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**FOUNDATION INVESTIGATION REPORT
COUNTRYSIDE DRIVE UNDERPASS
HIGHWAY 410 EXTENSION
BRAMPTON, ONTARIO
G.W.P. 101-00-00**

Submitted to:

URS Canada Inc.
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Thornhill, Ontario
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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 new Countryside Drive underpass structure, located on the existing Countryside Drive alignment. A foundation investigation has been carried out in September 2004 and February 2005 to determine the subsurface conditions at the structure site. A previous subsurface investigation, in October and November 2003, was also carried out by Golder for an earlier proposed structure location, approximately 25 m south of the existing Countryside Drive alignment.

The terms of reference for the scope of work are outlined in the Request For Proposal and 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 letters dated November 13, 2003, February 12, 2004 and June 14, 2004.

2.0 SITE DESCRIPTION

The proposed Countryside Drive underpass site is located along the existing Countryside Drive alignment, approximately 450 m east of Heart Lake Road, within the City of Brampton in the Regional Municipality of Peel. The existing land use at the structure site is agricultural (farm field).

The natural ground surface in the area undulates between approximately Elevation 248 m and 252 m. Within the limits of the proposed underpass structure itself, the existing natural ground surface varies from about Elevation 249.5 m to 252 m, sloping downward from the northeast to the southwest. A localized drainage swale bisects the farm field in the vicinity of the west abutment and approach embankment. The existing Countryside Drive grade is at approximately Elevation 250 m to 251 m, rising eastward; this is typically about 0.5 m higher than the surrounding grade.

3.0 INVESTIGATION PROCEDURES

A subsurface investigation was carried out for the proposed Countryside Drive underpass structure in September 2004 and February 2005. Five boreholes (Boreholes C-04-1 to C-04-3, C-05-1 and C-05-2) were drilled using a track-mounted drill rig supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. A previous subsurface investigation was carried out by Golder in October and November 2003, at which time six boreholes (Boreholes C-1 to C-6) were advanced at a previously proposed structure location, approximately 25 m south of the currently proposed structure location and the existing Countryside Drive alignment. The records of Boreholes C-1 to C-6 are contained in Appendix A of this report.

Boreholes C-04-1 to C-04-3 were advanced using hollow stem augers, in conjunction with drilling mud for the deeper portions of the boreholes, while Boreholes C-05-1 and C-05-2 were advanced using solid stem augers. At the west abutment, Borehole C-04-1 was advanced to 34.4 m depth (including bedrock coring) in order to extend at least 3 m below “refusal” as defined by material for which the measured Standard Penetration Test (SPT) “N” values are greater than 100 blows per 0.3 m of penetration. Boreholes C-04-2 and C-04-3 at the centre pier and east abutment were advanced to 19.9 m and 21.8 m depth, respectively, in order to extend at least 3 m below “refusal”. Boreholes C-05-1 and C-05-2, located at the north end of the west and east abutments, were advanced to 5.2 m and 6.7 m depth, respectively, in order to investigate the soils within the zone of influence of shallow foundations or embankment loadings.

Boreholes C-1 to C-6 were drilled to depths of between 9.8 m and 35.1 m, using hollow stem augers and/or casing and tricone, in conjunction with drilling mud for the deeper boreholes. Boreholes C-1 and C-4 were advanced to about 35 m and 26 m depth, respectively, in order to extend at least 3 m below “refusal” as defined by material for which the measured Standard Penetration Test (SPT) “N” values are greater than 100 blows per 0.3 m of penetration. Boreholes C-2, C-3, C-5 and C-6 were advanced to approximately 10 m and 11 m depth, in order to investigate the soils within the zone of influence of shallow foundations or embankment loadings.

Samples of the overburden were obtained at 0.75 m to 1.5 m intervals of depth using 50 mm outside diameter split-spoon samplers driven by an automatic hammer, in accordance with the Standard Penetration Test (SPT) procedure. In Borehole C-04-1, approximately 3 m of NQ-size coring was carried out within bedrock. The water level in the open boreholes was observed throughout the drilling operations, and piezometers were installed in Boreholes C-1 and C-2 as part of the 2003 investigation, to permit monitoring of the stabilized groundwater level(s). 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 and sampling 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 further examination. Index and classification tests (water content determinations, Atterberg limits testing and grain size distribution analyses) were carried out on selected soil samples.

The borehole locations were determined by Golder relative to points staked along the foundation elements by Callon Dietz Ltd., Ontario Land Surveyors, of London, Ontario. The ground surface elevations at the borehole locations from both the 2003 and 2004 investigations were determined by Golder relative to these known survey points. The borehole locations, including MTM NAD83 northing and easting coordinates and ground surface elevations referenced to geodetic datum, are shown on the Borehole Location and Soil Strata drawings contained in the Contract Documents, and are summarized in the following table:

<i>Borehole</i>	<i>Northing (m)</i>	<i>Easting (m)</i>	<i>Elevation</i>
C-04-1	4,845,364.2	281,544.7	249.7 m
C-04-2	4,845,411.2	281,553.5	250.8 m
C-04-3	4,845,413.8	281,586.7	251.0 m
C-05-1	4,845,386.2	281,532.2	250.0 m
C-05-2	4,845,435.8	281,574.3	251.7 m
C-1	4,845,349.9	281,550.2	249.5 m
C-2	4,845,381.4	281,569.8	249.8 m
C-3	4,845,373.6	281,574.2	249.7 m
C-4	4,845,402.4	281,595.3	250.6 m
C-5	4,845,338.3	281,540.7	249.6 m
C-6	4,845,415.8	281,603.9	250.8 m

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geological Conditions

The Countryside Drive structure site is located in the physiographic region known as the Peel Plain, which covers the central portion of York, Peel and Halton Regions, as delineated in *The Physiography of Southern Ontario*¹. The soils within this physiographic region are characterized by relatively thick deposits of clayey silt to silty clay till, that are overlain by lacustrine deposits (the “Peel ponds” deposits) consisting of thin, localized accumulations of sand, silt and clay. These overburden soils are underlain by shale bedrock of the Georgian Bay Formation.

4.2 Site Stratigraphy

The locations and ground surface elevations of the boreholes advanced at this structure site are shown on the Borehole Location and Soil Strata drawings contained in the Contract Documents. The detailed subsurface soil and groundwater conditions encountered in the boreholes and the results of the in situ and laboratory testing are given on the records of Boreholes C-04-1 to C-04-3, C-05-1 and C-05-2, on Figures 1 to 6 following the text of this report, and on the records of Boreholes C-1 to C-6 contained in Appendix A 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.

In summary, the soils encountered at this site consist of topsoil or fill overlying a surficial deposit of firm to very stiff silty clay to clayey silt, in turn overlying a thick glacial till deposit of variable composition. The till is generally comprised of very stiff to hard clayey silt, grading to silty sand to sandy silt till with depth. Water-bearing interlayers or lenses of cohesionless soil are present within the till deposit. The glacial till deposit is underlain by shale bedrock which was encountered at Elevation 218.0 m (approximately 31.7 m depth in Borehole C-04-1, and about 31.6 m depth in Borehole C-1) in the vicinity of the west abutment.

A more detailed description of the native subsurface conditions at the site is provided in the following sections, based on the results from Boreholes C-04-1 to C-04-3, C-05-1, C-05-2, and C-1 to C-6. Stratigraphic profiles and sections at the site are provided on the Borehole Location and Soil Strata drawings contained in the Contract Documents, and on Drawing A1 contained in Appendix A.

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.

4.2.1 Fill and Topsoil

Approximately 0.2 m to 0.8 m of sand and gravel fill, associated with the existing Countryside Drive, was encountered immediately below the ground surface in Boreholes C-04-2, C-05-1 and C-05-2.

A 400 mm thick topsoil layer was encountered below the 0.2 m thick layer of sand and gravel fill in Borehole C-04-2, located at the centre pier. A 200 mm to 700 mm thick topsoil layer was encountered immediately below ground surface in all of the boreholes (C-1 to C-6) advanced as part of the 2003 investigation.

4.2.2 Surficial Silty Clay to Clayey Silt

In all of the boreholes except Borehole C-05-2, a 0.3 m to 3.2 m thick surficial layer of silty clay to clayey silt was encountered below the fill or topsoil and atop the glacial till deposit. The base of this layer was encountered at the following depths and elevations in the boreholes advanced at and in the vicinity of the structure site:

<i>Borehole</i>	<i>Location</i>	<i>Depth</i>	<i>Elevation</i>
C-04-1	West abutment	1.5 m	247.4 m
C-04-2	Centre pier	2.4 m	248.7 m
C-04-3	East abutment	1.5 m	248.0 m
C-05-1	West abutment	1.4 m	248.6 m
C-05-2	East abutment	N/A	N/A
C-1	South of west abutment	2.7 m	246.8 m
C-2	South of centre pier	1.1 m	248.7 m
C-3	South of centre pier	1.7 m	248.0 m
C-4	South of east abutment	0.6 m	250.0 m
C-5	West approach	3.7 m	245.9 m
C-6	East approach	2.2 m	248.6 m

The surficial silty clay to clayey silt deposit contains trace sand and gravel; grain size distribution test results for three samples of this material are shown on Figure 1. Atterberg limits testing carried out on seven samples of this layer measured plastic limits of 16 to 20 per cent, liquid limits of 25 to 37 per cent, and corresponding plasticity indices of 9 to 18 per cent. The results of the limits testing, shown on Figure 2, confirm that this soil ranges from a low plasticity clayey silt to an intermediate plasticity silty clay. The measured natural moisture contents range from 15 to 28 per cent, typically at or slightly above the plastic limit for this material.

The surficial silty clay to clayey silt deposit varies in consistency from firm to very stiff, based on measured SPT “N” values that range from 5 to 25 blows per 0.3 m of penetration, with an average of about 13 blows per 0.3 m of penetration.

4.2.3 Surficial Silty Sand to Sandy Silt

A 0.8 m thick layer of sandy silt was encountered immediately below the surficial silty clay in Borehole C-04-1, located at the proposed west abutment. In Borehole C-04-3, at the proposed east abutment, a 0.8 m thick layer of silty sand was encountered overlying the surficial silty clay to clayey silt stratum.

This surficial silty sand to sandy silt has a compact relative density, based on measured SPT “N” values of 15 and 27 blows per 0.3 m of penetration.

