February 2011

FOUNDATION INVESTIGATION AND DESIGN REPORT

Proposed 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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Report Number: 08-1132-084-1-R11G
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PART A

FOUNDATION INVESTIGATION REPORT

PROPOSED 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 the foundation investigations as part of the detail design work for GWP 131-98-00, the reconstruction and widening of Highway 7/8, within the project limits. This report presents the results of the foundation investigation conducted for the proposed noise barrier wall 3 located between the Westmount Road overpass and the Homer Watson Boulevard Interchange from Stations 14+476 to 15+400 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 Foundations Engineering dated July 4, 2008.

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

2.0 SITE DESCRIPTION

2.1 General

The project area of Highway 7/8 is located in the south-central area of Kitchener, Ontario. The site extends from 1.9 km west of Fischer-Hallman Road easterly to 0.8 km east of Courtland Avenue. The location of the noise barrier wall is shown on the Key Plan, Figure 1 and 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, as well as an overhead structure for CNR tracks are situated within the project limits.

Land use adjacent to this site is typically urban residential north of Highway 7/8 with a mix of industrial, commercial and residential areas to the south. Concordia Park and Meinzinger Park are near the west and east ends of the proposed noise wall site.

Proposed noise barrier wall 3 is to be constructed between the Westmount Road overpass and the Homer Watson Boulevard Interchange from Stations 14+476 to 15+400 Lt along Highway 7/8. The topography beyond the Highway 7/8 roadway and embankment is gently undulating to hummocky with ground surface elevations ranging between 320 and 330 metres.

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 consist 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 Natural Resources Map P.2508 entitled “Quaternary Geology, Cambridge Area, Southern Ontario”, the site lies in an area of primarily ice contact sands deposited in the Pleistocene era. In localized areas, Maryhill clayey silt till and Port Stanley sandy silt till are indicated.

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.1985 entitled “Bedrock Topography Series, Southern

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

Ontario", the bedrock surface along the proposed noise barrier wall subcrops at about elevation 267 to 269 metres or some 51 to 63 metres below ground surface.

3.0 INVESTIGATION PROCEDURES

The foundation investigation field work for the design of the proposed noise barrier wall 3 was carried out between May 4 through 6, 17 and 27, 2010 during which time thirteen boreholes were drilled along Highway 7/8 in the vicinity of the proposed noise barrier wall 3. The borehole locations are shown on the Borehole Location Plan, Drawing 1.

All of the boreholes were advanced to a depth of 5.0 metres, with the exception of borehole 64, which was advanced to 5.8 metres due to encountering an abandoned pipe at elevation 325.5 metres. Borehole 64 was advanced to completion after relocation about 1.8 metres to the north and 2.5 metres west of the original location. 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)
55	4 809 859	223 890	335.48	5.03
56	4 809 891	223 951	334.88	5.03
57	4 809 924	224 018	333.92	5.03
58	4 809 955	224 086	333.26	5.03
59	4 809 986	224 153	332.75	5.03
60	4 810 021	224 222	331.31	5.03
61	4 810 046	224 294	331.11	5.03
62	4 810 071	224 371	330.63	5.03
63	4 810 091	224 439	329.88	5.03
64	4 810 116	224 510	328.13	5.79
65	4 810 135	224 582	328.59	5.03
66	4 810 153	224 655	329.10	5.03
67	4 810 172	224 723	329.04	5.03

The drilling was carried out using truck-mounted CME 45 power augers supplied and operated by a specialist drilling contractor. In the boreholes, samples of the overburden were obtained at generally 0.75 metre intervals of depth using 50 millimetre 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.

The groundwater conditions were observed throughout the drilling operations and, following completion of the drilling, 12.5 millimetre diameter standpipes were installed in boreholes 65 and 67 to monitor the groundwater conditions. 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 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 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 and stratigraphic profiles 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 thirteen boreholes drilled at the site generally encountered highly complex and variable conditions consisting of asphaltic concrete pavement and/or topsoil underlain by layers of granular and cohesive fill which overly native clayey silt, silt, sandy silt, silty sand, sand, clayey silt till and silty clay. An abandoned pipe was encountered at about elevation 325.5 metres in borehole 64. The borehole was then relocated 2.5 metres west of the original location but the pipe was again encountered during drilling. The borehole was then relocated about 1.8 metres to the north and advanced to completion.

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 ground surface in borehole 55 and underlying layers of granular fill in borehole 64 at elevation 327.4 metres. The thicknesses of the asphalt layers were 110 and 60 millimetres in boreholes 55 and 64, respectively. The asphalt in borehole 55 was underlain by 240 millimetres of granular roadbase material from elevation 335.3 metres.

4.1.2 Topsoil

Topsoil layers were encountered in all boreholes at the ground surface with the exception of borehole 55. In borehole 55, the topsoil was found underlying layers of granular and cohesive fill and overlying native silt at elevation 332.9 metres. In borehole 67, a layer of buried topsoil was also encountered at depth underlying granular fill and overlying native sandy silt at elevation 327.2 metres. The thickness of topsoil layers was between 90 and 310 millimetres. It should be noted that a trace to some topsoil was also observed in boreholes 56, 57, 59, 60, 63, 64, 65 and 66 at elevations 334.21, 333.8, 330.3 to 332.2, 329.9 to 331.2, 329.1, 325.0, 328.2 and 329.0 metres, respectively. 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

Fill was encountered underlying the asphaltic concrete or topsoil in all boreholes, with the exception of borehole 58, from elevations 327.9 to 335.1 metres. The fill generally comprised granular layers of sand and gravel, silty sand, sand, sandy silt and silt. In boreholes 55, 56, 59 and 64, layers of cohesive fill consisting of clayey silt were found underlying or between layers of granular fill at elevation 334.1, 334.2, 332.2 and 326.8 metres, respectively. A thin layer of cohesive fill was encountered underlying topsoil and overlying granular fill in borehole 57 at elevation 333.8 metres. The thickness of the granular fill ranged from 0.2 to 3.3 metres. In borehole 64, an abandoned sewer pipe was encountered between cohesive fill layers at elevation 325.5. The thickness of the cohesive fill layers were 0.1 to 3.1 metres.

