

Golder Associates Ltd.

2390 Argentia Road
Mississauga, Ontario, Canada L5N 5Z7
Telephone: (905) 567-4444
Fax: (905) 567-6561



**FOUNDATION INVESTIGATION
AND DESIGN REPORT
HIGH MAST LIGHT POLES
HIGHWAY 401 FROM AVENUE ROAD
TO BAYVIEW AVENUE
TORONTO, ONTARIO
G.W.P. 5-98-00**

Submitted to:

Morrison Hershfield
235 Yorkland Boulevard, Suite 600
Toronto, Ontario
M2J 1T1

GEOCREs No. 30M11-222

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TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
PART A - FOUNDATION INVESTIGATION REPORT	
1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	2
3.0 INVESTIGATION PROCEDURES	3
4.0 SITE GEOLOGY AND STRATIGRAPHY	4
4.1 Regional Geological Conditions	4
4.2 Site Stratigraphy	4
4.2.1 Asphalt / Fill	4
4.2.2 Clayey Silt to Silty Clay Till	5
4.2.3 Sand and Silt Till	5
4.2.4 Sand to Silt	6
4.3 Groundwater Conditions	6
5.0 CLOSURE	8
PART B - FOUNDATION DESIGN REPORT	
6.0 ENGINEERING RECOMMENDATIONS	9
6.1 General	9
6.2 Design of High Mast Light Pole Foundations	9
6.2.1 Lateral Geotechnical Resistance	9
6.2.2 Lateral Deflection for Structural Modelling	11
6.2.3 Axial Geotechnical Resistance for HML Pole Foundations in West Don River Valley	12
6.2.4 Geotechnical Uplift Resistance for HML Pole Foundations in West Don River Valley	12
6.3 Construction Considerations	13
6.3.1 Control of Soil and Groundwater	13
7.0 CLOSURE	14

In Order
Following
Page 14

Table 1
Lists of Abbreviations and Symbols
Records of Boreholes 07-10, 07-11, 07-14, 07-15 and 07-16
Drawing 1
Figures 1 to 8
Appendix A

LIST OF TABLES

Table 1	Design Parameters for High Mast Light Pole Foundations, Highway 401 from Avenue Road to Bayview Avenue, Toronto, Ontario, G.W.P. 5-98-00
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LIST OF DRAWINGS

Drawing 1	Highway 401 from Avenue Road to Bayview Avenue, High Mast Light Poles, Borehole Locations
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LIST OF FIGURES

Figure 1	Grain Size Distribution Test Results – Clayey Silt Fill
Figure 2	Plasticity Chart – Clayey Silt Fill
Figure 3	Grain Size Distribution Test Results – Clayey Silt to Silty Clay Till
Figure 4A/4B	Plasticity Chart – Clayey Silt to Silty Clay Till
Figure 5	Grain Size Distribution Test Results – Sand and Silt Till
Figure 6	Grain Size Distribution Test Results – Sand and Silt to Silt
Figure 7	Passive Earth Pressure Coefficients for Sloping Ground Conditions
Figure 8	Factored Geotechnical Uplift Resistance at Ultimate Limit States, Foundations for HML Poles 3 and 4 in West Don River Valley

LIST OF APPENDICES

Appendix A	Non-Standard Special Provisions
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PART A

**FOUNDATION INVESTIGATION REPORT
HIGH MAST LIGHT POLES
HIGHWAY 401 FROM AVENUE ROAD TO BAYVIEW AVENUE
TORONTO, ONTARIO
G.W.P. 5-98-00**

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Morrison Hershfield (MH) on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services associated with the rehabilitation/widening of Highway 401 eastbound and westbound core lanes between Avenue Road and Bayview Avenue, in the City of Toronto. Foundation engineering services are required for the widening of Hogg's Hollow bridge, replacement of the retaining walls associated with Hogg's Hollow bridge, new high mast light poles, new trichord overhead signs, and replacement of a noise barrier wall.

This report addresses the foundation investigation carried out for six proposed high mast light poles.

The terms of reference and scope of work for the foundation investigation are outlined in MTO's Request for Proposal for Agreement No. 2005-E-0035 dated January 2005, and in Section 6.8 of MH's *Technical Proposal* for G.W.P. 5-98-00.

2.0 SITE DESCRIPTION

The section of Highway 401 between Avenue Road and Bayview Avenue crosses the West Don River valley immediately to the west of Yonge Street. The ground surface elevation immediately adjacent to the West Don River banks is at about Elevation 134 m; the valley slopes rise approximately 33 m to 40 m, to about Elevation 167 m at the western crest of the valley, and about Elevation 174 m at the eastern crest of the valley. To the west and east of the West Don River valley, the “tableland” is relatively flat; at about Elevation 167 m to 171 m to the west of the river valley, and about Elevation 174 m to 178 m to the east of the river valley.

3.0 INVESTIGATION PROCEDURES

A subsurface investigation was carried out for the proposed high mast light poles in June 2007, at which time five boreholes (Boreholes 07-10, 07-11 and 07-14 to 07-16) were advanced using track- and truck-mounted drill rigs, supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The borehole locations are shown on Drawing 1.

The boreholes were advanced to depths ranging from 6.7 m to 15.7 m using solid stem augers. Soil samples were obtained at 0.75 m and 1.5 m intervals of depth, using 50 mm outside diameter split-spoon samplers driven by either a manual or an automatic hammer (as noted on each borehole record) in accordance with the Standard Penetration Test (SPT) procedure.

The water level in the open boreholes was observed throughout the drilling operations. Upon completion, the boreholes were backfilled to ground surface using bentonite pellets, in accordance with Ontario Regulation 903.

The field work was supervised on a full-time basis by a member of Golder's staff who located the boreholes in the field, obtained service clearances, 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 further examination and testing. Index and classification tests consisting of water contents, Atterberg limits and grain size distributions were carried out on selected soil samples.

The northings, eastings and elevations of the as-drilled borehole locations were measured in the field by a member of Golder's technical staff, relative to site features. The borehole locations (including MTM NAD83 northing and easting coordinates) and ground surface elevations (referenced to geodetic datum) are summarized below and are shown on Drawing 1.

<i>Borehole Number</i>	<i>MTM NAD83 Northing (m)</i>	<i>MTM NAD83 Easting (m)</i>	<i>Ground Surface Elevation (m)</i>
07-10	4,846,154.4	312,387.0	176.3
07-11	4,845,445.6	311,625.5	169.5
07-14	4,845,852.0	311,987.6	154.6
07-15	4,845,619.8	311,739.4	154.7
07-16	4,845,280.9	311,586.8	171.1

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geological Conditions

The Avenue Road to Bayview Avenue area of Highway 401 is located within the Peel Plain physiographic region, as delineated in *The Physiography of Southern Ontario*¹. A surficial till sheet, which generally follows the surface topography, is generally present throughout much of this area. The till is typically comprised of clayey silt to silty clay, with occasional sand to silt zones; it is mapped in this area as the Halton Till. Shallow, localized deposits of loose sand and silt and/or soft clay can overlie this uppermost till sheet, and these represent relatively recent deposits, formed in small glacial meltwater ponds scattered throughout the Peel Plain and concentrated near river valleys, such as the West Don River valley. The recent sand, silt and clay and uppermost till deposits in this area overlie and are interbedded with stratified deposits of sand, silt and clay.

4.2 Site Stratigraphy

Five boreholes (Boreholes 07-10, 07-11 and 07-14 to 07-16) were advanced at this site at the locations shown on Drawing 1. The detailed subsurface soil and groundwater conditions encountered in the boreholes and the results of in situ and laboratory testing are summarized on the Record of Borehole sheets and on Figures 1 to 6. 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. The subsoil conditions will vary between and beyond the borehole location.

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

4.2.1 Asphalt / Fill

Boreholes 07-10, 07-11 and 07-16 were drilled through the existing pavement structure, and encountered 90 mm to 290 mm of asphalt (overlying up to 175 mm of concrete at one location), in turn underlain by approximately 450 mm to 700 mm of sand and gravel fill.

In Boreholes 07-10 and 07-11, the sand and gravel road base fill was underlain by a 2.3 m to 3.8 m thick layer of clayey silt fill. The top of the clayey silt fill was encountered at Elevations 175.5 m and 168.7 m, and the base of the clayey silt fill was encountered at Elevations 171.7 m and 166.5 m, respectively, in these two boreholes. The clayey silt fill contains some sand and trace gravel; the result of a grain size distribution test carried out on one selected sample of the

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.

clayey silt fill is shown on Figure 1. An Atterberg limits test was conducted on one selected sample of the clayey silt fill and measured a plastic limit of 15 per cent, a liquid limit of 29 per cent, and a plasticity index of 14 per cent. This result, which is plotted on a plasticity chart on Figure 2, confirms that this fill material is a clayey silt of low plasticity. The measured Standard Penetration Test (SPT) “N” values within the clayey silt fill were between 10 and 36 blows per 0.3 m of penetration, indicating that the fill has a stiff to hard consistency.

Borehole 07-15, which was drilled on the west slope of the West Don River valley, encountered a 0.6 m thick layer of concrete rubble immediately below the ground surface.

4.2.2 Clayey Silt to Silty Clay Till

A glacial till deposit was encountered below the pavement structure and clayey silt fill in Boreholes 07-10 and 07-11, directly below the ground surface in Borehole 07-14, below the concrete rubble in Borehole 07-15, and below the road base (sand and gravel) fill in Borehole 07-16. The surface of this till deposit was encountered at Elevations 170.5 m and 166.5 m (at a depth of 0.6 m and 3.1 m below the Highway 401 pavement grade) in Boreholes 07-16 and 07-11 which were drilled west of the West Don River valley; at Elevation 171.7 m (at a depth of 4.6 m below the Highway 401 pavement grade) in Borehole 07-10 which was drilled east of the West Don River valley; and at Elevations 154.6 m and 154.1 m in Boreholes 07-14 and 07-15, which were drilled within the West Don River valley. This till deposit ranges in thickness from 1.5 m to 8.8 m in the boreholes in which it was fully penetrated.

