February 2011

FOUNDATION INVESTIGATION AND DESIGN REPORT

Relocation of Existing Noise Barrier Wall 3
Widening of Highway 7/8
From 1.9 km West of Fischer-Hallman Road Interchange
Easterly to 0.8 km East of Courtland Avenue Interchange
Kitchener
GWP 131-98-00
Ministry of Transportation, Ontario - West Region

Submitted to:
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REPORT

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FOUNDATION INVESTIGATION REPORT

RELOCATION OF EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
FROM 1.9 KM WEST OF FISCHER-HALLMAN ROAD INTERCHANGE EASTERLY TO 0.8 KM EAST OF COURTLAND AVENUE INTERCHANGE, KITCHENER
GWP 131-98-00
MINISTRY OF TRANSPORTATION, ONTARIO - WEST REGION

1.0 INTRODUCTION

Golder Associates Ltd. (Golder Associates) has been retained by Dillon Consulting Limited (Dillon) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out foundation investigations as part of the detail design work for GWP 131-98-00, the reconstruction and widening of Highway 7/8. This report presents the results of the foundation investigation conducted for the relocation of existing noise barrier wall 3 which is located in the area of the Westmount Road overpass from Station 13+791 to 14+476 Lt along Highway 7/8.

The purpose of the foundation investigation is to determine the subsurface conditions at the locations of the proposed works by drilling boreholes and carrying out in situ testing and laboratory testing on selected samples. The terms of reference for the scope of work are outlined in the MTO's Request for Proposal, Golder Associates' proposal P81-3002 dated April 8, 2008, our letters dated July 21 and 22, 2008 and our revised scope of work letter dated April 13, 2010. The work was carried out in accordance with our Quality Control Plan for Foundation Engineering dated July 4, 2008.

Dillon provided Golder Associates with the locations and extents of the noise barrier walls in plan for this project in digital format.

2.0 SITE DESCRIPTION

2.1 General

The area of GWP 131-98-00 on Highway 7/8 is located in the south-central area of Kitchener, Ontario. The project extends from 1.9 km west of Fischer-Hallman Road easterly to 0.8 km east of Courtland Avenue. The location of the wall is shown on the Key Plan, Figure 1 and on the Noise Barrier Wall Location Plan, Figure 2.

This section of Highway 7/8 is currently a four lane divided highway oriented generally east-west. Four overpass structures for Westmount Road, Homer Watson Boulevard, Ottawa Street South and Courtland Avenue East, one underpass structure for Fischer-Hallman Road and an overhead structure for Canadian National Rail (CNR) tracks are situated within the project limits.

Land use adjacent to this site is typically urban residential north of Highway 7/8 with predominantly industrial, commercial, institutional and residential areas to the south.

Existing noise barrier wall 3 extends from Station 13+791 to 14+476 Lt along Highway 7/8 in the area of the Westmount Road overpass. The topography in this area is hummocky to gently undulating with ground surface elevations sloping downwards from west to east and ranging from elevation 342 metres at the west end to 335 metres at the east end of the relocated wall.

2.2 Site Geology

This project lies within the physiographic region of southwestern Ontario known as the Waterloo Hills[1]. The soils generally consist of sandy hills; some are ridges of sandy till while others are kames or kame moraines, with outwash sands deposited in the valleys. Adjoining the sandy hills is the Grand River spillway system comprised of alluvial terraces of sand and gravel.

Based on the Ministry of Northern Development and Mines Map 2559 entitled “Quaternary Geology, Stratford Area”, the site extends across an area transitioning from Maryhill Till to ice-contact sand zones, all deposited in the Pleistocene era. The ice-contact sand deposits are described as “poorly to well sorted, fine sand and/or gravel to coarse sand and/or gravel textured” while the Maryhill Till is described as “clay till”.

[1] L.J. Chapman and D.F. Putnam: The Physiography of Southern Ontario, Third Edition. Ontario Geological Survey, Special Volume 2, 1984.

The Geologic Survey of Canada Map 1263A entitled “Geology, Toronto-Windsor Area, Ontario” indicates that the subcropping bedrock in the area of site is dolomite and mudstone of the Salina formation of Upper Silurian age. Based on the Ministry of Natural Resources Map P.168 entitled “Bedrock Topography Series, Stratford Area, Southern Ontario”, the bedrock surface at the site is at an elevation of about 268 metres with the bedrock sloping downwards towards the east end of the site.

3.0 INVESTIGATION PROCEDURES

The field work for the foundation investigation for the design of the relocation of existing noise barrier wall 3 was carried out between May 26 and 29, 2010, during which time six boreholes were drilled along Highway 7/8 in the vicinity of the noise barrier wall. The borehole locations are shown on the Borehole Location Plan, Drawing 1.

The boreholes (numbered 50 to 55) were advanced to a depth of 5.0 to 5.2 metres. This information was supplemented at the remaining locations of the relocated noise barrier wall 3 with boreholes advanced for other components of this project as follows:

- Boreholes 308 and 310 (Geocres No. 40P7-55)
- Borehole 901 and 902 (Geocres No. 40P8-191)
- Borehole 922 (Geocres No. 40P8-185)

The table below summarizes the borehole locations, ground surface elevations at the borehole locations and the borehole depths:

Borehole	Location (m)		Ground Surface Elevation	Borehole Depth
	Northing	Easting	(m)	(m)
50	4 809 655	223 332	341.72	5.18
51	4 809 690	223 403	341.37	5.18
52	4 809 723	223 483	340.57	5.18
53	4 809 816	223 779	336.55	5.03
54	4 809 834	223 830	335.65	5.18
55	4 809 859	223 890	335.48	5.03
308 (40P7-55)	4 809 769	223 627	338.55	23.27
310 (40P7-55)	4 809 748	223 561	339.27	14.17
901 (40P8-191)	4 809 787	223 688	337.83	9.60
902 (40P8-191)	4 809 802	223 736	337.27	9.60
922 (40P8-185)	4 809 625	223 260	341.50	6.55

The drilling was carried out using truck mounted CME 45 and CME 55 power augers supplied and operated by a specialist drilling contractor. In the boreholes, samples of the overburden were generally obtained at 0.75 metre intervals of depth using 50 millimetres outside diameter split spoon sampling equipment in accordance with the standard penetration test (SPT) procedures. The samplers used in the investigations limit the maximum particle size that can be sampled and tested to about 40 millimetres. Therefore, particles or objects that may exist within the soils that are larger than this dimension will not be sampled or represented in the grain size distributions. Larger particle sizes, including cobbles and boulders, are known to be present in the glacial till deposits as

discussed in the text of this report. In addition, a shear vane test was carried out in borehole 53 in order to further characterize the soils at that location.

The groundwater conditions were observed throughout the drilling operations. A summary of the groundwater level readings for all boreholes is presented in Table 1. The boreholes were backfilled in accordance with current Ontario Ministry of Transportation (MTO) procedures and Ontario Regulation 372/07.

The field work was monitored on a full-time basis by experienced members of our engineering staff who located the boreholes in the field, monitored the drilling, sampling and in situ testing operations, logged the boreholes and surveyed the borehole locations and elevations. The samples were identified in the field, placed in labelled containers and transported to our London laboratory for further examination and testing. Index and classification tests, consisting of water content determinations, grain size distribution analyses and Atterberg limits determinations, were carried out on selected samples. The results of the testing are shown on the Record of Borehole sheets and in Appendix A. The Record of Borehole sheets for boreholes 308, 310, 901, 902 and 922 are presented in Appendix B.

The locations of the boreholes are shown on the Record of Borehole sheets and on Drawing 1, attached.

4.0 SUBSURFACE CONDITIONS

4.1 Site Stratigraphy

The detailed subsurface soil and groundwater conditions encountered in the current boreholes, together with the results of the in situ and laboratory testing carried out on selected samples, are given on the attached Record of Borehole sheets following the text of this report and in Appendix A. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling and observations of drilling resistance and represent transitions between soil types rather than exact planes of geological change. Subsurface conditions will vary between and beyond the borehole locations.

The boreholes drilled at the site generally encountered highly complex and variable conditions consisting of asphaltic concrete pavement and/or topsoil and/or layers of granular and cohesive fill underlain by silty sand, silty clay, sandy silt, clayey silt till, silty clay till, clayey silt, sand and gravel and silt.

For the following discussion, the ground conditions from boreholes 308 and 310 (40P7-55), which were advanced in the area of noise barrier wall 3 for other components of the project have been limited to elevation 330 metres.

The borehole locations are shown on Drawing 1. A detailed description of the subsurface conditions encountered in the boreholes is provided on the Record of Borehole sheets and is summarized below.

4.1.1 Pavements

Asphaltic concrete was encountered from the pavement surface in all boreholes with the exception of boreholes 308 (40P7-55) and 922 (40P8-185). The thickness of the asphalt layer ranged from 80 to 150 millimetres.

Granular base and subbase materials were found underlying the asphaltic concrete in all the above mentioned boreholes. Granular roadbase material was also encountered at the ground surface in borehole 308 (40P7-58) overlying cohesive fill. The thickness of the granular base and subbase fill ranged from 330 millimetres to 1.4 metres. It should be noted that evidence of cobbles were observed when drilling through the granular subbase in boreholes 51, 54 and 310 (40P7-55).

4.1.2 Topsoil

Topsoil was found at the ground surface in borehole 922 (40P8-185). Buried topsoil layers were encountered at depth in boreholes 55, 901 (40P8-191) and 902 (40P8-191) underlying layers of granular and cohesive fill at elevations 332.9, 330.1 and 341.5 metres, respectively. The thickness of the topsoil layers ranged from 150 to

460 millimetres. It should be noted that evidence of topsoil was also encountered within the cohesive and granular fill layers in boreholes 50, 51, 53, 54, 310, 901 (40P8-191), 902 (40P8-191) and 922 (40P8-185).

The topsoil layers had N values of 9 to 26 blows per 0.3 metres indicating a loose to compact condition. The water contents ranged from 12 to 32 per cent. Materials designated as topsoil in this report were classified solely based on visual and textural evidence. Testing of organic content or for other nutrients was not carried out. Therefore, the use of materials classified as topsoil cannot be relied upon for support and growth of landscaping vegetation.

4.1.3 Fill

Layers of fill were found in all boreholes underlying the granular roadbase or topsoil from elevations 335.4 to 341.6 metres. In boreholes 308 (40P7-55), 901 and 902 (40P8-191) the granular fill was interlayered with cohesive fill layers. The granular fill was generally comprised of sandy silt, silty sand and sand and was 0.3 to 3.0 metres thick. The cohesive fill ranged from 0.6 to 6.0 metres thick and was generally comprised of clayey silt. Topsoil fill was encountered at elevations 331.9 and 330.7 metres in borehole 901. The topsoil fill layers were 0.3 metres thick.

The granular fill layers had N values of 7 to 36 blows per 0.3 metres indicating a loose to dense relative density and water contents generally ranged from 4 to 17 per cent.

The cohesive fill had N values ranging from 4 to 42 blows per 0.3 metres indicating a soft to hard consistency. An in situ shear vane test attempted in borehole 53 indicated that the undrained shear strength of a firm cohesive zone was above 144 kilopascals. The water contents were 10 to 28 per cent. The cohesive fill layer is of low plasticity based on the results of the Atterberg limit tests carried out on sample obtained during standard penetration testing. The plastic limit, liquid limit and plasticity index ranges were 11 to 16, 18 to 23 and 6 to 10 per cent, respectively. The Atterberg limit results for the cohesive fill layers are presented on Figure A-10 and indicate that the fill is of low plasticity.

The results of the grain size testing conducted on granular and cohesive fill layers are presented on Figures A-1 and A-2, respectively, in Appendix A.

4.1.4 Silty Sand

A layer of compact silty fine sand was encountered in borehole 922 (40P8-185) from elevation 340.1 metres. The silty sand was found underlying the granular fill. The thickness of the layer was 2.6 metres.

The silty sand had N values of 12 to 29 blows per 0.3 metres, generally increasing with depth. The water content was 13 per cent.

The results of grain size testing conducted on a silty sand sample obtained during standard penetration testing are presented on Figure A-3.

4.1.5 Silty Clay

A layer of silty clay was encountered in borehole 50 from elevation 338.1 metres underlying layers of fill. Borehole 50 was terminated in the silty clay after exploring it for 1.5 metres.

The N values in the silty clay were 10 blows per 0.3 metres indicating a stiff consistency. The water content was 23 per cent and the silty clay is of intermediate plasticity based on a plastic limit, liquid limit and plasticity index of 21, 48 and 27 per cent, respectively. The results of the Atterberg limit test are presented on Figure A-10.

