	Ground Surface						20	40	60	80	100									
0.0	Topsoil																			
249.0																				
0.7	Silty Clay, trace sand and gravel, containing sand seams Stiff to very stiff Brown to grey-brown Moist		1	SS	8															
248.0																				
1.7	Clayey Silt, with sand to some sand, trace to some gravel (TILL) Hard Brown, becoming grey below 3.8 m depth Moist		2	SS	22								○							
			3	SS	43															
			4	SS	54								○	—						
			5	SS	41															
			6	SS	25								○							
244.1																				
5.6	Sand, some silt, trace clay Compact Moist to wet Grey		7	SS	25								○			0 74 24 2				
242.5																				
7.2	Silt, some sand, trace gravel and clay Compact Grey Wet		8	SS	24								○			1 13 79 7				
241.0																				
8.7	Silty Clay to Clayey Silt, some sand, trace gravel (TILL) Very stiff Grey Moist		9	SS	19															

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

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

PROJECT <u>001-1159-2</u>		RECORD OF BOREHOLE No C-3				2 OF 2 METRIC												
W.P. <u>101-00-00</u>		LOCATION <u>N 4845373.6 ; E 281574.2</u>				ORIGINATED BY <u>SB</u>												
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm ID Hollow Stem Augers</u>				COMPILED BY <u>LCC</u>												
DATUM <u>Geodetic</u>		DATE <u>October 20, 2003</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										
	--- CONTINUED FROM PREVIOUS PAGE ---						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					25 50 75 WATER CONTENT (%)						
238.4	Silty Clay to Clayey Silt, some sand, trace gravel (TILL) Very stiff Grey Moist		10	SS	16	▼	239											
11.3	End of Borehole Note: 1. Water encountered during drilling at about 6.7 m depth (Elev. 243.0 m). 2. Water level in open borehole at 10.4 m depth (Elev. 239.3 m) on completion of drilling.																	

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

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

PROJECT <u>001-1159-2</u>		RECORD OF BOREHOLE No C-04-2		2 OF 3 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845411.2 ; E 281553.5</u>		ORIGINATED BY <u>PKS</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>D-50 Bombardier, 108 mm I.D. Hollow Stem Augers</u>		COMPILED BY <u>LCC</u>	
DATUM <u>Geodetic</u>		DATE <u>September 9-10, 2004</u>		CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT			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				WATER CONTENT (%)				
	--- CONTINUED FROM PREVIOUS PAGE ---															
	Clayey Silt with sand to some sand, trace to some gravel (TILL) Very stiff to hard Grey Moist		11	SS	40		240									
							239									
			12	SS	42		238									
237.5																
13.3	Sand and Silt, trace to some gravel, trace clay (TILL) Very dense Grey Moist to wet		13	SS	107		237									
							236									
			14	SS	100/13		235									
			15	SS	100/10		234									
							233									
			16	SS	100/07		232									
230.9			17	SS	100/07		231									
19.9																

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












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



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

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

PROJECT		001-1159-3		RECORD OF BOREHOLE No E-6		1 OF 1 METRIC												
W.P.		101-00-00		LOCATION		N 4845906.1 ; E 281281.7												
DIST		HWY 410		BOREHOLE TYPE		CME 55 Bombardier, 108 mm Diameter Solid Stem Augers												
DATUM		Geodetic		DATE		May 10, 2001												
ORIGINATED BY		AR		COMPILED BY		SP												
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	Wp	W	WL	25 50 75	kN/m³				
250.4		Ground Surface																
250.0		Topsoil																
250.2	0.2	Clayey Silt, some sand, trace gravel, containing rootlets Brown Moist		1	AS	-		250										
249.7	0.8	Clayey Silt with sand to some sand, trace gravel (TILL) Very stiff to hard Brown becoming grey below 3.8 m depth Moist		2	SS	22		249										
				3	SS	26		248										
				4	SS	33		247										
		Containing sand layers below approximately 3.0 m depth		5	SS	59		246										
				6	SS	29												
				7	SS	24												
245.4	5.0	End of Borehole																
		Notes: 1. Open borehole dry upon completion of drilling operations																

PROJECT <u>001-1159-5</u>		RECORD OF BOREHOLE No HML-1		1 OF 2 METRIC													
W.P. <u>101-00-00</u>		LOCATION <u>N 4845015.7 ; E 281788.6</u>		ORIGINATED BY <u>PKS</u>													
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME-55 Bombardier, 150 mm Solid Stem Auger</u>		COMPILED BY <u>SP</u>													
DATUM <u>Geodetic</u>		DATE <u>May 30, 2001</u>		CHECKED BY <u>LCC</u>													
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
248.3 0.0	Ground Surface Topsoil		1	SS	8		248										
247.5 0.8	Clayey Silt with sand to some sand, trace to some gravel (TILL) Hard Brown becoming grey below 2.1 m depth Moist		2	SS	42		247										
			3	SS	54		246										
			4	SS	94		245										
			5	SS	90		244										
			6	SS	76		243										
			7	SS	50		242										
			8	SS	64		241										
			9	SS	41		240										
			10	SS	35		239										
238.5 9.8																	

MIS-MTO 001 001-1159-5-MTO.GPJ ON_MOT.GDT 12/2/06

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

PROJECT <u>001-1159-5</u>		RECORD OF BOREHOLE No HML-1		2 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845015.7 ; E 281788.6</u>		ORIGINATED BY <u>PKS</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME-55 Bombardier, 150 mm Solid Stem Auger</u>		COMPILED BY <u>SP</u>	
DATUM <u>Geodetic</u>		DATE <u>May 30, 2001</u>		CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)					
	— CONTINUED FROM PREVIOUS PAGE —							20	40	60	80	100		25	50	75		
	End of Borehole																	
	Note:																	
	1. Open borehole dry upon completion of drilling operations																	

MIS-MTO 001 001-1159-5-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT <u>001-1159-5</u>		RECORD OF BOREHOLE No HML-2		1 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845992.8 ; E 281231.8</u>		ORIGINATED BY <u>PKS</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME-55 Bombardier, 150 mm Solid Stem Auger</u>		COMPILED BY <u>SP</u>	
DATUM <u>Geodetic</u>		DATE <u>May 30, 2001</u>		CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIQUID LIMIT			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					WATER CONTENT (%)				
								<div><div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × REMOULDED</div></div></div>					W _p	W	W _L		
249.5	Ground Surface																
0.0	Topsoil																
249.2			1	SS	4		249										
0.3	Clayey Silt, trace sand and gravel Firm to stiff Brown Moist		2	SS	8												
248.1							248										
1.4	Clayey Silt with sand to some sand, trace to some gravel (TILL) Very stiff to hard Brown becoming grey below 3.1 m depth Moist		3	SS	40												
			4	SS	59		247										
			5	SS	66		246								4 25 47 24		
			6	SS	44		245										
			7	SS	44		244										
			8	SS	34		243										
			9	SS	29		242										
			10	SS	29		241										
239.8							240										
9.8																	

Continued Next Page

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

PROJECT <u>001-1159-5</u>		RECORD OF BOREHOLE No HML-2				2 OF 2 METRIC										
W.P. <u>101-00-00</u>		LOCATION <u>N 4845992.8 ; E 281231.8</u>				ORIGINATED BY <u>PKS</u>										
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME-55 Bombardier, 150 mm Solid Stem Auger</u>				COMPILED BY <u>SP</u>										
DATUM <u>Geodetic</u>		DATE <u>May 30, 2001</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								
--- CONTINUED FROM PREVIOUS PAGE ---																
	End of Borehole Note: 1. Water level in open borehole at 9.7 m depth (Elev. 239.8 m) upon completion of drilling operations															

MIS-MTO 001 001-1159-5-MTO.GPJ ON MOT.GDT 12/2/06

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

PROJECT <u>001-1159-5</u>		RECORD OF BOREHOLE No HML-3				2 OF 2 METRIC										
W.P. <u>101-00-00</u>		LOCATION <u>N 4846211.6 ; E 281029.2</u>				ORIGINATED BY <u>PKS</u>										
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME-55 Bombardier, 150 mm Solid Stem Auger</u>				COMPILED BY <u>SP</u>										
DATUM <u>Geodetic</u>		DATE <u>May 30, 2001</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								
--- CONTINUED FROM PREVIOUS PAGE ---																
	End of Borehole Note: 1. Water level in open borehole at 1.2 m depth (Elev. 249.6 m) upon completion of drilling operations															