The granular fill had N values ranging from 1 to 27 blows per 0.3 metres. The water contents were generally from 2 to 24 per cent with the exception of a single water content of 32 per cent in borehole 66 at elevation 327.3 metres. The higher water content is likely to be attributable to the topsoil found within the silt fill.

The cohesive fill had N values ranging from 2 to 21 blows per 0.3 metres. The water contents were 9 to 21 per cent. The cohesive fill layer is of low plasticity based on the results of four Atterberg limits determinations. The plastic limit, liquid limit and plasticity index ranges were 12 to 15, 21 to 25 and 8 to 9 per cent, respectively. The Atterberg limits results for the tests performed on the cohesive fill are presented on Figure A-7.

The results of the grain size testing conducted on fill samples are presented on Figure A-1, Appendix A.

4.1.4 Clayey Silt

Layers of clayey silt were encountered in boreholes 56, 57, 58 and 67 at elevations 332.8, 332.6, 332.8 and 325.7 metres, respectively. The clayey silt was found underlying layers of fill in borehole 56, underlying silt in borehole 57, underlying sand and silt in borehole 58 and underlying sandy silt in borehole 67. The clayey silt was interlayered with silt in borehole 58 and sandy silt in borehole 67. The clayey silt layers were 0.3 to 2.2 metres thick in boreholes 56, 58 and 67. Borehole 57 was terminated in the clayey silt after exploring the stratum for 3.7 metres.

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 13 to 20 per cent. The clayey silt is of low plasticity based on the results of two Atterberg limits determinations. Plastic limits, liquid limits and plasticity indices were 16 to 17, 31 to 33 and 14 to 17 per cent, respectively. The Atterberg limit results for the clayey silt are shown on Figure A-7.

The results of the grain size testing conducted on two clayey silt samples obtained during the standard penetration testing are presented on Figure A-2.

4.1.5 Silt

Loose to dense silt layers were encountered in boreholes 55, 57, 58, 62 and 64 through 66 from elevations 323.7 to 333.5 metres. The silt was found underlying topsoil in borehole 55, underlying fill in boreholes 57 and 64 through 66, interlayered with clayey silt in borehole 58 and underlying sandy silt and sand in borehole 62. Where fully penetrated, the silt layers were 0.2 to 1.0 metres thick. Boreholes 64 through 66 were terminated in the silt after exploring the stratum for 1.4 to 2.9 metres.

The silt had N values of 6 to 44 blows per 0.3 metres with water contents of 11 to 20 per cent.

The grain size distribution curves for the samples of the silt are shown on Figure A-3.

4.1.6 Sandy Silt

Layers of sandy silt were found in boreholes 55, 58 through 62 and 67 from elevations 325.7 to 333.0 metres. The sandy silt was found underlying silt in borehole 55, underlying topsoil in borehole 58, underlying fill and sand in borehole 59, underlying sand in borehole 60, between sand layers in borehole 61, underlying fill in borehole 62 and underlying topsoil and clayey silt in borehole 67. In borehole 59, a layer of sand was found between the sandy silt at elevation 329.1 metres. Clayey silt was observed between sandy silt layers in borehole 67 at elevation 325.7 metres. The thickness of the sandy silt layers ranged from 0.2 to 1.8 metres. Boreholes 59 (lower layer), 60 and 67 (lower layer) were terminated in the sandy silt after exploring the stratum for 0.7, 1.1 and 0.6 metres, respectively.

The sandy silt layers had N values of 8 to 33 blows per 0.3 metres indicating a loose to dense density. The general trend of the N values indicates that sandy silt is typically compact. The water contents were 7 to 15 per cent.

The results of grain size analyses conducted on sandy silt samples obtained during standard penetration testing are presented on Figure A-4.

4.1.7 Silty Sand

Deposits of loose to compact silty sand and silty fine sand were encountered in boreholes 58, 61 and 63 at elevations 330.4, 326.3 and 328.1 metres, respectively. The silty sand was found underlying sandy silt and a layer of sand was observed between the silty sand layers in borehole 58. Silty sand was encountered at depth underlying sand in borehole 61. In borehole 63, the silty sand was found underlying layers of granular fill. The silty sand layers were 0.8 and 1.9 metres thick in boreholes 58 and 63, respectively. Boreholes 58 and 61 were terminated in the silty sand after exploring it for 1.1 and 0.2 metres, respectively.

The N values for the silty sand were 7 to 21 blows per 0.3 metres indicating a loose to compact condition. Water contents of 4 and 12 per cent were measured in silty sand samples.

The results of grain size testing conducted on silty sand samples obtained during standard penetration testing are presented on Figure A-5.

4.1.8 Sand

Loose to dense sand layers were encountered in boreholes 58 through 63 from elevations 325.9 to 333.0 metres. The fine to medium grained sand layers were generally found underlying silt, sandy silt or silty sand layers with the exception of boreholes 60 and 61 where the sand underlies fill and borehole 62 where the sand was found between silt layers. The thickness of the sand layers ranged from 0.2 to 1.7 metres. Boreholes 62 and 63 were terminated in the sand after exploring the deposits for 0.3 and 1.4 metres, respectively.

N values in the sand layers varied from 4 to 47 blows per 0.3 metres and water contents of 3 and 4 per cent were measured for sand samples.

The grain size distribution curves for sand samples obtained during standard penetration testing are presented on Figure A-6.