The grain size distribution curve for a silty clay sample obtained during standard penetration testing is presented on Figure A-4.

4.1.6 Silt

A dense, 0.8 metre thick layer of silt was encountered in borehole 55 underlying topsoil at elevation 332.6 metres.

The silt had an N value of 44 blows per 0.3 metres and a water content of 11 per cent.

The grain size distribution curve for the silt sample recovered during standard penetration testing is shown on Figure A-5.

4.1.7 Sandy Silt

Layers of sandy silt were found in boreholes 51, 55 and 308 (40P7-55) at elevations 338.9, 331.8 and 333.6 metres, respectively. The sandy silt was found underlying fill in boreholes 51 and 308 (40P7-55) and underlying silt in borehole 55. It should be noted that clayey silt layers were observed in the sandy silt in borehole 308 (40P7-55). The thicknesses of the sandy silt layers were 0.8 and 3.5 metres in borehole 55 and 308 (40P7-55), respectively. Borehole 51 was terminated in sandy silt after exploring the stratum for 2.7 metres.

The N values for the sandy silt layers ranged from 4 to over 100 blows per 0.3 metres, indicating a loose to very dense relative density. The water contents were 9 and 16 per cent.

The results of grain size analyses conducted on samples of the sandy silt obtained during standard penetration testing are presented on Figure A-6.

4.1.8 Clayey Silt Till

Clayey silt till was encountered in boreholes 52, 54, 55 and 901 (40P8-191) at elevations 338.6, 331.2, 331.1 and 328.8 metres, respectively. The clayey silt till was found underlying layers of fill, sandy silt and sand and gravel. All of the above mentioned boreholes (52, 54, 55 and 901 (40P8-191)) were terminated in the clayey silt till after exploring the stratum for 3.2, 0.8, 0.6 and 0.6 metres, respectively. Although not specifically encountered in the boreholes, cobbles and boulders should be anticipated in the clayey silt till due to the depositional history of this material.

The stiff to hard clayey silt till had N values of 10 to 25 blows per 0.3 metres. The water contents were 14 and 15 per cent. An Atterberg limits determination carried out on a clayey silt till sample indicated the material to be of low plasticity. The plasticity limit, liquid limit and plasticity index for the clayey silt till sample were 14, 25 and 11 per cent, respectively. The Atterberg limit results for the clayey silt till are shown on Figure A-10.

The results of the grain size testing conducted on a clayey silt till sample obtained during standard penetration testing is presented on Figure A-7.

4.1.9 Silty Clay Till

A layer of stiff to very stiff silty clay till was encountered in borehole 922 (40P8-185) from elevation 337.5 metres. The silty clay till was found underlying silty sand. Borehole 922 (40P8-185) was terminated in the silty clay till after exploring the stratum for 2.6 metres.

The N values for the silty clay till were 11 to 18 blows per 0.3 metres. An in situ shear vane test indicated the undrained shear strength to be above 144 kilopascals at about elevation 336.1 metres. A water content of 20 per cent was measured. The silty clay till is of intermediate plasticity based on an Atterberg limit test, giving a plastic limit, liquid limit and a plasticity index of 14, 36 and 22 per cent, respectively. The results of the Atterberg limits test are presented on Figure A-10. Although not specifically found in the borehole, cobbles and boulders should be expected in silty clay till deposits due to the depositional history of the material.

The results of the grain size testing conducted on a silty clay till sample obtained during standard penetration testing is presented on Figure A-8.

4.1.10 Clayey Silt

Layers of clayey silt were encountered in boreholes 53, 310 (40P7-55) and 902 (40P8-191) at elevations 332.1, 332.6 and 329.2 metres, respectively. The clayey silt was found underlying layers of fill in boreholes 53 and 310 (40P7-55) and underlying topsoil in borehole 902 (40P8-191). Sand layers and silt layers were observed within the clayey silt in boreholes 53 and 902 (40P8-191), respectively. The thickness of the clayey silt was 3.4 metres

in borehole 310 (40P7-55). Boreholes 53 and 902 (40P8-191) were terminated in the clayey silt after exploring the layers for 0.6 and 1.5 metres, respectively.

The clayey silt had N values of 7 to 20 blows per 0.3 metres indicating a firm to very stiff consistency. Water contents in the clayey silt were 14 to 19 per cent. The clayey silt is of low plasticity based on plastic limits, liquid limits and plasticity indices of 14 and 17, 22 and 34 and 8 and 18 per cent, respectively. The Atterberg limits results for tests performed on samples of the clayey silt are shown on Figure A-10.

The results of the grain size testing conducted on selected clayey silt samples obtained during standard penetration testing are presented on Figure A-9.

4.1.11 Sand and Gravel

A layer of very dense sand and gravel was encountered in borehole 901 (40P8-191) at elevation 329.6 metres underlying the topsoil. The thickness of the sand and gravel was 0.6 metres.

An N value of 57 blows per 0.3 metres was measured in the sand and gravel. The water content was 11 per cent.

4.2 Groundwater Conditions

The groundwater conditions in the boreholes were monitored during and upon completion of drilling. The observed groundwater conditions are noted on the Record of Borehole sheets, and are summarized in the following text and Table 1.

Table 1: Summary of Encountered Groundwater Levels

Borehole	Ground Surface Elevation	Encountered Groundwater Level	
		Depth	Elevation
	(m)	(m)	(m)
50	341.72	Dry	Below 336.5
51	341.37	Dry	Below 336.2
52	340.57	Dry	Below 335.4
53	336.55	Dry	Below 331.5
54	335.65	Dry	Below 330.5
55	335.48	4.0	331.5
308 (40P7-55)	338.55	9.2	329.4
310 (40P7-55)	339.27	11.6	327.7

Borehole	Ground Surface Elevation	Encountered Groundwater Level	
		Depth	Elevation
901 (40P8-191)	337.83	Dry	Below 328.2
902 (40P8-191)	337.27	Dry	Below 327.7
922 (40P8-185)	341.5	Dry	Below 335.0

During the fieldwork, the groundwater was encountered between elevation 327.7 and 331.5 metres in boreholes 55, 308 (40P7-55) and 310 (40P7-55).

The inferred groundwater level at the site varies as follows:

- Station 13+790 to 13+835 Lt - elevation 337 metres
- Station 13+835 to 14+000 Lt - below elevation 336 metres
- Station 14+000 to 14+085 Lt - below elevation 335 metres
- Station 14+085 to 14+220 Lt - elevation 330 metres
- Station 14+220 to 14+270 Lt - elevation 328 metres
- Station 14+270 to 14+320 Lt - elevation 329 metres
- Station 14+320 to 14+480 - below elevation 331.5 metres

The inferred groundwater levels are based on groundwater levels encountered and the soil colour change from brown to grey.

The above noted groundwater levels are not necessarily considered to be representative of the long-term, stabilized groundwater conditions as the readings were taken for a short duration only. The groundwater levels are expected to fluctuate due to climatic and seasonal variations.

5.0 MISCELL ANEOUS

This investigation was carried out using equipment supplied and operated by Aardvark Drilling Ltd. who is an Ontario Ministry of Environment licensed well contractor. The field operations were supervised by Mr. Michael Arthur and Mr. Matthew Rhody under the direction of Mr. David J. Mitchell.

The laboratory testing was carried out at Golder Associates' London laboratory under the direction of Mr. Chris M. Sewell. The laboratory is an accredited participant in the MTO Soil and Aggregate Proficiency Program and is certified by the Canadian Council of Independent Laboratories for testing Types C and D aggregates. This report was prepared by the Project Engineer, Ms. Dirka U. Prout, P.Eng., under the direction of the Team Leader, Mr. Philip R. Bedell, P.Eng. This report was reviewed by Mr. Fintan J. Heffernan, P.Eng., the Designated MTO Contact and Quality Control Auditor for this assignment.

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PART B

FOUNDATION DESIGN REPORT

RELOCATION OF EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
FROM 1.9 KM WEST OF FISCHER-HALLMAN ROAD INTERCHANGE
EASTERLY TO 0.8 KM EAST OF COURTLAND AVENUE INTERCHANGE
KITCHENER
GWP 131-98-00
MINISTRY OF TRANSPORTATION, ONTARIO - WEST REGION

6.0 ENGINEERING RECOMMENDATIONS

6.1 General

This section of the report provides geotechnical parameters and recommendations for the geotechnical aspects of the design for the relocation of the existing noise barrier wall 3 along Highway 7/8 between Stations 13+791 and 14+476 Lt. The relocated wall will be shoulder mounted.

The design parameters and recommendations have been developed based on interpretation of the factual data obtained from the boreholes advanced at the site. The interpretation and recommendations provided are intended to provide the designers with sufficient information to design the proposed noise barrier wall foundations. Where comments are made on construction, they are provided in order to highlight those aspects that could affect the design or 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 the equipment selection, proposed construction methods, scheduling and the like.

6.2 Noise Barrier Wall Foundation Design

The noise barrier wall foundation should be designed and constructed in accordance with MTO's SP599F01. It is recommended that the noise barrier wall be supported using conventional augered caissons with a diameter of 0.6 to 0.9 metres. Foundation design parameters for design of the caisson foundations are provided in Table I following the text of this report and are based on the soil conditions encountered along the proposed noise barrier wall alignment. The stratigraphy presented in Table I has been simplified for the purposes of the noise barrier wall foundation design.

Where both an undrained shear strength, c_u and an effective friction angle, ϕ', have been given for a specific stratum, the caisson design should be checked for both the drained and undrained condition and the larger of the two calculated caisson depths shall govern.

Portions of the caisson that will be embedded in organic materials, such as buried topsoil or topsoil fill layers found in boreholes 55, 901 (40P8-191) and 902 (40P8-191) at Stations 14+475, 14+250 and 14+300 Lt, respectively, should be neglected in the design. The passive resistance in the upper 1.4 metres below the ground should be neglected to account for frost action. In addition, for foundation design, full passive resistance will be mobilized only where the ground surface in front and behind the caisson is level. Where sloping ground is present adjacent to the noise barrier wall, the K_p values used in the calculation should be adjusted to account for the presence of the sloping ground. The embankment side slope behind the noise barrier wall is anticipated to slope downwards with an approximate slope inclination of 2 horizontal to 1 vertical along Stations 13+790 to 14+045 and 14+080 Lt and from the east abutment of the Westmount Road Overpass to approximately Station 14+385. At all other locations, the side slope will have an approximate inclination of 3 horizontal to 1 vertical.

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 toe of the slope; below this elevation, the full K_p is to be applied.

Deeper or larger diameter caissons may be required in the vicinity of Stations 14+220 to 14+320 Lt as boreholes 901 and 902 (40P8-191) encountered loose granular fill and/or firm cohesive fill extending to elevations 330.5 to 332.5 metres.

The existing Westmount Road overpass is located between approximately Stations 14+140 and 14+183 Lt and existing twin culverts are located between Stations 14+265 and 14+280 Lt. Due to the right-of-way restrictions, and to accommodate the embankment widening and grade raise, it has also been proposed to install a Retained Soil System (RSS) wall between Westmount Road and approximately Station 14+300 Lt. In this area, placement of noise wall foundations will need to be coordinated with the design of the underlying existing twin culverts.

6.3 Construction Considerations

Excavations for the construction of the caisson noise barrier wall foundations will penetrate the surficial fill and will extend through deposits of silty sand, silty clay, sandy silt, clayey silt till, silty clay till, clayey silt, sand and gravel and silt. The sands, silts, clayey silt tills and silty clay tills at this site are susceptible to disturbance during caisson excavation and construction. Cobbles and boulders are to be expected in the clayey silt till and silty clay till soils. In addition, excavation of granular materials below the groundwater level may be required in localized areas such as adjacent to borehole 55 in the vicinity of Station 14+480 Lt, Highway 7/8.

With proactive dewatering, a temporary liner will be required to support the sides of the excavation and permit cleaning and inspection of the base. Careful cleaning of the base of the caisson should be carried out prior to placement of concrete to remove all loosened or disturbed materials. Alternatively, the foundations could be installed using mud drilling techniques (augered with the hole filled with bentonite slurry) and placement of concrete by tremie. Surface water run off should be directed away from the excavation. It is recommended that Non-Standard Special Provisions (NSSP) be included in the Contract Documents to alert the Contractor about the requirements for support of the augered excavations, measures to deal with excavation of saturated granular soils below the groundwater level and cobbles and boulders in the fill and glacial till material.

The caissons should be constructed and inspected in accordance with Ontario Provisional Standard Specifications 903 and SP599F01. Following construction, the Quality Verification Engineer shall submit a Certificate of Conformance confirming that the noise barrier wall foundations have been constructed in general conformance with the Contract Documents.