This till deposit consists of clayey silt to silty clay with sand to some sand, and trace to some gravel. The results of grain size distribution tests completed on six selected samples of this cohesive till are shown on Figure 3. Atterberg limits testing was carried out on nine selected samples of the deposit, and measured plastic limits of 11 to 21 per cent, liquid limits of 16 to 39 per cent, and plasticity indices of 5 to 22 per cent. These results, which are plotted on plasticity charts on Figures 4A and 4B, confirm that the till deposit consists of clayey silt to silty clay of low to intermediate plasticity.

The measured SPT “N” values within the clayey silt to silty clay till range from 5 blows per 0.3 m of penetration to 75 blows per 0.15 m of penetration. The lower SPT “N” values of 5 to 15 blows per 0.3 m of penetration were measured in the upper portion of the clayey silt to silty clay till deposit encountered in Boreholes 07-10, 07-14 and 07-15, and this portion of the till at these locations has a firm to stiff consistency. Elsewhere, the SPT “N” values were greater than 16 blows per 0.3 m of penetration, indicative of a very stiff to hard consistency.

4.2.3 Sand and Silt Till

A 1.8 m to 3.1 m thick deposit of sand and silt till was encountered below the clayey silt to silty clay till deposit in Boreholes 07-14 and 07-15. The surface of the sand and silt till was

encountered at Elevation 145.8 m in Borehole 07-14, and at Elevation 145.6 m in Borehole 07-15.

The sand and silt till deposit contains trace gravel and clay; the results of grain size distribution tests completed on two selected samples of this deposit are shown on Figure 5.

The measured SPT “N” values in the sand and silt till range from 34 blow per 0.3 m of penetration to 95 blows per 0.25 m of penetration, indicating that this till has a dense to very dense relative density.

4.2.4 Sand to Silt

A cohesionless soil deposit was encountered below the clayey silt to silty clay till and (where present) sand and silt till, in all of the boreholes except Borehole 07-16. The surface of this lower deposit was encountered at Elevation 164.9 m (at a depth of 4.6 m below the pavement grade) in Borehole 07-11 west of the West Don River valley; at Elevation 167.2 m (at a depth of 9.1 m below the pavement grade) in Borehole 07-10 east of the West Don River valley; and at Elevations 144 m and 142.5 m (at a depth of 10.6 m and 12.2 m) in Boreholes 07-14 and 07-15, respectively, which were drilled within the West Don River valley. This soil deposit was not fully penetrated in any of the boreholes.

The lower cohesionless soil deposit varies in composition from sand containing trace silt, to sand and silt containing trace gravel, to sandy silt, to silt containing trace to some clay. The results of grain size distribution tests completed on four selected samples of this lower sand to silt deposit are shown on Figure 6. An Atterberg limits test was completed on Sample 10 from Borehole 07-14 (where the grain size distribution test measured 12 per cent clay-size particles), and determined this material to be non-plastic.

The measured SPT “N” values within the sand to silt deposit range from 19 blows per 0.3 m of penetration to 67 blows per 0.15 m of penetration, indicating that this deposit has a compact to very dense, but generally very dense, relative density.

4.3 Groundwater Conditions

The boreholes drilled for the high mast light poles were found to be dry upon completion of drilling, except Borehole 07-10 in which the water level in the open borehole was measured at a depth of 9.5 m (Elevation 166.8 m) on completion of drilling.

The groundwater level across the site is expected to follow the surface topography of the West Don River valley. Based on water level monitoring completed in previous boreholes advanced at the site, the groundwater level in the “tableland” to the west of the valley is typically at or below about Elevation 167 m (at a depth of approximately 3 m to 5 m below the ground surface), while

the groundwater level in the “tableland” to the east of the valley varies from about Elevation 164.5 m to 170.5 m (at a depth of about 1.5 m to 5 m below the ground surface), generally rising toward the east.

The groundwater level is expected to fluctuate seasonally and is expected to rise during periods of high precipitation.

5.0 CLOSURE

This Foundation Investigation Report was prepared by Mr. Matthew Kelly and reviewed by Ms. Lisa Coyne, P.Eng., an Associate and geotechnical engineer with Golder. Mr. Jorge Costa, P.Eng., a Principal and Designated MTO Contact for Golder, conducted an independent quality review of the report.

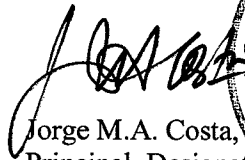
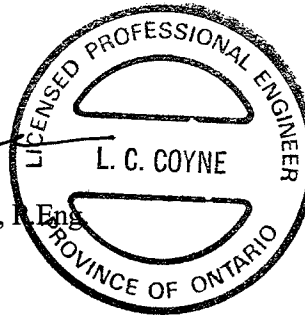
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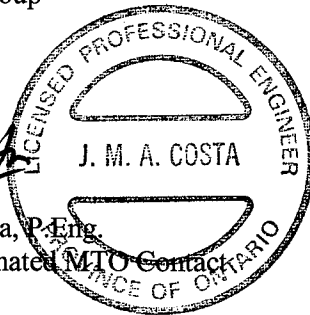
Matthew W. Kelly
Geotechnical Group



Lisa C. Coyne, P.Eng.
Associate



Jorge M.A. Costa, P.Eng.
Principal, Designated MTO Contact



MWK/LCC/JMAC/mwk/lcc

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PART B

**FOUNDATION DESIGN REPORT
HIGH MAST LIGHT POLES
HIGHWAY 401 FROM AVENUE ROAD TO BAYVIEW AVENUE
TORONTO, ONTARIO
G.W.P. 5-98-00**

6.0 ENGINEERING RECOMMENDATIONS

6.1 General

This section of the report provides recommendations for the geotechnical design of the proposed HML pole foundations along Highway 401 between Avenue Road and Bayview Avenue in Toronto, including two HML poles located within the West Don River valley. These recommendations are based on interpretation of the factual data obtained during the subsurface investigation. The interpretation and recommendations contained in this report are intended for use by the design engineer. Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project, and for which special provisions or operational constraints may be required in the contract documents. Those requiring information on aspects of construction should make their own interpretation of the factual information provided as it may affect equipment selection, construction method and scheduling.

6.2 Design of High Mast Light Pole Foundations

The HML pole foundations should be designed in accordance with MTO's *Procedures for the Design of High Mast Pole Foundations*, dated May 2004. For HML Poles 1, 2, 5 and 6, which will be located along the Highway 401 centre median, it is anticipated that single caisson foundations will be used. For HML Poles 3 and 4, which are located on the slopes of the West Don River valley, consideration could be given to the use of single caissons, caisson groups or groups of steel H-pile foundations. Where steel H-piles are adopted, lateral loading could be resisted fully or partially by the use of battered piles; where vertical caissons or piles are used, the resistance to lateral loading will have to be derived from the soil in front of the caissons or piles.

6.2.1 Lateral Geotechnical Resistance

The unfactored passive lateral earth pressure, P_p (kPa), distributed along the caisson or pile foundations for each HML pole may be calculated using the following equations, based on the stratigraphy and geotechnical design parameters given in Table 1 following the text of this report.

$$P_p = K_p \gamma d + 2 c_u / K_p \quad \text{above the groundwater table}$$

$$P_p = K_p \gamma d_w + K_p \gamma' (d - d_w) + 2 c_u / K_p \quad \text{below the groundwater table}$$

where

- K_p is the passive earth pressure coefficient, which must be adjusted where sloping ground is present adjacent to the HML foundation;
- γ is the bulk unit weight (kN/m³);
- γ' is the effective unit weight below the groundwater level (kN/m³);
- d is the depth below the ground surface (m);
- d_w is the depth to the groundwater level (m); and
- c_u is the undrained shear strength (kPa).

In the design of the foundations, the passive resistance within the upper 1.2 m below ground surface should be neglected to account for frost action. The unfactored lateral resistance should be calculated assuming an equivalent pile width equal to three times the caisson or pile diameter. A resistance factor of 0.5 should be applied to this calculated lateral resistance in order to obtain the factored lateral geotechnical resistance, in accordance with Section 6.6.2.1 of the *CHBDC*.

As noted above, where sloping ground is present adjacent to the HML pole (as is the case for HML Poles 3 and 4 to be installed in the West Don River valley), the passive earth pressure coefficient must be adjusted. Table 1, following the text of this report, presents K_p values for HML Poles 3 and 4 based on 2 horizontal to 1 vertical (2H:1V) and 2.5 horizontal to 1 vertical (2.5H:1V) valley slope configurations adjacent to these HML pole foundations. If, depending on the natural valley slope and proposed grading around these poles, K_p values are required for alternate slope configurations, reference should be made to the chart included on Figure 7 (NAVFAC, 1982²), using the values for internal friction angle (ϕ') provided in Table 1. The adjusted K_p value is to be applied to that portion of the caisson that is above the elevation of the ground surface at the embankment toe; below this elevation, the full K_p value is applied.

Where an undrained shear strength, c_u , is provided, the undrained capacity of the caisson or pile should be checked to determine whether the drained or undrained case will govern. In this case, the lateral resistance for the length of the caisson within cohesive soil should be calculated assuming an internal angle of friction, $\phi' = 0$ degrees and an unfactored passive lateral pressure distribution equivalent to nine times the undrained shear strength acting over the actual width of the caisson or pile. A resistance factor of 0.5 should be applied to this calculated lateral resistance in order to obtain the factored lateral geotechnical resistance, as noted above.

If pile groups are adopted for support of HML Poles 3 and 4, group action for lateral loading should be considered if the pile spacing in the direction of the loading is less than six to eight pile diameters. Group action can be evaluated by reducing the coefficient of horizontal subgrade reaction in the direction of loading by a reduction factor, R , as follows:

<i>Pile Spacing in direction of Loading (d = Pile Diameter)</i>	<i>Subgrade Reaction Reduction Factor</i>
8d	1.00
6d	0.70
4d	0.40
3d	0.25

Reference: Foundations and Earth Structures – Design Manual 7.2, NAVFAC DM-7.2. Department of the Navy, Naval Facilities Engineering Command (NAVFAC, 1982²).

The subgrade reaction reduction factor should be interpolated for pile spacings in between those provided in the above table.

² Department of the Navy, Naval Facilities Engineering Command (NAVFAC). 1982. *Foundations and Earth Structures, Design Manual 7.2*.