4.1.9 Clayey Silt Till

A layer of clayey silt till was encountered in borehole 55 at elevation 331.1 metres underlying sandy silt layers. Borehole 55 was terminated in the clayey silt till after exploring the stratum for 0.6 metres. Although not specifically encountered in the borehole, cobbles and boulders should be anticipated in the clayey silt till due to the depositional history of this material.

The very stiff clayey silt till had a single N value of 22 blows per 0.3 metres.

4.1.10 Silty Clay

Silty clay was encountered at depth in borehole 56 at elevation 330.5 metres. The silty clay was found underlying layers of clayey silt. Borehole 56 was terminated in the silty clay after exploring the stratum for 0.6 metres.

A single N value of 17 blows per 0.3 metres was measured for the silty clay during standard penetration testing indicating a very stiff consistency.

4.2 Groundwater Conditions

The groundwater conditions in all of 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 Tables 1 and 2.

Table 1: Summary of Encountered Groundwater Levels

Borehole	Ground Surface Elevation	Encountered Groundwater Level	
		Depth	Elevation
	(m)	(m)	(m)
55	335.48	4.0	331.5
56	334.88	Dry	Below 329.9
57	333.92	Dry	Below 328.9
58	333.26	Dry	Below 328.2
59	332.75	Dry	Below 327.7
60	331.31	Dry	Below 326.3
61	331.11	Dry	Below 326.1
62	330.63	Dry	Below 325.6
63	329.88	Dry	Below 324.9
64	328.13	Dry	Below 322.3
65	328.59	2.1	326.5
66	329.10	4.0	325.1
67	329.04	3.8	325.2

Table 2: Summary of Measured Groundwater Levels

Borehole	Ground Surface Elevation (m)	Installation	Measured Groundwater Elevation (m)			
			May 26/10	Jun 03/10	Oct 13/10	Following Installation
65	328.59	Standpipe	326.51	326.48	325.67	326.02
67	329.04	Standpipe	325.00	324.87	324.47	325.00

During the field work period, the groundwater was encountered at elevations 325.1 to 331.5 metres in four of the boreholes. The remaining boreholes were dry to a depth of 5.0 metres. Of the dry boreholes, grey native soils were only encountered from approximately elevation 332 metres in borehole 57 and from about elevation 323.7 metres in borehole 64. Following completion of the drilling, 12.5 millimetre diameter slotted groundwater

monitoring standpipes were installed in boreholes 65 and 67. The groundwater monitoring results for the boreholes (65 and 67) are summarized in Table 2.

The above-noted encountered water 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 inferred groundwater level at this site is assumed to vary as follows:

- Station 14+476 to 14+525 – 331 metres
- Station 14+525 to 14+650 – 328 metres
- Station 14+650 to 15+100 – 325 metres
- Station 15+100 to 15+175 – 324 metres
- Station 15+175 to 15+235 – 326 metres
- Station 15+235 to 15+400 – 325 metres

The groundwater levels are expected to fluctuate due to climatic and seasonal variations.

5.0 MISCELLANEOUS

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, 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

PROPOSED 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 foundation design parameters and recommendations for the design for the proposed noise barrier wall 3 along the north side of Highway 7/8 between Stations 14+476 and 15+400 Lt. This noise barrier wall is to 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 foundations 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 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 the undrained condition and the larger of the two calculated caisson depths shall govern.

Portions of the caisson that will be embedded in organic materials should be neglected in the design. The passive resistance in the upper 1.4 metres below 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 of 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. With the exception of a short section where Highway 7/8 is at-grade between Stations 15+255 and 15+275, the remainder of the wall will be constructed along the crest of the highway embankment which will have side slopes of 3 horizontal to 1 vertical. Adjusted K_p values are provided in Table I for these areas. 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 embankment or slope; below this elevation, the full K_p is to be applied.

It may be necessary to use deeper caissons in the vicinity of Station 14+835 Lt and Station 15+135 Lt as boreholes 60 and 64, respectively, encountered very loose/soft fills in the order of 3.4 to 4.4 metres deep in these areas. An abandoned pipe was located at the original location of borehole 64. Due to the lack of construction control records and inherent variation of existing trench backfill, no lateral soil resistance should be attributed to the existing trench backfill such as that encountered in borehole 64. If foundations are required in the footprint of the trench backfill, all of the existing backfill and piping should be excavated and replaced with compacted Granular B Type III.

6.3 Construction Considerations

Excavations for construction of the caissons for the noise barrier wall foundations will penetrate the surficial fill and will extend through deposits of sand, silty fine sand, silt, sandy silt, clayey silt till, clayey silt and silty clay. The sands are predominantly fine grained and uniform in composition. The sands, silts and clayey silt at this site are susceptible to disturbance during caisson excavation and construction. In addition, excavation of granular materials below the groundwater level will be required in the vicinity of Station 14+835 and between approximately Stations 15+100 to 15+400.

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 (augering 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 a Non-Standard Special Provision (NSSP) be included in the Contract Documents to alert the Contractor about the requirements for support of the augered excavation and measures to deal with excavation of saturated granular soils below the groundwater level. In addition, an NSSP should be included to alert the contractor that he may have to deal with buried obstructions, such as the abandoned pipe encountered in borehole 64. The NSSP should include a note to the designer that near Stations 14+835 Lt and 15+135 Lt, use of deeper caissons may be warranted due to the presence of deep soft/loose fills.