7.0 MISCELLANEOUS

This report was prepared by Ms. Dirka U. Prout, P.Eng. under the direction of the Team Leader, Mr. Philip R. Bedell, P.Eng. This report was reviewed by Mr. Fintan J. Heffernan, P.Eng., the Designated MTO Contact and Quality Control Auditor for this assignment.

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TABLE I

FOUNDATION DESIGN PARAMETERS
RELOCATION OF EXISTING NOISE BARRIER WALL 3

Widening of Highway 7/8
GWP 131-98-00

Station and Borehole	Soil Type	Elevation Interval (m)	Design Groundwater Elevation (m)	Undrained Shear Strength, c_u[1] (kPa)	Effective Angle of Friction, ϕ'[1] (°)	Coefficient of Passive Pressure, K_p Level Ground	Coefficient of Passive Pressure, K_p[2] 3H:1V/ 2H:1V Slope	Coefficient of Active Pressure, K_a Level Ground	Unit Weight[3] (kNm^{-3})	
									Bulk, γ	Effective, γ'
13+791 to 13+835 Borehole 922 (40P8-185)	Compact silty sand	340.0 to 337.5	337	-	32	3.3	1.8/N/A	0.31	19.0	9.0
	Stiff to very stiff clayey silt till	Below 337.5		150	29	2.9	1.6/N/A	0.35	21.0	11.0
13+835 to 13+915 Borehole 50	Stiff cohesive fill	340 to 338	Below 336	50	28	2.8	1.5/N/A	0.36	19.0	9.0
	Stiff silty clay	Below 338		75	28	2.8	1.5/N/A	0.36	20.0	10.0
13+915 to 14+000 Borehole 51	Firm to stiff cohesive fill	340 to 339	Below 336	100	28	2.8	1.5/N/A	0.36	19.0	9.0
	Loose to compact sandy silt	Below 339		-	30	3.0	1.6/N/A	0.33	19.0	9.0
14+000 to 14+085 Borehole 52	Compact granular fill	Above 339	Below 335	-	30	3.0	1.6/1.1	0.33	19.0	9.0
	Stiff to very stiff clayey silt till	Below 339		150	29	2.9	1.6/1.1	0.35	21.0	11.0
14+085 to 14+160 Borehole 310 (40P7-55)	Stiff to very stiff cohesive fill	338 to 333	332	100	28	2.8	1.5/N/A	0.36	19.0	9.0
	Firm to very stiff clayey silt	Below 333		100	28	2.8	1.5/N/A	0.36	20.0	10.0

FOUNDATION DESIGN PARAMETERS

RELOCATION OF EXISTING NOISE BARRIER WALL 3

Station and Borehole	Soil Type	Elevation Interval (m)	Design Groundwater Elevation (m)	Undrained Shear Strength, c_u[1] (kPa)	Effective Angle of Friction, ϕ'[1] (°)	Coefficient of Passive Pressure, K_p Level Ground	Coefficient of Passive Pressure, K_p[2] 3H:1V/ 2H:1V Slope	Coefficient of Active Pressure, K_a Level Ground	Unit Weight[3] (kNm^{-3})	
									Bulk γ	Effective , γ'
14+160 to 14+220 Borehole 308 (40P7-55)	Firm to hard cohesive fill	337 to 334	330	100	27	2.7	N/A/0.9	0.38	19.0	9.0
	Compact to very dense sandy silt	Below 334		-	32	3.3	N/A/1.2	0.31	19.0	9.0
14+220 to 14+270 Borehole 901 (40P8-191)	Stiff cohesive fill	336 to 335	328	75	28	2.8	N/A/1.0	0.36	19.0	9.0
	Loose to compact granular fill	335 to 330		-	30	3.0	N/A/1.1	0.33	18.5	8.5
	Very dense sand and gravel	330 to 329		-	35	3.7	N/A/1.4	0.27	21.0	11.0
	Very stiff clayey silt till	Below 329		150	30	3.0	N/A/1.1	0.33	21.0	11.0
14+270 to 14+320 Borehole 902 (40P8-191)	Firm to stiff cohesive fill	336 to 334	329	75	28	2.8	N/A/1.0	0.36	19.0	9.0
	Loose to compact granular fill	334 to 332		-	30	3.0	N/A/1.1	0.33	18.5	8.5
	Firm to very stiff cohesive fill	332 to 329		150	28	2.8	N/A/1.0	0.36	20.0	10.0
14+320 to 14+370 Borehole 53	Firm to stiff cohesive fill	335 to 332	Below 331.5	75	28	2.8	N/A/1.0	0.36	19.0	9.0
	Very stiff clayey silt	Below 332		100	29	2.9	N/A/1.1	0.35	20.0	10.0
14+370 to 14+430 Borehole 54	Stiff cohesive fill	334.5 to 331	Below 331.5	150	28	2.8	N/A/1.0	0.36	19.0	9.0
	Stiff clayey silt till	Below 331		75	29	2.9	N/A/1.1	0.35	21.0	11.0
14+430 to 14+476 Borehole 55	Stiff cohesive fill	334 to 333	331.5	100	28	2.8	1.5/N/A	0.36	19.0	9.0
	Compact to dense sandy silt	333 to 331		-	30	3.0	1.6/N/A	0.33	19.0	9.0
	Very stiff clayey silt till	Below 331		150	30	3.0	1.6/N/A	0.33	21.0	11.0

FOUNDATION DESIGN PARAMETERS
RELOCATION OF EXISTING NOISE BARRIER WALL 3

NOTES:

1. Where both c_u and ϕ' have been given for a specific stratum, the foundation design should be checked for both the drained and undrained conditions and the larger of the two calculated foundation depths shall govern.
2. Passive earth pressure coefficient (K_p) values are provided for level ground. Where sloping ground is present adjacent to the noise barrier wall, adjusted K_p values must be used in the foundation design. Between Stations 14+045 and 14+080 Lt and from the east side of the Westmount Road overpass and the existing culvert areas, from approximately Stations 14+175 to 14+385 Lt, the ground behind the existing noise barrier wall will slope downwards at 2 horizontal to 1 vertical. For the remaining areas of noise barrier wall 3, the ground behind the noise barrier will slope downwards at 3 horizontal to 1 vertical.
3. Below the groundwater level, the effective unit weight of the soil (γ') should be used.
4. This table is to be read in conjunction with the accompanying report.

Prepared By: MSWL

Checked By: DUP

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

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.) split spoon sampler for a distance of 300 mm (12 in.)

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, 60º 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 cm^2 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.

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

(b) Cohesive Soils

Consistency	c_u, s_u kPa	c_u, s_u 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

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
v	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 = σ'_p/σ'_{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 δ
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)

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 50

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC
LOCATION N 4809655.3 ;E 223332.2
BOREHOLE TYPE POWER AUGER / SOLID STEM
DATE May 29, 2010
ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	SOIL PROFILE: *Elevation has been interpolated from existing AGM survey data.* DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
341.72	ROAD SURFACE										
0.08	ASPHALT										
0.34	FILL, sand and gravel, crushed										
341.05	FILL, sand and gravel Brown						341				
0.67	FILL, sandy silt, trace gravel, with clayey silt layers Compact Brown		1	SS	18						
			2	SS	17		340				0 35 48 17
339.59											
2.13	FILL, clayey silt, trace topsoil, trace sand, trace gravel Stiff Brown		3	SS	11		339				
			4	SS	8						
338.06											
3.66	SILTY CLAY, some sand, trace gravel Stiff Brown		5	SS	10		338		48		0 16 42 42
			6	SS	10		337				
336.54											
5.18	END OF BOREHOLE Borehole dry during drilling on May 29, 2010.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 51

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
LOCATION N 4809690.2 ;E 223402.5
ORIGINATED BY MA
DIST HWY 7/8
BOREHOLE TYPE POWER AUGER / SOLID STEM
COMPILED BY WDF
DATUM GEODETIC
DATE May 26, 2010
CHECKED BY

ELEV / DEPTH	SOIL PROFILE: *Elevation has been interpolated from existing AGM survey data.* DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
341.37	ROAD SURFACE										
0.08	ASPHALT										
	FILL, sand and gravel, crushed						341				
0.37 / 340.67	FILL, sand and gravel, with cobbles Brown										
0.70	FILL, silty sand, some clay, trace topsoil		1	SS	16				○		
340.15	Compact Brown						340				
1.22	FILL, clayey silt, trace topsoil, trace sand, trace gravel Stiff Brown		2	SS	15				○	○	
338.93							339			○	
2.44	SANDY SILT, trace clay Loose to compact Brown		3	SS	4						
			4	SS	7		338		○		0 45 49 6
			5	SS	11						
							337				
336.19			6	SS	14						
5.18	END OF BOREHOLE Borehole dry during drilling on May 26, 2010.										

+ 3, × 3: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 52

1 OF 1 **METRIC**

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC
LOCATION N 4809722.8 ;E 223482.5
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 26, 2010
ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	SOIL PROFILE: *Elevation has been interpolated from existing AGM survey data.* DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
340.57	ROAD SURFACE										
0.10	ASPHALT										
	FILL, sand and gravel, crushed										
0.40	FILL, sand and gravel Brown										
0.70	FILL, silty fine sand, trace gravel, with clayey silt pockets Compact Brown		1	SS	12		340		○		
338.59			2	SS	20		339		○		
1.98	CLAYEY SILT TILL, some sand, trace gravel Stiff to very stiff Brown		3	SS	16		338		⊖		0 16 53 31
			4	SS	16		337				
			5	SS	13						
			6	SS	13		336				
335.39											
5.18	END OF BOREHOLE Borehole dry during drilling on May 26, 2010.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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RECORD OF BOREHOLE No 53

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
LOCATION N 4809815.7 ;E 223778.9
ORIGINATED BY MR
DIST HWY 7/8
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
COMPILED BY WDF
DATUM GEODETIC
DATE May 26, 2010
CHECKED BY

ELEV / DEPTH	SOIL PROFILE: *Elevation has been interpolated from existing AGM survey data.* DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
336.55	ROAD SURFACE										
0.11	ASPHALT										
0.30	FILL, sand and gravel, crushed Brown										
335.85	FILL, sand and gravel Brown						336				
0.70	FILL, clayey silt, trace gravel, trace topsoil, with sand layers Firm to very stiff Brown		1	SS	11						
			2	SS	8		335				0 34 46 20
			3	SS	13		334				
			4	SS	6						0 20 58 22
			5	SS	7		333	(>143.6)			
332.13											
4.42	CLAYEY SILT, trace sand, trace gravel, with sand layers Very stiff Brown		6	SS	17		332				
331.52											
5.03	END OF BOREHOLE Borehole dry during drilling on May 26, 2010.										

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 54

1 OF 1 **METRIC**

PROJECT 08-1132-084-1
W.P. 131-98-00 LOCATION N 4809833.6 ;E 223829.7 ORIGINATED BY MA
DIST HWY 7/8 BOREHOLE TYPE POWER AUGER / SOLID STEM COMPILED BY WDF
DATUM GEODETIC DATE May 26, 2010 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
335.65	ROAD SURFACE								
0.10	ASPHALT								
0.30	FILL, sand and gravel, crushed Brown								
334.95	FILL, sand and gravel, with cobbles Brown						335		
0.70	FILL, sand, fine to medium, trace silt, with clayey silt layers		1	SS	17				
334.28	Compact Brown								
1.37	FILL, clayey silt, some sand, trace gravel, trace topsoil Stiff to very stiff Brown		2	SS	11		334		0 22 52 26
			3	SS	14		333		
			4	SS	18				1 15 59 25
			5	SS	12		332		
331.23									
4.42	CLAYEY SILT TILL, trace sand, trace gravel Stiff Brown		6	SS	10		331		
330.47									
5.18	END OF BOREHOLE Borehole dry during drilling on May 26, 2010.								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11