6.2.2 Lateral Deflection for Structural Modelling

For the HML poles, the resistance to lateral loading developed by the soils in front of the caissons or piles may also be modelled using subgrade reaction theory, where the coefficient of horizontal subgrade reaction is determined based on the equations given below³.

For cohesionless soils:

$$k_h = \frac{n_h z}{B} \quad \text{where}$$

k_h is the coefficient of horizontal subgrade reaction (MPa/m);
 n_h is the constant of subgrade reaction (MPa/m);
 z is the depth (m); and
 B is the caisson or pile diameter (m).

For cohesive soils:

$$k_h = \frac{67s_u}{B} \quad \text{where}$$

k_h is the coefficient of horizontal subgrade reaction (kPa/m);
 s_u is the undrained shear strength of the soil (kPa); and
 B is the caisson or pile diameter (m).

The following ranges for the value of n_h and s_u may be assumed in structural modelling for HML pole foundations:

<i>Soil Unit</i>	<i>Elevation</i>	<i>n_h</i>	<i>s_u</i>
<u>HML Pole 1 (Borehole 07-16)</u>			
Fill /Very stiff clayey silt till	171.1 – 169.0	-	150 kPa
Hard clayey silt till	Below 169.0	-	300 kPa
<u>HML Pole 2 (Borehole 07-11)</u>			
Stiff fill	169.5 – 166.5	-	75 kPa
Hard clayey silt till	166.5 – 164.9	-	250 kPa
Compact sand and silt	Below 164.9	10 MPa/m	-
<u>HML Pole 3 (Borehole 07-15)</u>			
Firm to very stiff clayey silt till	154.7 – 151.7	-	100 kPa
Very stiff to hard clayey silt till	151.7 – 149.0	-	200 kPa
Hard clayey silt till	149.0 – 145.6	-	300 kPa
Very dense sand and silt till / sandy silt	Below 145.6	20 MPa/m	-
<u>HML Pole 4 (Borehole 07-14)</u>			
Firm to stiff clayey silt till	154.6 – 150.0	-	75 kPa
Very stiff clayey silt till	150.0 – 145.8	-	125 kPa
Dense sand and silt till	145.8 – 144.0	15 MPa/m	-
Very dense silt	Below 144.0	20 MPa/m	-
<u>HML Poles 5 and 6 (Borehole 07-10)</u>			
Stiff to hard fill / clayey silt till	176.3 – 170.5	-	125 kPa
Hard clayey silt till	170.5 – 167.2	-	300 kPa
Very dense sand	Below 167.2	20 MPa/m	-

NOTE: Although the lateral resistance in the upper 1.2 m is to be neglected to account for frost action, n_h and s_u values are given in the event that the ground surface elevation varies significantly between the borehole location and the actual high mast light pole location.

³ Canadian Foundation Engineering Manual, 1992, 3rd Edition, in accordance with Section 6.8.7.3 of the CHBDC.

6.2.3 Axial Geotechnical Resistance for HML Pole Foundations in West Don River Valley

Steel H-Pile Foundations

The factored axial geotechnical resistances at Ultimate Limit States (ULS) and geotechnical resistances at Serviceability Limit States (SLS) for steel H-pile foundations for support of HML Poles 3 and 4 within the West Don River valley are provided below. These values are based on maximum (highest) pile tip levels of Elevation 144.5 m at HML Pole 3, and Elevation 143.5 m at HML Pole 4.

<i>Pile Type</i>	<i>Factored Geotechnical Resistance at ULS</i>	<i>Geotechnical Resistance at SLS</i>
HP 310x110	650 kN	500 kN
HP 360x110	750 kN	575 kN

Caisson Foundations

The factored axial geotechnical resistances at ULS and geotechnical resistances at SLS for caisson foundations for support of HML Poles 3 and 4 within the West Don River valley are provided below. These values are based on maximum (highest) caisson base levels of Elevation 144.5 m at HML Pole 3, and Elevation 143.5 m at HML Pole 4.

<i>Caisson Diameter</i>	<i>Factored Geotechnical Resistance at ULS</i>	<i>Geotechnical Resistance at SLS</i>
0.76 m	1,650 kN (Approx. 3,600 kPa)	1,100 kN (Approx. 2,400 kPa)
0.9 m	2,300 kN (Approx 3,600 kPa)	1,600 kN (Approx. 2,500 kPa)
1.2 m	3,800 kN (Approx 3,350 kPa)	2,550 kN (Approx. 2,250 kPa)

The axial (compressive) loading for HML Poles 3 and 4 will be relatively small and it is anticipated that the foundation design will be governed by lateral loading and uplift resistance; however, if higher geotechnical resistances are required, deeper pile tip/caisson base elevations can be provided.

6.2.4 Geotechnical Uplift Resistance for HML Pole Foundations in West Don River Valley

The pile or caisson foundations that support HML Poles 3 and 4 in the West Don River valley will have to resist larger than normal uplift forces. The factored geotechnical uplift resistances at ULS for these HML poles, for various pile types, caisson diameters and founding elevations, are plotted on Figure 8; the factored geotechnical uplift resistances for caissons have been assessed

assuming that permanent steel liners are used. The recommended design values have been assessed based on the methods outlined in NAVFACs Design Manual 7.2.

6.3 Construction Considerations

6.3.1 Control of Soil and Groundwater


Deposits, lenses and interlayers of potentially water-bearing cohesionless soils are present within or below the predominantly clayey silt till soils at the site. These soils should be expected to run or flow into the caisson hole during or after drilling for the caisson foundations. Therefore, temporary or permanent caisson liners are recommended to minimize ground loss during drilling and concrete placement.

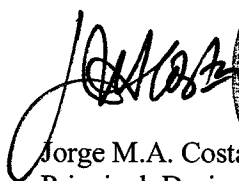
It is recommended that a Non-Standard Special Provision (NSSP) be included in the Contract Documents to warn the Contractor of this condition, which will affect the installation of the HML pole foundations at this site. A sample NSSP to address this condition is included in Appendix A.

7.0 CLOSURE

This Foundation Design Report was prepared by Mr. Matthew Kelly and reviewed by Ms. Lisa Coyne, P.Eng., an Associate and geotechnical engineer with Golder, with technical input from Mr. Murty Devata, P.Eng., a specialist foundations consultant to Golder. Mr. Jorge Costa, P.Eng., a Principal and Designated MTO Contact for Golder, conducted an independent review of the report.

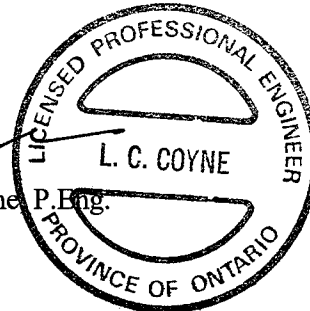
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Matthew W. Kelly
Geotechnical Group


Jorge M.A. Costa, P.Eng.
Principal, Designated MTO Contact




Lisa C. Coyne P.Eng.
Associate



MWK/LCC/MSD/JMAC/mwk/lcc

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TABLE 1
DESIGN PARAMETERS FOR HIGH MAST LIGHT POLE FOUNDATIONS
HIGHWAY 401 FROM AVENUE ROAD TO BAYVIEW AVENUE, TORONTO, ONTARIO
G.W.P. 5-98-00

HML Pole No(s).	Borehole No.	Borehole Location	Stratum	Depth ³ (m)	Elevation ³ (m)	Groundwater Elevation (m)	Design Parameters ^{1,2}						
							c_u	ϕ'	γ	γ'	K_p Level Ground	K_p 2H:1V	K_p 2.5H:1V
1	07-16	N 4,845,280.9 E 311,586.8	Fill /Very stiff clayey silt till	0.0 – 2.1	171.1 – 169.0	166.0	-	30	20	10	3.0	-	-
			Hard clayey silt till	Below 2.1	Below 169.0		-	35	21	11	3.7		
2	07-11	N 4,845,445.6 E 311,625.5	Stiff fill	0.0 – 3.1	169.5 – 166.5	166.0	75	28	20	10	2.8	-	-
			Hard clayey silt till	3.1 – 4.6	166.5 – 164.9		-	35	21	11	3.7		
			Compact sand and silt	Below 4.6	Below 164.9		-	32	20	10	3.3		
3	07-15	N 4,845,619.8 E 311,739.4	Firm to very stiff clayey silt till	0.0 – 3.0	154.7 – 151.7	149.0	100	28	20	10	2.8	1.0	1.3
			Very stiff to hard clayey silt till	3.0 – 5.7	151.7 – 149.0		-	32	21	11	3.3	1.2	1.6
			Hard clayey silt till / Very dense sand and silt till	5.7 – 12.2	149.0 – 142.5		-	35	21	11	3.7	1.4	1.8
			Very dense sandy silt	Below 12.2	Below 142.5		-	32	21	11	3.3	1.2	1.6
			Firm to stiff clayey silt till	0.0 – 4.6	154.6 – 150.0		75	28	20	10	2.8	1.0	1.3
4	07-14	N 4,845,852.0 E 311,987.6	Very stiff clayey silt till	4.6 – 8.8	150.0 – 145.8	149.0	-	30	20	10	3.0	1.1	1.5
			Dense sand and silt till	8.8 – 10.6	145.8 – 144.0		-	32	21	11	3.3	1.2	1.6
			Very dense silt	Below 10.6	Below 144.0		-	35	21	11	3.7	1.4	1.8
			Stiff to hard fill / clayey silt till	0.0 – 5.8	176.3 – 170.5	170.5	-	30	20	10	3.0	-	-
5, 6	07-10	N 4,846,154.4 E 312,387.0	Hard clayey silt till	5.8 – 9.1	170.5 – 167.2		-	32	21	11	3.3		
			Very dense sand	Below 9.1	Below 167.2		-	35	20	10	3.7		

NOTES:

- Design parameters: c_u = undrained shear strength (kPa); ϕ' = effective friction angle (degrees)
 γ = bulk unit weight (kN/m³) γ' = effective unit weight below the groundwater level (kN/m³)
 K_p = passive earth pressure coefficient
- Passive earth pressure coefficient (K_p) values have been provided for level ground (for HML Poles 1, 2, 5 and 6), and for sloping ground in the West Don River valley (for HML Poles 3 and 4). Refer to Figure 7 if K_p values are required for valley slope configurations other than 2H:1V and 2.5H:1V.
- Although the passive resistance in the upper 1.2 m is neglected to account for frost action, ϕ' and K_p parameters are given in the event that the ground surface elevation varies significantly between the borehole location and the actual high mast light pole location.