4.2.4 Glacial Till

Below the surficial deposits, a glacial till deposit was encountered in all of the boreholes at depths of between 0.6 m and 3.7 m. The surface of the till deposit is lower at the west abutment and rises eastward, as summarized in the following table:

<i>Location</i>	<i>Borehole Numbers</i>	<i>Approximate Elevation of Surface of Glacial Till</i>
West abutment	C-04-1, C-05-1	247.4 m to 248.6 m
Centre pier	C-04-2, C-2	248.3 m to 248.7 m
East abutment	C-04-3, C-05-2	249.5 m to 250.9 m

The upper portion of the glacial till deposit is typically comprised of clayey silt with sand, trace to some gravel, to clayey silt, trace sand and gravel. Below about Elevation 237.5 m to 240 m in the deeper boreholes, the glacial till generally grades to a silty sand to sandy silt till, containing trace to some gravel and trace clay, as well as zones of gravel and cobbles. Lenses or interlayers of cohesionless soil are also present within the glacial till deposit, as shown on the borehole records; these lenses / interlayers are discussed further in Section 4.2.5. Grain size distribution test results obtained from seven samples of the clayey silt till and eight samples of the silty sand till to sandy silt till are shown on Figures 3 and 4, respectively.

Atterberg limit testing was carried out on twenty samples of the glacial till. In general, the measured plastic limits ranged from 11 to 14 per cent, the liquid limits from 15 to 25 per cent, and the corresponding plasticity indices from 3 to 12 per cent. The results of the limits testing, shown on Figures 5A to 5C, confirm that the upper portion of the till is generally an inorganic clayey silt of low plasticity, although one sample (Sample 10, from approximately Elevation 238.8 m in Borehole C-3) is a silty clay of intermediate plasticity, based on a plastic limit of 17 per cent, a liquid limit of 37 per cent, and a plasticity index of 20 per cent. The measured natural moisture contents range from about 8 to 20 per cent, typically near the plastic limit for the clayey silt till material.

Within the clayey silt till, the measured SPT “N” values range from 6 to 105 blows per 0.3 m of penetration, but are typically between about 15 and 60 blows per 0.3 m of penetration. The clayey silt till generally has a very stiff to hard consistency. Within the silty sand to sandy silt till, the measured SPT “N” values range from 36 to greater than 100 blows per 0.3 m of penetration, indicating that this portion of the till deposit has a dense to very dense relative density. SPT “N” values of greater than 100 blows per 0.3 m of penetration were measured within the glacial till below the following depths / elevations:

<i>Foundation Element</i>	<i>Approximate Depth To 100-Blow Till</i>	<i>Approximate Elevation of Surface of 100-Blow Till</i>
West abutment	29 m	221 m
Centre pier	14 m	237 m
East abutment	15 m	236 m

It is noted that difficult drilling conditions, including slow drilling progress and the presence of cobbles and boulders, were encountered within the very dense silty sand to sandy silt till stratum. As indicated on the record for Borehole C-4, breakage of the N-casing and of a split-spoon sampler occurred within the very dense till in this borehole at about Elevation 231 m.

4.2.5 Cohesionless Lenses and Interlayers in Glacial Till

Lenses or interlayers of cohesionless soil were encountered within the glacial till deposit in some of the boreholes. These lenses / interlayers typically vary from about 0.4 m to 3 m in thickness; however, an 8 m thick interlayer was encountered in Borehole C-1. The lenses / interlayers range in composition from sand and gravel, to sand containing trace to some silt, trace gravel and clay, to silt containing trace to some sand, trace gravel and clay. The results of grain size distribution tests carried out on five samples of these cohesionless soil lenses or interlayers are shown on Figure 6.

It is noted that a boulder was cored at about 26.2 m depth (Elevation 223.3 m) within the 8 m thick silty sand interlayer in Borehole C-1. The coring indicated that the boulder was about 300 mm in diameter.

The measured SPT “N” values within the granular interlayers / lenses vary from 16 to greater than 100 blows per 0.3 m of penetration, but are typically less than 50 blows per 0.3 m of penetration, indicative of a compact to dense relative density. In the 8 m thick silty sand interlayer that was encountered near the base of the glacial till deposit in Borehole C-1, the SPT “N” values range from 16 to 22 blows per 0.3 m of penetration, indicating that this interlayer has a compact relative density.

4.2.6 Bedrock

The surface of the bedrock was encountered below the glacial till at 31.7 m depth (Elevation 218.0) in Borehole C-04-1, and at 31.6 m depth (Elevation 218.0 m) in Borehole C-1. Approximately 3 m of bedrock coring was carried out in each of these two boreholes. The dark grey shale bedrock encountered at this site is a member of the Georgian Bay Formation. This formation is known to contain limestone seams and interbeds; a 0.7 m thick interbed of limestone containing shale seams is present between about 32.7 m depth and 33.4 m depth (Elevations 216.8 m and 216.1 m) in Borehole C-1.

Based on the recovered rock core, the upper 0.7 m of the shale bedrock is slightly or slightly to moderately weathered; below this, the shale and limestone bedrock is fresh to slightly weathered. The shale is very weak to weak, and very thinly- to thinly-bedded; and the limestone (where present) is thinly-bedded and medium strong to strong. Rock Quality Designation (RQD) values measured on the recovered bedrock core samples varied from about 13 to 60 per cent, but were typically between 13 and 30 per cent, indicating that the bedrock is generally of poor quality. The discontinuities observed in the rock core are horizontal to sub-horizontal, associated with the bedding planes.

The terms used in the description of the bedrock samples from this site are provided on the *Lithological and Geotechnical Rock Description Terminology* sheet which precedes the Record of Borehole sheets included with this report.

4.3 Groundwater Conditions

During drilling, water was generally noted in samples retrieved from within the granular lenses or interlayers in the till. The water levels encountered in the open boreholes during drilling are noted on the borehole records. Piezometers were installed in Boreholes C-1 and C-2 as part of the 2003 investigation, to permit monitoring of groundwater level(s) at the site. The following table summarizes the water levels measured in the piezometers:

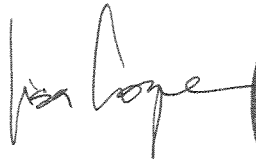
<i>Borehole No.</i>	<i>November 24/25, 2003</i>		<i>December 11, 2003</i>	
	<i>Depth</i>	<i>Elevation</i>	<i>Depth</i>	<i>Elevation</i>
C-1	6.0 m	243.5 m	4.5 m	245.0 m
C-2	4.4 m	245.4 m	3.2 m	246.6 m

It should be noted that the groundwater levels at the site are anticipated to fluctuate with seasonal variations in precipitation and runoff.

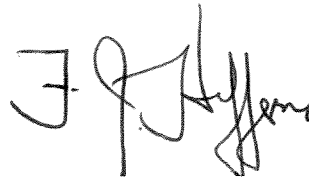
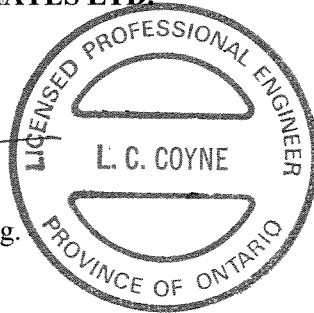
5.0 CLOSURE

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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BL/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.)

(b) Cohesive Soils

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)

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE

Fresh: no visible sign of weathering.

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	> 2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	< 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	> 3 m
Wide	1 - 3 m
Moderately close	0.3 - 1 m
Close	50 - 300 mm
Very close	< 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	> 60 mm
Coarse Grained	2 - 60 mm
Medium Grained	60 microns - 2 mm
Fine Grained	2 - 60 microns
Very Fine Grained	< 2 microns

Note: * Grains > 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

B - Bedding	P - Polished
FO - Foliation/Schistosity	S - Slickensided
CL - Cleavage	SM - Smooth
SH - Shear Plane/Zone	R - Ridged/Rough
VN - Vein	ST - Stepped
F - Fault	PL - Planar
CO - Contact	FL - Flexured
J - Joint	UE - Uneven
FR - Fracture	W - Wavy
MF - Mechanical Fracture	C - Curved
- Parallel To	
⊥ - Perpendicular To	

PROJECT 001-1159-2			RECORD OF BOREHOLE No C-04-1			1 OF 4 METRIC											
W.P. 101-00-00			LOCATION N 4845364.2 ; E 281544.7			ORIGINATED BY PKS											
DIST _____ HWY 410			BOREHOLE TYPE D-50 Bombardier, 108 mm I.D. Hollow Stem Augers			COMPILED BY LCC											
DATUM Geodetic			DATE September 3, 2004			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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%) W _p W W _L			γ kN/m ³	GR SA SI CL
							20 40 60 80 100	20 40 60 80 100	25 50 75								
249.7	Ground Surface																
0.0	Silty Clay, trace sand, trace gravel, trace organics Firm Brown Moist		1	SS	7		249										0 6 51 43
248.2			2	SS	7												
1.5	Sandy Silt, trace gravel Compact Brown Wet		3	SS	27		248										
247.4																	
2.3	Clayey Silt with sand to some sand, trace to some gravel (TILL) Very stiff to hard Brown to grey Moist		4	SS	26		247										
			5	SS	27												
			6	SS	18		246										
			7	SS	20		245										
			8	SS	32		244										
			9	SS	67		243										
			10	SS	39		242										
							241										
							240										

Continued Next Page

+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-04-1		2 OF 4 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845364.2 ; E 281544.7</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 3, 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 ---																
238.1	Clayey Silt with sand to some sand, trace to some gravel (TILL) Very stiff to hard Brown to grey Moist		11	SS	35		239										
11.6	Sand and Silt to Sandy Silt, trace gravel, trace to some clay (TILL) Compact to dense Grey Wet						238										
							237										
							236										
							235										
							234										
							233										
							232										
							231										
							230										

Continued Next Page

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

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

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Continued Next Page

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

PROJECT 001-1159-2		RECORD OF BOREHOLE No C-04-1				4 OF 4 METRIC											
W.P. 101-00-00		LOCATION N 4845364.2 ; E 281544.7				ORIGINATED BY PKS											
DIST _____ HWY 410		BOREHOLE TYPE D-50 Bombardier, 108 mm I.D. Hollow Stem Augers				COMPILED BY LCC											
DATUM Geodetic		DATE September 3, 2004				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/m ³	GR SA SI CL
							20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	25 50 75					
	--- CONTINUED FROM PREVIOUS PAGE ---																
218.0	Sand and Silt, trace to some gravel, trace clay (TILL) Very dense Grey-brown Moist						219										
31.7	Shale (BEDROCK), containing limestone seams Slightly weathered to fresh Weak Very thinly to thinly bedded Grey Bedrock cored between 31.7 m and 34.4 m depth. For bedrock coring details, refer to Record of Drillhole C-04-1.						218										
							217										
							216										
215.3	End of Borehole																
34.4	Note: 1. Water level in open borehole at 7.6 m depth (Elev. 242.1 m) upon completion of drilling.																