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London, Ontario

RECORD OF BOREHOLE No 55

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC

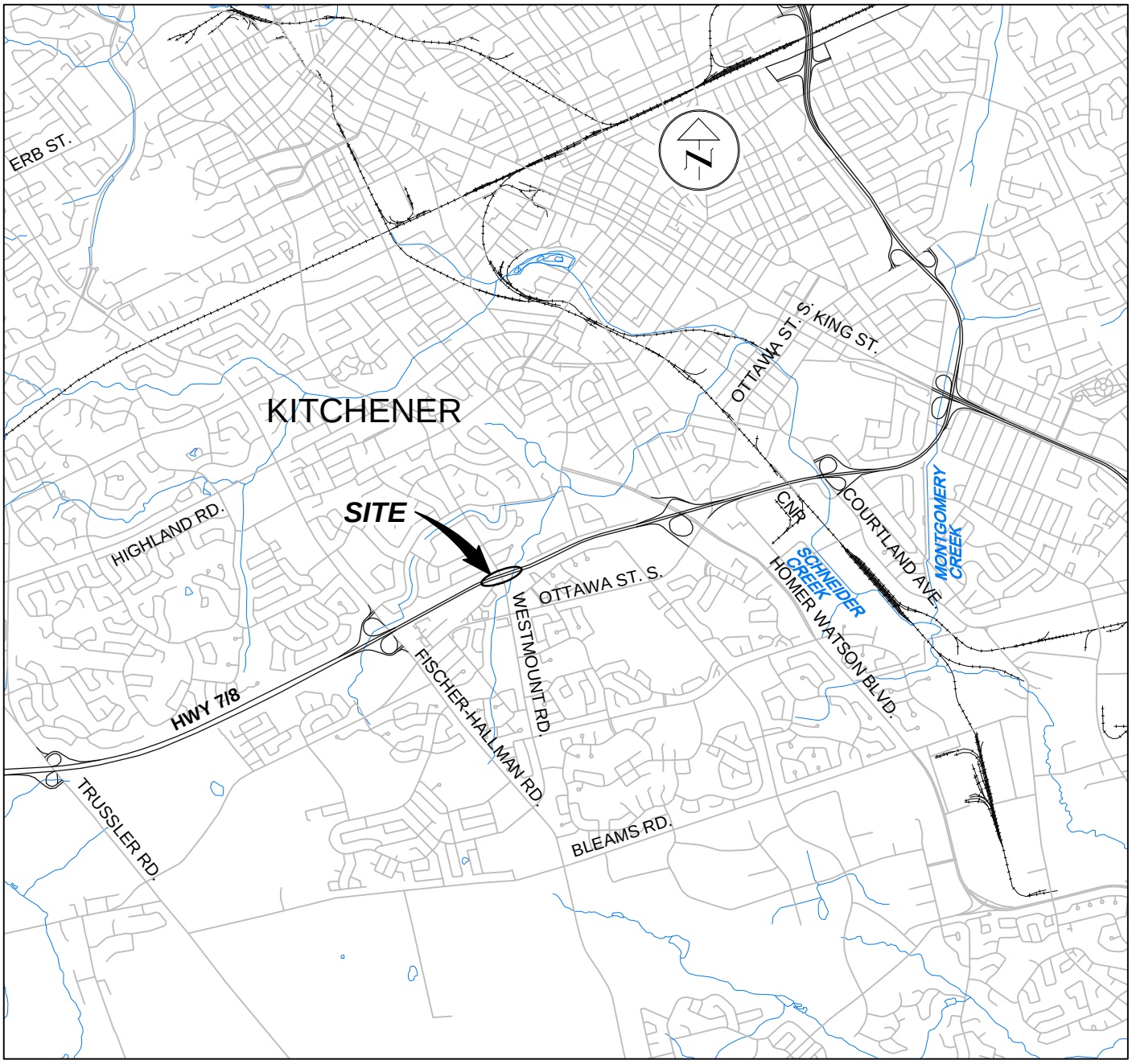
LOCATION N 4809859.1 ;E 223890.0
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 27, 2010

ORIGINATED BY MR
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	SOIL PROFILE	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
335.48	ROAD SURFACE										
0.11	ASPHALT										
0.34	FILL, sand and gravel, crushed Brown										
0.61	FILL, sand and gravel Brown		1	SS	16		335		○		
334.11	FILL, silty fine sand, trace gravel Compact										
1.37	FILL, clayey silt, some sand, trace gravel Stiff to very stiff Brown		2	SS	11		334		○		0 22 53 25
332.89			3	SS	15		333		○		
2.59	TOPSOIL, silty, trace sand Compact								○		
332.58											
2.90	Grey SILT, some sand, trace clay Dense		4	SS	44				○		0 16 77 7
331.82	Brown						332				
3.66	SANDY SILT Compact Brown		5	SS	15	▽					
331.06											
4.42	CLAYEY SILT TILL, trace sand, trace gravel Very stiff		6	SS	22		331				
330.45	Grey										
5.03	END OF BOREHOLE Groundwater encountered at about elev. 331.5m during drilling on May 27, 2010.										

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

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11



SCALE IN METRES

0 1000 2000

1:50000

REFERENCE

DRAWING BASED ON CANMAP STREETFILES V2005.4.

NOTE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

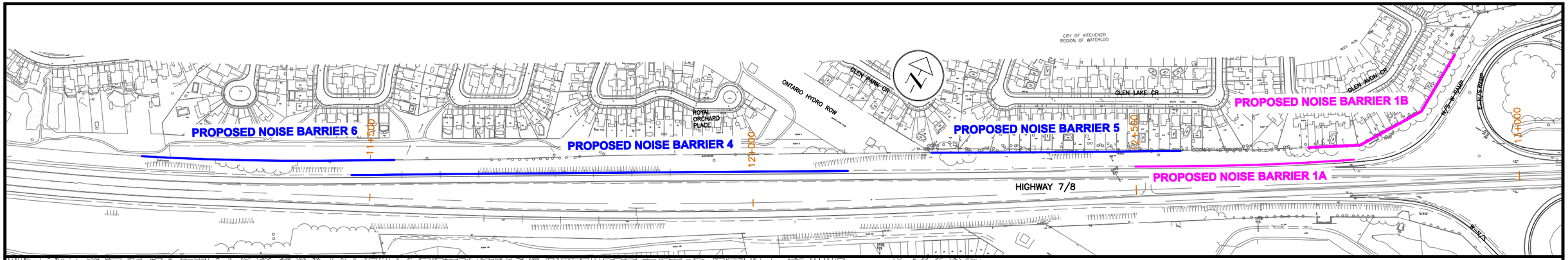
KEY PLAN

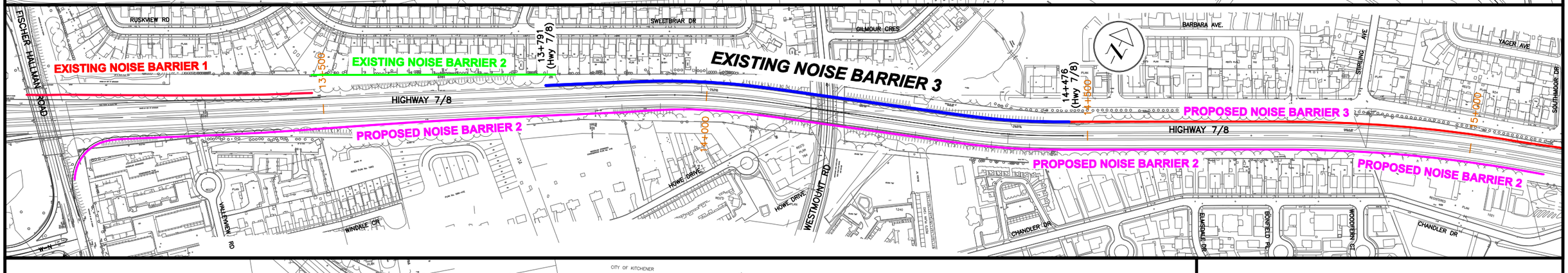
Golder Associates
LONDON, ONTARIO

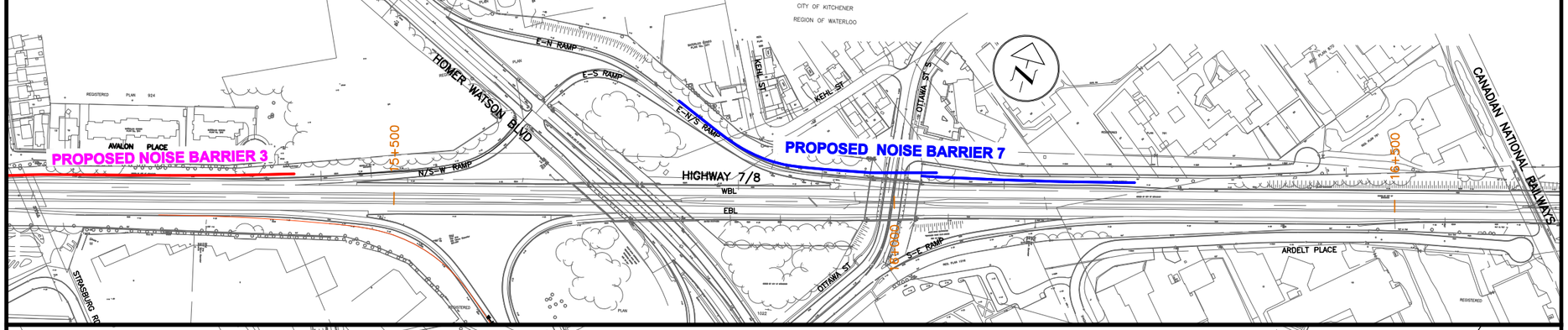
PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11F001
			SCALE	AS SHOWN REV.
CADD	WDF	Feb. 18/11		
CHECK				

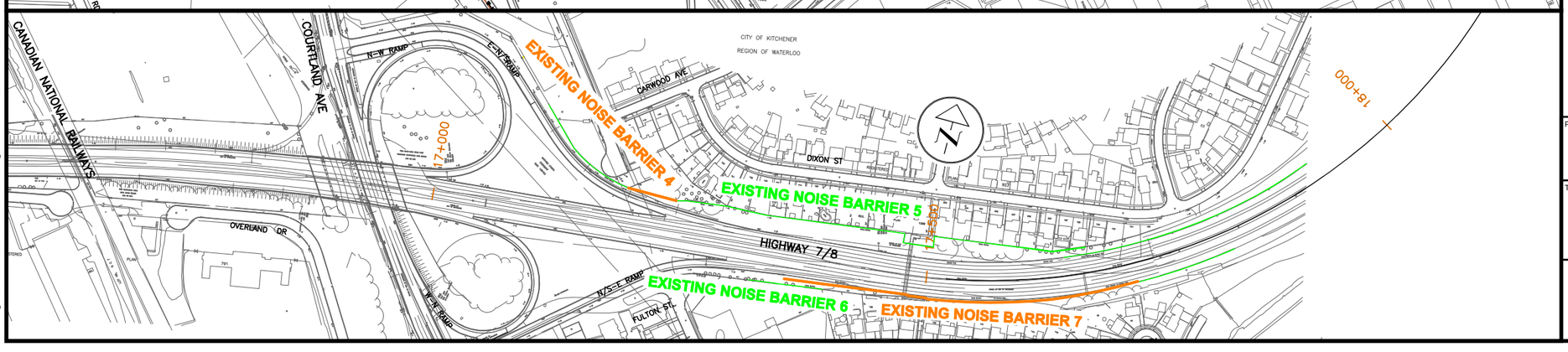
FIGURE 1

Drawing file: 0811320841-F11F001.DWG Feb 18, 2011 - 4:42pm









SCALE IN METRES

0 100 200 m

1:5000

REFERENCE

BASE PLANS PROVIDED IN DIGITAL FORMAT
BY DILLON CONSULTING.