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

	<u>kPa</u>	<u>psf</u>
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

(b) Cohesive Soils

c_u, s_u

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
*	Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

(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

PROJECT		06-1111-060		RECORD OF BOREHOLE No 07-10		1 OF 1 METRIC							
W.P.		5-98-00		LOCATION		N 4846154.4 ; E 312387.0							
DIST		Central HWY 401		BOREHOLE TYPE		Truck-Mount D-25, 108 mm Diameter Solid Stem Augers, Manual Hammer							
DATUM		Geodetic		DATE		June 7, 2007							
				ORIGINATED BY		GPD							
				COMPILED BY		MK							
				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	20 40 60 80 100					
176.3	GROUND SURFACE												
0.0	Asphalt												
0.3	Sand and gravel, trace silt (FILL) Brown												
175.5													
0.8	Clayey silt with sand to some sand, trace gravel, containing organic clayey silt seams in Sample 1 (FILL) Stiff to hard Brown Moist		1	SS	36								
			2	SS	24								
			3	SS	12								
			4	SS	17								
171.7													
4.6	CLAYEY SILT with sand to some sand, trace gravel (TILL) Stiff to hard Brown/grey to brown Moist to wet		5	SS	10								
			6	SS	40								
168.7													
7.6	SILTY CLAY, trace sand and gravel (TILL) Hard Brown Moist		7	SS	74								
167.2													
166.8	SAND, trace silt Very dense Brown Wet		8	SS	57/0.15								
9.5	END OF BOREHOLE												
NOTES: 1. Water level measured in open borehole at a depth of 9.5m (Elevation 166.8m) upon completion of drilling.													

PROJECT <u>06-1111-060</u>		RECORD OF BOREHOLE No 07-11		1 OF 1 METRIC	
W.P. <u>5-98-00</u>		LOCATION <u>N 4845445.6 ; E 311625.5</u>		ORIGINATED BY <u>GPD</u>	
DIST <u>Central</u> HWY <u>401</u>		BOREHOLE TYPE <u>Truck-Mount D-25, 108 mm Diameter Solid Stem Augers, Manual Hammer</u>		COMPILED BY <u>MK</u>	
DATUM <u>Geodetic</u>		DATE <u>June 7, 2007</u>		CHECKED BY <u>LCC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT 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 (%)				
169.5	GROUND SURFACE						20	40	60	80	100	W _p	W	W _L			
0.0	Asphalt																
168.7	Sand and gravel, trace silt (FILL) Brown Moist																
0.8	Clayey silt, some sand, trace gravel (FILL) Stiff Brown Moist		1	SS	10												
			2	SS	11												
			3	SS	15												
166.5																	
3.1	CLAYEY SILT, some sand, trace gravel (TILL) Hard Brown Moist		4	SS	36												
164.9																	
4.6	SAND and SILT, trace gravel and clay Compact Brown Moist		5	SS	19												
			6	SS	27												
162.8																	
6.7	END OF BOREHOLE																
	NOTES: 1. Open borehole dry upon completion of drilling.																

MIS-MTO 001 061111060.GPJ GAL-MISS.GDT 4/2/08 DD/RJ

1 OF 2 METRIC

ORIGINATED BY SB

COMPILED BY MWK

CHECKED BY LCC

Continued Next Page

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

MIS-MTO 001 061111060.GPJ GAL-MISS.GDT 4/2/08 DD/RJ



PROJECT		RECORD OF BOREHOLE		2 OF 2		METRIC	
W.P.		LOCATION		ORIGINATED BY			
DIST		BOREHOLE TYPE		COMPILED BY			
DATUM		DATE		CHECKED BY			
06-1111-060		N 4845852.0 ; E 311987.6		SB			
5-98-00		Track-Mount CME-55, 108 mm Diameter Solid Stem Augers, Automatic Hammer		MWK			
Central HWY 401		June 19, 2007		LCC			
Geodetic							
Soil Profile		Samples		Dynamic Cone Penetration Resistance Plot		Remarks & Grain Size Distribution (%)	
ELEV DEPTH		STRAT PLOT		ELEVATION SCALE		UNIT WEIGHT	
DESCRIPTION		NUMBER		GROUND WATER CONDITIONS		REMARKS	
--- CONTINUED FROM PREVIOUS PAGE ---		TYPE		ELEVATION		GRAIN SIZE DISTRIBUTION (%)	
		"N" VALUES		20 40 60 80 100		GR SA SI CL	
		13 SS 67/0.15		139			
139.2							
15.4							
END OF BOREHOLE							
NOTES:							
1. Open borehole dry upon completion of drilling.							
* High SPT "N" value is considered to be due to the split spoon sampler bouncing on cobbles.							

PROJECT <u>06-1111-060</u>		RECORD OF BOREHOLE No 07-15		1 OF 2 METRIC	
W.P. <u>5-98-00</u>		LOCATION <u>N 4845619.8 ; E 311739.4</u>		ORIGINATED BY <u>SB</u>	
DIST <u>Central</u> HWY <u>401</u>		BOREHOLE TYPE <u>Track-Mount D-50, 108 mm Diameter Solid Stem Augers, Automatic Hammer</u>		COMPILED BY <u>MK</u>	
DATUM <u>Geodetic</u>		DATE <u>June 27, 2007</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		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	WATER CONTENT (%)					
154.7	GROUND SURFACE													
0.0	Concrete rubble (FILL)													
154.1														
0.6	CLAYEY SILT with sand to trace sand, trace to some gravel (TILL) Firm to hard Brown Moist		1	SS	14		154							
			2	SS	7		153			18	35	33	14	
			3	SS	18		152							
			4	SS	39		151							
			5	SS	29		150							
			6	SS	25		149							
			7	SS	71		148							
			8	SS	64		147							
							146							
145.6			9	SS	95/0.25		145							
9.1	SAND and SILT, trace clay (TILL) Very dense Brown Moist		10	SS	93		144							
							143							
142.5			11	SS	67		142							
12.2	Sandy SILT Very dense Brown Moist		12	SS	70		141							
							140							

Continued Next Page

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

MIS-MTO 001 061111060.GPJ GAL-MISS.GDT 4/2/08 DD/RJ

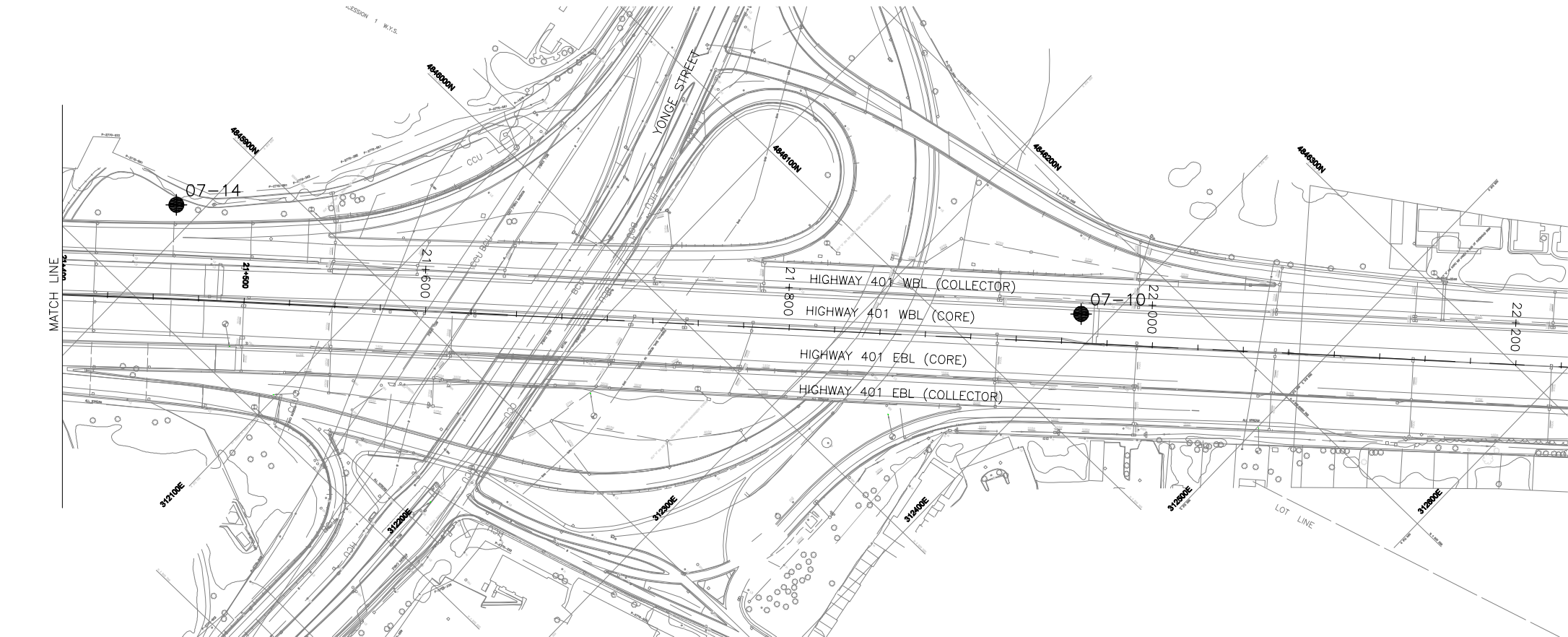
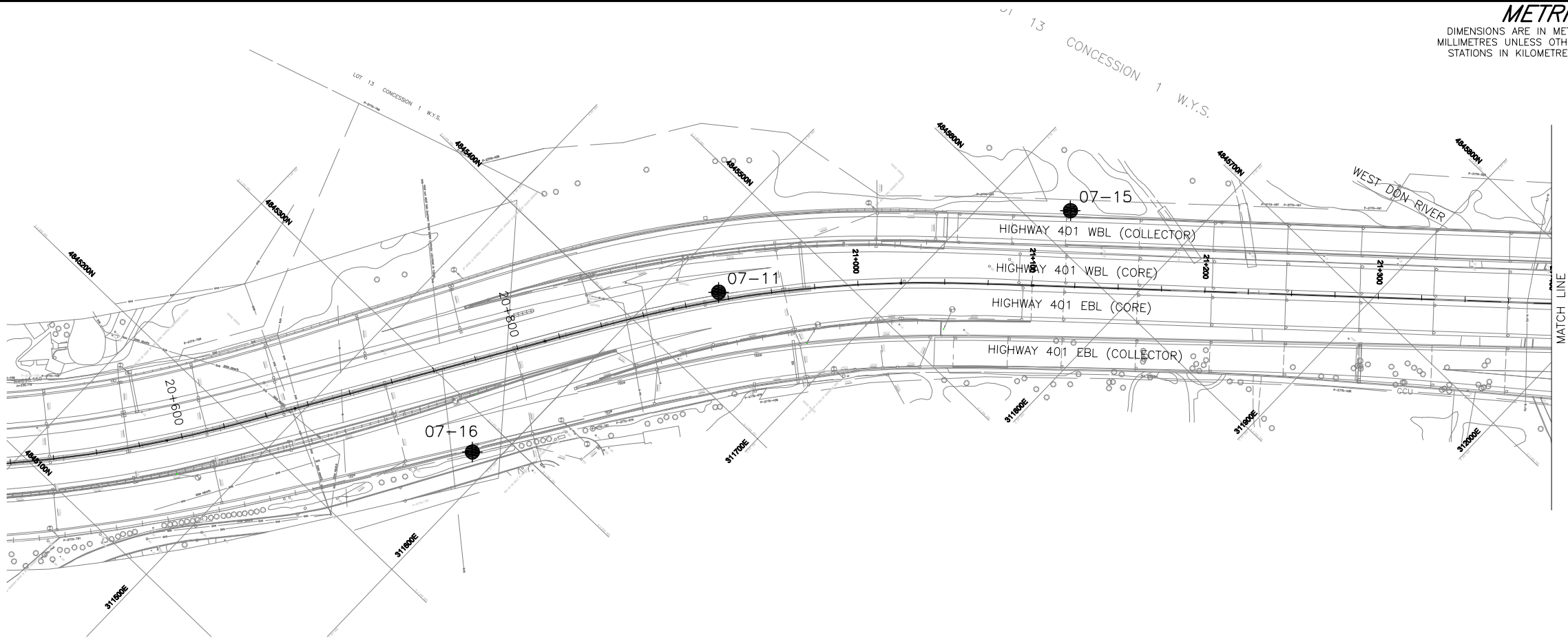