PROJECT: 001-1159-2

RECORD OF DRILLHOLE: C-04-1

SHEET 1 OF 1

LOCATION: N ;E

DRILLING DATE: September 13, 2004

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: D-50 Bombardier

DRILLING CONTRACTOR: Walker Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH	COL- OUR % RETURN	FR/FX-FRACTURE F-FAULT				SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
									CL-CLEAVAGE		SH-SHEAR		J-JOINT		P-POLISHED		R-ROUGH				UE-UNEVEN		MB-MECH. BREAK	
									VN-VEIN		S-SLICKENSIDED		PL-PLANAR		ST-STEPPED		W-WAVY				B-BEDDING			
									C-CURVED															
									RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY								
									TOTAL CORE %	SOLID CORE %			DIP w.r.t. CORE AXIS	K _s cm/sec										
		Refer to Record of Borehole		218.00 31.70					80 80 40 40 20	80 80 40 40 20	80 80 40 40 20	5 5 5 5 5	0 0 0 0 0				10 ⁻⁶ 10 ⁻⁶ 10 ⁻⁶ 10 ⁻⁶ 10 ⁻⁶	2 4 6						
32		Shale (BEDROCK) containing limestone seams Slightly weathered to fresh Weak Very thinly to thinly bedded Grey			1																			
33																								
34					2																			
35		End of Borehole		215.26 34.44																				
36																								
37																								
38																								
39																								
40																								
41																								

DEPTH SCALE

1 : 50



LOGGED:

CHECKED:




MIS-RCK 001 001-1159-2-ROCK GPJ GLDR CAN.GDT 12/2/06 KG

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

Continued Next Page

+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 (%)					
								20 40 60 80 100			W _P W W _L					
— 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							237								
								236								
				14	SS		100/13		235							
				15	SS		100/10		234							
									233							
				16	SS	100/07		232								
230.9																
19.9			17	SS	100/07		231									

Continued Next Page

+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 001-1159-2			RECORD OF BOREHOLE No C-04-3			1 OF 3 METRIC														
W.P. 101-00-00			LOCATION N 4845413.8 ; E 281586.7			ORIGINATED BY PKS														
DIST HWY 410			BOREHOLE TYPE D-50 Bombardier, 108 mm I.D. Hollow Stem Augers			COMPILED BY LCC														
DATUM Geodetic			DATE September 8-9, 2004			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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100					W _p W W _L 25 50 75			γ	GR SA SI CL			
251.0	Ground Surface																			
0.0	Silty Sand, trace gravel Compact Brown Moist		1	SS	15															
250.2																				
0.8	Silty Clay to Clayey Silt, some sand, trace gravel, trace organics Stiff Brown Moist		2	SS	9		250													
249.5																				
1.5	Clayey Silt to Silty Clay, some sand, trace gravel (TILL) Very stiff to hard Brown Moist		3	SS	24		249													
			4	SS	27		248													
247.7																				
3.4	Silty Sand, trace gravel Very dense Grey Moist to wet		5	SS	50															
247.3																				
3.7	Clayey Silt with sand to some sand, trace to some gravel (TILL) Very stiff to hard Grey Moist		6	SS	35		247													
			7	SS	44		246													
							245													
			8	SS	28															
							244													
			9	SS	31		243													
							242													
			10	SS	27															

Continued Next Page

+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 001-1159-2			RECORD OF BOREHOLE No C-04-3			2 OF 3 METRIC											
W.P. 101-00-00			LOCATION N 4845413.8 ; E 281586.7			ORIGINATED BY PKS											
DIST HWY 410			BOREHOLE TYPE D-50 Bombardier, 108 mm I.D. Hollow Stem Augers			COMPILED BY LCC											
DATUM Geodetic			DATE September 8-9, 2004			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	20 40 60 80 100	25 50 75	W _p	W	W _L				
	--- CONTINUED FROM PREVIOUS PAGE ---																
239.4	Clayey Silt with sand to some sand, trace to some gravel (TILL) Very stiff to hard Grey Moist		11	SS	60		240										
11.6	Silty Sand, trace to some gravel, trace clay (TILL) Very dense Grey Wet		12	SS	62		239										
							238										
			13	SS	42		237										
							236										
			14	SS	124/.25		235										
234.5	Silty Sand, some gravel Very dense Grey Moist		15	SS	115/.25		234										
233.3	Sand and Silt to Silt, some sand, trace gravel, trace clay (TILL) Very dense Grey Moist		16	SS	134/.20		233										
17.7							232										
			17	SS	100/.10												

Continued Next Page

+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-04-3				3 OF 3 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845413.8 ; E 281586.7</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 8-9, 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 LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
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 (%)						
						20	40	60	80	100							
230.3	Sand and Silt to Silt, some sand, trace gravel, trace clay (TILL) Very dense Grey Moist																
20.7	Sandy Silt, trace gravel, trace clay Very dense Grey Moist					230											
229.2			18	SS	153/28												
21.8	End of Borehole Note: 1. Water level in open borehole at 9.1 m depth (Elev. 241.9 m) upon completion of drilling.																

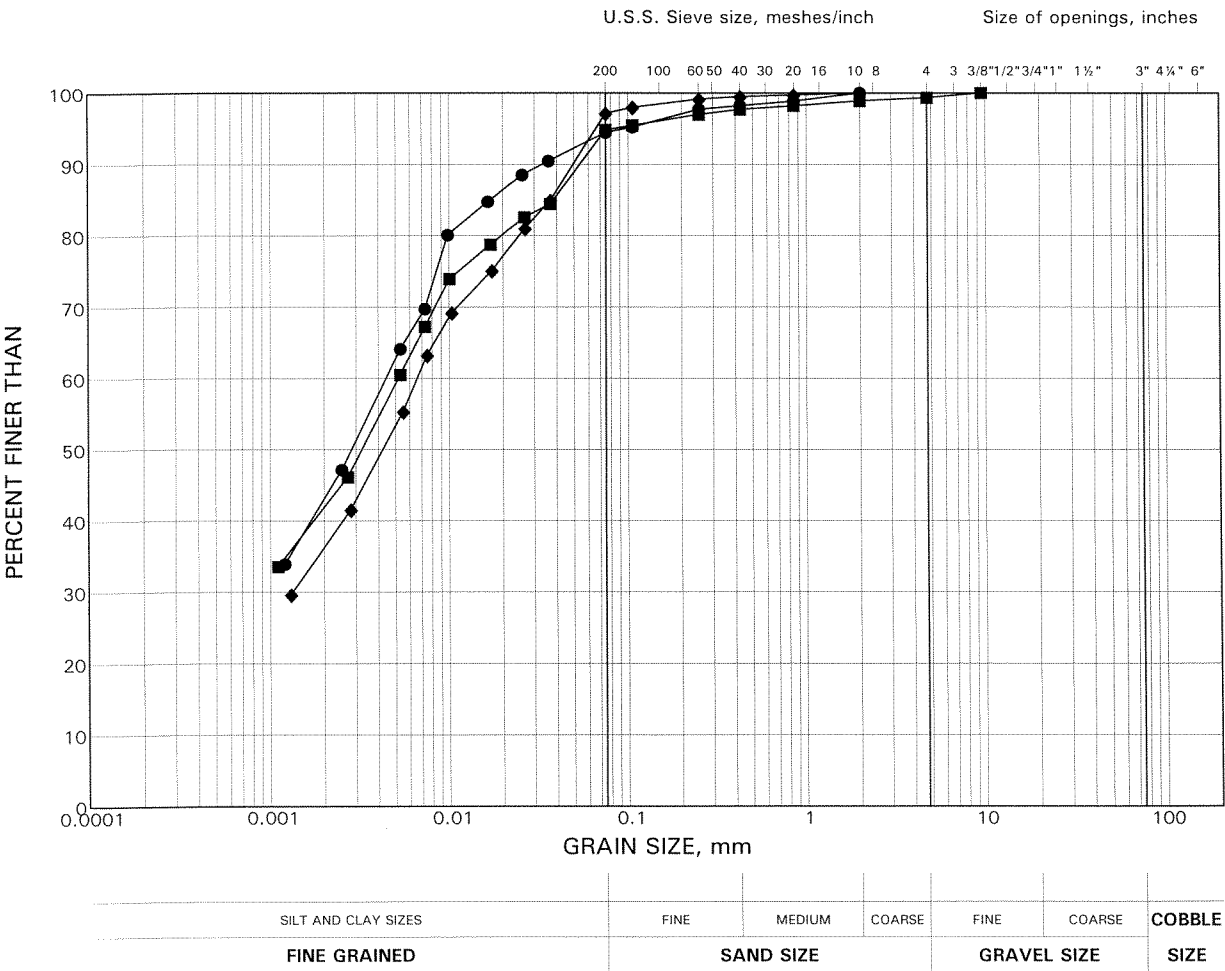
PROJECT <u>001-1159-2</u>		RECORD OF BOREHOLE No C-05-1				1 OF 1 METRIC											
W.P. <u>101-00-00</u>		LOCATION <u>N 4845386.2 ; E 281532.2</u>				ORIGINATED BY <u>PKS</u>											
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>108 mm Diameter Solid Stem Augers</u>				COMPILED BY <u>SP</u>											
DATUM <u>Geodetic</u>		DATE <u>February 25, 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									
250.0	Ground Surface																
0.0	Sand and gravel (FILL) Compact Brown Moist		1	AS	-												
249.2																	
0.8	Silty Clay, some sand, containing organics Firm Grey/black Moist		2	SS	7												
248.6																	
1.4	Clayey Silt to Silty Clay, some sand, trace gravel (TILL) Firm to very stiff Brown/grey Moist		3	SS	6												
			4	SS	17												
247.0																	
3.1	Clayey Silt, some sand, trace gravel, containing silty sand seams (TILL) Hard Brown to grey Moist to wet		5	SS	39												
			6	SS	30												
			7	SS	42												
244.8																	
5.2	End of Borehole																
	Note: 1. Water level in open borehole at 3.4 m depth (Elev. 246.6 m) upon completion of drilling.																