NOTE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

NOISE BARRIER WALL LOCATION PLAN

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.		0811320841-F11F002
			SCALE	AS SHOWN	REV. 0
CADD	WDF	Feb. 18/11			
CHECK					

FIGURE 2

Drawing file: 0811320841-F11F002.dwg Feb 24, 2011 - 9:54am

MINISTRY OF TRANSPORTATION, ONTARIO

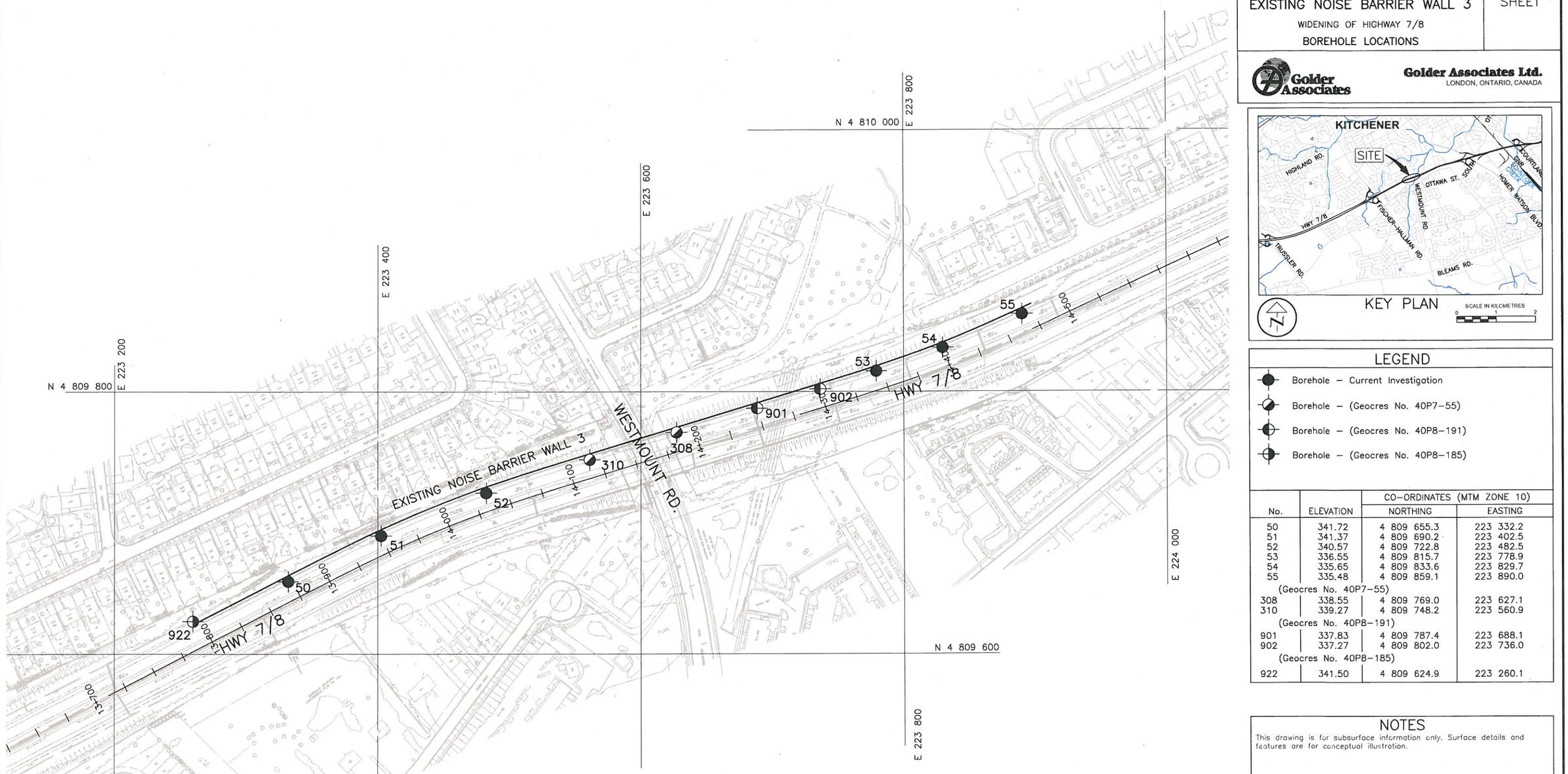
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 131-98-00

SHEET

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
BOREHOLE LOCATIONS

Golder Associates Ltd.
LONDON, ONTARIO, CANADA



PLAN
SCALE
30 0 30 m

KEY PLAN
SCALE IN KILOMETRES 0 1 2

LEGEND
- Borehole – Current Investigation
- Borehole – (Geocres No. 40P7-55)
- Borehole – (Geocres No. 40P8-191)
- Borehole – (Geocres No. 40P8-185)

No.	ELEVATION	CO-ORDINATES (MTM ZONE 10) NORTHING	EASTING
50	341.72	4 809 655.3	223 332.2
51	341.37	4 809 690.2	223 402.5
52	340.57	4 809 722.8	223 482.5
53	336.55	4 809 815.7	223 778.9
54	335.65	4 809 833.6	223 829.7
55	335.48	4 809 859.1	223 890.0
(Geocres No. 40P7-55)			
308	338.55	4 809 769.0	223 627.1
310	339.27	4 809 748.2	223 560.9
(Geocres No. 40P8-191)			
901	337.83	4 809 787.4	223 688.1
902	337.27	4 809 802.0	223 736.0
(Geocres No. 40P8-185)			
922	341.50	4 809 624.9	223 260.1

NOTES
This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

REFERENCE
Base plans provided in digital format by Dillon Consulting.

LICENSED PROFESSIONAL ENGINEER D.J.O. PROUT Feb. 24/11 PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER F.J. HEFFERNAN Feb. 24/11 PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION

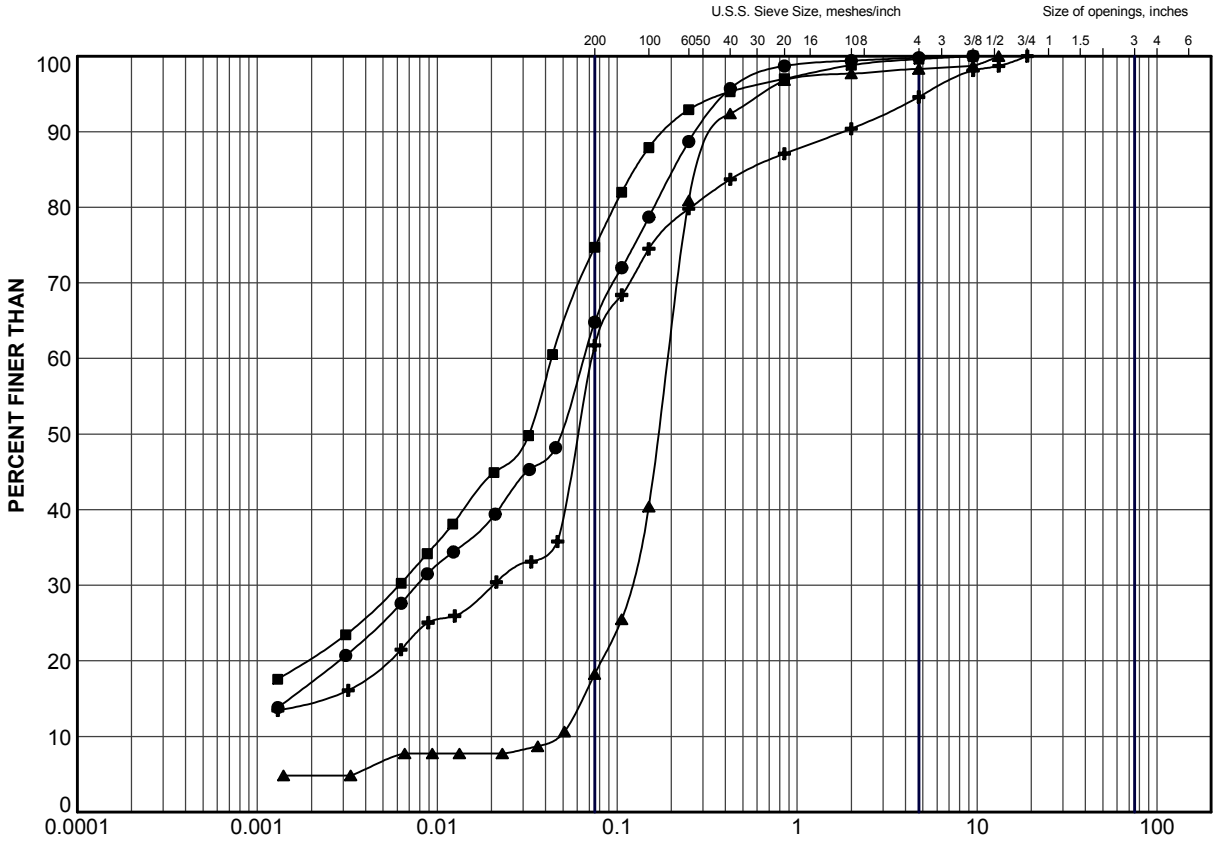
Geocres No. 40P8-188

HWY. 7/8	PROJECT NO. 08-1132-084-1		DIST.
SUBM'D. ML	CHKD.	DATE: Oct. 22/10	SITE:
DRAWN: WDF	CHKD.	APPD.	DWG. 1

PLOT DATE: February 24, 2011
FILENAME: N:\cad\4-2d\1132 - Geotechnical\1132-000-00\08-1132-084-1 DILLON - GWP 131-98-00 EDNC - HWY 7-8\Drafting\AutoCAD files\08113201

APPENDIX A

Laboratory Test Data



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	50	2	340.0
■	901	6	333.0
▲	901	9	330.8
✚	902	4	334.0

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

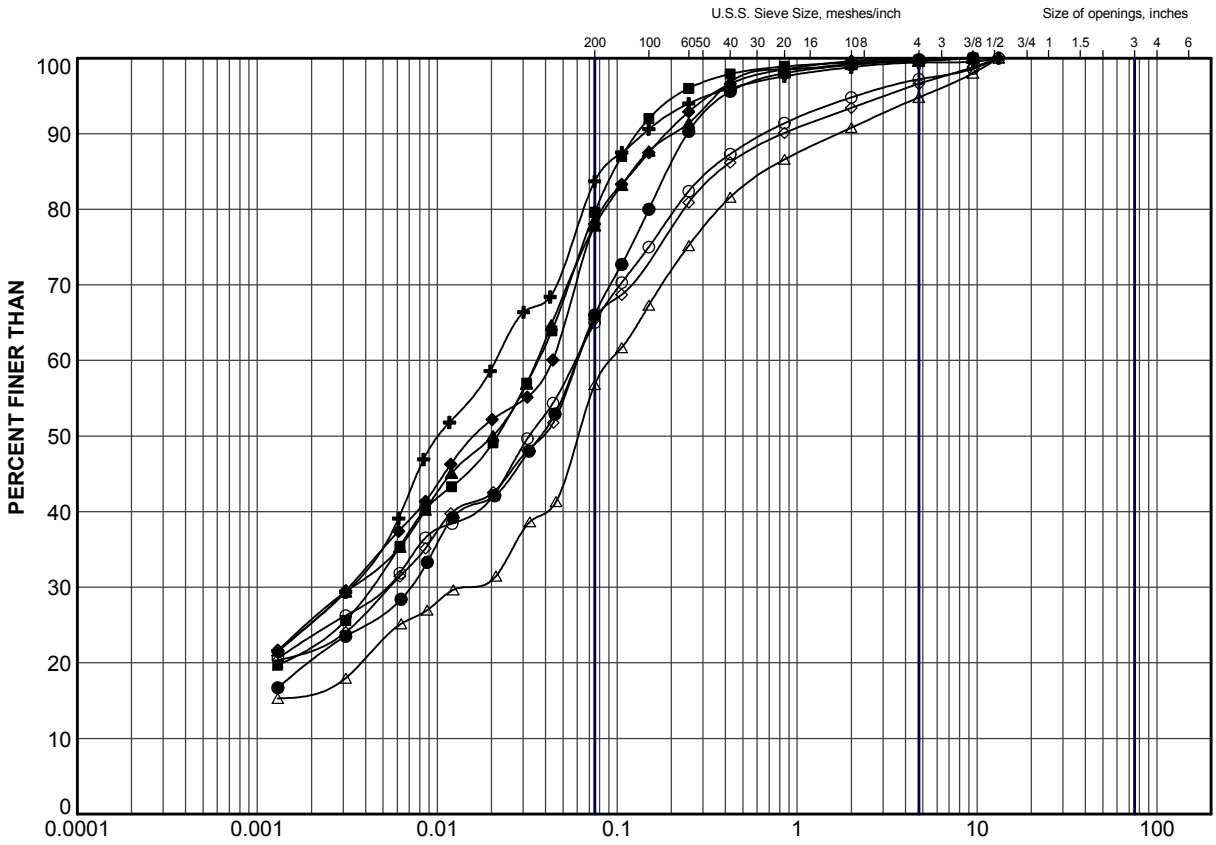
GRAIN SIZE DISTRIBUTION

FILL - NON COHESIVE

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11F0A1
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE A-1**	

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	53	2	334.8
■	53	4	333.3
▲	54	2	333.9
✚	54	4	332.4
◆	55	2	333.7
◇	308	3	336.0
○	901	3	335.3
△	902	7	331.7