PROJECT		RECORD OF BOREHOLE				No 07-15		2 OF 2		METRIC						
W.P.		LOCATION				ORIGINATED BY		SB								
DIST		BOREHOLE TYPE				COMPILED BY		MK								
DATUM		DATE				CHECKED BY		LCC								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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								
139.0			13	SS	69											
15.7	END OF BOREHOLE															
	NOTES: 1. Open borehole dry upon completion of drilling.															

MIS-MTO 001 061111060.GPJ GAL-MISS.GDT 4/2/08 DD/RJ

PROJECT		06-1111-060		RECORD OF BOREHOLE No 07-16		1 OF 1		METRIC	
W.P.		5-98-00		LOCATION		N 4845280.9 ; E 311586.8		ORIGINATED BY	
DIST		Central HWY 401		BOREHOLE TYPE		Track-Mount CME-55, 108 mm Diameter Solid Stem Augers, Automatic Hammer		COMPILED BY	
DATUM		Geodetic		DATE		June 18, 2007		CHECKED BY	
LCC									
SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS		DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	20 40 60 80 100	W _p W W _L	UNIT WEIGHT
171.1	GROUND SURFACE								
0.0	Asphalt					171			
0.2	Concrete								
170.5	Sand, some gravel (FILL)								
0.6	Compact Brown Moist								
	CLAYEY SILT with sand, trace gravel, containing cobbles (TILL)		1	SS	19	170			
	Very stiff to hard								
	Brown, becoming grey at 5.0 m depth		2	SS	25	169			
	Moist								
			3	SS	41	168			
			4	SS	50	167			
			5	SS	50	166			
			6	SS	65	165			
			7	SS	60/0.15	164			
						163			
			8	SS	73/0.25	162			
			9	SS	75/0.16				
161.8	END OF BOREHOLE								
9.3									
NOTES:									
1. Open borehole dry upon completion of drilling.									

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



PLAN
SCALE
30 0 30 60 m

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

CONT No.
WP No. 5-98-00



HIGHWAY 401
AVENUE ROAD TO BAYVIEW AVENUE
High Mast Light Poles
BOREHOLE LOCATIONS


SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

 Borehole - Current Investigation

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
07-10	176.3	4846154.4	312387.0
07-11	169.5	4845445.6	311625.5
07-14	154.6	4845852.0	311987.6
07-15	154.7	4845619.8	311739.4
07-16	171.1	4845290.9	311586.8

NOTES

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

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

REFERENCE

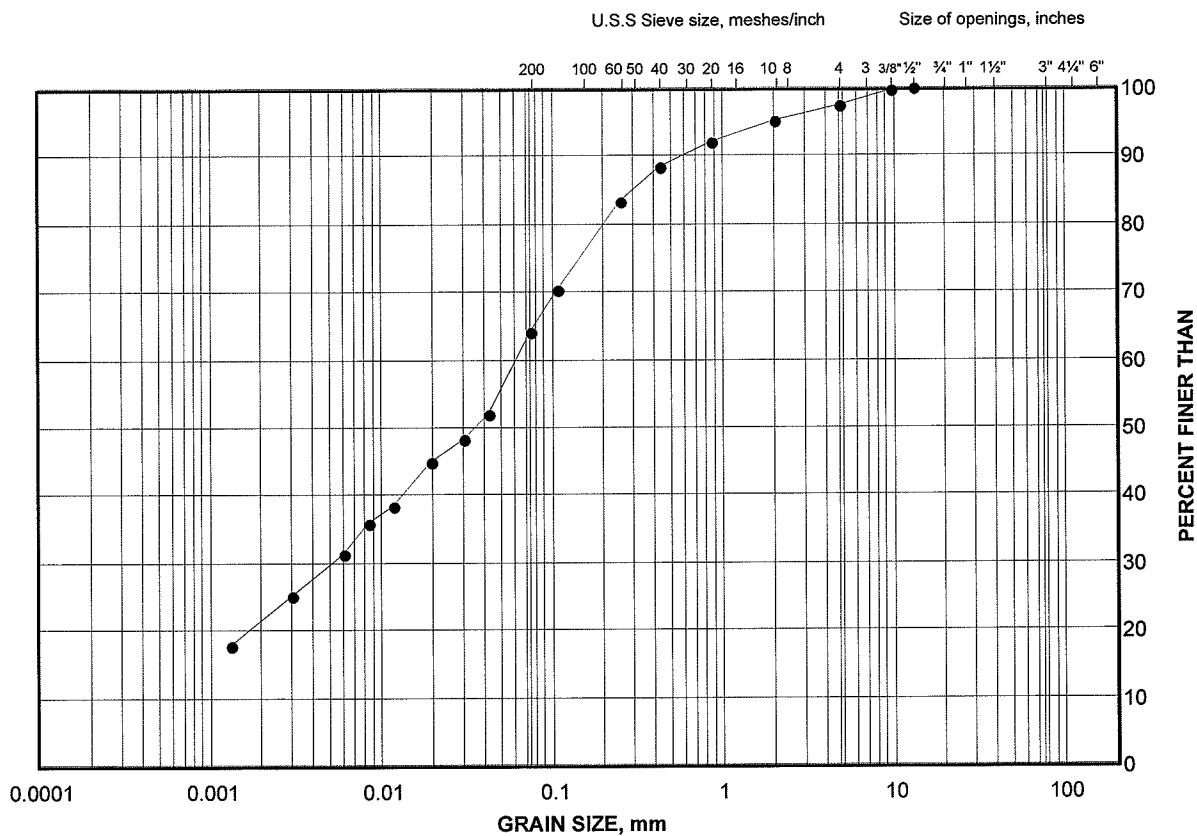
Base plans provided in digital format by Morrison Hershfield Limited, received Aug. 09, 2007.

NO.	DATE	BY	REVISION
Geocres No. 30M11-222			
HWY. 401	PROJECT NO. 06-1111-060-2		DIST.
SUBM'D. PKS	CHKD. LCC	DATE: 15/02/2008	SITE:
DRAWN: RJ	CHKD. PKS	APPD. LCC	DWG. 1