PROJECT 001-1159-2			RECORD OF BOREHOLE No C-05-2			1 OF 1 METRIC											
W.P. 101-00-00			LOCATION N 4845435.8 ; E 281547.3			ORIGINATED BY PKS											
DIST _____ HWY 410			BOREHOLE TYPE 108 mm Diameter Solid Stem Augers			COMPILED BY SP											
DATUM Geodetic			DATE February 25, 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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%) W _p W W _L			γ	GR SA SI CL
251.7	Ground Surface							20 40 60 80 100									
0.0	Sand and gravel (FILL) Compact Brown Moist		1	AS	-												
250.9							251										
0.8	Clayey Silt, some sand, trace gravel (TILL) Stiff to hard Brown Moist		2	SS	12												
			3	SS	19		250										
			4	SS	38		249										
248.7																	
3.1	Sand, trace to some silt, trace gravel Compact to very dense Brown to grey Wet		5	SS	27		248										
			6	SS	50												
247.4																	
4.3	Clayey Silt, some sand, trace gravel (TILL) Hard Grey Moist		7	SS	46		247										
			8	SS	40		246										
245.0																	
6.7	End of Borehole						245										
	Note: 1. Water level in open borehole at 2.1 m depth (Elev. 249.6 m) upon completion of drilling.																

GRAIN SIZE DISTRIBUTION TEST RESULTS

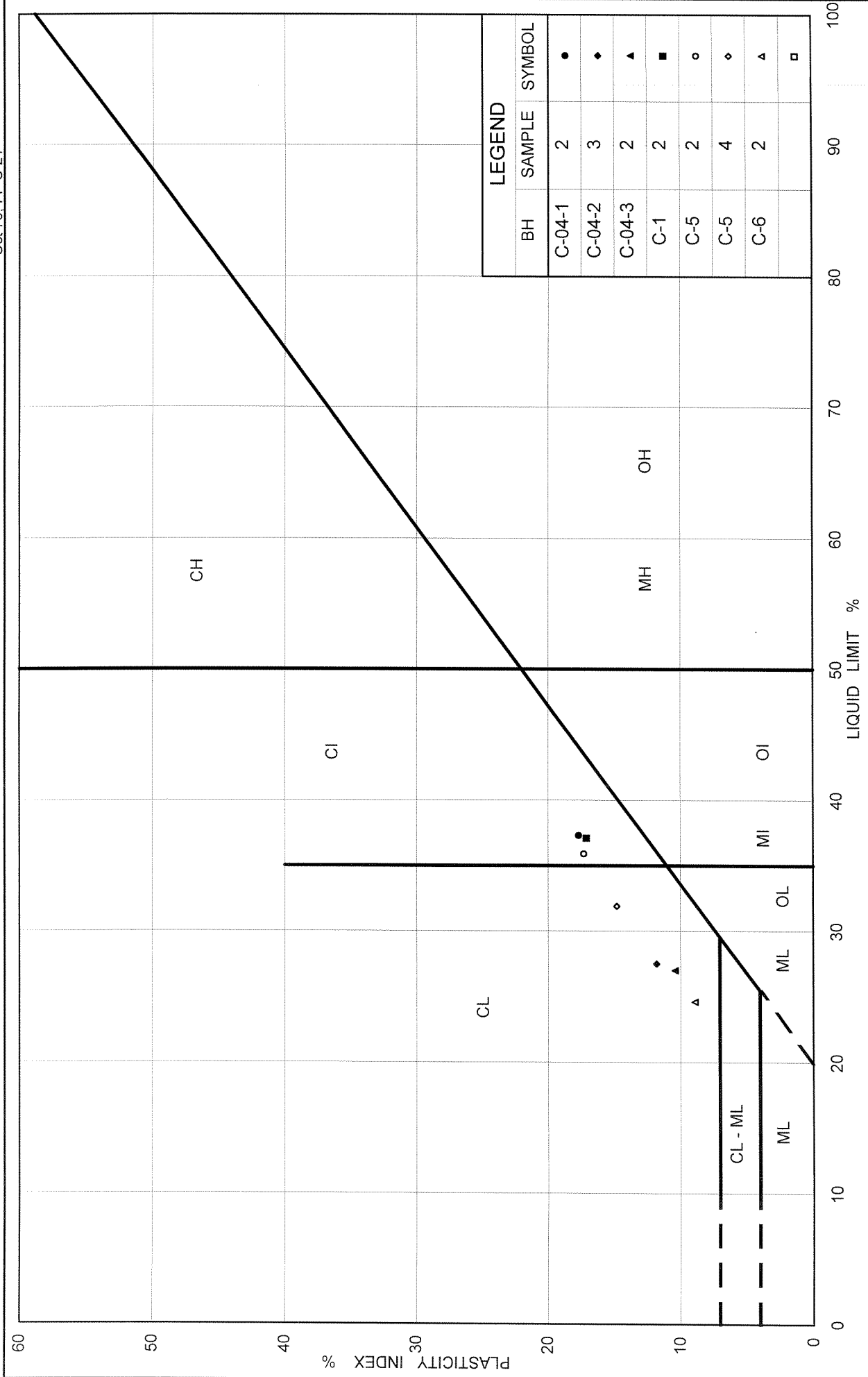
Surficial Silty Clay to Clayey Silt

FIGURE 1



LEGEND

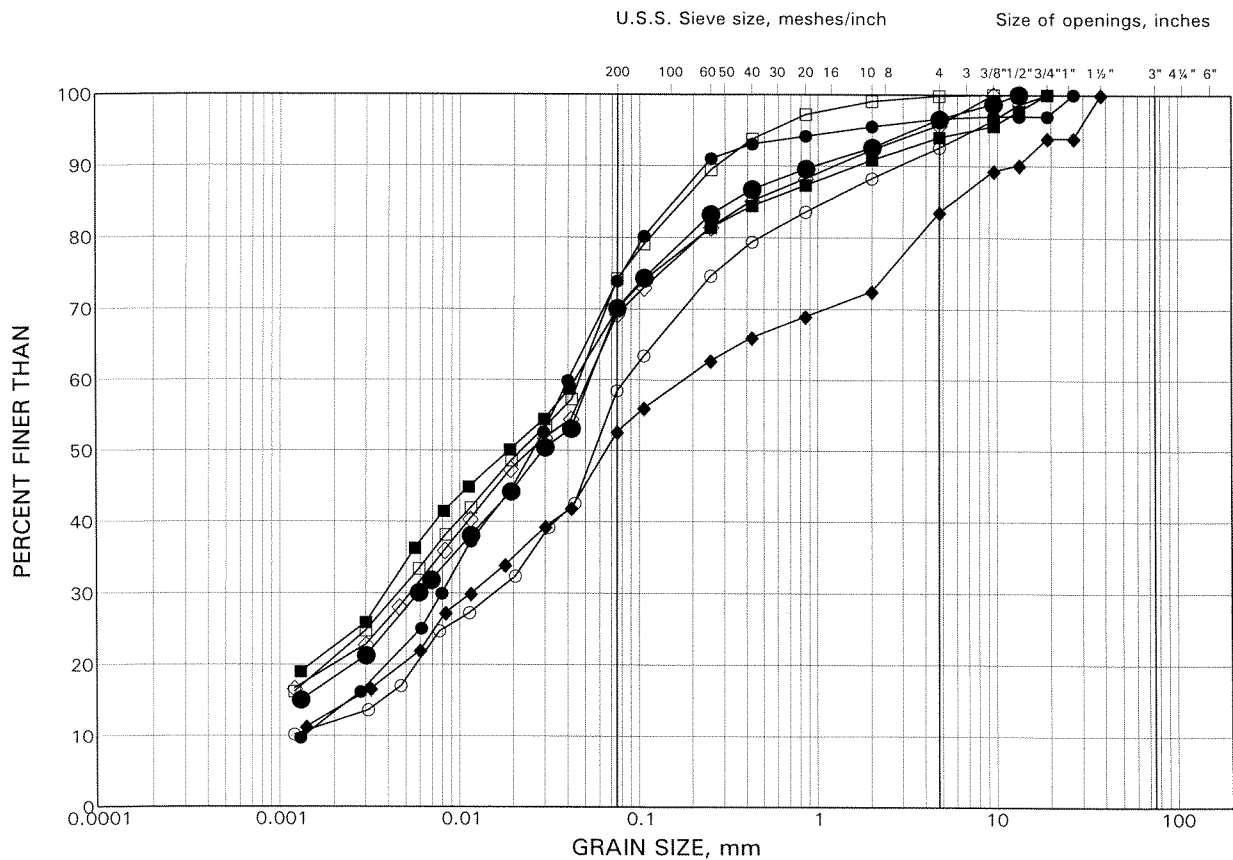
SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	C-04-1	2	248.6
■	C-1	2	247.7
◆	C-5	2	247.8