MIS-MTO 001 001-1159-5-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT 001-1159-5		RECORD OF BOREHOLE No HML-4		1 OF 2 METRIC													
W.P. 101-00-00		LOCATION N 4846329.1 ; E 280306.9		ORIGINATED BY PKS													
DIST _____ HWY 410		BOREHOLE TYPE CME-55 Bombardier, 150 mm Solid Stem Auger		COMPILED BY SP													
DATUM Geodetic		DATE June 13, 2001		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 kN/m³	GR SA SI CL
							20 40 60 80 100	○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × REMOULDED	W _p	W	W _L	25 50 75				
266.3	Ground Surface																
0.0	Topsoil																
266.1																	
0.2	Clayey Silt with sand to some sand, trace gravel (TILL) Very stiff to hard Brown Moist		1	SS	19		266										
							265										
			2	SS	74		264										
							263										
			3	SS	66		262										
			4	SS	80		261										
			5	SS	111		260										
			6	SS	115		259										
			7	SS	121		258										
260.1			8	SS	109		257										
6.3	Silty Sand to Sand, some silt, trace gravel Dense to very dense Brown Moist		9	SS	50/0.15												
			10	SS	50/0.13												




Continued Next Page

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

MIS-MTO 001 001-1159-5-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT <u>001-1159-5</u>		RECORD OF BOREHOLE No HML-4				2 OF 2 METRIC												
W.P. <u>101-00-00</u>		LOCATION <u>N 4846329.1 ; E 280306.9</u>				ORIGINATED BY <u>PKS</u>												
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME-55 Bombardier, 150 mm Solid Stem Auger</u>				COMPILED BY <u>SP</u>												
DATUM <u>Geodetic</u>		DATE <u>June 13, 2001</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									WATER CONTENT (%)	
--- CONTINUED FROM PREVIOUS PAGE ---																		
	Silty Sand to Sand, some silt, trace gravel Dense to very dense Brown Moist		11	SS	50/0.15		256											
								255										
								254										
								253										
								252										
			12	SS	55/0.15		251											
							250											
																		
			13	SS	40		249											
249.0 17.3	End of Borehole																	
	Note: 1. Water level in open borehole at 16.7 m depth (Elev. 249.6 m) upon completion of drilling operations																	

MIS-MTO 001 001-1159-5-MTO.GPJ ON_MOT.GDT 12/2/06

PROJECT 001-1159-3		RECORD OF BOREHOLE No SWM-1				1 OF 1 METRIC							
W.P. 101-00-00		LOCATION N 4846299.3 ; E 280946.6				ORIGINATED BY PKS							
DIST _____ HWY 410		BOREHOLE TYPE CME 55 Bombardier, 108 mm ID Hollow Stem Augers				COMPILED BY JDR							
DATUM Geodetic		DATE December 12, 2003				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	○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × REMOULDED	W _p W W _L			
251.5	Ground Surface												
0.0	Organic Silty Clay, some sand Soft Brown Moist		1	SS	3		251						
250.7													
0.8	Silty Sand to Sandy Silt, trace clay, containing rootlets Compact Brown Moist		2	SS	14								
250.0							250						
1.5	Clayey Silt with sand to some sand, trace gravel, containing sand seams (TILL) Stiff to very stiff Grey Moist to wet		3	SS	8								
							249						
							248						
							247						
							246						
							245						
							244						
243.3	End of Borehole												
8.2	Note: 1. Water level in open borehole at 1.5 m depth (Elev. 250.0 m) during drilling.												

MIS-MTO 001 001-1159-3-MTO.GPJ ON_MOT.GDT 12/2/06


PROJECT <u>001-1159-3</u>		RECORD OF BOREHOLE No WS-5		1 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4846255.2 ; E 280811.7</u>		ORIGINATED BY <u>PKS</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm ID Hollow Stem Augers</u>		COMPILED BY <u>JDR</u>	
DATUM <u>Geodetic</u>		DATE <u>December 11, 2003</u>		CHECKED BY <u>LCC</u>	

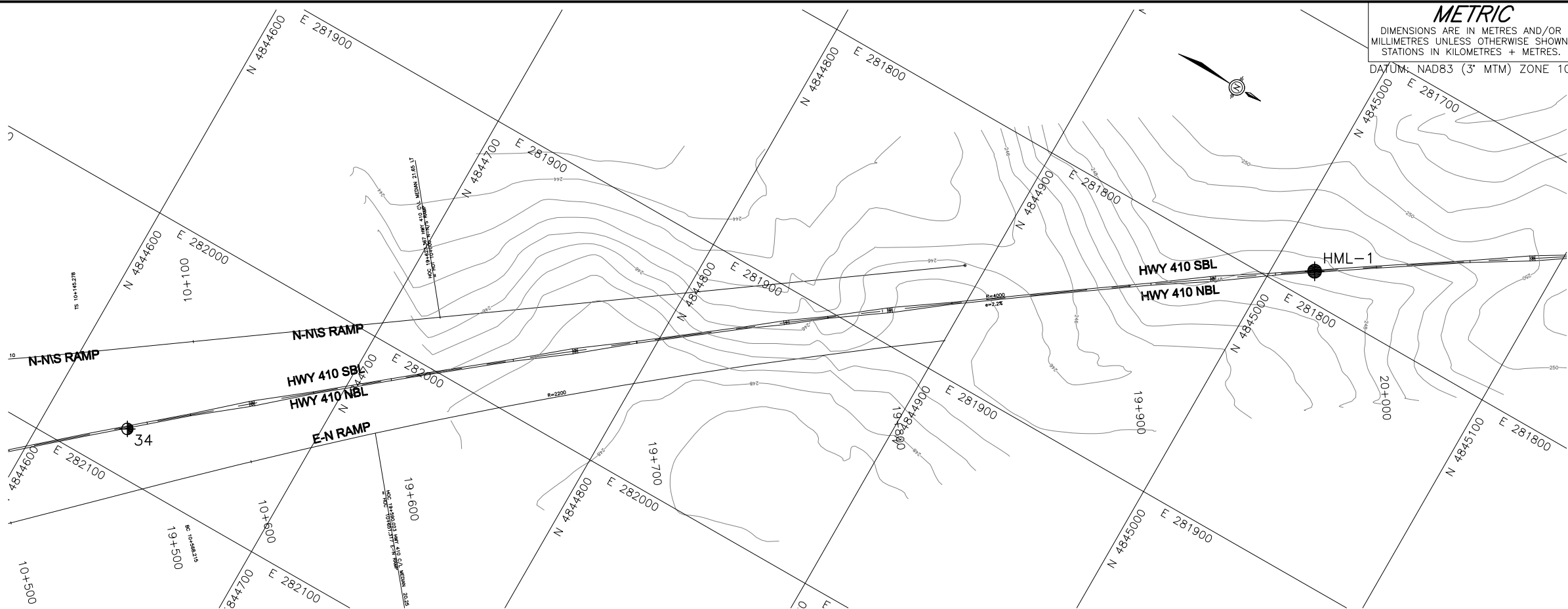
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
254.2	Ground Surface						20 40 60 80 100	W _p W W _L									
0.0	Clayey Silt to Silty Clay, some sand, containing rootlets Firm to stiff Brown Moist		1	SS	7												
253.0			2	SS	11												
1.2	Clayey Silt with sand to some sand, trace gravel, containing sandy silt seams (TILL) Hard Brown becoming grey below 3.7 m depth Moist		3	SS	30												
			4	SS	44												
			5	SS	48												
			6	SS	39												
			7	SS	32												
			8	SS	30												
247.2	Silty Sand to Sand, some silt, trace gravel Compact to dense Brown to grey Wet																
7.0			9	SS	22												
			10	SS	36												