GRAIN SIZE DISTRIBUTION TEST RESULT

Clayey Silt Fill

FIGURE 1



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

LEGEND

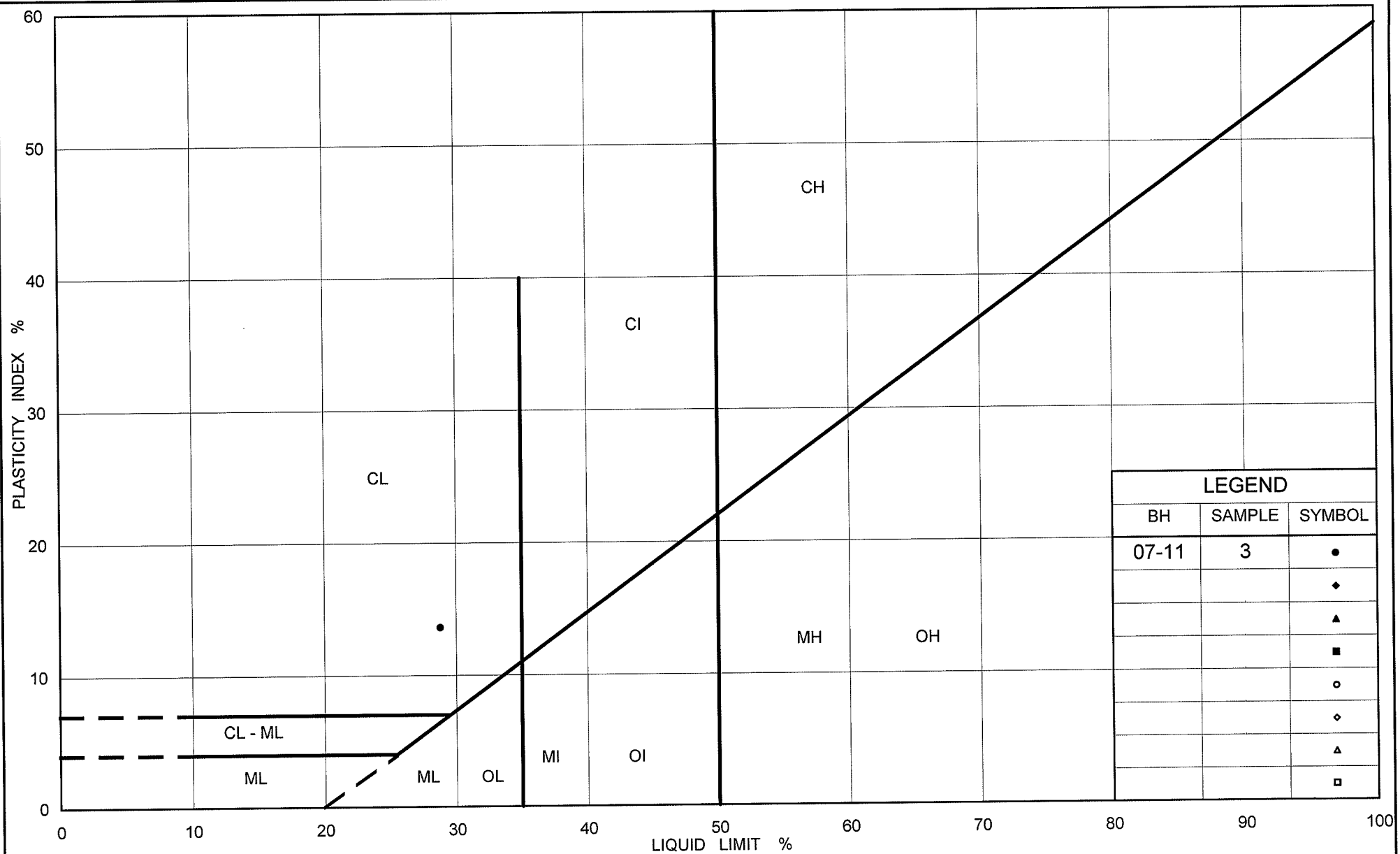
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	07-10	3	173.7

Project Number: 06-1111-060

Checked By: *Mayer*

Golder Associates

Date: 15-Feb-08



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Ontario

PLASTICITY CHART Clayey Silt Fill

Figure No. 2

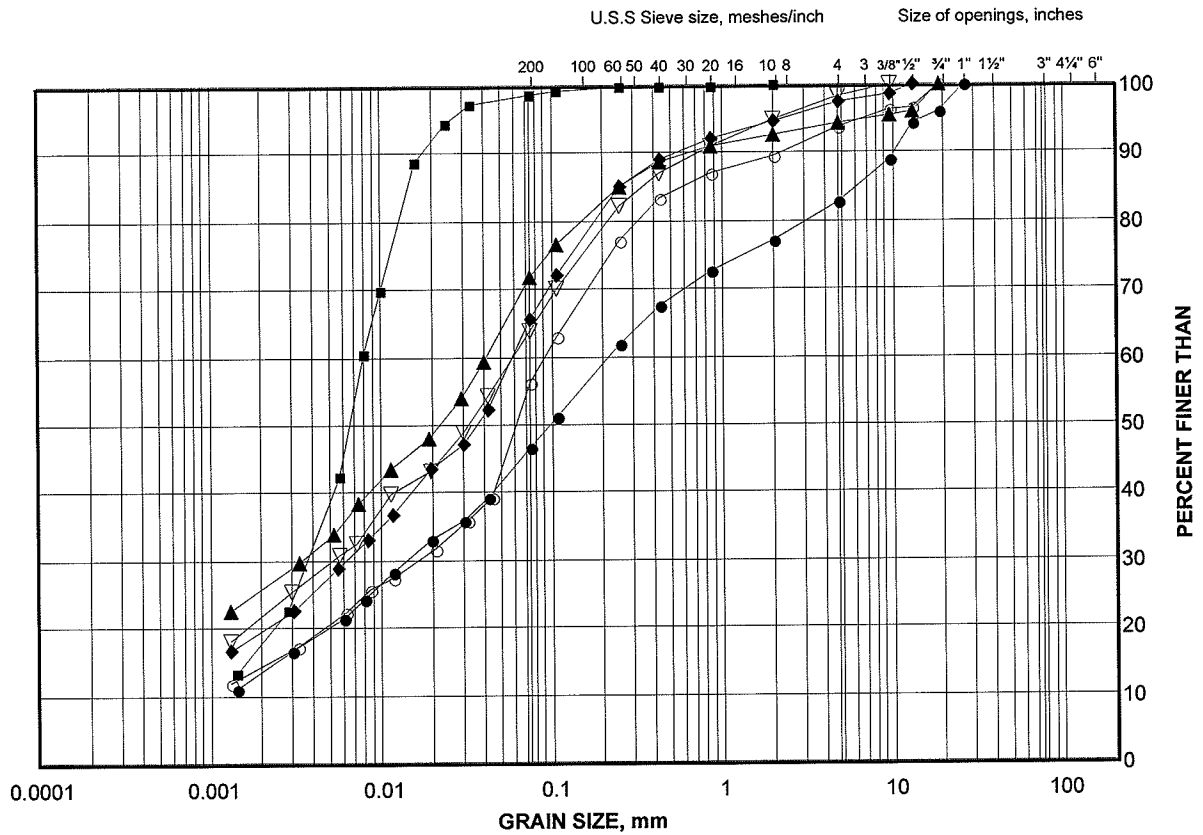
Project No. 06-1111-060

Checked By: *Ulyse*

GRAIN SIZE DISTRIBUTION TEST RESULTS

Clayey Silt to Silty Clay Till

FIGURE 3



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

LEGEND

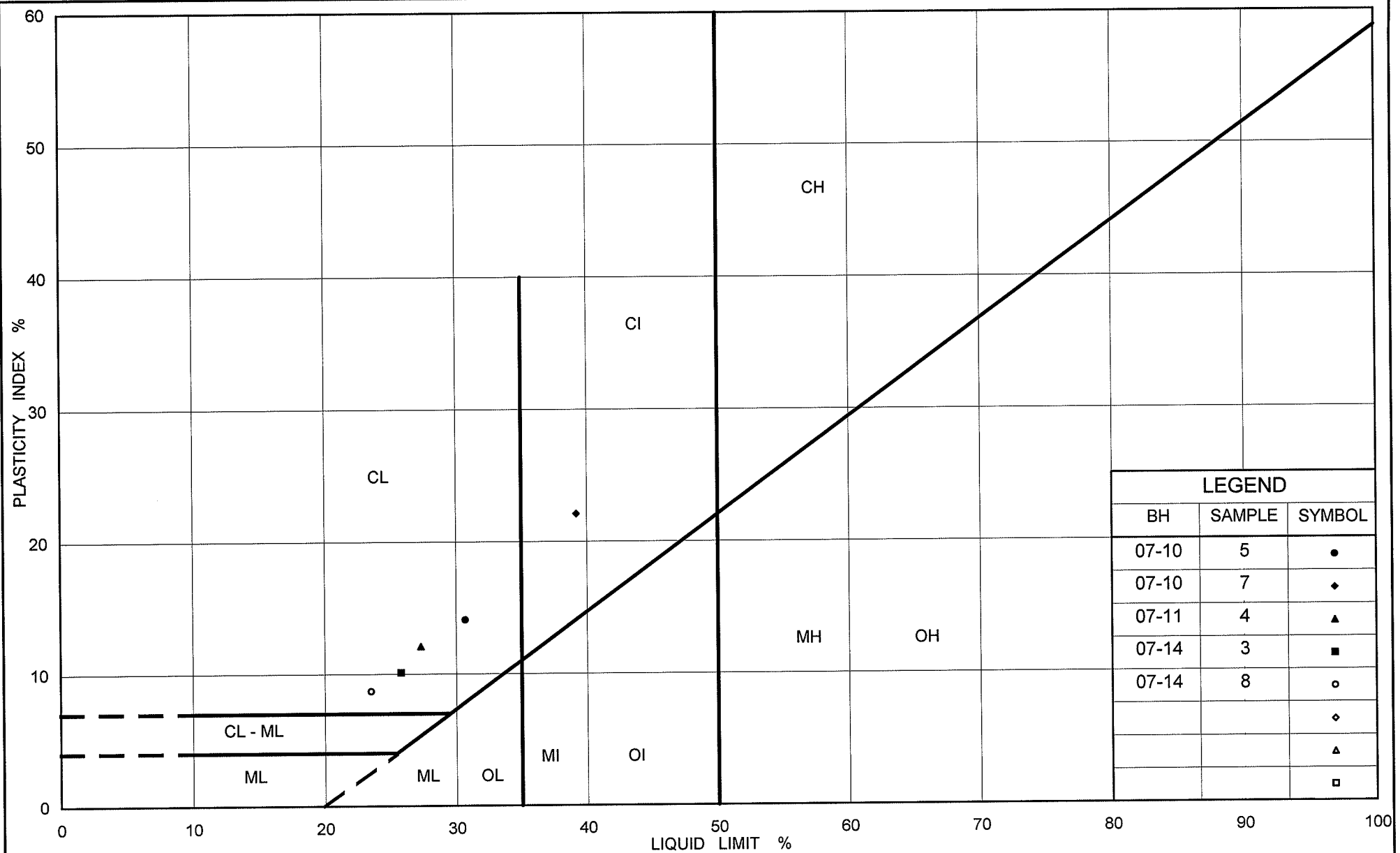
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	07-15	3	152.1
■	07-15	5	150.6
◆	07-16	5	167.0
▲	07-14	5	150.5
▽	07-10	6	169.9
○	07-16	9	161.9