GRAIN SIZE DISTRIBUTION TEST RESULTS

Clayey Silt Till

FIGURE 3



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

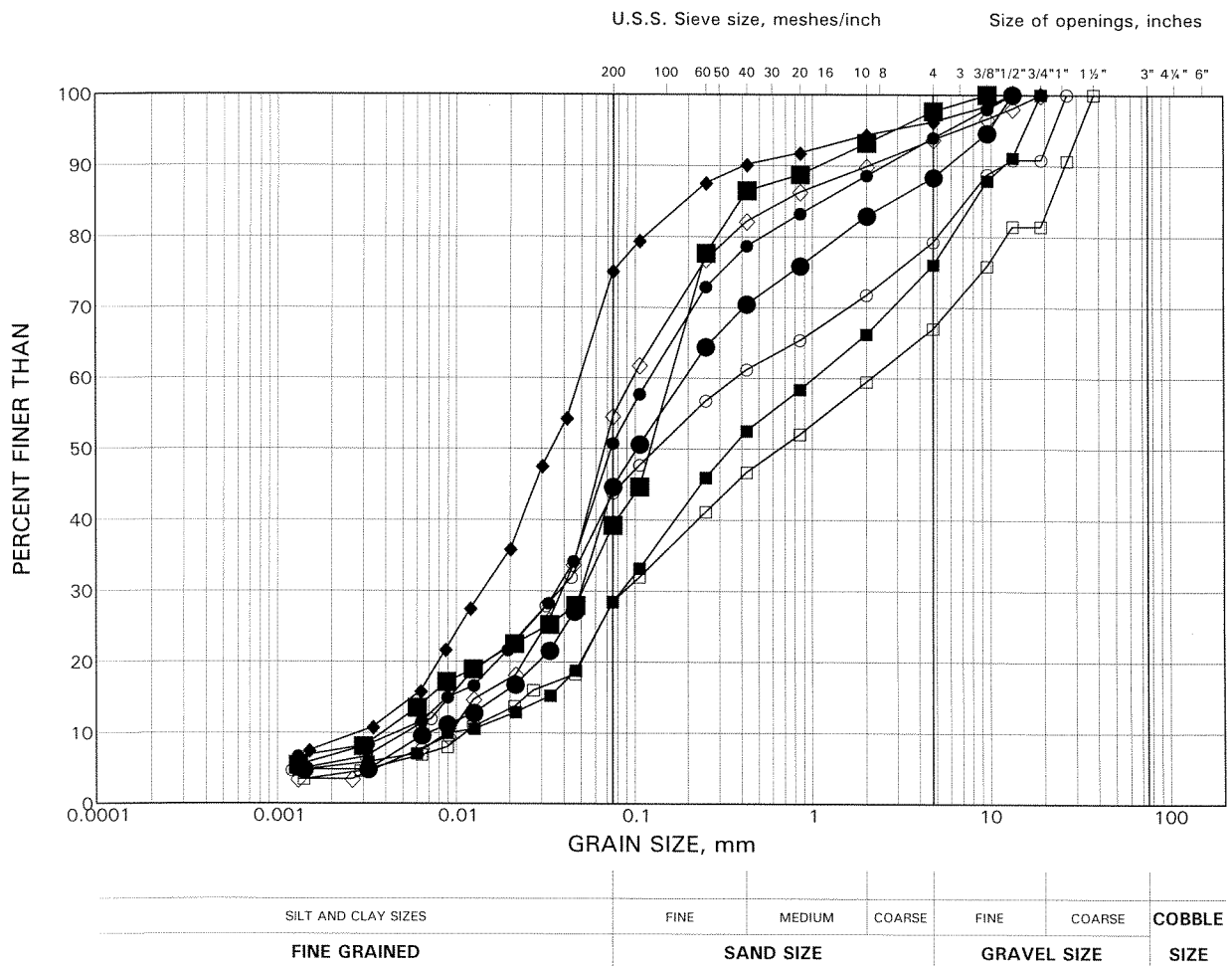
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	C-04-1	19	226.5
■	C-04-2	10	241.4
◆	C-04-3	8	244.5
○	C-1	5	245.4
□	C-1	16	229.4
◇	C-2	6	245.7
●	C-4	8	244.3

GRAIN SIZE DISTRIBUTION TEST RESULTS

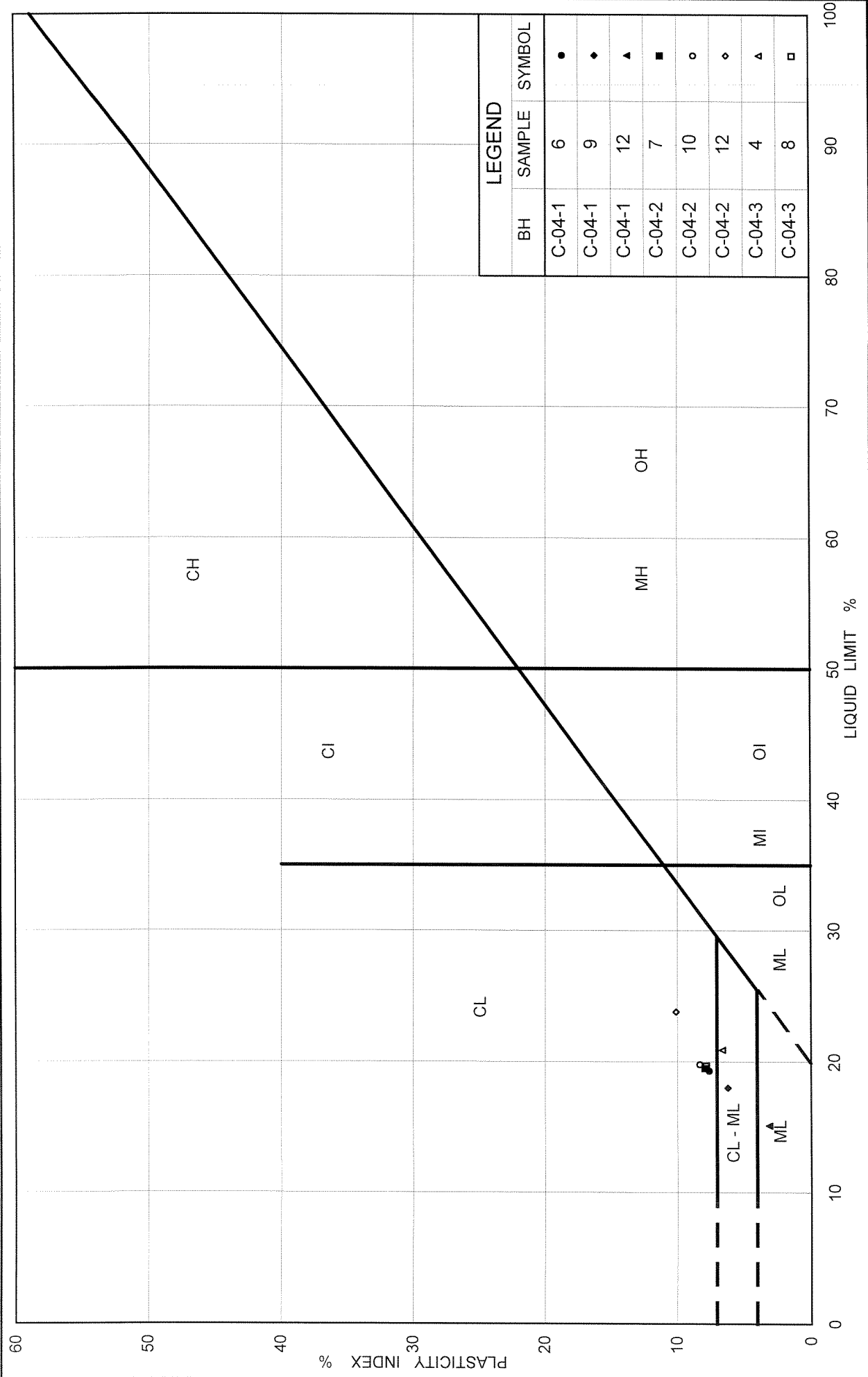
Silty Sand Till to Sandy Silt Till

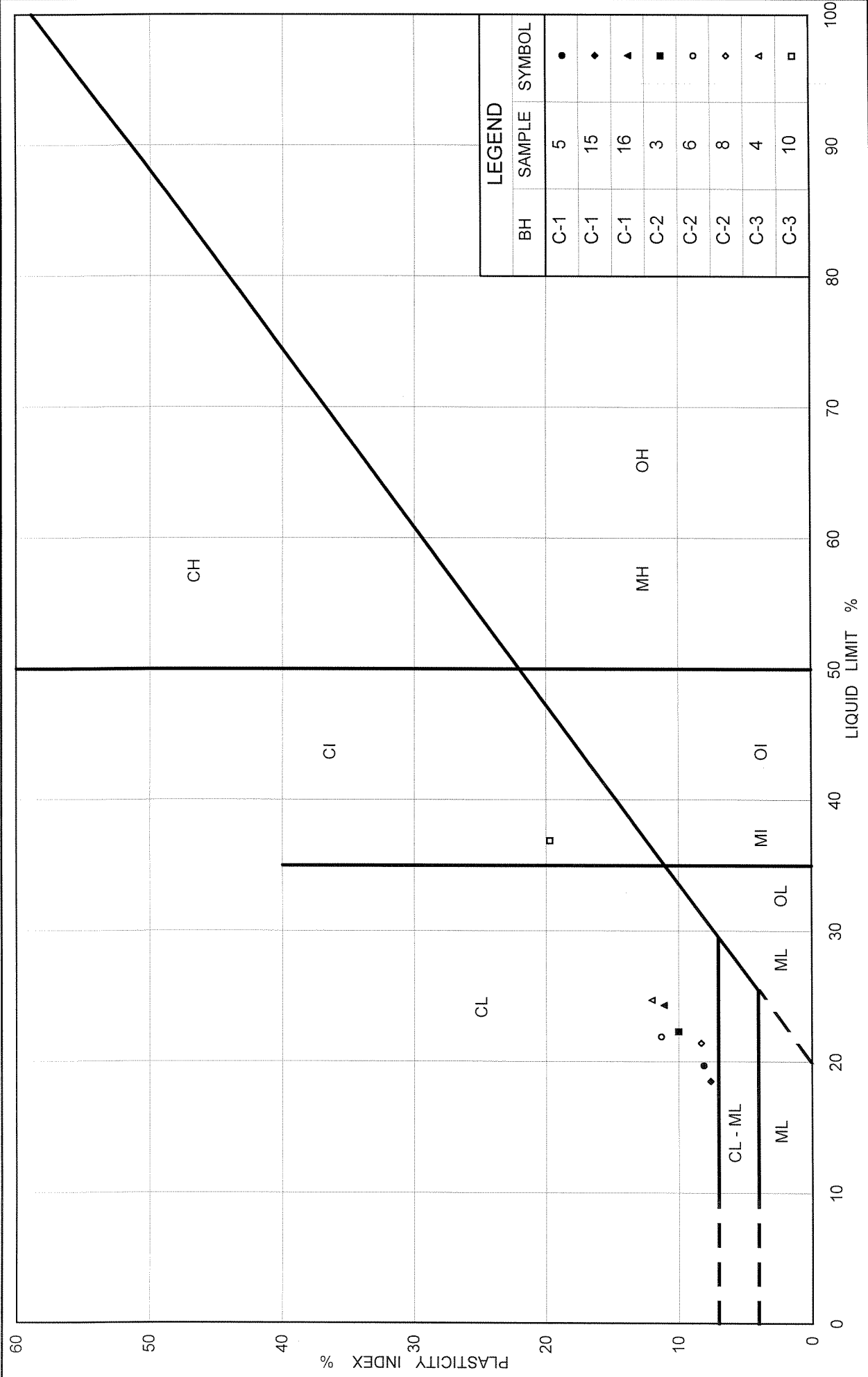
FIGURE 4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	C-04-2	15	234.0
■	C-04-3	13	236.9
◆	C-04-3	16	232.6
○	C-2	10	240.4
□	C-4	12	238.2
◇	C-4	13	236.8
●	C-4	17	230.7
■	C-4	18	227.7