Continued Next Page

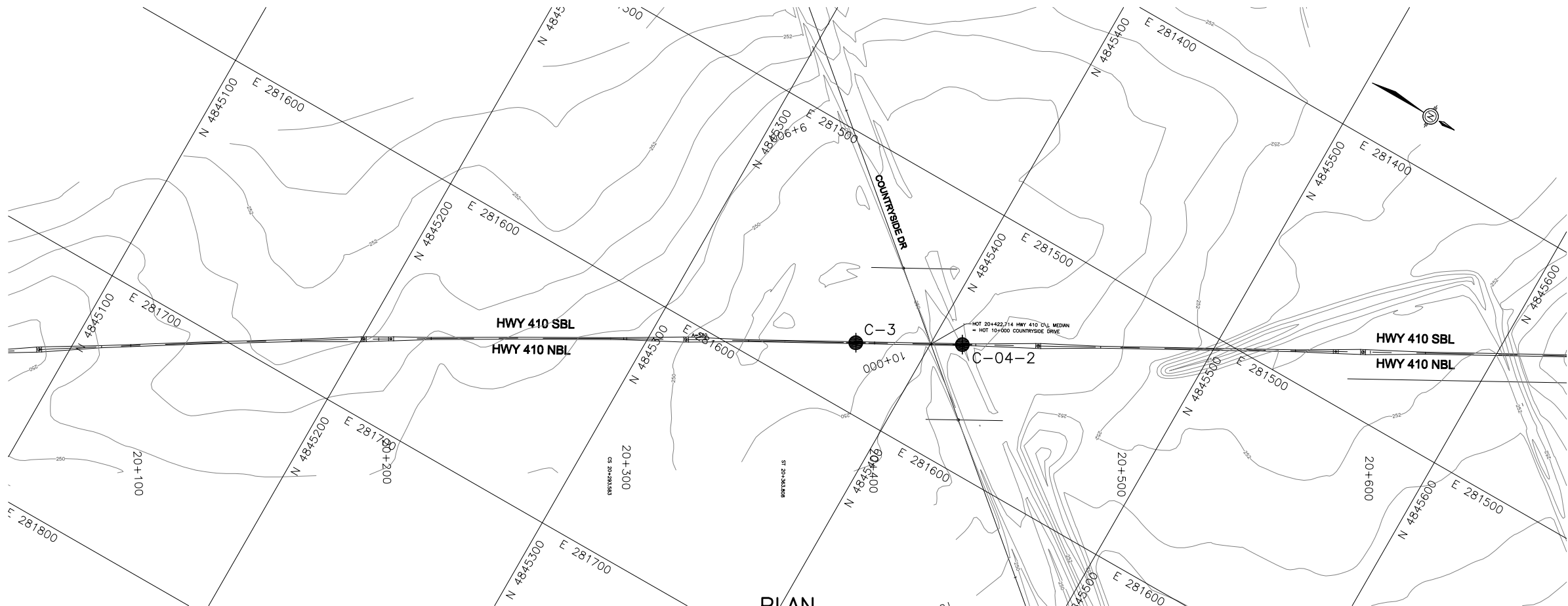
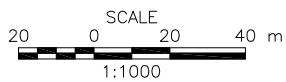
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

MIS-MTO 001 001-1159-3-MTO.GPJ ON_MOT.GDT 12/2/06

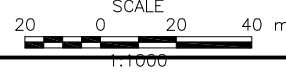
PROJECT <u>001-1159-3</u>		RECORD OF BOREHOLE No WS-5		2 OF 2 METRIC														
W.P. <u>101-00-00</u>		LOCATION <u>N 4846255.2 ; E 280811.7</u>		ORIGINATED BY <u>PKS</u>														
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108 mm ID Hollow Stem Augers</u>		COMPILED BY <u>JDR</u>														
DATUM <u>Geodetic</u>		DATE <u>December 11, 2003</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									WATER CONTENT (%)	
	--- CONTINUED FROM PREVIOUS PAGE ---																	
	Silty Sand to Sand, some silt, trace gravel Compact to dense Brown to grey Wet		11	SS	16		244											
								243										
								242										
241.4			12	SS	17													
12.8	End of Borehole																	
	Note: 1. Water level in open borehole at 7.6 m depth (Elev. 246.6 m) upon completion of drilling.																	



PLAN



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.
DATUM: NAD83 (3° MTM) ZONE 10

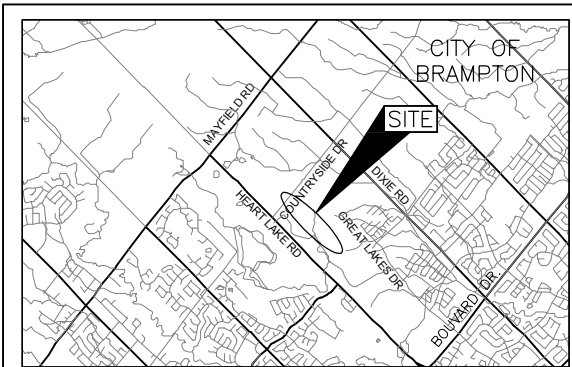
CONT No.
WP No.101-00-00

HIGHWAY 410
STA. 19+500 TO 20+650
HIGH MAST LIGHT POLES
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



LEGEND

- Borehole - 2001 to 2004 Investigations
- Borehole - 1999 Investigation (Golder Associates Ltd)
- Borehole - 1999 Investigations (Shaheen and Peaker Ltd.)

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
34	246.6	4844632.0	282082.0
C-04-2	250.8	4845411.2	281553.5
C-3	249.7	4845373.6	281574.2
HML-1	248.3	4845015.7	281788.6

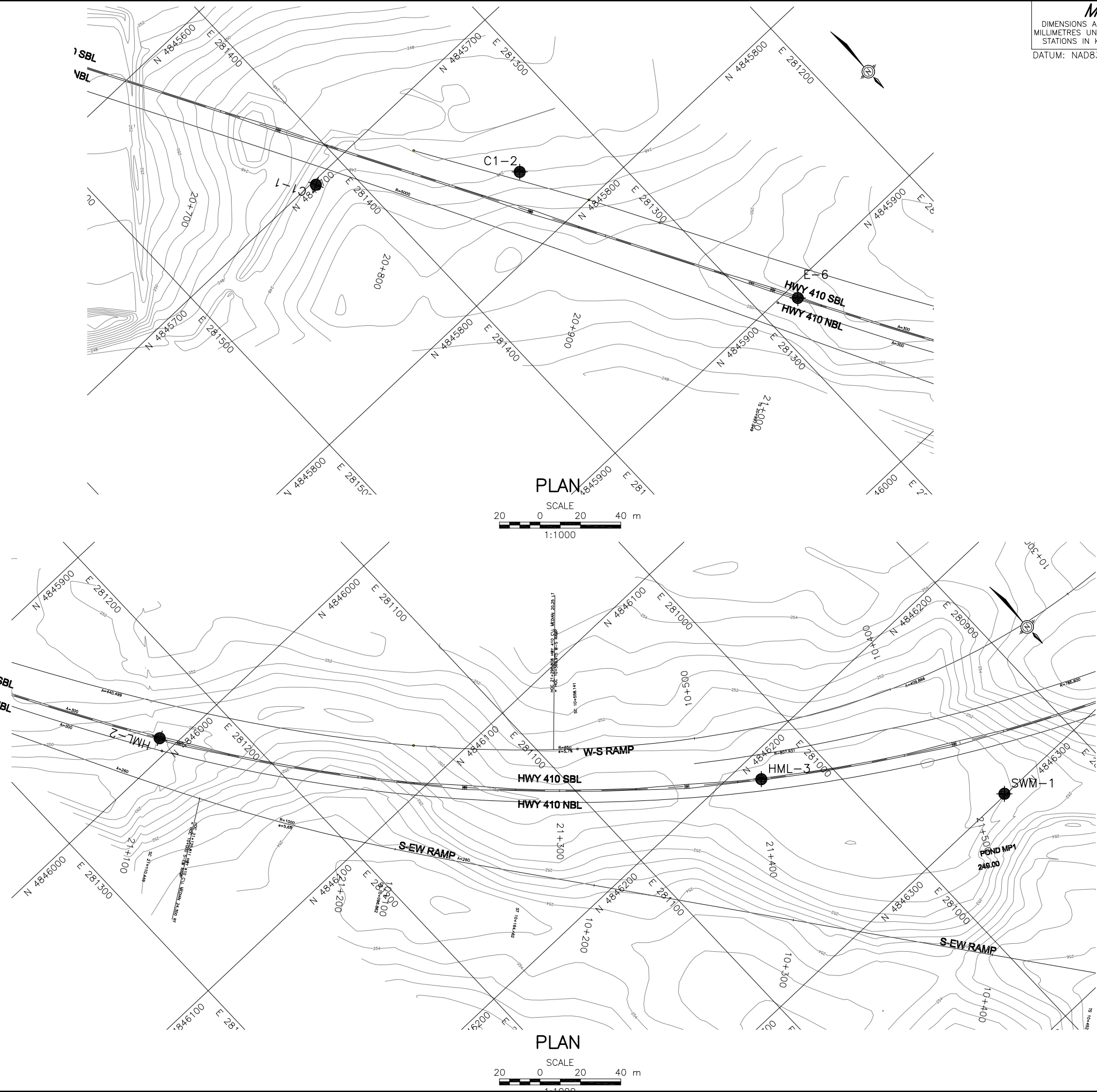
NOTES

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

Base plans provided in digital format by URS Canada Inc., on October 20, 2004.