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

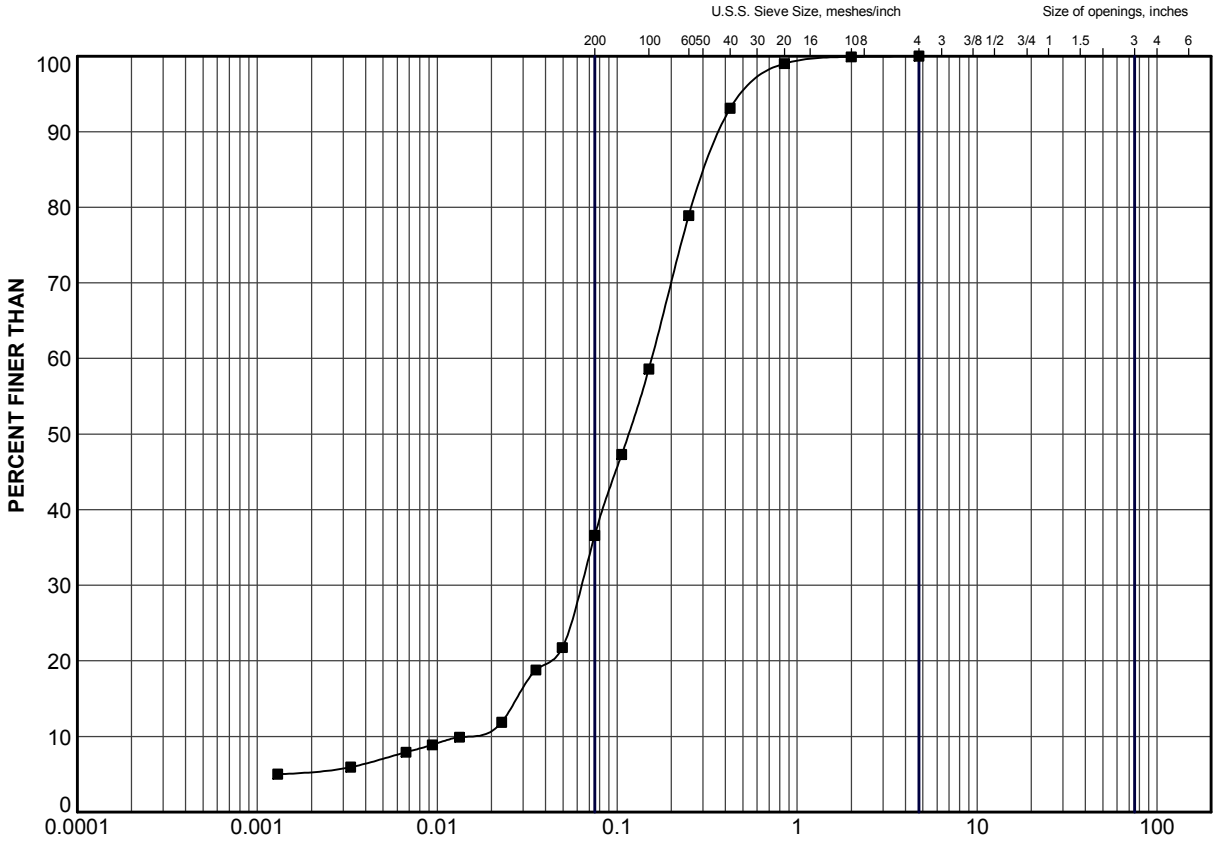
GRAIN SIZE DISTRIBUTION

FILL - COHESIVE

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11F0A2
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE**	**A-2**

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
■	922	2	339.8

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

GRAIN SIZE DISTRIBUTION

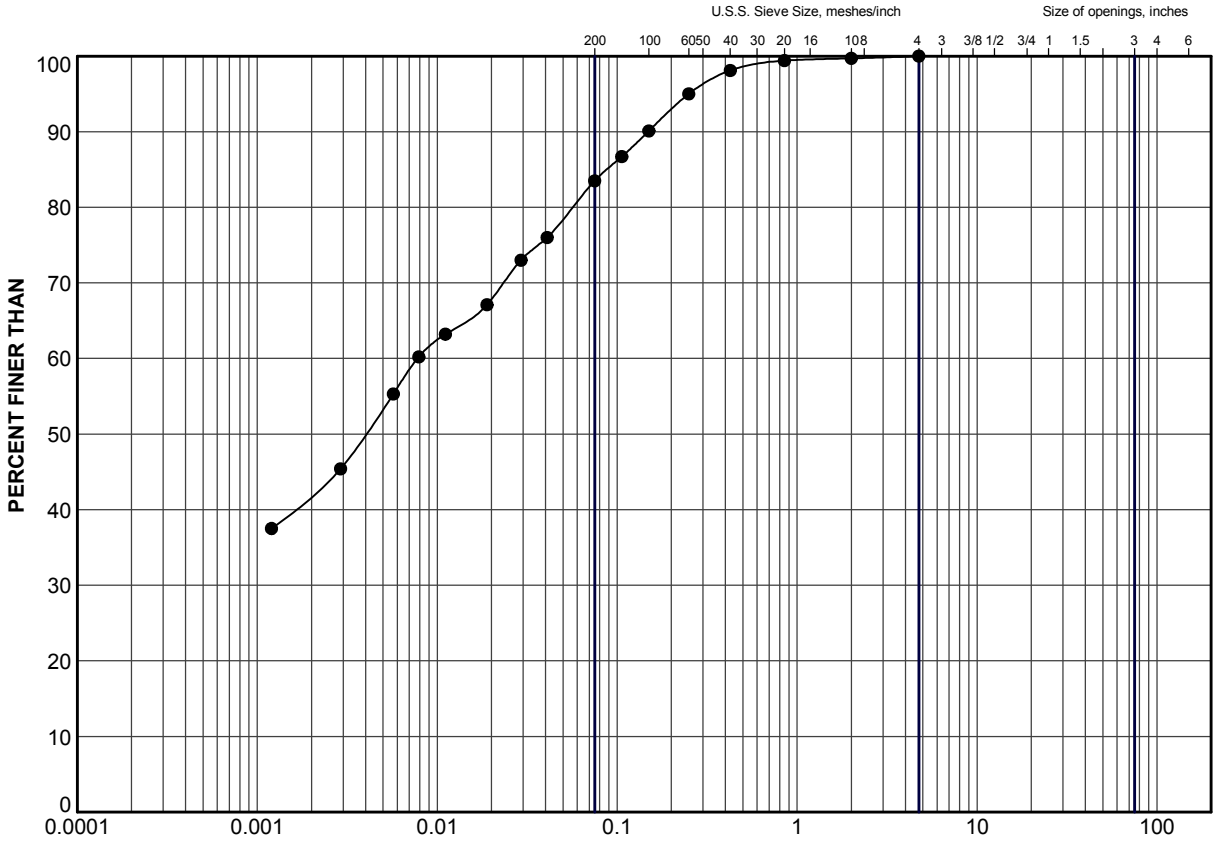
SILTY SAND

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.	0811320841-F11F0A3
			SCALE	N/A
DRAWN	LMK	Feb. 22/11	REV.	
CHECK				

FIGURE A-3

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	50	5	337.7

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

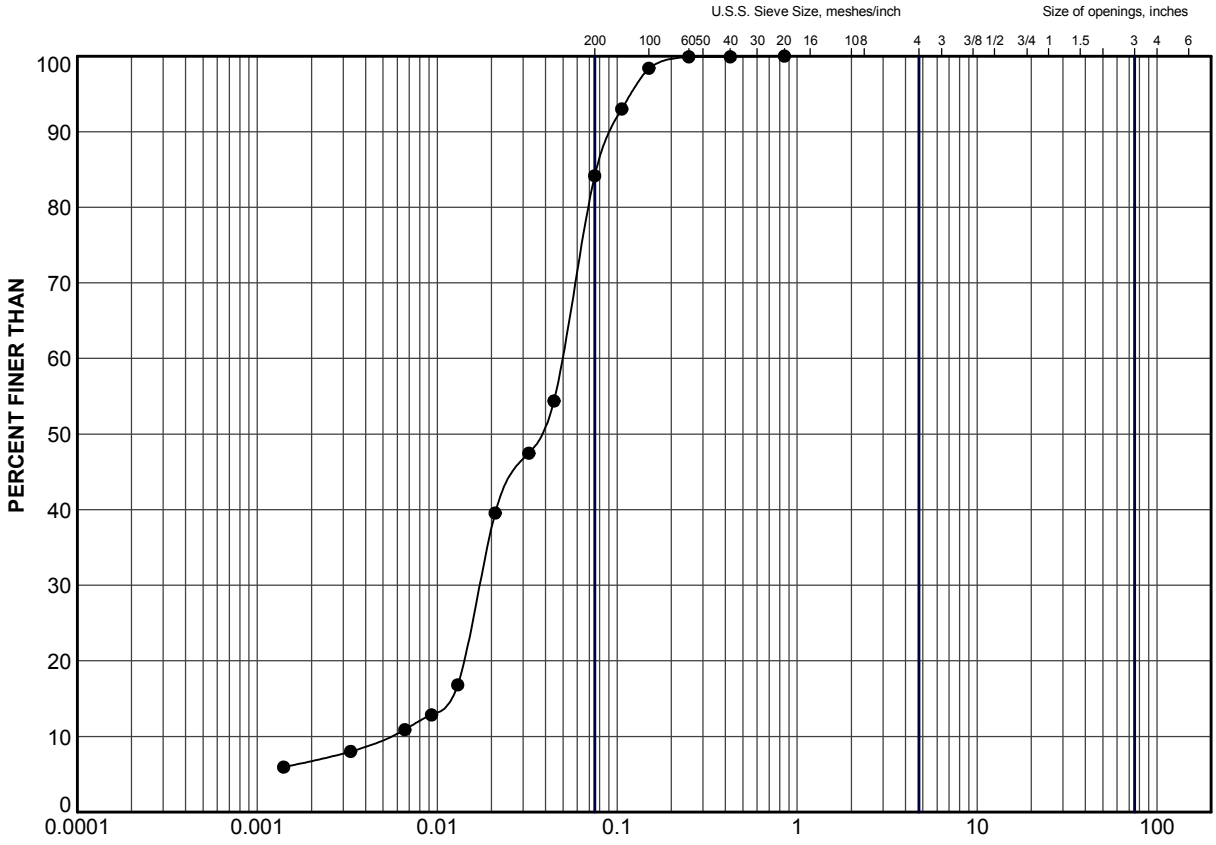
GRAIN SIZE DISTRIBUTION

SILTY CLAY

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11F0A4
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE**	**A-4**

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	55	4	332.2

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

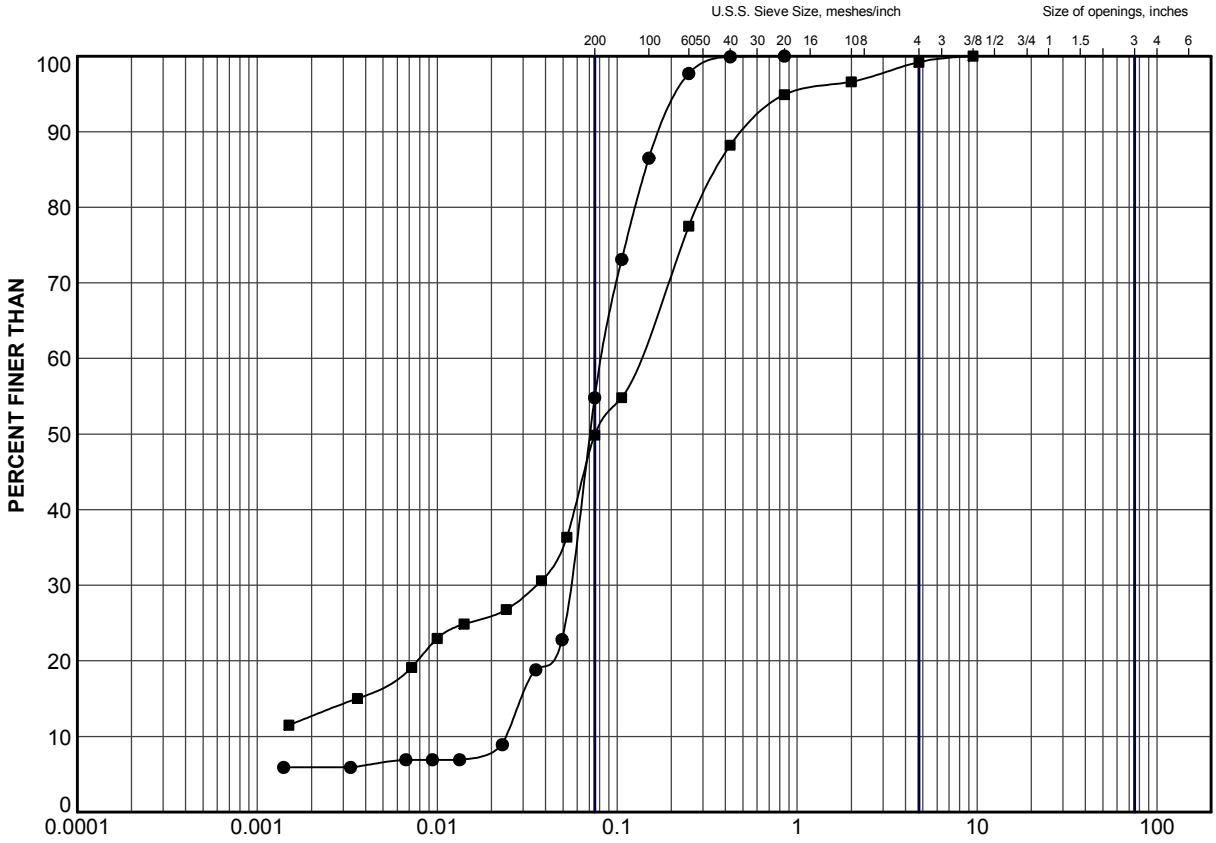
GRAIN SIZE DISTRIBUTION

SILT

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.	0811320841-F11F0A5
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE A-5**	