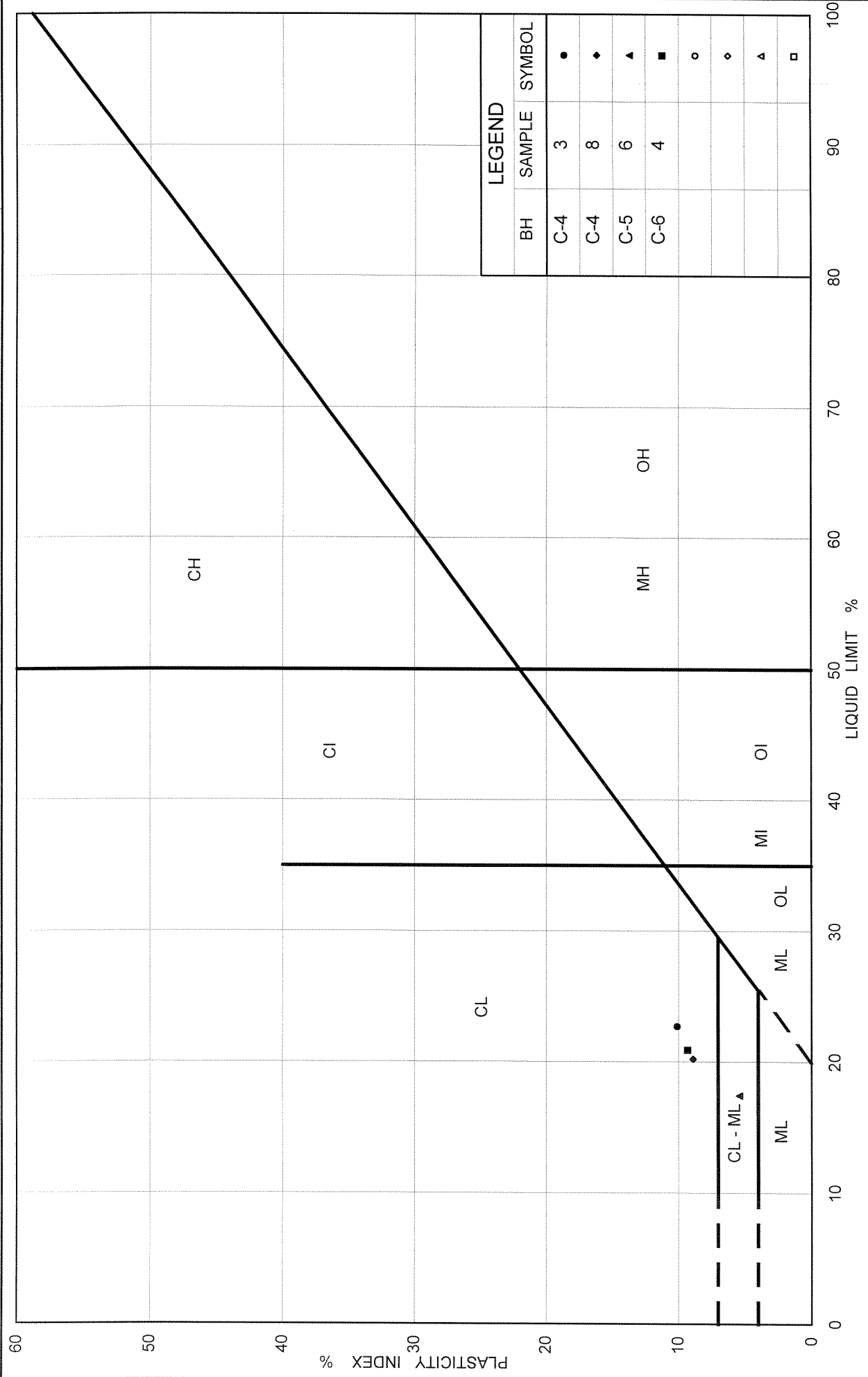


FIG No. 5C

Project No. 001-1159

PLASTICITY CHART

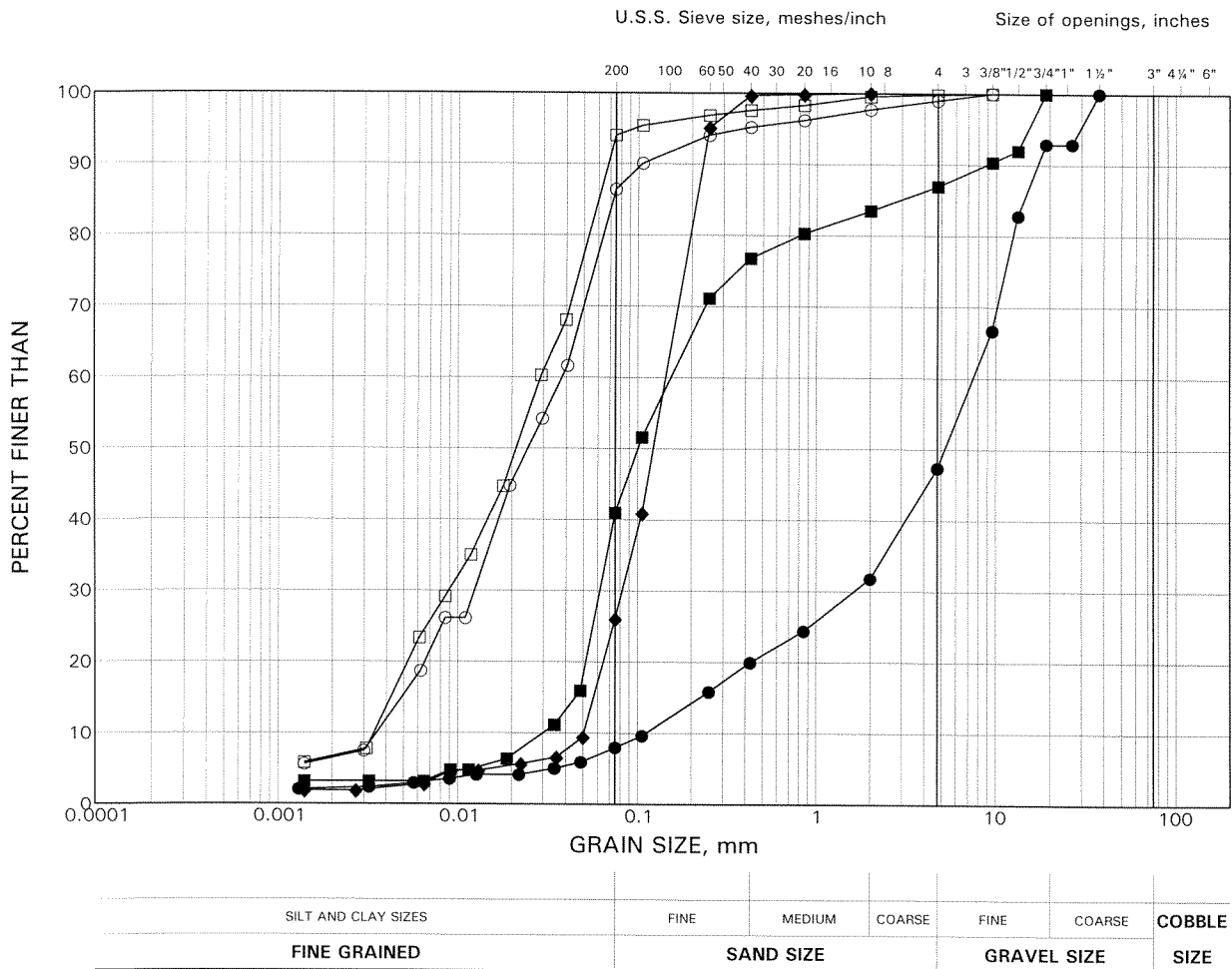
Clayey Silt Till to Sand and Silt Till



GRAIN SIZE DISTRIBUTION TEST RESULTS

Granular Interlayers

FIGURE 6



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)
●	C-04-1	21	223.5
■	C-1	20	221.8
◆	C-3	7	243.4
○	C-3	8	241.8
□	C-6	9	241.3

APPENDIX A

RECORD OF BOREHOLES

2003 SUBSURFACE INVESTIGATION

PROJECT <u>001-1159-2</u>			RECORD OF BOREHOLE No C-1			1 OF 4 METRIC									
W.P. <u>101-00-00</u>			LOCATION <u>N 4845349.9 ; E 281550.2</u>			ORIGINATED BY <u>SB</u>									
DIST <u> </u> HWY <u>410</u>			BOREHOLE TYPE <u>CME 55 Bombardier, Hollow Stem Augers, Casing and Tricone</u>			COMPILED BY <u>LCC</u>									
DATUM <u>Geodetic</u>			DATE <u>October 15 to 17, 2003</u>			CHECKED BY <u>LCC</u>									
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	<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;"> 20 40 60 80 100 20 40 60 80 100 </div>			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
249.5	Ground Surface														
249.3	Topsoil														
0.2	Silty Clay, trace sand and gravel, trace organics above 0.9 m depth Firm to very stiff Brown to grey-brown Moist		1	SS	5		249								
							248								2 3 53 42
			2	SS	12										
							247								
246.8	Clayey Silt, with sand, trace gravel (TILL) Very stiff to hard Grey Moist		3	SS	18										
2.7							246								
			4	SS	28										
							245								7 35 46 12
			5	SS	16										
							244								
			6	SS	24										
							243								
			7	SS	26										
							242								
			8	SS	28										
							241								
			9	SS	25		240								

Continued Next Page

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

PROJECT <u>001-1159-2</u>		RECORD OF BOREHOLE No C-1		2 OF 4 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845349.9 ; E 281550.2</u>		ORIGINATED BY <u>SB</u>	
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, Hollow Stem Augers, Casing and Tricone</u>		COMPILED BY <u>LCC</u>	
DATUM <u>Geodetic</u>		DATE <u>October 15 to 17, 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 (%)				
								<div><div></div><div>20406080100</div></div>					W _p	W	W _L		
	--- CONTINUED FROM PREVIOUS PAGE ---																
	Clayey Silt, with sand, trace gravel (TILL) Very stiff to hard Grey Moist						239										
			10	SS	34												
							238										
			11	SS	21		237										
							236										
234.7							235										
14.8	Silty Sand, trace gravel Dense Grey Moist																
			13	SS	33		234										
233.2							233										
16.3	Clayey Silt, trace sand and gravel (TILL) Very stiff to hard Grey Moist																
			14	SS	20		232										
			15	SS	35		231										
230.2							230										
19.4	Clayey Silt, some sand, trace gravel (TILL) Stiff to very stiff Grey Moist																