NO.	DATE	BY	REVISION
Geocres No.			
HWY. 410		PROJECT NO. 001-1159	DIST.
SUBM'D.	CHKD.	DATE: NOV. 2004	SITE:
DRAWN: JDR	CHKD. LCC	APPD. LCC	DWG. 1



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.
DATUM: NAD83 (3° MTM) ZONE 10

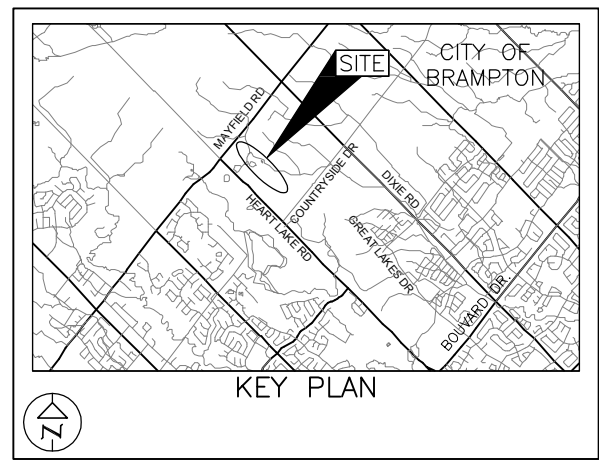
CONT No.
WP No.101-00-00

HIGHWAY 410
STA. 20+650 TO 21+550
HIGH MAST LIGHT POLES
BOREHOLE LOCATIONS

SHEET

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



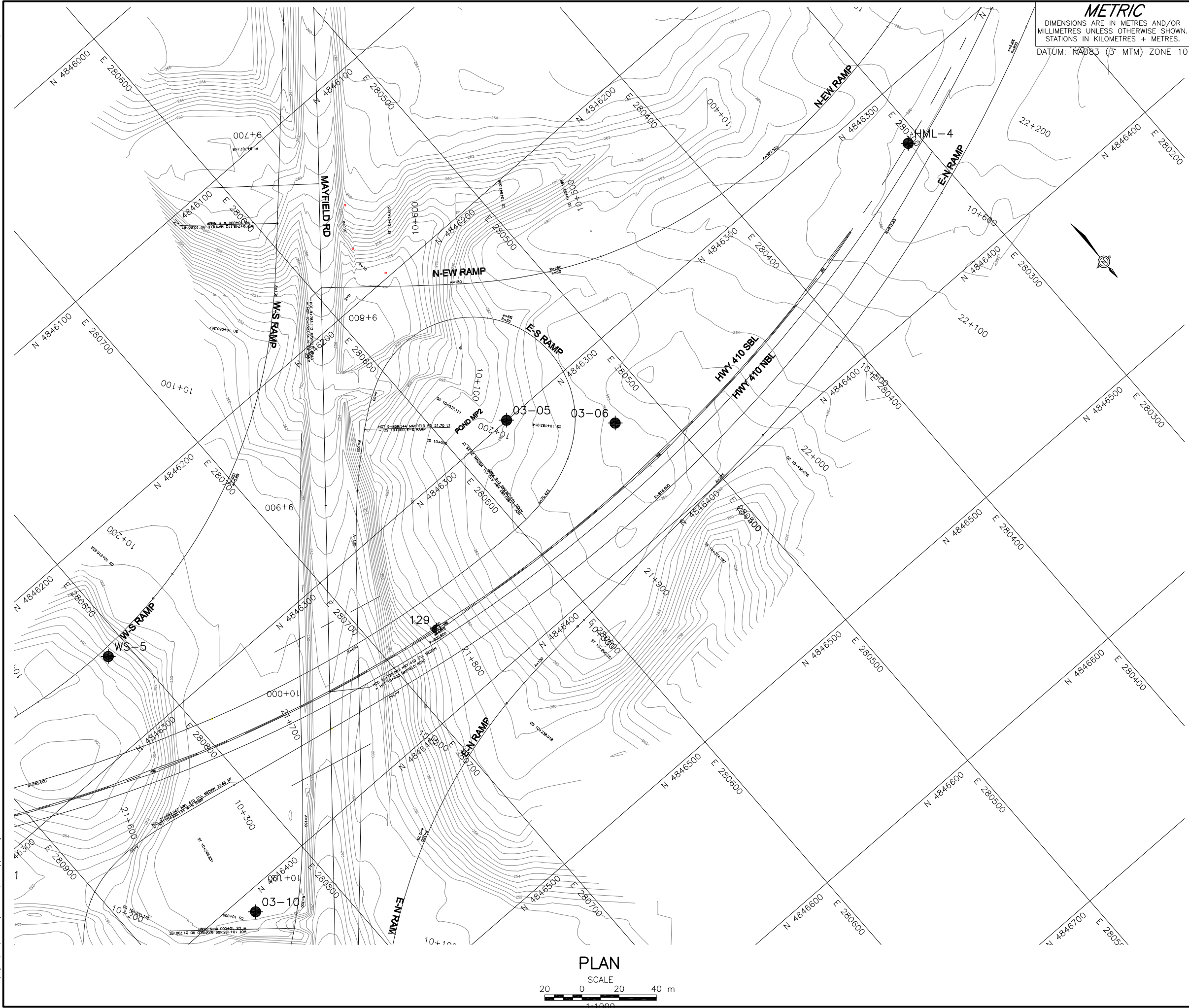
LEGEND				
	Borehole	-	2001 to 2004 Investigations	
	Borehole	-	1999 Investigation (Golder Associates Ltd.)	
	Borehole	-	1999 Investigations (Shaheen and Peaker Ltd.)	

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
C1-1	247.3	4845701.9	281416.7
C1-2	149.7	4845766.4	281339.0
E-6	250.4	4845906.1	281281.7
HML-2	249.5	4845992.8	281231.8

NOTES
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
Base plans provided in digital format by URS Canada Inc., on October 20, 2004.

NO.	DATE	BY	REVISION
Geocres No.			
HWY. 410	PROJECT NO. 001-1159		DIST.
SUBM'D.	CHKD.	DATE: NOV. 2004	SITE:
DRAWN: JDR	CHKD. LCC	APPD. LCC	DWG. 2

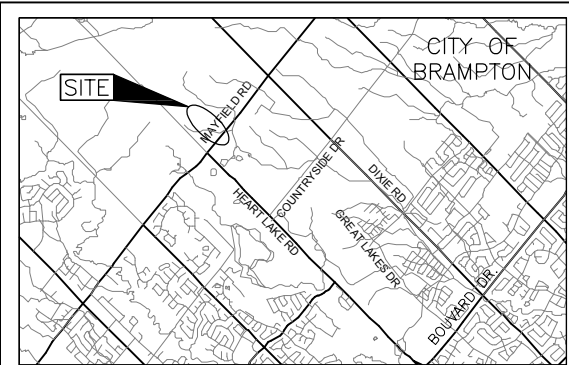


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.
DATUM: NAD83 (3° MTM) ZONE 10