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	51	4	338.1
■	308	9	330.7

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

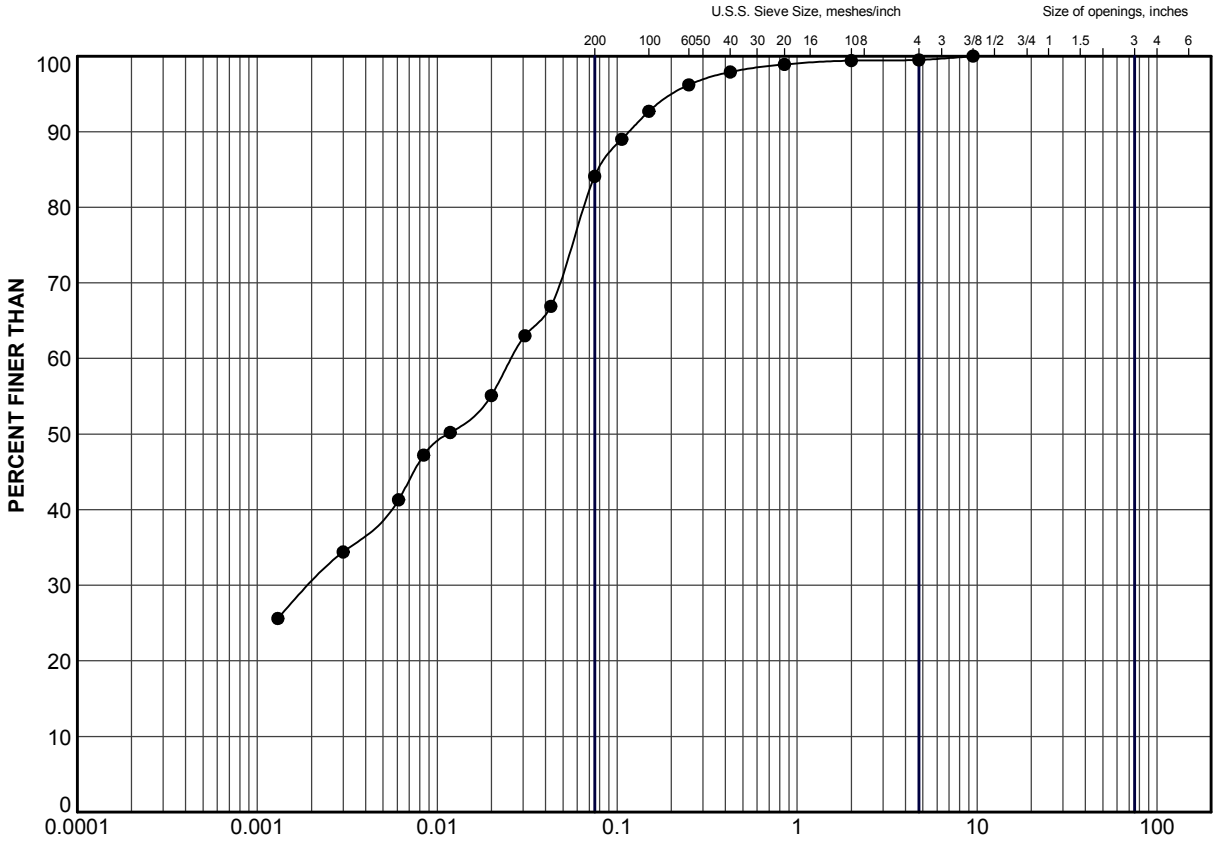
GRAIN SIZE DISTRIBUTION

SANDY SILT

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.	0811320841-F11F0A6
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE**	**A-6**

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	52	3	338.1

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

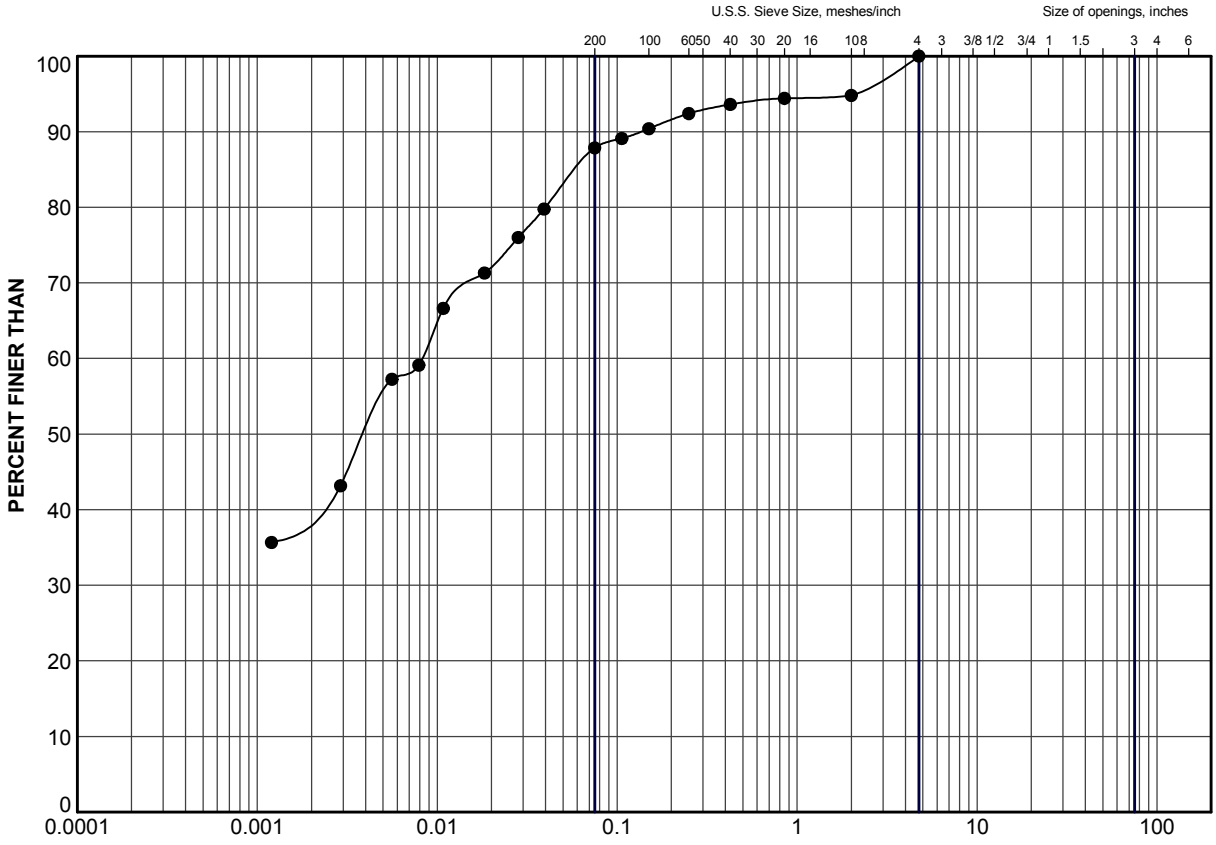
GRAIN SIZE DISTRIBUTION

CLAYEY SILT TILL

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.	0811320841-F11F0A7
			SCALE N/A	REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE A-7**	

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	922	6	336.7

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

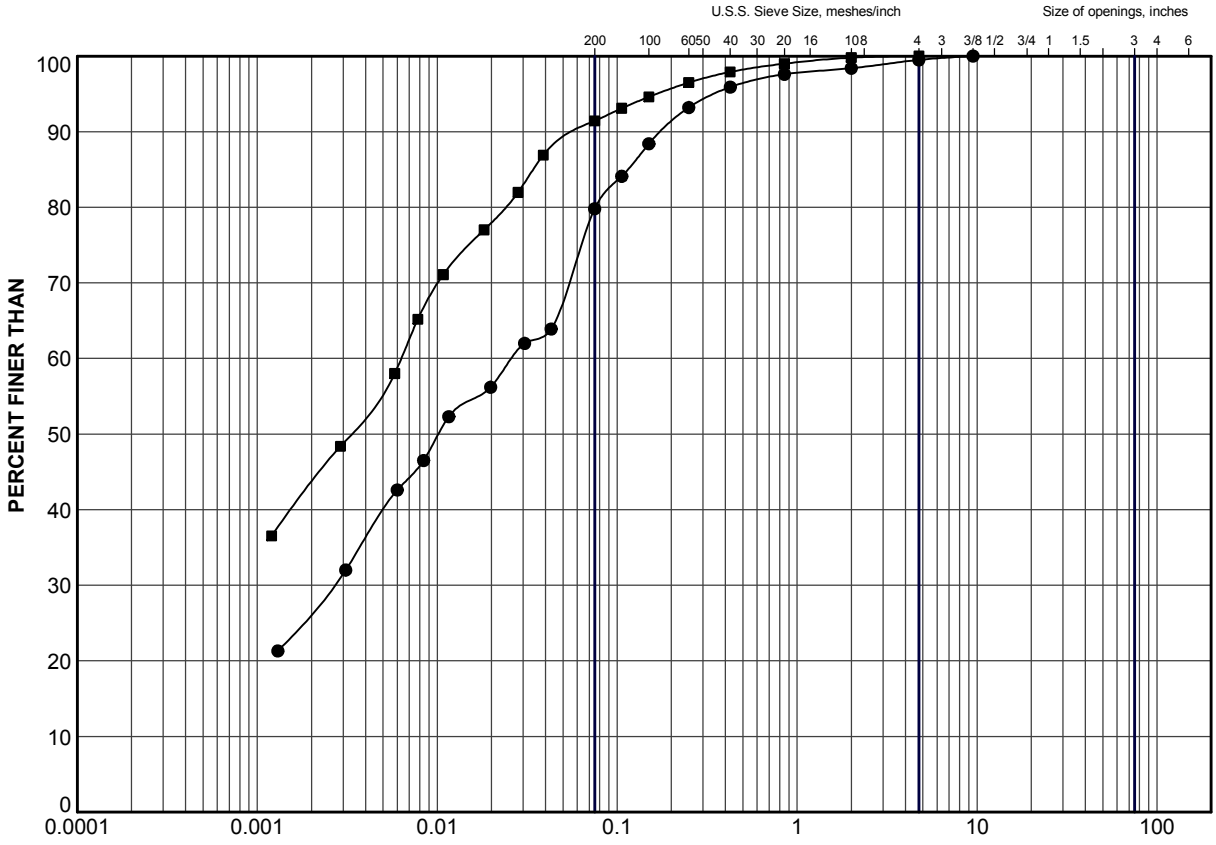
GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11F0A8
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE**	**A-8**

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	310	10	331.4
■	902	11	328.7