Continued Next Page

+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 <u>001-1159-2</u>		RECORD OF BOREHOLE No C-1				4 OF 4 METRIC								
W.P. <u>101-00-00</u>		LOCATION <u>N 4845349.9; E 281550.2</u>				ORIGINATED BY <u>SB</u>								
DIST <u> </u> HWY <u>410</u>		BOREHOLE TYPE <u>CME 55 Bombardier, Hollow Stem Augers, Casing and Tricone</u>				COMPILED BY <u>LCC</u>								
DATUM <u>Geodetic</u>		DATE <u>October 15 to 17, 2003</u>				CHECKED BY <u>LCC</u>								
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/m ³	GR SA SI CL
								20 40 60 80 100	20 40 60 80 100	W _p	W	W _L		
	--- CONTINUED FROM PREVIOUS PAGE ---													
218.0	Clayey Silt, trace sand and gravel (TILL) Hard Grey Moist		21	SS	87		219							
31.6	Shale (BEDROCK), containing limestone seams Slightly weathered to fresh Weak Thinly bedded Grey Bedrock cored between 32.0 m and 35.1 m depth. For bedrock coring details, refer to Record of Drillhole C-1.		22	SS	50/05		218							
							217							
							216							
							215							
214.5	End of Borehole													
35.1	Notes: 1. Borehole was advanced using hollow stem augers to 22.9 m depth. Due to binding of the augers, N-casing and a tricone bit were used to advance below this level 2. Water level in open borehole during drilling at about 6 m depth (Elev. 243.5 m). 3. Water level in piezometer at 6.0 m depth (Elev. 243.5 m) on November 24, 2003, and at 4.5 m depth (Elev. 245.0 m) on December 11, 2003.													

PROJECT: 001-1159-2

RECORD OF DRILLHOLE: C-1

SHEET 1 OF 1

LOCATION: N 4845349.9 ;E 281550.2

DRILLING DATE: October 17, 2003

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55 Bombardier, Hollow Stem Augers, Casing and Tricone

DRILLING CONTRACTOR: Geo-Environmental Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH	COLOUR % RETURN	FR/FX-FRACTURE F-FAULT				SM-SMOOTH				FL-FLEXURED				BC-BROKEN CORE				DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
									CL-CLEAVAGE				J-JOINT				R-ROUGH				UE-UNEVEN						MB-MECH. BREAK			
									SH-SHEAR				P-POLISHED				ST-STEPPED				W-WAVY						B-BEDDING			
									VN-VEIN				S-SLICKENSIDED				PL-PLANAR				C-CURVED									
		RECOVERY		R.Q.D. %		FRACT. INDEX PER 0.3		DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY																		
		TOTAL CORE %		SOLID CORE %				DIP w.r.t. CORE AXIS				TYPE AND SURFACE DESCRIPTION				K ₁₀ cm/sec														
		80 60 40 20		80 60 40 20		80 60 40 20		0 30 60 90								10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³														
32		Refer to Record of Borehole		217.50																										
	NQ Coring	Shale (BEDROCK) containing limestone seams		32.00																										
		Slightly to moderately weathered																												
		Very thinly to thinly bedded																												
		Very weak to weak																												
		Dark grey																												
		Limestone (BEDROCK) containing shale seams		216.77	1	100																								
		Fresh to slightly weathered		32.73																										
		Thinly bedded																												
	Medium strong to strong																													
	Grey																													
	Shale (BEDROCK) containing limestone seams		216.13																											
	Fresh to slightly weathered		33.37																											
	Very thinly to thinly bedded																													
	Very weak to weak																													
	Dark grey																													
35		End of Drillhole		214.45																										
				35.05																										
36																														
37																														
38																														
39																														
40																														
41																														
42																														

DEPTH SCALE

1 : 50



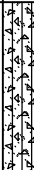
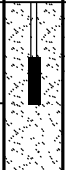
LOGGED: PKS

CHECKED:

MIS-RCK 001 001-1159-2-ROCK GPJ GLDR CAN.GDT 12/2/06 KG

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

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



PROJECT <u>001-1159-2</u>		RECORD OF BOREHOLE No C-2				2 OF 2 METRIC											
W.P. <u>101-00-00</u>		LOCATION <u>N 4845381.4 ; E 281569.8</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>LCC</u>											
DATUM <u>Geodetic</u>		DATE <u>October 28, 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 ---																
238.7	Sand and Silt, some gravel, trace clay (TILL) Dense Grey Moist		11	SS	48		239										
11.1	End of Borehole Notes: 1. Water level in piezometer at 4.4 m depth (Elev. 245.4 m) on Nov. 24, 2003, and at 3.2 m depth (Elev. 246.6 m) on December 11, 2003.																

PROJECT 001-1159-2			RECORD OF BOREHOLE No C-3			1 OF 2 METRIC		
W.P. 101-00-00			LOCATION N 4845373.6 ; E 281574.2			ORIGINATED BY SB		
DIST HWY 410			BOREHOLE TYPE CME 55 Bombardier, 108 mm ID Hollow Stem Augers			COMPILED BY LCC		
DATUM Geodetic			DATE October 20, 2003			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
249.7	Ground Surface							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%) 25 50 75
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		249	
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		248	
			3	SS	43		247	
			4	SS	54		246	
			5	SS	41		245	
			6	SS	25		244	
244.1								
5.6	Sand, some silt, trace clay Compact Moist to wet Grey		7	SS	25		243	
242.5								
7.2	Silt, some sand, trace gravel and clay Compact Grey Wet		8	SS	24		242	
241.0								
8.7	Silty Clay to Clayey Silt, some sand, trace gravel (TILL) Very stiff Grey Moist		9	SS	19		241	
							240	

Continued Next Page

+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									WATER CONTENT (%)
	--- CONTINUED FROM PREVIOUS PAGE ---						<div style="display: flex; justify-content: space-between;"> 20 40 60 80 100 20 40 60 80 100 </div> <div style="display: flex; justify-content: space-between;"> ○ UNCONFINED + FIELD VANE </div> <div style="display: flex; justify-content: space-between;"> ● QUICK TRIAXIAL × REMOULDED </div>					<div style="display: flex; justify-content: space-between;"> 25 50 75 </div>					
238.4	11.3	Silty Clay to Clayey Silt, some sand, trace gravel (TILL) Very stiff Grey Moist		10	SS	16	▼	239									
		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

Continued Next Page

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

PROJECT 001-1159-2			RECORD OF BOREHOLE No C-4			2 OF 3 METRIC										
W.P. 101-00-00			LOCATION N 4845402.4 ; E 281595.3			ORIGINATED BY PKS / GPD										
DIST HWY 410			BOREHOLE TYPE CME 55 Bombardier, Hollow Stem Augers, Casing and Tricone			COMPILED BY LCC										
DATUM Geodetic			DATE October 27 to November 10, 2003			CHECKED BY LCC										
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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								WATER CONTENT (%)
	--- CONTINUED FROM PREVIOUS PAGE ---						20	40	60	80	100					
240.4																
10.2	Silt and Sand to Silty Sand, trace to some gravel, trace clay, with zones of gravelly sand, some silt, trace clay (TILL) Dense to very dense Grey Moist		11	SS	38											
			12	SS	89											33 39 23 5
			13	SS	75/15											6 39 51 4
	Cobbles encountered below about 15 m depth		14	SS	102/15											
			15	SS	70/08											
			16	SS	88/15											
	Zone of very dense gravel and cobbles encountered at 18 m depth. N-casing was snapped during advance in this material, at about 19 m depth.															
			17	SS	82/15											12 43 40 5

Continued Next Page

+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

PROJECT 001-1159-2			RECORD OF BOREHOLE No C-5			1 OF 2 METRIC		
W.P. 101-00-00			LOCATION N 4845338.3 ; E 281540.7			ORIGINATED BY SB		
DIST _____ HWY 410			BOREHOLE TYPE CME 55 Bombardier, 108 mm ID Hollow Stem Augers			COMPILED BY LCC		
DATUM Geodetic			DATE October 15, 2003			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
249.6	Ground Surface							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%) 25 50 75
0.0	Topsoil							
249.1								
0.5	Silty Clay to Clayey Silt, trace sand Firm to very stiff Brown to grey-brown Moist		1	SS	6		249	
			2	SS	7		248	
			3	SS	20		247	
			4	SS	10		246	
245.9								
3.7	Clayey Silt, trace sand and gravel (TILL) Very stiff Grey Moist		5	SS	12		245	
			6	SS	25		244	
243.8								
5.8	Sand, some gravel, trace silt Dense Grey Wet		7	SS	34		243	
243.2								
6.4	Clayey Silt, trace to some sand, trace gravel (TILL) Very stiff to hard Grey Moist		8	SS	21		242	
							241	
			9	SS	21		240	
239.9								
9.8								

Continued Next Page

+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-5	2 OF 2	METRIC
W.P. <u>101-00-00</u>	LOCATION <u>N 4845338.3 ; E 281540.7</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 15, 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					W _p	W	W _L		
								<div><div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × REMOULDED</div></div><div>20406080100</div></div>					<div><div><div>255075</div><div>WATER CONTENT (%)</div></div></div>				
	<div>— CONTINUED FROM PREVIOUS PAGE —</div> <div>End of Borehole</div> <div>Note:</div> <div>1. Water encountered during drilling at about 6.0 m depth (Elev. 243.6 m).</div> <div>2. Water level in open borehole at 8.2 m depth (Elev. 241.4 m) on completion of drilling.</div>																

PROJECT 001-1159-2			RECORD OF BOREHOLE No C-6			1 OF 2 METRIC		
W.P. 101-00-00			LOCATION N 4845415.8 ; E 281603.9			ORIGINATED BY SB		
DIST HWY 410			BOREHOLE TYPE CME 55 Bombardier, 108 mm ID Hollow Stem Augers			COMPILED BY LCC		
DATUM Geodetic			DATE October 20, 2003			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
250.8	Ground Surface							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%) 25 50 75
0.0	Topsoil							
250.4								
0.4	Clayey Silt, trace sand and gravel Very stiff Moist Brown to grey-brown		1	SS	20		250	
			2	SS	18		249	
248.6								
2.2	Clayey Silt, trace to some sand, trace gravel (TILL) Very stiff to hard Grey Moist		3	SS	26		248	
			4	SS	53		247	
			5	SS	61		246	
			6	SS	42		245	
			7	SS	33		244	
			8	SS	48		243	
242.1							242	
8.7	Silt, trace clay and sand Dense Grey Wet		9	SS	31			
241.1								
9.8								