CONT No.
WP No.101-00-00

HIGHWAY 410
STA. 21+550 TO 22+250
HIGH MAST LIGHT POLES
BOREHOLE LOCATIONS

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

Borehole – 2001 to 2004 Investigations

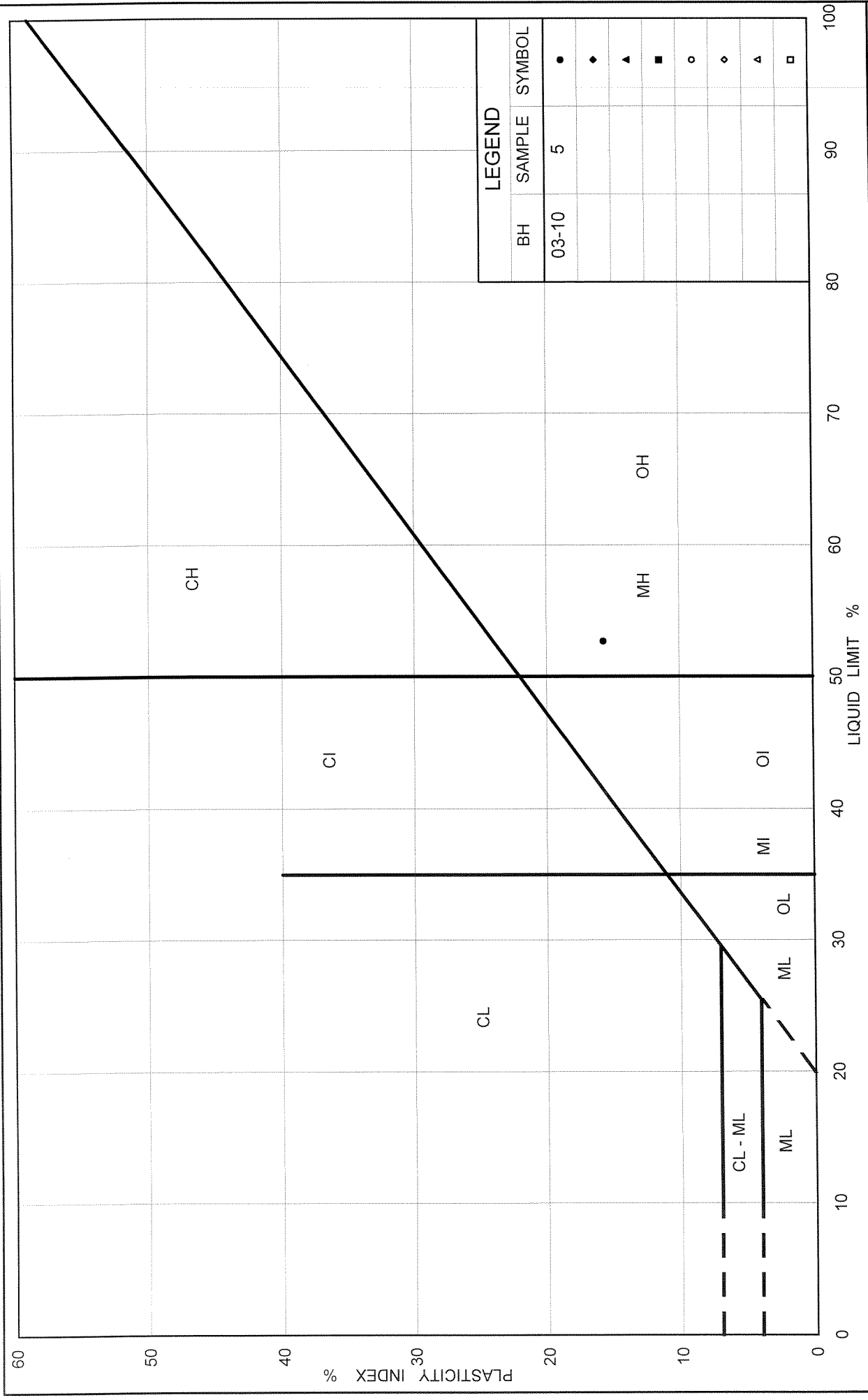
Borehole – 1999 Investigation
(Golder Associates Ltd.)

Borehole – 1999 Investigations
(Shaheen and Peaker Ltd.)

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
129	259.0	4846359.7	280669.1
03-05	261.8	4846299.8	280567.1
03-06	263.9	4846339.2	280524.1
03-10	248.9	4846410.5	280841.9
HML-3	250.8	4846211.6	281029.2
HML-4	266.3	4846329.1	280306.9
SWM-1	251.5	4846299.3	280946.6
WS-5	254.2	4846255.2	280811.7

NOTES
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.

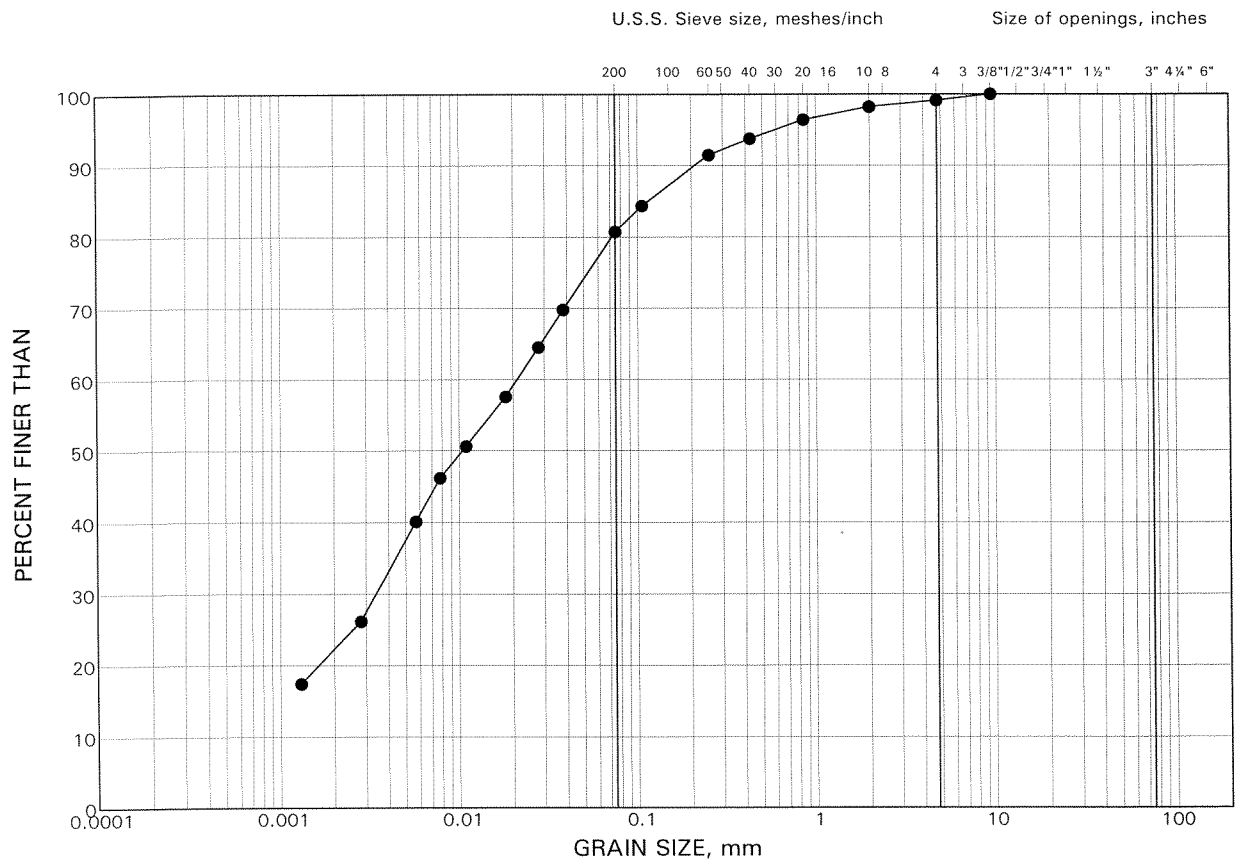
REFERENCE			
Base plans provided in digital format by URS Canada Inc., on October 20, 2004.			
Geocres No.			
HWY. 410	PROJECT NO. 001-1159		DIST.
SUBM'D.	CHKD.	DATE: NOV. 2004	SITE:
DRAWN: JDR	CHKD: LCC	APPD: LCC	DWG. 3