The caissons should be constructed and inspected in accordance with Ontario Provincial Standard Specification 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
PROPOSED NOISE BARRIER WALL 3

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

Station and Borehole(s)	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[2] Level Ground/ 3H:1V Slope	Coefficient of Active Pressure, K_a Level Ground	Unit Weight[3] (kNm^{-3})	
								Bulk γ	Effective, γ'
14+476 to 14+525 Borehole 55	Stiff to very stiff cohesive fill	334 to 333	331	80	28	2.8 / 1.5	0.36	18.5	8.5
	Compact to dense silt / sandy silt	333 to 331		-	30	3.0 / 1.6	0.33	19.0	9.0
	Very stiff clayey silt till	Below 331		150	30	3.0 / 1.6	0.33	21.0	11.0
14+525 to 14+600 Borehole 56	Firm to stiff clayey silt	Above 330	328	75	28	2.8 / 1.5	0.36	19.0	9.0
	Very stiff silty clay	Below 330		115	28	2.8 / 1.5	0.36	19.0	9.0
14+600 to 14+650 Borehole 57	Stiff to very stiff clayey silt	Below 333	328	75	28	2.8 / 1.5	0.36	19.0	9.0
14+650 to 14+725 Borehole 58	Loose to compact silt to sand	Below 332	325	-	30	3.0 / 1.6	0.33	19.0	9.0
14+725 to 14+800 Borehole 59	Compact granular fill	331 to 330	325	-	30	3.0 / 1.6	0.33	19.0	9.0
	Compact sandy silt to sand	Below 330		-	30	3.0 / 1.6	0.33	19.0	9.0
14+800 to 14+875 Borehole 60	Very loose to loose granular fill	330 to 328	325	-	25	2.5 / 1.4	0.40	18.0	8.0
	Loose sand to compact sandy silt	Below 328		-	28	2.8 / 1.5	0.36	19.0	9.0

FOUNDATION DESIGN PARAMETERS
PROPOSED NOISE BARRIER WALL 3

Station and Borehole(s)	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[2] Level Ground/ 3H:1V Slope	Coefficient of Active Pressure, K_a Level Ground	Unit Weight[3] (kNm^{-3})	
								Bulk γ	Effective, γ'
14+875 to 14+950 Borehole 61	Compact sand to sandy silt	Below 330	325	-	32	3.3 / 1.7	0.31	19.5	9.5
14+950 to 15+025 Borehole 62	Compact to dense silt to sand	Below 329	325	- -	32	3.3 / 1.8	0.31	19.0	9.0
15+025 to 15+100 Borehole 63	Compact silty sand to sand	Below 328	325	- -	32	3.3 / 1.8	0.31	19.5	9.5
15+100 to 15+175 Borehole 64	Compact silt	Below 324	324	-	30	3.0 / 1.6	0.33	18.5	8.5
15+175 to 15+235 Borehole 65	Loose fill Loose to compact silt	Above 326 Below 326	326	- -	27 29	2.7 / 1.5 2.9 / 1.6	0.38 0.35	18.0 18.5	8.0 8.5
15+235 to 15+325 Borehole 66	Loose to compact silt	Below 327	325	-	29	2.9 / 1.6	0.35	18.5	8.5
15+325 to 15+400 Borehole 67	Loose to compact sandy silt Stiff to very stiff clayey silt Compact sandy silt	327 to 326 326 to 325 Below 325	325	- 100 -	29 29 31	2.9 / 1.6 2.9 / 1.6 3.1 / 1.7	0.35 0.35 0.32	19.0 19.0 19.0	9.0 9.0 9.0

FOUNDATION DESIGN PARAMETERS
PROPOSED 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 approximately Stations 14+475 and 15+225 and 15+275 to 15+400, the embankment slope behind the proposed noise barrier wall 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: DUP
Checked By: PRB

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 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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 56

1 OF 1

METRIC

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

LOCATION N 4809890.8 ;E 223950.8
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 6, 2010

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
334.88	GROUND SURFACE										
0.09	TOPSOIL, sandy Brown										
334.21	FILL, sand, some gravel Brown										
0.67	FILL, clayey silt, trace to some sand, trace gravel, trace topsoil Stiff Brown		1	SS	11		334		○		
			2	SS	14		333		○ —		0 21 58 21
332.75											
2.13	CLAYEY SILT, trace sand Stiff Brown		3	SS	14				○ —		0 8 60 32
331.98							332				
2.90	CLAYEY SILT, some sand, trace gravel Firm to stiff Brown		4	SS	7						
			5	SS	12		331				
330.46											
4.42	SILTY CLAY, trace sand Very stiff Brown		6	SS	17		330				
329.85											
5.03	END OF BOREHOLE Borehole dry during drilling on May 6, 2010.										

$+^3, \times^3$: 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 57

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
LOCATION N 4809923.8 ;E 224018.1
ORIGINATED BY MA
DIST HWY 7/8
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
COMPILED BY WDF
DATUM GEODETIC
DATE May 6, 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 (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
333.92	GROUND SURFACE										
0.09	TOPSOIL, sandy Brown										
0.21											
0.40	FILL, clayey silt, some sand, trace gravel, trace topsoil Brown										
	FILL, sand, trace gravel, trace silt Brown		1	SS	20		333				
332.55											
1.37	SILT, trace clay, trace sand Compact Brown		2	SS	20						
	CLAYEY SILT, trace sand Stiff to very stiff Brown becoming grey at about elev. 331.8m						332				
			3	SS	11						0 1 55 44
							331				
			4	SS	9						
							330				
			5	SS	8						
328.89			6	SS	9		329				
5.03	END OF BOREHOLE Borehole dry during drilling on May 6, 2010.										

$+^3, \times^3$: 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 58

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC
LOCATION N 4809955.4 ;E 224086.2
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 6, 2010
ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
333.26	GROUND SURFACE						333				
0.09	TOPSOIL, sandy Brown										
0.27	SANDY SILT, some clay Brown										
0.46	SAND, some gravel, trace silt Brown		1	SS	14						
331.89	CLAYEY SILT, with silt seams, trace sand						332				
1.37	Stiff Brown		2	SS	14				○		0 5 77 18
331.13	SILT, some clay, trace sand, trace gravel										
2.13	Compact Brown		3	SS	24		331				
330.79	CLAYEY SILT										
2.47	Very stiff Brown		4	SS	14		330		○		0 70 25 5
330.36	SANDY SILT, trace gravel										
2.90	Compact Brown		5	SS	8						
329.60	SILTY FINE SAND, trace clay						329				
3.66	Compact Brown		6	SS	7						
3.96	SAND, fine to medium, trace silt Loose Brown										
328.23	SILTY FINE SAND, with silt seams, trace clayey silt seams										
5.03	Loose Brown										
	END OF BOREHOLE										

Borehole dry during drilling on May 6, 2010.