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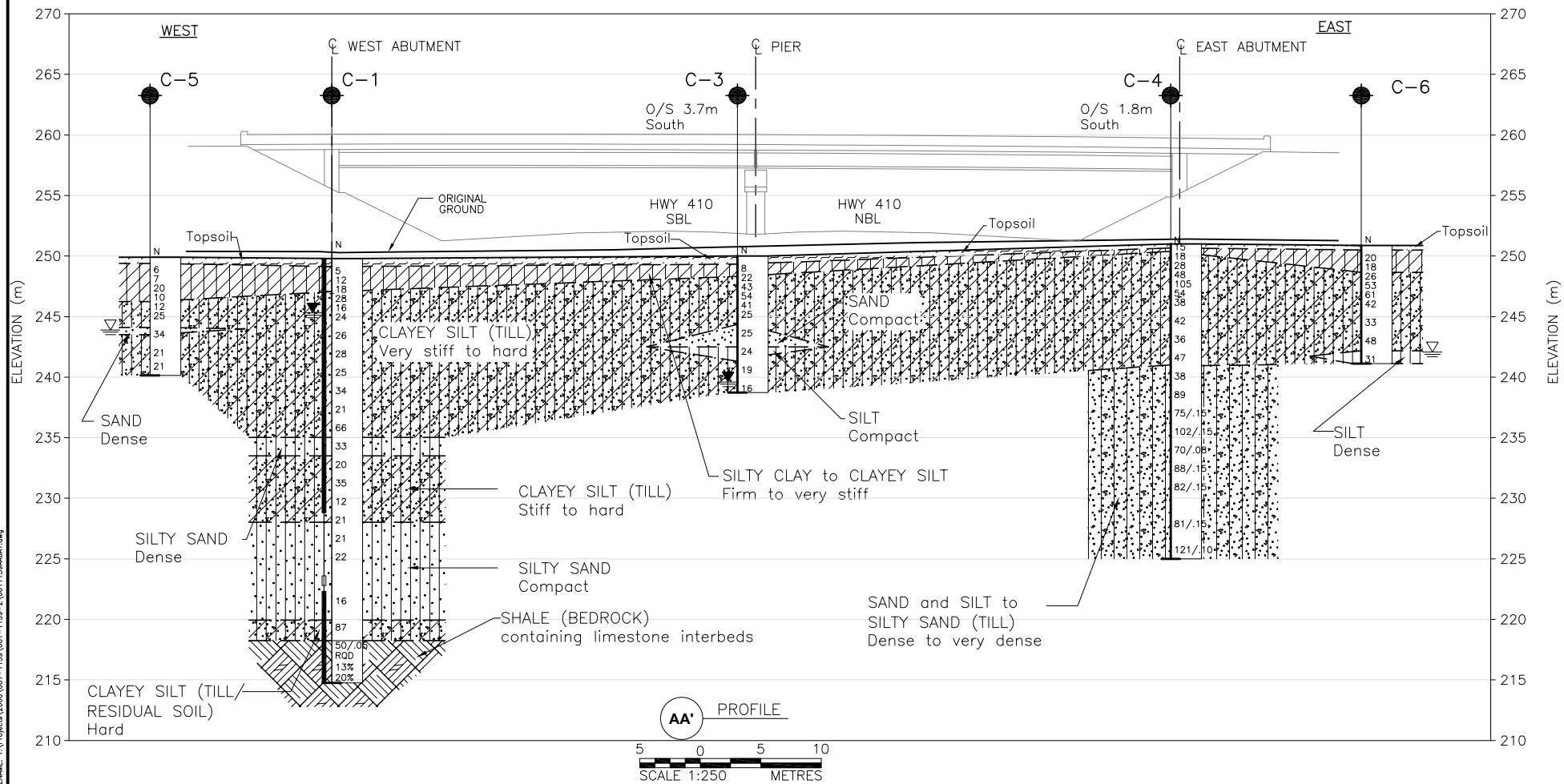
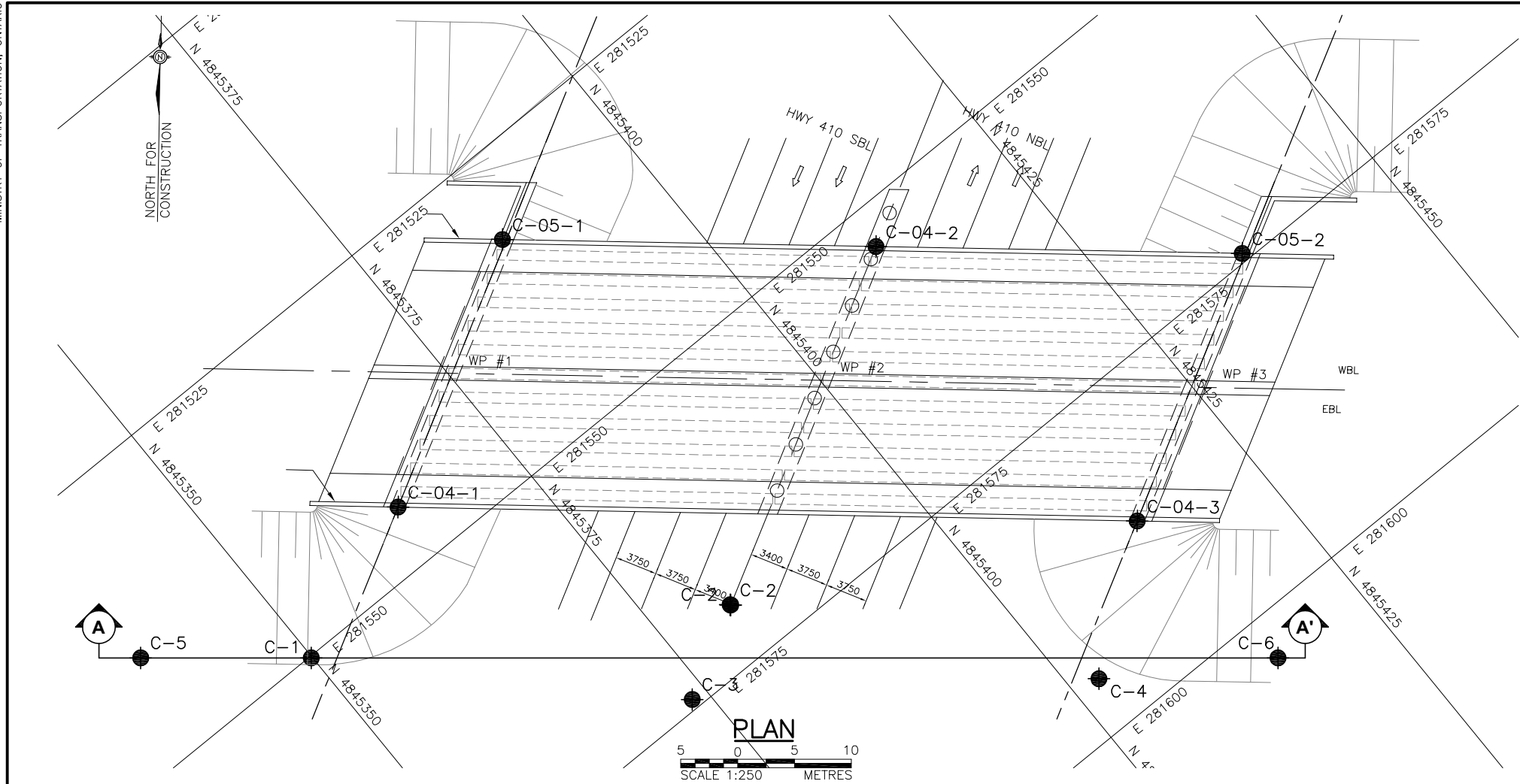
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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-6		2 OF 2 METRIC	
W.P. <u>101-00-00</u>		LOCATION <u>N 4845415.8 ; E 281603.9</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 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 ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)								
	--- CONTINUED FROM PREVIOUS PAGE ---								20	40	60	80	100		25	50	75		
	End of Borehole Note: 1. Water level in open borehole at 8.8 m depth (Elev. 242.0 m) on completion of drilling																		

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

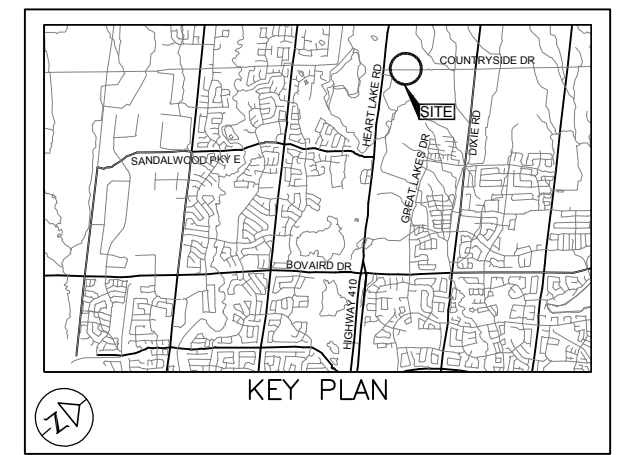


DIST.	HWY. 410	
CONT No.		
WP No.101-00-00		
COUNTRYSIDE DRIVE UNDERPASS		SHEET
BOREHOLE LOCATIONS & SOIL STRATA		

Golder Associates

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

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



LEGEND

- Borehole - Current Investigation
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- WL in piezometer, measured on November 24, 2003
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
C-1	249.5	4845349.9	281550.1
C-2	249.8	4845381.4	281569.8
C-3	249.7	4845373.6	281574.2
C-4	250.6	4845402.4	281595.3
C-5	249.6	4845338.3	281540.7
C-6	250.8	4845415.8	281603.9
C-04-1	249.7	4845364.2	281544.7
C-04-2	250.8	4845411.2	281553.5
C-04-3	251.0	4845413.8	281586.7
C-05-1	250.0	4845386.2	281532.2
C-05-2	251.7	4845435.8	281574.3

NOTES

- The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 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 are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REFERENCE

Base plans provided in digital format by URS Canada Inc. on October 21, 2004.

NO.	DATE	BY	REVISION
Geocres No.			
HWY. 410		PROJECT NO. 001-1159	DIST.
SUBM'D.	CHKD. LCC	DATE: NOV. 2004	SITE:
DRAWN: JFC	CHKD. LCC	APPD. LCC	DWG. A1