GRAIN SIZE DISTRIBUTION TEST RESULT

Surficial Clayey Silt to Silty Clay

FIGURE 2



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
•	C1-1	2	246.3

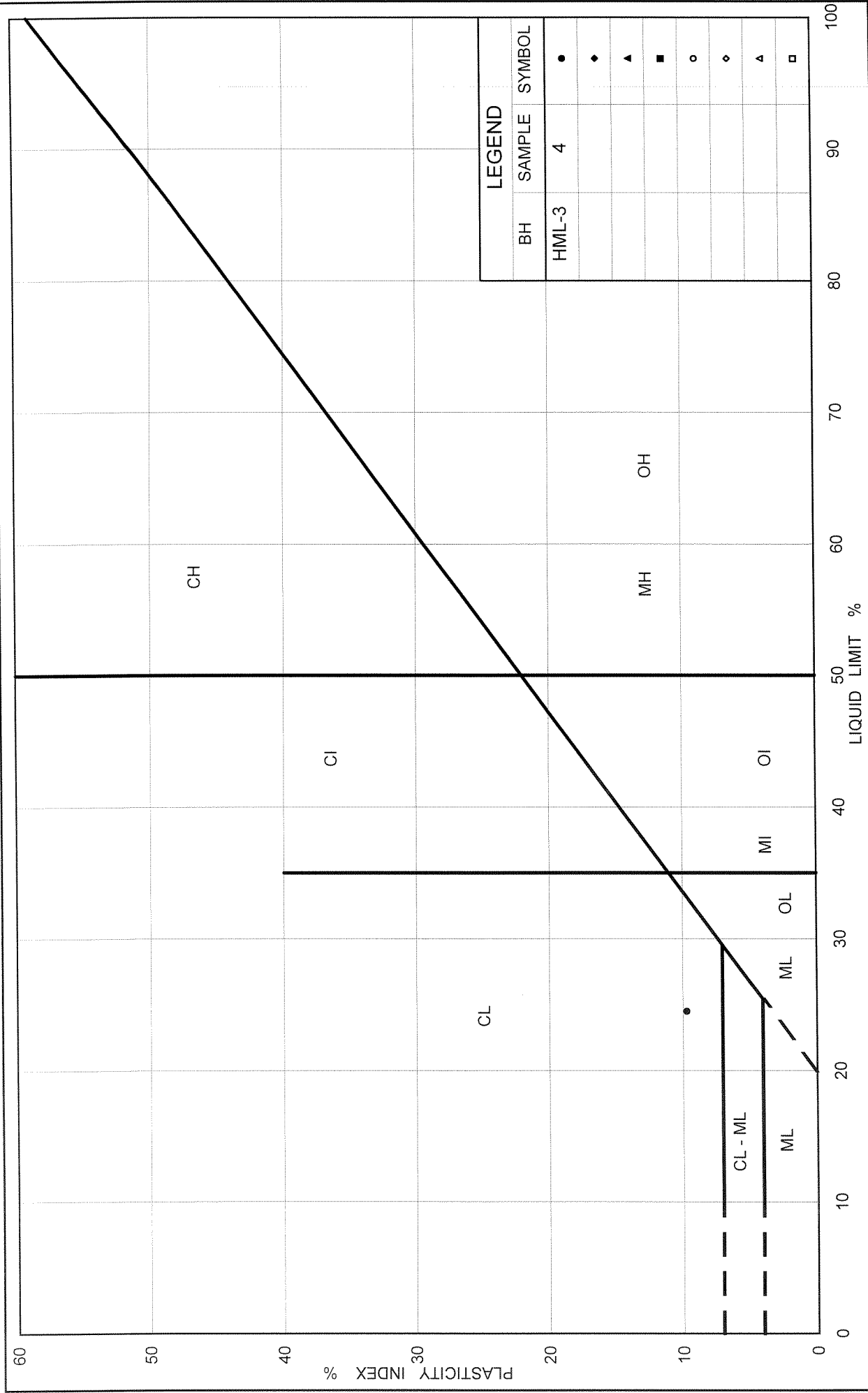


FIG No. 3

PLASTICITY CHART
Surficial Clayey Silt to Silty Clay

Ministry of Transportation



Ontario

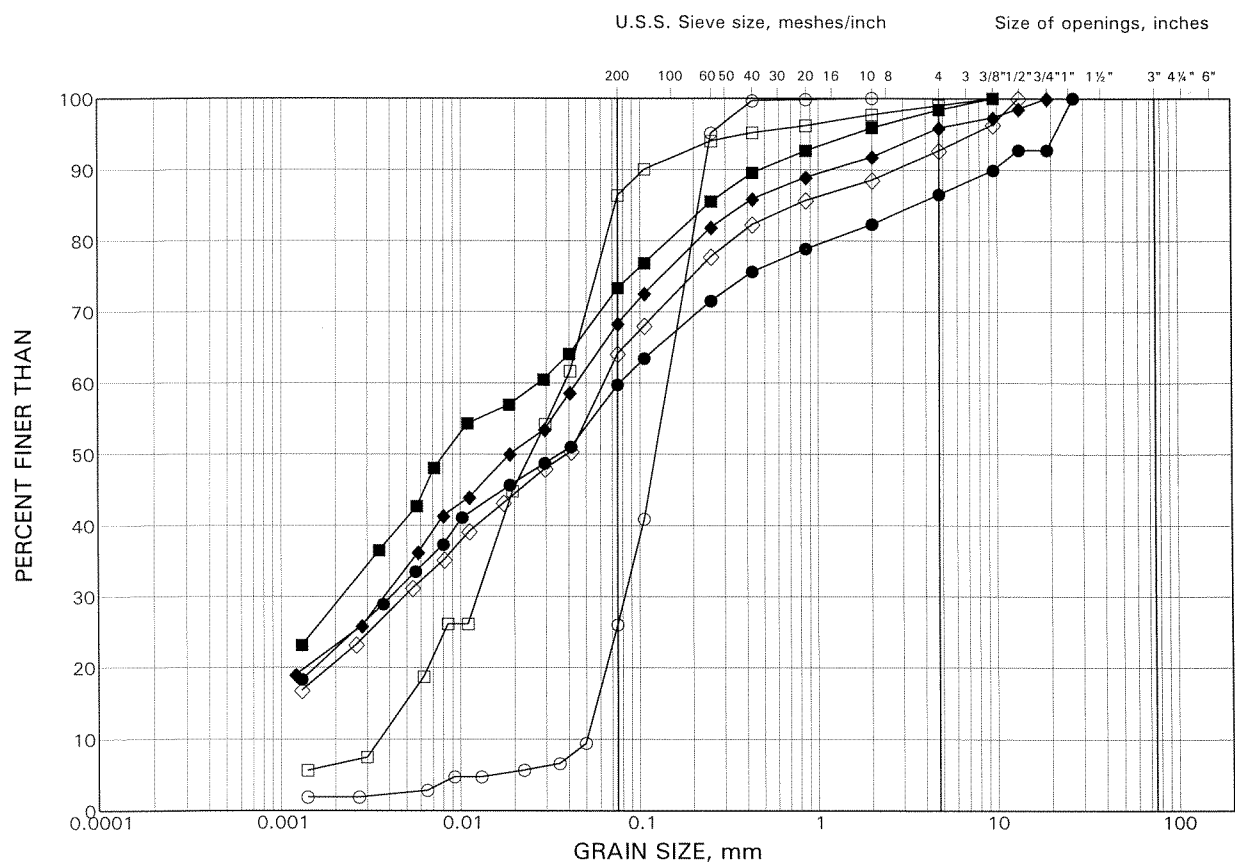
Project No. 001-1159

GRAIN SIZE DISTRIBUTION TEST RESULTS

Clayey Silt Till to Silty Clay Till

(Including Interlayers)

FIGURE 4A



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

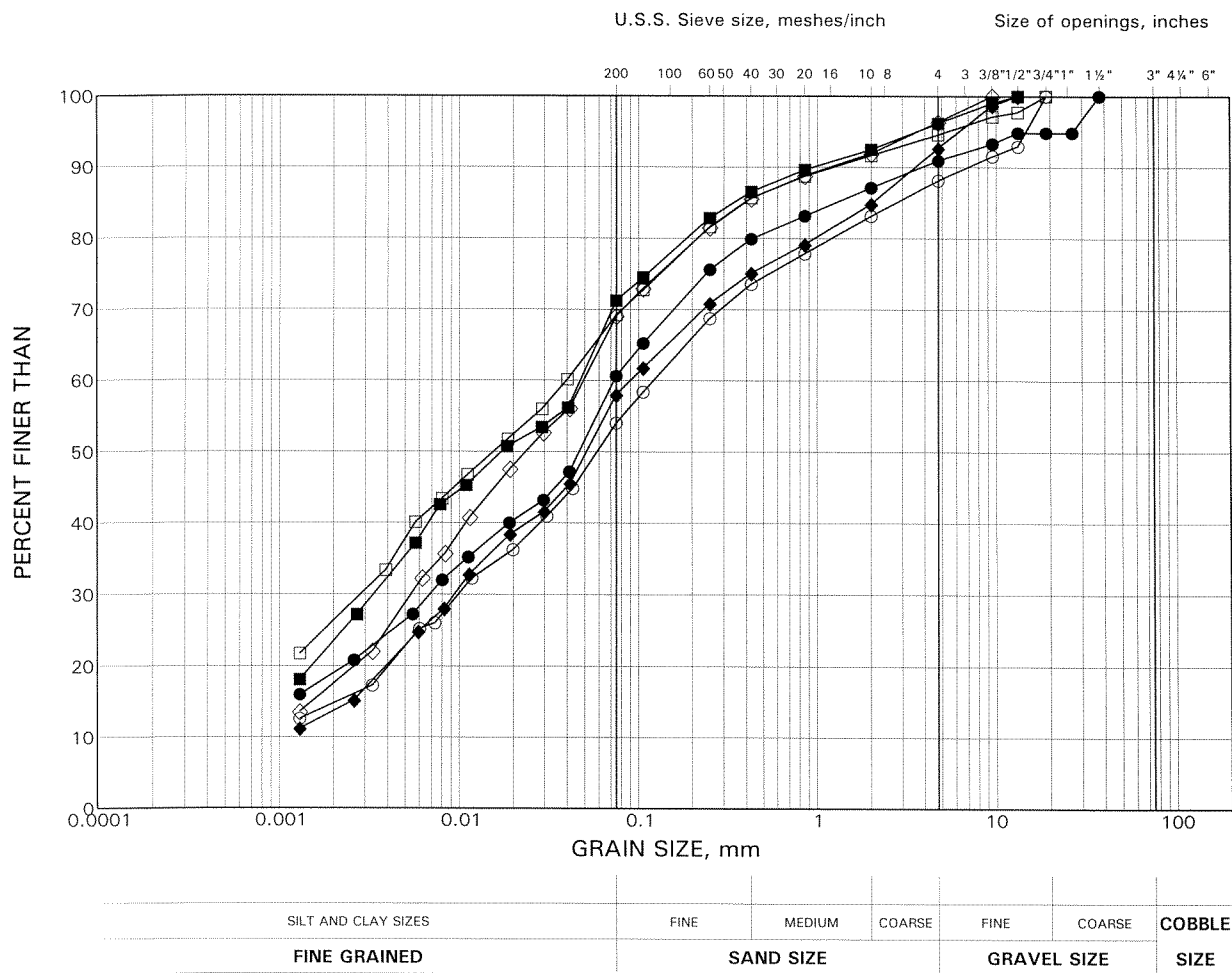
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	03-06	8	257.6
■	03-10	8	241.1
◆	C1-2	4	247.2
○	C-3	7	243.4
□	C-3	8	241.8
◇	E6	4	247.9