$+^3, \times^3$: 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 59

1 OF 1

METRIC

PROJECT 08-1132-084-1
W.P. 131-98-00
DIST _____ HWY 7/8
DATUM GEODETIC
LOCATION N 4809985.9 ;E 224152.9
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 6, 2010
ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
332.75	GROUND SURFACE										
0.09	TOPSOIL, sandy Brown										
0.21	FILL, silt, some clay, trace sand, trace gravel Brown										
0.37	FILL, sand and gravel, trace silt Brown		1	SS	20		332				
0.52	FILL, sand, fine to coarse, some gravel, trace silt Brown		2	SS	17		331				2 55 34 9
331.47	FILL, clayey silt, with silty sand seams, trace topsoil Very stiff Brown to grey		3	SS	12		330				
1.28	FILL, silty sand, some topsoil, trace gravel, trace clay Compact Brown		4	SS	15		329				9 37 47 7
330.62	FILL, sandy silt, trace clay, trace topsoil Compact Brown		5	SS	13		328				
2.13	SANDY SILT, trace clay, trace gravel Compact Brown		6	SS	11						
330.31	SAND, fine to medium, trace to some silt Compact Brown										
2.44	SANDY SILT, trace clay, with silt seams Compact Brown										
329.09	END OF BOREHOLE										
3.66	Borehole dry during drilling on May 6, 2010.										
328.39											
4.36											
327.72											
5.03											

$+^3, \times^3$: 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 60

1 OF 1

METRIC

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

LOCATION N 4810020.7 ;E 224222.2
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 5, 2010 and May 17, 2010.

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
331.31	GROUND SURFACE										
0.00	TOPSOIL, silty						331				
0.12	Brown										
0.40	FILL, silty sand, trace topsoil Loose Brown										
	FILL, sandy silt, with topsoil Loose		1	SS	5				○		
329.94	Black						330				
1.37	FILL, silt, trace clay, trace sand Very loose Grey		2	SS	1				○		
329.18											
2.13	FILL, sandy silt, some clay Very loose						329				
328.66	Brown		3	SS	2				○		0 26 61 13
2.65	FILL, silt, trace sand										
2.90	Very loose Brown										
327.90	FILL, silty sand		4	SS	4		328		○		
3.41	Loose Brown										
327.38	SAND, fine to medium, trace silt										
3.93	Loose Brown		5	SS	8						
	SANDY SILT, trace clay Loose to compact						327				
	Brown		6	SS	13				○		0 21 71 8
326.28											
5.03	END OF BOREHOLE Borehole dry during drilling on May 5, 2010.										

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

$\bigcirc^{3\%}$ 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 61

1 OF 1 **METRIC**

PROJECT 08-1132-084-1 | W.P. 131-98-00 | LOCATION N 4810046.4 ;E 224293.7 | ORIGINATED BY MA

DIST | HWY 7/8 | BOREHOLE TYPE POWER AUGER / HOLLOW STEM | COMPILED BY WDF

DATUM GEODETIC | DATE May 5, 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 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
331.11	GROUND SURFACE						331			
0.09	TOPSOIL, sandy, trace silt, Brown									
0.30	FILL, sand, with gravel, trace silt, Brown									
	SAND, fine to medium, trace silt, trace clay, trace gravel, Compact, Brown		1	SS	11		330			
329.25			2	SS	18			○		0 90 8 2
1.86	SANDY SILT, trace gravel, trace clay, Compact, Brown		3	SS	22		329			
328.21										
2.90	SANDY SILT, trace clay, Compact, Brown		4	SS	25		328	○		0 46 47 7
327.45										
3.66	SAND, fine, trace silt, Compact, Brown		5	SS	22		327			
326.26			6	SS	21					
4.85	SILTY SAND, Compact, Brown									
5.03	END OF BOREHOLE									

Borehole dry during drilling on May 5, 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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 62

1 OF 1

METRIC

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

LOCATION N 4810071.3 ;E 224370.7
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 4, 2010

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
330.63	GROUND SURFACE										
0.00	TOPSOIL, silty, some sand										
0.15 / 330.17	Brown										
0.46	FILL, silty sand, trace gravel Brown										
	SANDY SILT, trace clay Compact to dense Brown		1	SS	19		330				
			2	SS	33		329		○		0 29 62 9
328.50											
2.13	SILT, trace clay, some sand Dense Brown		3	SS	35		328				
327.73											
2.90	SAND, fine, some silt, trace clay Dense Brown		4	SS	37				○		0 82 15 3
			5	SS	47		327				
326.06											
4.57	SILT, some sand, trace clay		6	SS	41		326				
4.75	Dense Brown										
5.03	SAND, fine to medium, trace silt Dense Brown										
	END OF BOREHOLE Borehole dry during drilling on May 4, 2010.										

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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 63

1 OF 1

METRIC

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

LOCATION N 4810090.7 ;E 224438.8
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 4, 2010

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
329.88	GROUND SURFACE										
0.00	TOPSOIL, sandy Brown										
0.12	FILL, sand, trace silt, trace gravel Brown										
329.12							329				
0.76	FILL, silt, some clay, trace sand, trace topsoil, with clay tile fragments Loose to compact Brown		1	SS	8				○		
328.11			2	SS	17		328		○		
1.77	SILTY SAND, trace clay Compact Brown		3	SS	19				○		0 53 41 6
326.22			4	SS	17		327				
3.66	SAND, fine to medium, trace silt Compact Brown		5	SS	24		326				
324.85			6	SS	29		325				
5.03	END OF BOREHOLE Borehole dry during drilling on May 4, 2010.										