Project Number: 06-1111-060

Checked By: *[Signature]*

Golder Associates

Date: 25-Sep-07



Ministry of Transportation

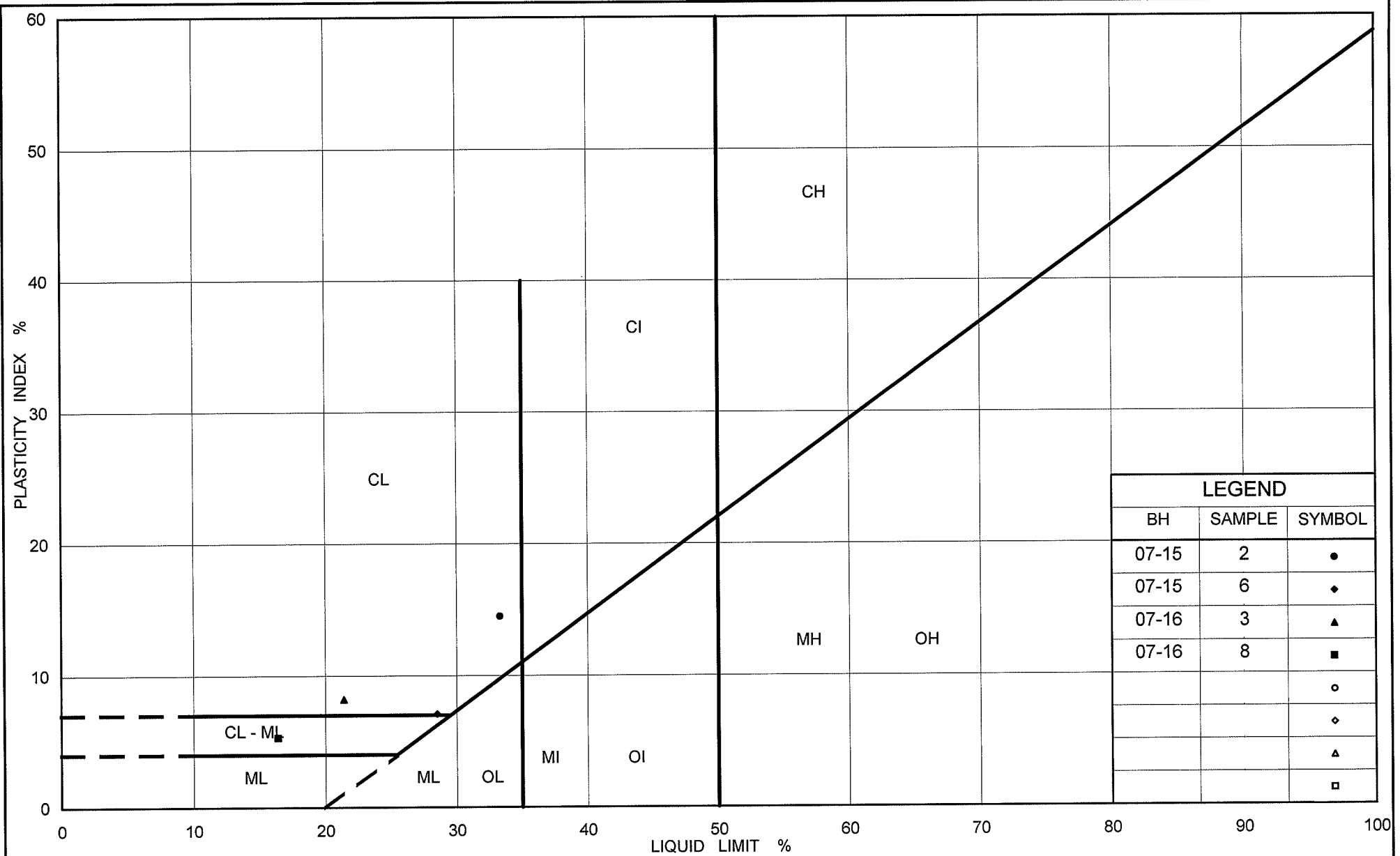
Ontario

PLASTICITY CHART Clayey Silt to Silty Clay Till

FIG No. 4A

Project No. 06-1111-060

Checked By: *W. H. H. H.*



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt to Silty Clay Till

FIG No. 4B

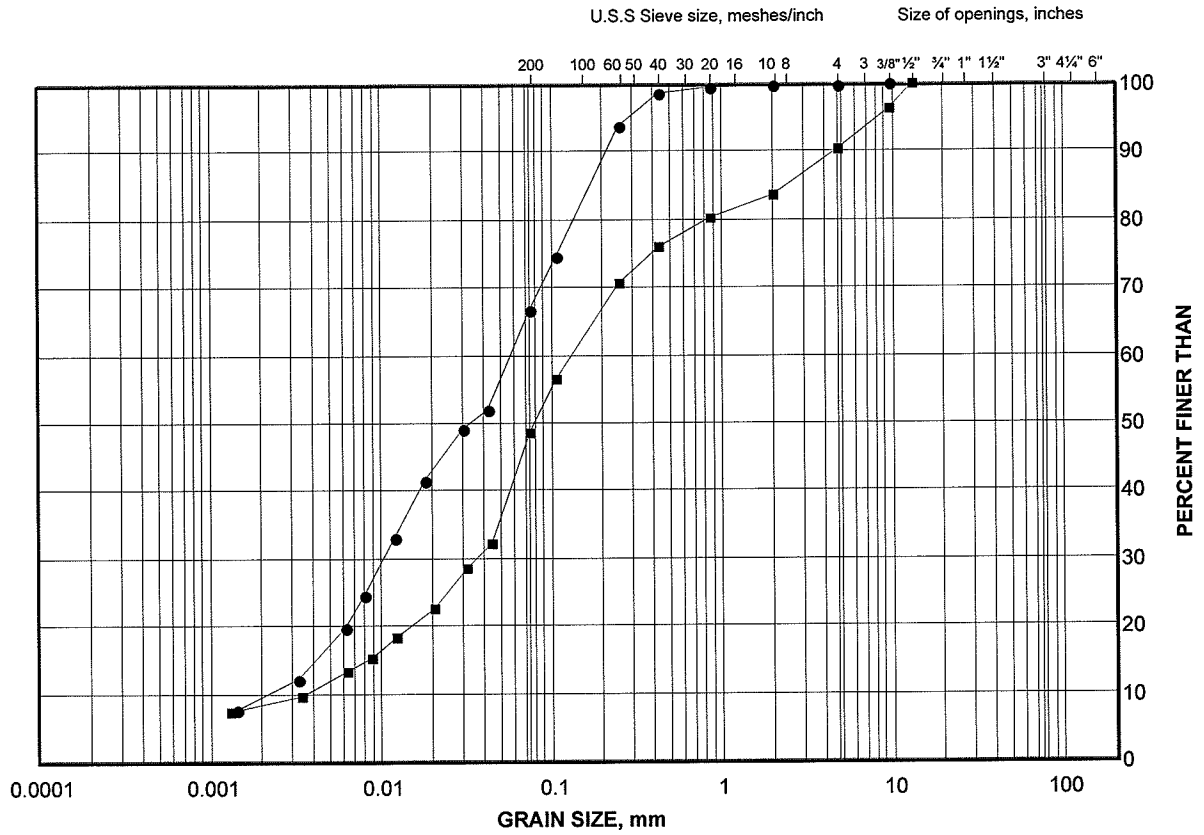
Project No. 06-1111-060

Checked By: *Wozze*

GRAIN SIZE DISTRIBUTION TEST RESULTS

Sand and Silt Till

FIGURE 5



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	07-15	9	145.4
■	07-14	9	145.2

Project Number: 06-1111-060

Checked By: *Ulage*

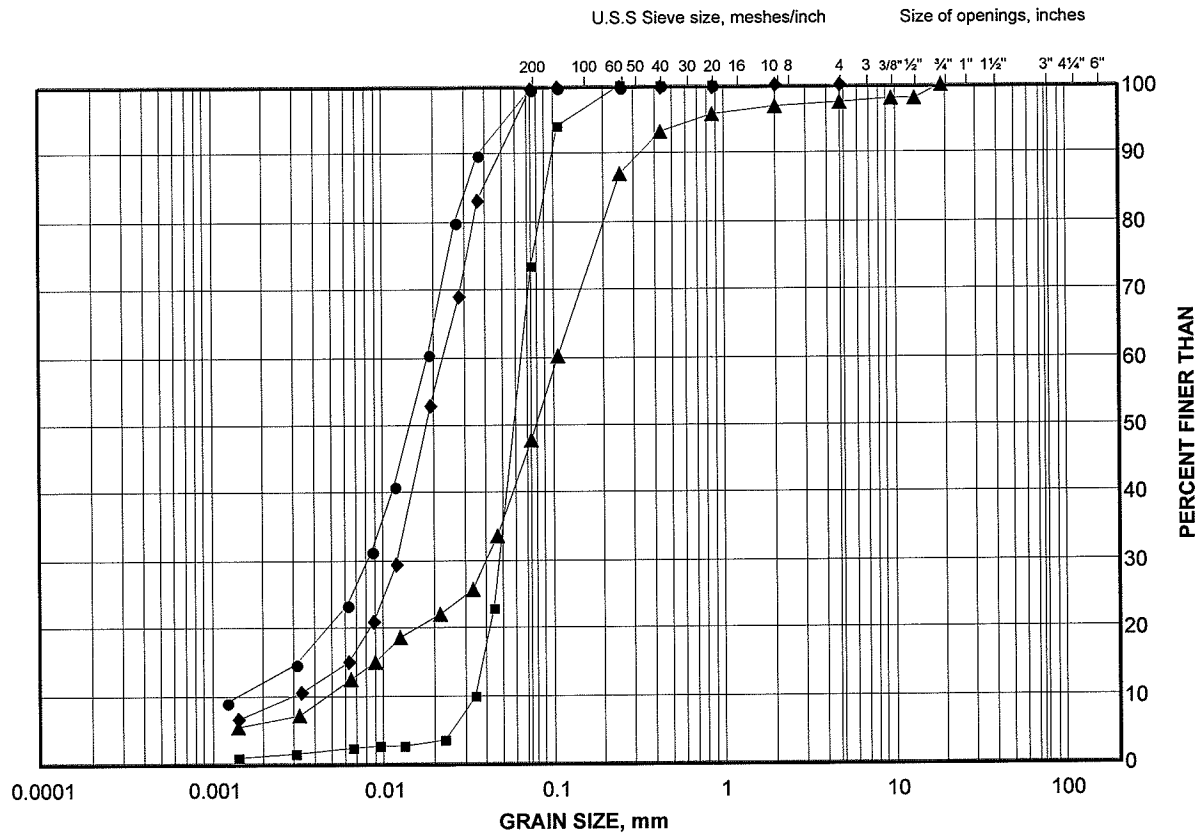
Golder Associates

Date: 25-Sep-07

GRAIN SIZE DISTRIBUTION TEST RESULTS

Sand and Silt to 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)
●	07-14	10	143.7
■	07-15	12	140.8
◆	07-14	12	140.7
▲	07-11	5	164.6