GRAIN SIZE DISTRIBUTION TEST RESULTS

Clayey Silt Till to Silty Clay Till

FIGURE 4B



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	HML-1	3	246.5
■	HML-2	5	246.2
◆	HML-3	7	245.9
○	SWM-1	3	249.7
□	SWM-1	8	245.1
◇	WS-5	8	247.8

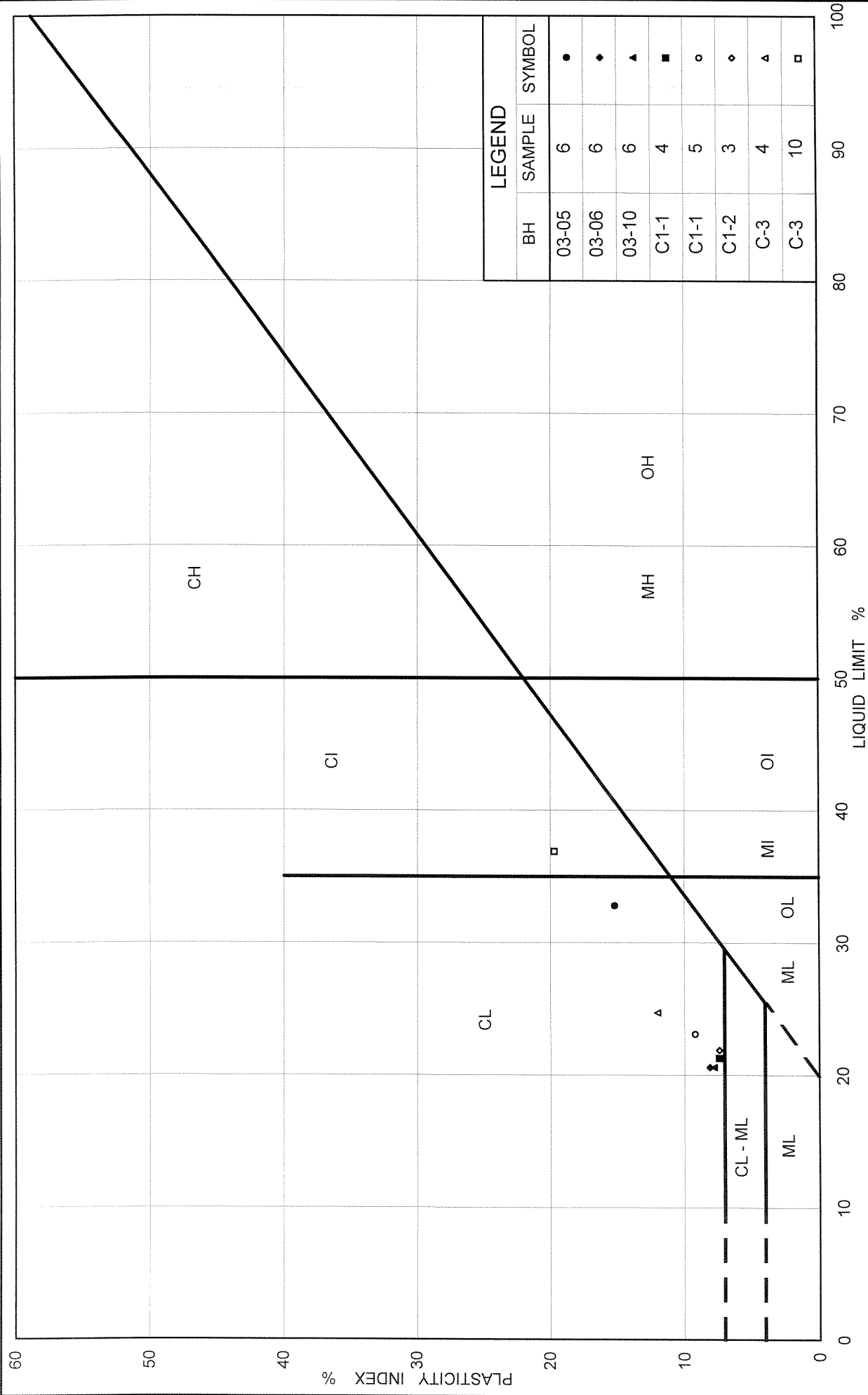


FIG No. 5A

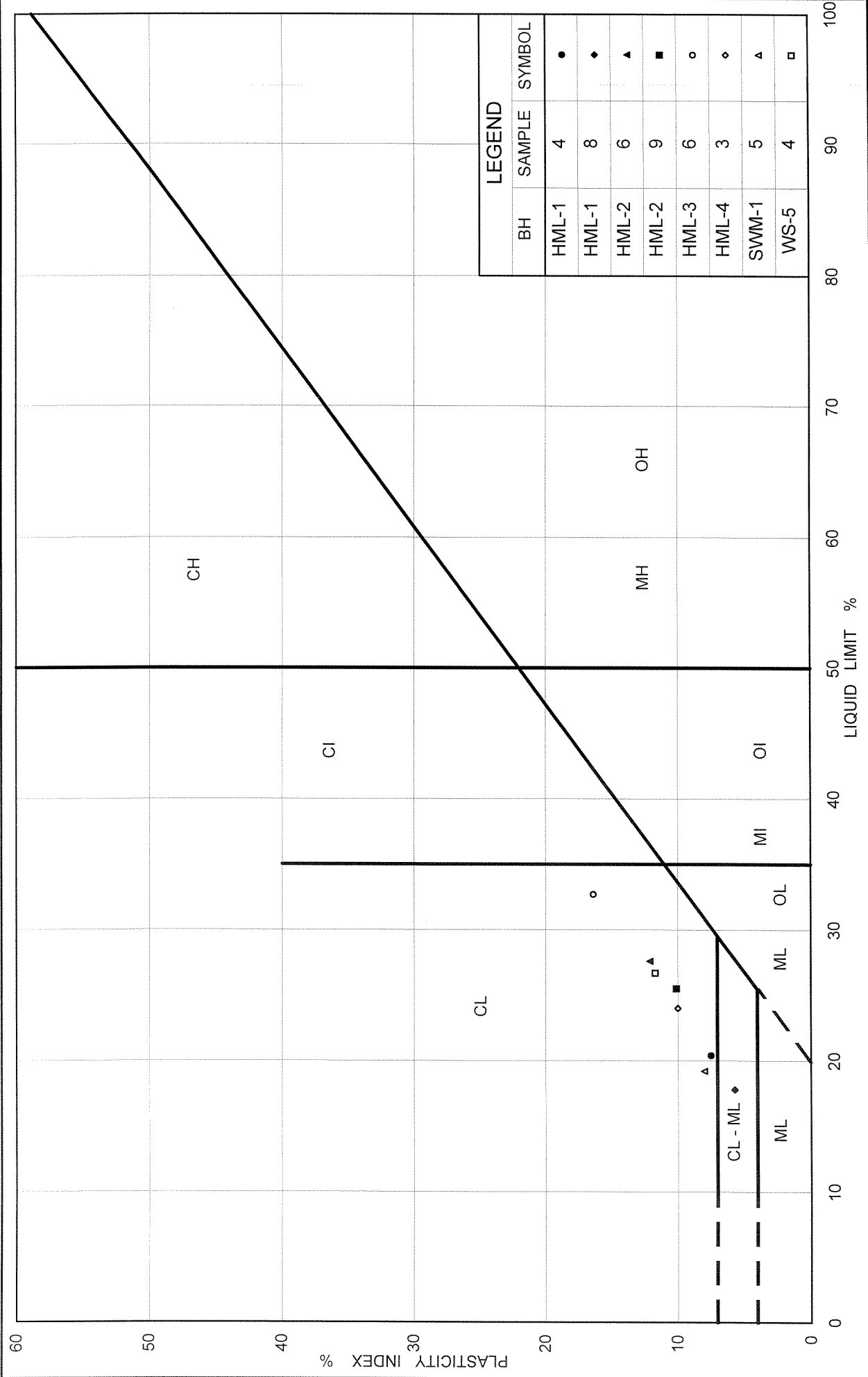
Project No. 001-1159

Ministry of Transportation



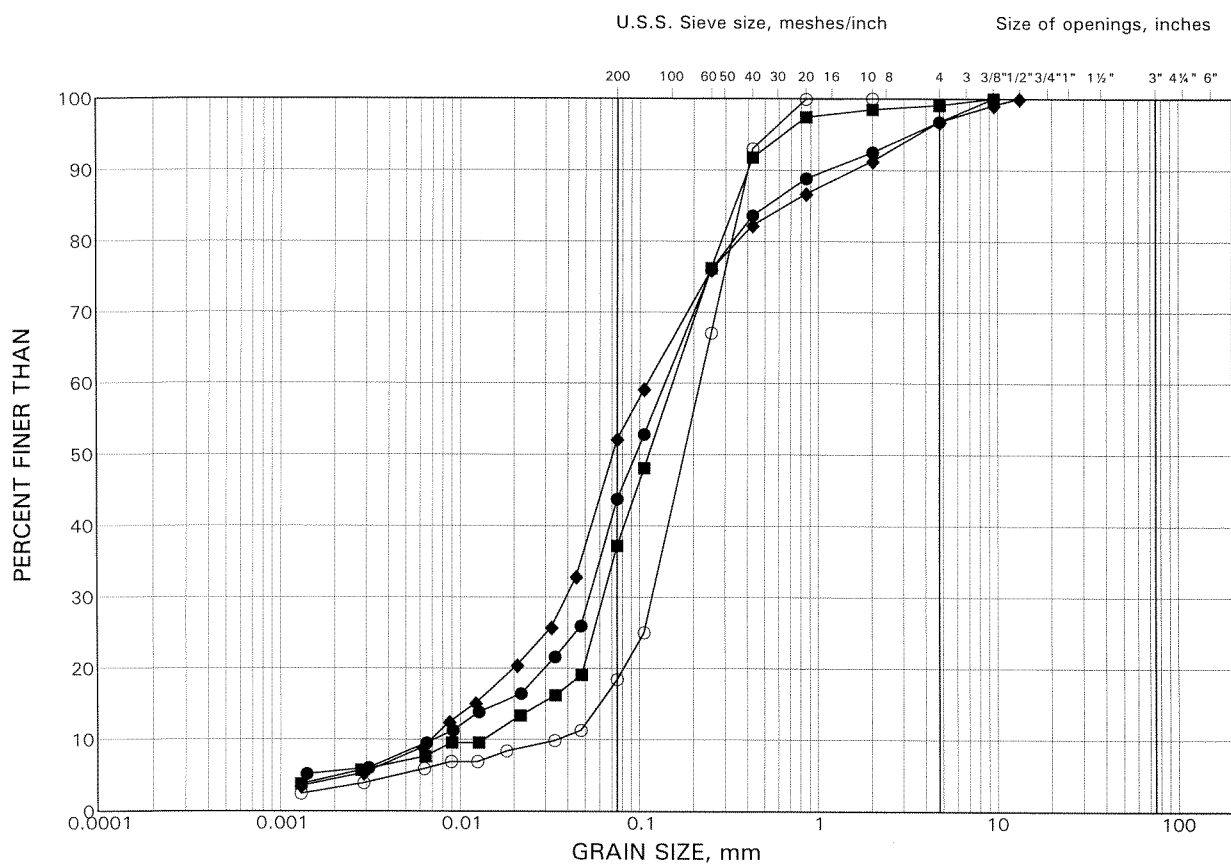
Ontario

PLASTICITY CHART
Clayey Silt Till to Silty Clay Till



Sand to Sand and Silt

FIGURE 6



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	03-05	7	257.0
■	03-05	12	249.4
◆	03-10	11	236.5
○	HML-4	7	259.8

APPENDIX A

**RECORD OF BOREHOLE 34
1999 INVESTIGATION
SHAHEEN & PEAKER LTD.**

RECORD OF BOREHOLE No 34										1 OF 1		METRIC		
W.P. 130-99-00		LOCATION 4844632N; 282062E				ORIGINATED BY M.T								
DIST Central HWY 410		BOREHOLE TYPE Solid Stem Augers				COMPILED BY G.T								
DATUM Geodetic		DATE 22.10.99				CHECKED BY Z.O								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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						
248.6	Ground Surface						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100							
0.0	400 mm TOPSOIL		1	SS	7									
248.2			2	SS	17							21.6	9 40 41 10	
0.4	Heterogeneous mixture of Clayey Silt some sand and gravel (CLAYEY SILT TILL) with Sandy Silt Till zones, some sand and silt seams/lenses, occasional cobbles and boulders, brown to 3.3 m, grey below, firm to stiff to 1.1 m, very stiff to hard below, damp to moist to 7.0 m, moist to wet below		3	SS	32									
			4	SS	42							21.3		
			5	SS	52									
			6	SS	66/25							21.5		
			7	SS	36								7 37 44 12	
			8	SS	30							22.6		
			9	SS	26									
			10	SS	30							21.6		
237.0			11	SS	68									
9.6	End of borehole Water level on completion at 6.8 m Water level not stabilized													

APPENDIX B

**RECORD OF BOREHOLE 129
1999 INVESTIGATION
GOLDER ASSOCIATES LTD.**

W.P. 22-79-00
DIST. Stn 5+515
LOCATION: N 4845562 E 596628 (NAD 83)

RECORD OF BOREHOLE 129

BORING DATE: Jan. 18, 1999

SHEET 1 OF 2