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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 64

1 OF 1

METRIC

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

LOCATION N 4810116.0 ;E 224509.6
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 5, 2010

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
328.13	GROUND SURFACE						328				
0.00	TOPSOIL, silty										
0.21	Brown										
327.37	FILL, silty fine sand, trace clay, trace gravel										
0.82	ASPHALT										
0.98	FILL, sand, some gravel		1	SS	27				○ ○		
326.76	Compact						327				
1.37	Brown										
	FILL, sandy silt, trace gravel		2	SS	5				○		
	Compact										
	Brown										
	FILL, clayey silt, some sand, trace gravel						326				
325.54	Firm to very stiff		3	SS	21				⊢○⊣		6 20 50 24
2.59	Brown										
325.02	Abandoned pipe										
3.11	FILL, clayey silt, trace to some sand, trace topsoil, trace gravel		4	SS	2		325				
	Soft										
	Grey		5	SS	2				⊢○⊣		2 29 51 18
323.71							324				
4.42	SILT, some clay, with sand layers		6	SS	16				○		0 9 67 24
	Compact										
	Grey						323				
322.34			7	SS	25						
5.79	END OF BOREHOLE										

Borehole dry during drilling on May 5, 2010.

NOTE:
Top of pipe at elev. 325.5m, Bottom at elev. 325.0m.
Moved borehole 2.5m west .
Encountered pipe at elev. 325.5m.
Moved borehole 1.8m North .
Sampled from 3.0m depth.

$+^3, \times^3$: 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 65

1 OF 1

METRIC

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

LOCATION N 4810135.3 ;E 224582.3
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 4, 2010

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
328.59	GROUND SURFACE										
0.00	TOPSOIL, silty										
0.18	Brown										
0.37	FILL, sand, trace gravel Brown										
	FILL, silt, some clay, trace sand, with topsoil layers Loose to compact Brown		1	SS	10		328		○		
							Backfill				
			2	SS	5		327		○		0 7 77 16
325.94			3	SS	3		326		○		
2.65	SILT, some clay, trace sand, with clayey silt layers Loose to compact Brown and grey						*Bentonite*				
			4	SS	6				○		0 1 86 13
							325				
			5	SS	14		*Standpipe*				
							324				
323.56			6	SS	10						
5.03	END OF BOREHOLE										

Groundwater encountered at about elev. 326.5m during drilling on May 4, 2010.

Water level in standpipe measured at elev. 326.02m on May 4, 2010.

Water level in standpipe measured at elev. 326.51m on May 26, 2010.

Water level in standpipe measured at elev. 326.48m on June 3, 2010.

Water level in standpipe measured at elev. 325.67m on Oct. 13, 2010.

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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 66

1 OF 1

METRIC

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

LOCATION N 4810153.3 ;E 224655.1
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 4, 2010

ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
329.10	GROUND SURFACE										
0.00	TOPSOIL, silty						329				
0.15	Brown FILL, silt, trace sand, some topsoil Very loose to compact Brown		1	SS	11						
							328				
			2	SS	2				○		
326.97							327				
2.13	SILT, some sand, trace clay, trace gravel with clayey silt layers Loose to compact Brown		3	SS	6				○		
			4	SS	13		326		○		0 16 77 7
			5	SS	14	▽	325				
324.07			6	SS	23						
5.03	END OF BOREHOLE Groundwater encountered at about elev. 325.1m during drilling on May 4, 2010.										

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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 67