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

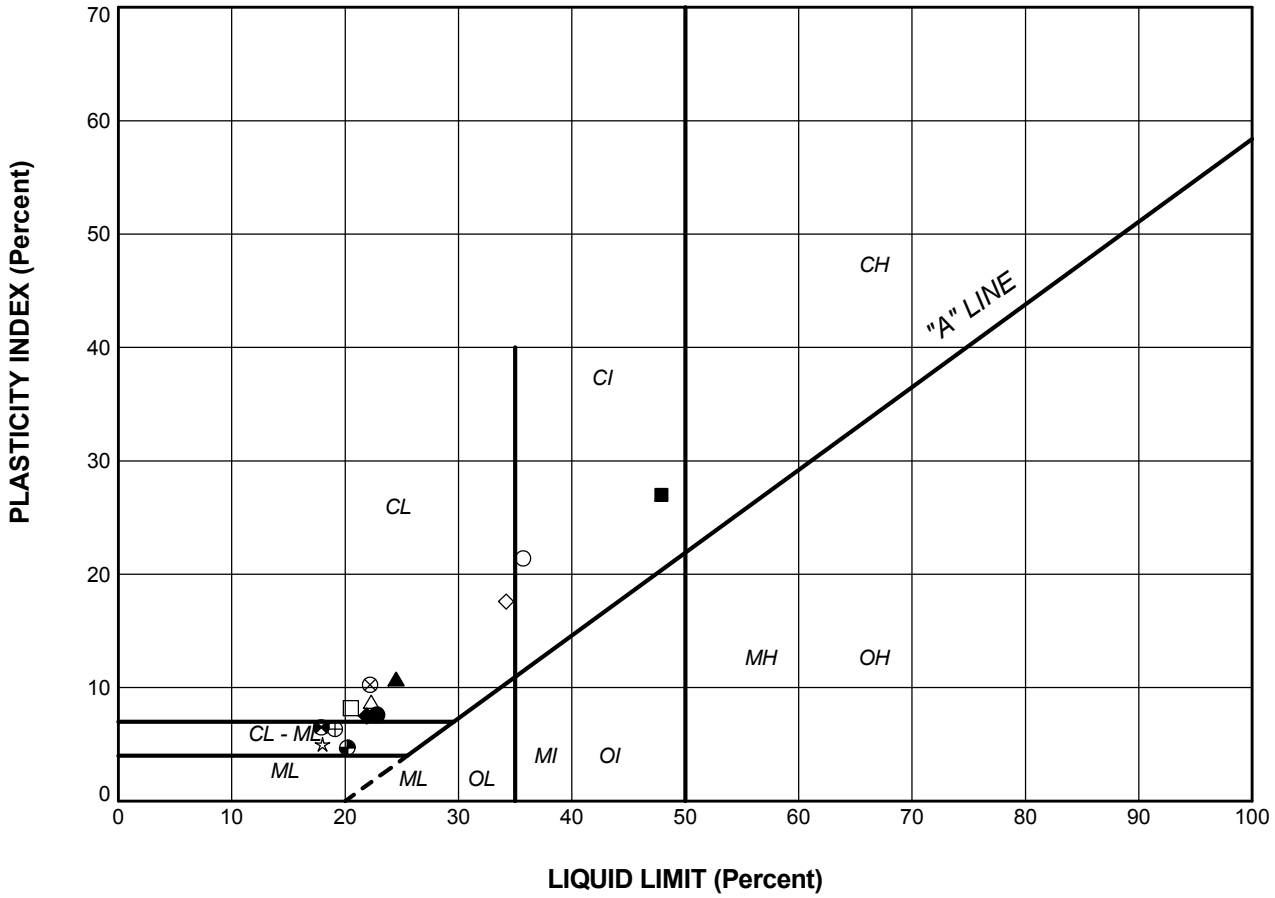
GRAIN SIZE DISTRIBUTION

CLAYEY SILT

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.	0811320841-F11F0A9
			SCALE	N/A REV.
DRAWN	LMK	Feb. 22/11		
CHECK			**FIGURE**	**A-9**

LDN_MTO_NEW GLDR_LDN.GDT



SOIL TYPE
C = Clay
M = Silt
O = Organic

PLASTICITY
L = Low
I = Intermediate
H = High

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
SILTY CLAY					
■	50	5	47.9	20.9	27.0
CLAYEY SILT TILL					
▲	52	3	24.5	13.8	10.8
CLAYEY SILT					
◆	310	10	21.9	14.4	7.5
◇	902	11	34.2	16.6	17.6
SILTY CLAY TILL					
○	922	6	35.7	14.3	21.4
FILL - CLAYEY SILT					
⊗	53	2	22.2	12.0	10.3
⊕	53	4	19.1	12.8	6.4
△	54	2	22.3	13.6	8.8
●	54	4	22.8	15.2	7.6
□	55	2	20.5	12.3	8.2
◓	308	3	17.9	11.4	6.5
◕	901	3	20.2	15.5	4.7
☆	902	7	18.0	13.0	5.0

PROJECT

EXISTING NOISE BARRIER WALL 3
WIDENING OF HIGHWAY 7/8
GWP 131-98-00

TITLE

PLASTICITY CHART

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No. 0811320841-F11F0A10	
			SCALE N/A	REV.
DRAWN	LMK	Feb. 22/11	FIGURE A-10	
CHECK				

MTO_PI_25 GLDR_LDN.GDT

APPENDIX B

Records of Boreholes From Other Components of GWP 131-98-00

APPENDIX B-1

Records of Boreholes – Westmount Road Overpass
(Site No. 33-228)
(Geocres No. 40P7-55)

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 308

1 OF 2

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC

LOCATION N 4809769.0 ;E 223627.1
BOREHOLE TYPE POWER AUGER / ROTARY DRILLING / TRICONE
DATE November 24, 2008

ORIGINATED BY JB
COMPILED BY LMK
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
338.55	GROUND SURFACE							
0.00	FILL, sand and gravel, some silt Compact Brown		1	SS	20		338	
337.18								
1.37	FILL, clayey silt, some sand, trace gravel Firm to hard Brown		2	SS	6		337	
			3	SS	8		336	2 32 45 21
334.89			4	SS	42			
3.66	FILL, sandy silt, some clay, trace gravel Dense Brown		5	SS	33		335	
334.13								
4.42	FILL, clayey silt, trace sand and gravel Very stiff Brown		6	SS	21		334	
333.55								
5.00	SANDY SILT, some clay with clayey silt layers Compact to very dense Brown		7	SS	42		333	
			8	SS	17		332	
			9	SS	106/200mm		331	1 49 37 13
330.02								
8.53	SILTY FINE SAND Compact Grey		10	SS	14	▽	330	
328.49							329	
10.06	SILT, some clay with peat Compact Grey		11	SS	15		328	
326.97							327	
11.58	CLAYEY SILT TILL, some sand, trace gravel Stiff to hard Grey		12	SS	27		326	0 18 61 21
			13	SS	49		325	
							324	

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH kPa (20 40 60 80 100)
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

UNIT WEIGHT γ kN/m³

Continued Next Page

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 308

2 OF 2 **METRIC**

PROJECT 08-1132-084-1 | W.P. 131-98-00 | LOCATION N 4809769.0 ;E 223627.1 | ORIGINATED BY JB

DIST | HWY 7/8 | BOREHOLE TYPE POWER AUGER / ROTARY DRILLING / TRICONE | COMPILED BY LMK

DATUM GEODETIC | DATE November 24, 2008 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	CLAYEY SILT TILL, some sand, trace gravel Stiff to hard Grey		14	SS	45		323				
			15	SS	64		322				
			16	SS	14		321				
319.35							320				
19.20	SAND AND GRAVEL, some silt Very dense Grey		17	SS	109		319		○		62 21 12 5
317.75							318				
20.80	SILTY FINE SAND, with clayey silt layers Very dense Grey		18	SS	110		317		○		0 42 41 17
315.28			19	SS	106/250mm		316				
23.27	END OF BOREHOLE Groundwater encountered at about elev. 329.4m during drilling on November 24, 2008.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 310

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC
LOCATION N 4809748.2 ;E 223560.9
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE June 3, 2009
ORIGINATED BY MA
COMPILED BY DMB
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
339.27	GROUND SURFACE						339				
0.00	ASPHALT										
0.15	FILL, sand and gravel, crushed										
0.40 / 338.54	FILL, sand and gravel, with cobbles Brown										
0.73	FILL, clayey silt, some sand, trace gravel Stiff to very stiff Brown and grey		1	SS	9		338				
			2	SS	12						
			3	SS	21		337		○		
336.37											
2.90	FILL, clayey silt, trace sand, trace gravel, trace topsoil Stiff to very stiff Brown and grey		4	SS	15		336				
			5	SS	10						
			6	SS	11		335		○		
			7	SS	12		334				
			8	SS	16		333		○		
332.56											
6.71	CLAYEY SILT, trace sand Firm Brown		9	SS	7		332		○		
331.80											
7.47	CLAYEY SILT, trace to some sand, trace gravel Very stiff Grey		10	SS	18		331		⊢○⊣		1 19 54 26
			11	SS	20		330				
329.21											
10.06	SANDY SILT, some clay Compact Grey		12	SS	26	▽	329		○		5 27 52 16
			13	SS	13		328		○		
326.16											
13.11	SAND, trace silt Compact Grey		14	SS	17		327		○		0 96 3 1
325.10							326				
14.17	END OF BOREHOLE Groundwater encountered at about elev. 327.7m during drilling on June 3, 2009.										

+ ³, × ³: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11

APPENDIX B-2

Record of Borehole – Overhead Signs (Geocres No. 40P8-185)

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 922

1 OF 1 **METRIC**

PROJECT 08-1132-084-1 | W.P. 131-98-00 | LOCATION N 4809624.9 ;E 223260.1 | ORIGINATED BY MR
DIST | HWY 7/8 | BOREHOLE TYPE POWER AUGER / HOLLOW STEM | COMPILED BY WDF
DATUM GEODETIC | DATE May 11, 2010 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
341.50	GROUND SURFACE										
0.00	TOPSOIL, clayey silt										
0.15	Brown FILL, silt, some clay, trace sand, trace topsoil Loose Brown		1	SS	8		341				
340.13											
1.37	SILTY SAND, fine, trace clay Compact Brown		2	SS	12		340		○		0 63 31 6
			3	SS	18		339				
			4	SS	29		338				
337.54											
3.96	SILTY CLAY TILL, trace to some sand, trace gravel Stiff to very stiff Brown to grey at about elev. 337.1m		5	SS	18		337				
			6	SS	11				⊢○⊣		0 12 49 39
							336	(>143.6)			
334.95			7	SS	13		335				
6.55	END OF BOREHOLE Borehole dry during drilling on May 11, 2010.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11

APPENDIX B-3

Records of Boreholes – Retained Soil System Walls (Geocres No. 40P8-191)

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 901

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST HWY 7/8
DATUM GEODETIC

LOCATION N 4809787.4 ;E 223688.1
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 27, 2010

ORIGINATED BY MR
COMPILED BY WDF
CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
337.83	ROAD SURFACE								
0.09	ASPHALT								
0.30	FILL, sand and gravel, crushed Brown								
0.55	FILL, sand and gravel Brown								
	FILL, clayey silt, some sand, trace gravel, trace topsoil Stiff Brown		1	SS	8		337		
			2	SS	13		336		
			3	SS	9				3 33 40 24
334.93							335		
2.90	FILL, sandy silt, some clay, trace gravel, trace topsoil Loose to compact Brown		4	SS	11				
			5	SS	15		334		
			6	SS	7		333		0 26 54 20
			7	SS	15				
331.89							332		
5.94 331.58	FILL, topsoil, silty, some sand, some gravel								
6.25	Compact FILL, sand, fine to medium, trace to some gravel, some silt, trace clay Compact to dense		8	SS	25				
330.67			9	SS	36		331		2 81 12 5
7.16 330.36	FILL, topsoil, silty, some sand, some gravel								
7.47	Dense Black								
7.77	FILL, sandy silt, trace gravel, trace clay		10	SS	26		330		
329.60	Compact Grey								
8.23	TOPSOIL, silty Compact Black		11	SS	57				
328.84							329		
8.99	SAND AND GRAVEL, trace silt, trace topsoil Very dense		12	SS	25				
328.23									
9.60	CLAYEY SILT TILL, trace sand, trace gravel Very stiff Brown to grey at about 328.3m								
	END OF BOREHOLE Borehole dry during drilling on May 27, 2010.								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

LDN_MTO_06 08-1132-084-1.GPJ LDN_MTO.GDT 22/02/11

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 902

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST HWY 7/8
DATUM GEODETIC
LOCATION N 4809802.0 ;E 223736.0
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 26, 2010
ORIGINATED BY MR
COMPILED BY WDF
CHECKED BY

ELEV / DEPTH	SOIL PROFILE: *Elevation has been interpolated from existing AGM survey data.* DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
337.27	ROAD SURFACE						337				
0.09	ASPHALT										
0.27	FILL, sand and gravel, crushed Brown										
0.55	FILL, sand and gravel Brown										
	FILL, clayey silt, trace sand, trace gravel Firm to very stiff Brown		1	SS	7						
							336				
			2	SS	13						
							335				
			3	SS	16						
334.37											
2.90	FILL, sandy silt, some clay, trace gravel Loose to compact Brown		4	SS	12		334				5 33 48 14
			5	SS	9						
332.85							333				
4.42	FILL, clayey silt, trace to some sand, trace gravel, trace topsoil Firm to very stiff Brown and grey		6	SS	9						
			7	SS	5		332				5 38 41 16
			8	SS	9		331				
			9	SS	18		330				
329.65											
7.62	TOPSOIL, silty Loose Black		10	SS	9						
329.19											
8.08	CLAYEY SILT, trace sand, with silt layers Stiff Grey		11	SS	14		329				0 9 48 43
			12	SS	14		328				
327.67											
9.60	END OF BOREHOLE Borehole dry during drilling on May 26, 2010.										

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

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