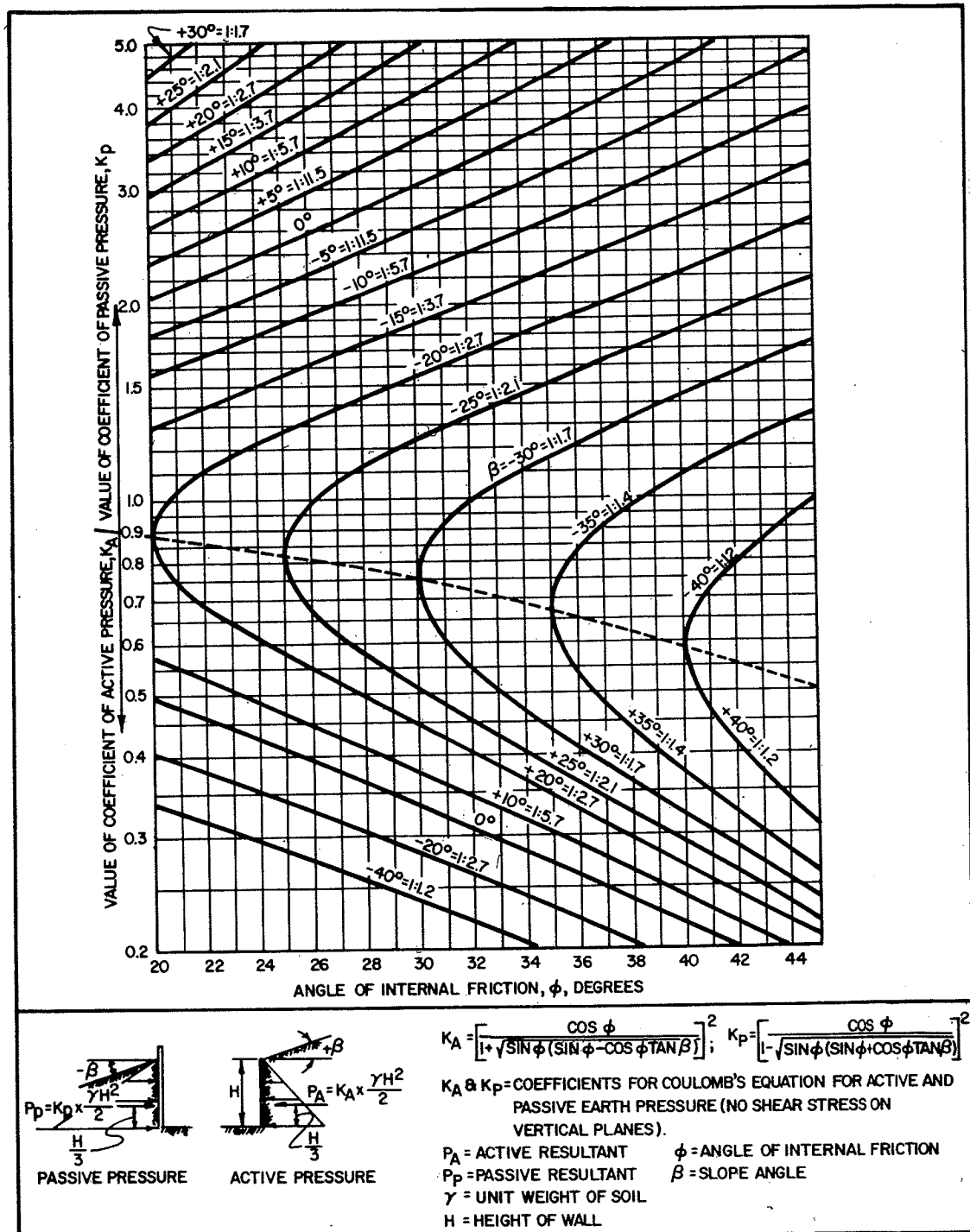
Project Number: 06-1111-060

Checked By: *W. H. Hays*

Golder Associates

Date: 25-Sep-07

Figure 7



SOURCE:

Department of the Navy, Naval Facilities Engineering Command (NAVFAC). 1982. *Foundations and Earth Structures, Design Manual 7.2*, Chapter 3, Figure 3.

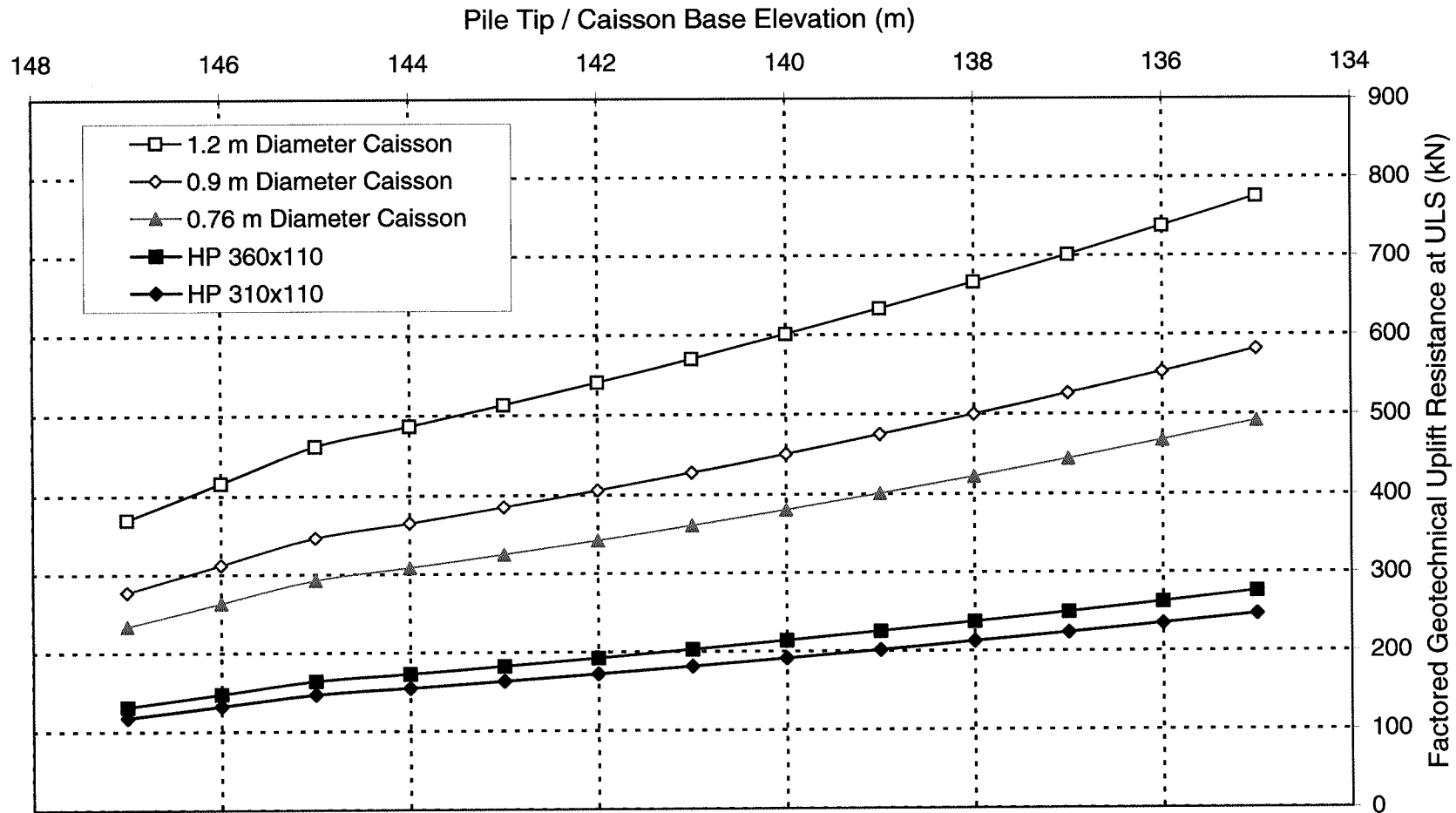
Date: November 2007
Project: 06-1111-060-2

Golder Associates

Drawn: LCC
Checked: JMAC

**Factored Geotechnical Uplift Resistance at Ultimate Limit States
Foundations for HML Poles 3 and 4 in West Don River Valley**

Figure 8



NOTE: The uplift resistances given for caissons assume that permanent steel liners are used for the caisson installation.

Date: November 2007
Project: 06-1111-060-2

Golder Associates

Drawn: LCC
Checked: MSD

APPENDIX A

NON-STANDARD SPECIAL PROVISIONS

**CONTROL OF OVERBURDEN SOILS AND GROUNDWATER DURING HML
FOUNDATION INSTALLATION - Item No.**

Special Provision

Excavations for the HML pole foundations will be advanced through fill materials (where present) into clayey silt to silty clay till and cohesionless sand to silt soils; lenses or layers of cohesionless soils should also be expected to be present within the till. The cohesionless soil deposits and lenses/interlayers should be expected to be unstable below the groundwater level. Where cohesionless soil deposits, layers or lenses are encountered, appropriate construction procedures and equipment will be required to minimize ground loss during drilling and concrete placement.

Basis of Payment

Payment at the lump sum contract price for this tender item shall be full compensation for all labour, equipment and materials for completion of the work.

END OF SECTION