1 OF 1

METRIC

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

LOCATION N 4810171.5 ;E 224722.7
BOREHOLE TYPE POWER AUGER / HOLLOW STEM
DATE May 4, 2010

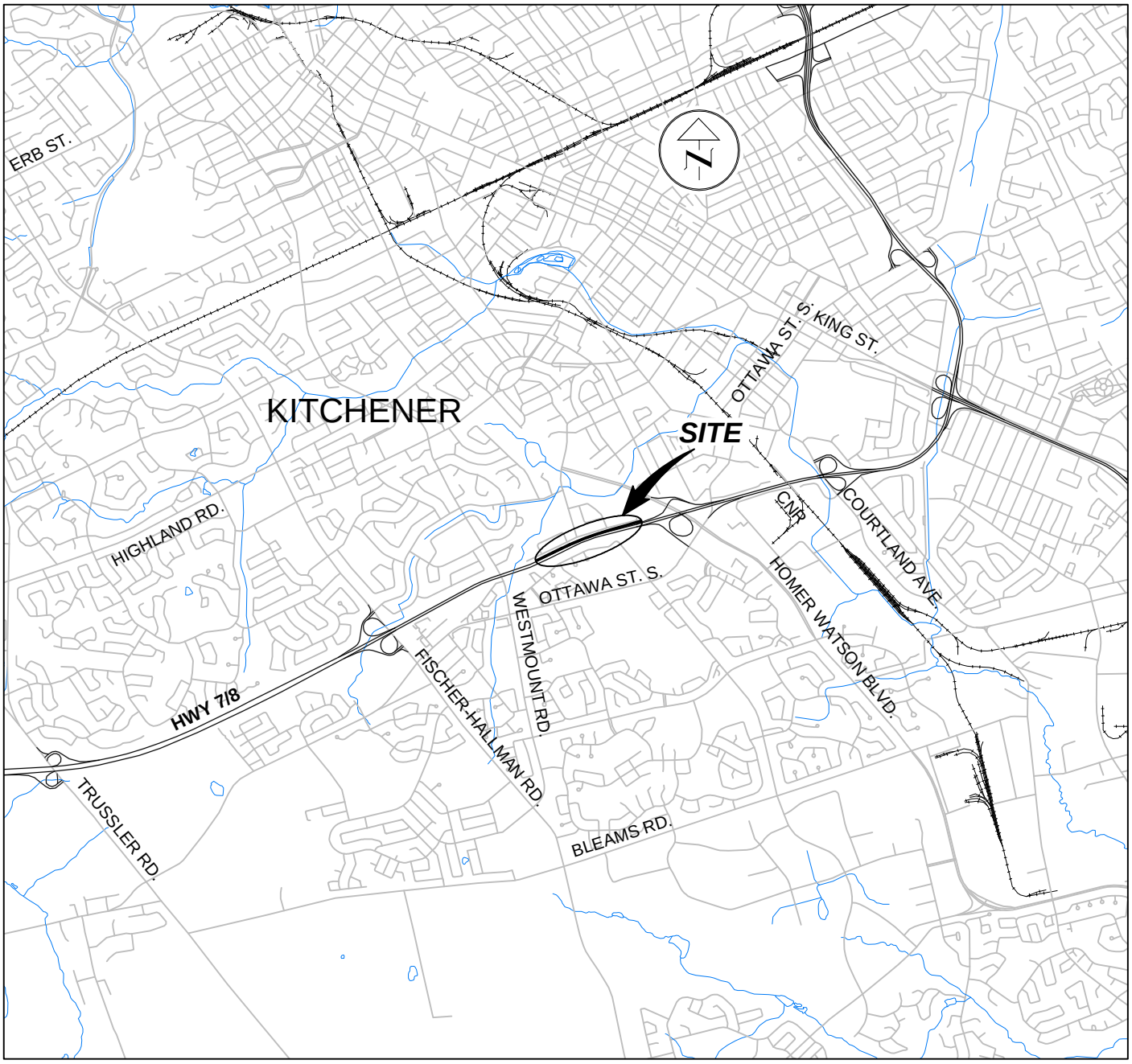
ORIGINATED BY MA
COMPILED BY WDF
CHECKED BY _____

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "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
329.04	GROUND SURFACE						329				
0.00	TOPSOIL, sandy brown										
0.15	FILL, silt, some sand, some clay, trace gravel Loose to compact Grey and brown		1	SS	10		328				
								Backfill			
327.18			2	SS	9				○		
1.86	TOPSOIL, silty Loose Black						327				
2.13	SANDY SILT, with clayey silt layers, trace gravel Loose to compact Brown		3	SS	7				○		2 26 53 19
								Bentonite			
325.69			4	SS	14		326				
3.35	CLAYEY SILT, some sand, with silty sand layers Stiff to very stiff Brown										
			5	SS	15		325				
324.62								*Standpipe*			
4.42	SANDY SILT Compact Brown		6	SS	26						
324.01											
5.03	END OF BOREHOLE Groundwater encountered at about elev. 325.2m during drilling on May 4, 2010. Water level in standpipe measured at elev. 325.00m on May 4, 2010. Water level in standpipe measured at elev. 325.00m on May 26, 2010. Water level in standpipe measured at elev. 324.87m on June 3, 2010. Water level in standpipe measured at elev. 324.47m on Oct. 13, 2010.										

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

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

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



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

PROPOSED 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-F11G001
			SCALE	AS SHOWN REV.
CADD	WDF	Feb. 22/11		
CHECK				

FIGURE 1

Drawing file: 0811320841-F11G001.DWG Feb 22, 2011 - 10:37pm

PROPOSED NOISE BARRIER 6
PROPOSED NOISE BARRIER 4
PROPOSED NOISE BARRIER 5
PROPOSED NOISE BARRIER 1B
PROPOSED NOISE BARRIER 1A
HIGHWAY 7/8
ROYAL ORCHARD PLACE
ONTARIO HYDRO ROW
GLEN PARK CR
GLEN LAKE CR
GLEN AVON CR
CITY OF KITCHENER
REGION OF WATERLOO
N/S-W RAMP
E-N/S RAMP
W-N/S
11+500
12+000
12+500
13+000

EXISTING NOISE BARRIER 1
EXISTING NOISE BARRIER 2
EXISTING NOISE BARRIER 3
PROPOSED NOISE BARRIER 2
PROPOSED NOISE BARRIER 3
HIGHWAY 7/8
FISCHER HALLMAN ROAD
RUSKVIEW RD
SWEETBRIAR DR
WESTMOUNT RD
GILMOUR CRES
BARBARA AVE.
STREUNG AVE
YAGER AVE
SOUTHMOOR DR
VALLEYVIEW RD
WINDALE CR
HOWE DRIVE
CHANDLER DR
ELMSDALE DR
BONFIELD PL
WOODFERN CT
14++476 (Hwy 7/8)
13+500
14+000
14+500
15+000

PROPOSED NOISE BARRIER 3
15+400 (Hwy 7/8)
HOMER WATSON BLVD
E-N RAMP
E-S RAMP
N/S-W RAMP
E-N/S RAMP
KEHL ST
OTTAWA ST S
HIGHWAY 7/8
WBL
EBL
PROPOSED NOISE BARRIER 7
OTTAWA ST
S-E RAMP
ARDELT PLACE
CANADIAN NATIONAL RAILWAYS
STRASBURG RD
15+500
16+000
16+500

CANADIAN NATIONAL RAILWAYS
COURTLAND AVE
N-W RAMP
E-N RAMP
CARWOOD AVE
DIXON ST
EXISTING NOISE BARRIER 4
EXISTING NOISE BARRIER 5
EXISTING NOISE BARRIER 6
EXISTING NOISE BARRIER 7
HIGHWAY 7/8
OVERLAND DR
FULTON ST
W-N RAMP
N/S-E RAMP
17+000
17+500
18+000