DATUM: Geodetic

PROJECT: 981-8057



N8057129 BH

DATA INPUT: ph n8057129.bh 1/99

SOIL M6

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH		WATER CONTENT, PERCENT			
								Cu, kPa	nat V - + rem V - ⊕ U - ○	Wp			W 10 20 30 40
0	POWER AUGER 115 mm Dia. Solid Stem Augers	GROUND SURFACE		259.00									
		TOPSOIL		0.00									
		CLAYEY SILT, some sand, trace gravel, trace organics Hard Brown Moist Some oxidation noted (TILL)		0.10									
			1	AS									
1			2	50 DO	75							MH	
			3	50 DO	50/ .10								
2				257.04									
		SAND and SILT, trace to some gravel, trace clay, cobbles Very dense Brown Moist Some oxidation noted (TILL)		1.96									
			4	50 DO	95							MH	
3													Backfill
4													
5													
6													
7		SAND, some silt to SILTY SAND, trace gravel Very dense Brown Moist, becoming wet below 7.5 m depth		252.75									
				6.25									
			7	50 DO	50/ .15							Bentonite Seal	
8													
9												Silica Sand	
10												Cave	

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: MG

CHECKED:

W.P. 22-79-00
DIST. Stn 5+515
LOCATION: N 4845562 E 596628 (NAD 83)

RECORD OF BOREHOLE 129

BORING DATE: Jan. 18, 1999

SHEET 2 OF 2

DATUM: Geodetic

PROJECT: 981-8057



N8057129 BH

DATA INPUT: ph n8057129.bh 1/99

SOILM6

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT	
								Cu, kPa	nat V - + Q - ● rem V - ⊕ U - ○			Wp	W
10	POWER AUGER 115 mm Dia. Solid Stem Augers	CONTINUED FROM PREVIOUS PAGE											
11		SAND, some silt to SILTY SAND, trace gravel Very dense Brown Moist, becoming wet below 7.5 m depth		10	50 DO	60/ .15							
12													
13		END OF BOREHOLE		246.50 12.50	11	50 DO	50/ .15						
14													
15													
16													
17													
18													
19													
20													

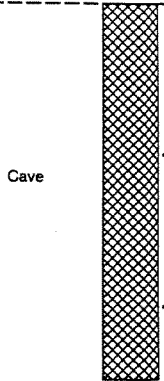
DEPTH SCALE

1 to 50

Golder Associates

LOGGED: MG

CHECKED:



Water level in
open borehole at
8.0 m depth upon
completion of
drilling

Borehole caved to
9.1 m depth upon
completion of
drilling

Water level in
piezometer at
7.8 m depth on
Jan. 21, 1999