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

PROPOSED 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-F11G002	
			SCALE	AS SHOWN	REV. 0
CADD	WDF	Feb. 22/11			
CHECK					

FIGURE 2

Drawing file: 0811320841-F11G002.dwg Feb 22, 2011 - 10:35pm

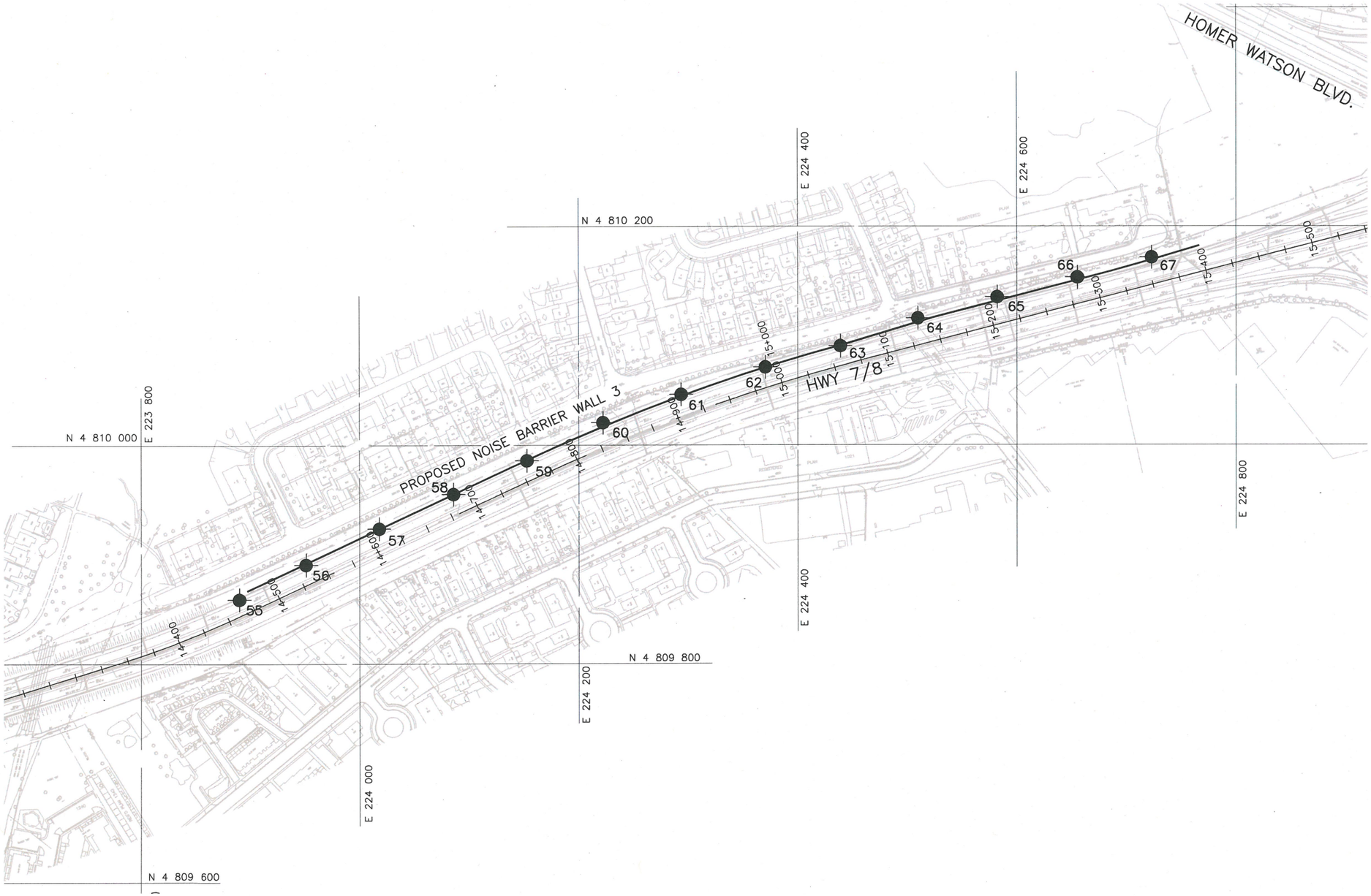
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 131-98-00

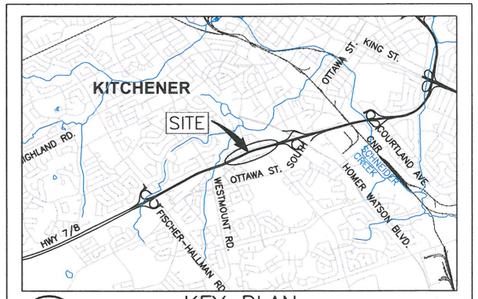
SHEET

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

Golder Associates Ltd.
LONDON, ONTARIO, CANADA



PLAN
SCALE
40 0 40 m



KEY PLAN
SCALE IN KILOMETRES

LEGEND
Borehole – Current Investigation

No.	ELEVATION	CO-ORDINATES (MTM ZONE 10) NORTHING	EASTING
55	335.48	4 809 859.1	223 890.0
56	334.88	4 809 890.8	223 950.8
57	333.92	4 809 923.8	224 018.1
58	333.26	4 809 955.4	224 086.2
59	332.75	4 809 985.9	224 152.9
60	331.31	4 810 020.7	224 222.2
61	331.11	4 810 046.4	224 293.7
62	330.63	4 810 071.3	224 370.7
63	329.88	4 810 090.7	224 438.8
64	328.13	4 810 116.0	224 509.6
65	328.59	4 810 135.3	224 582.3
66	329.10	4 810 153.3	224 655.1
67	329.04	4 810 171.5	224 722.7

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

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

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.

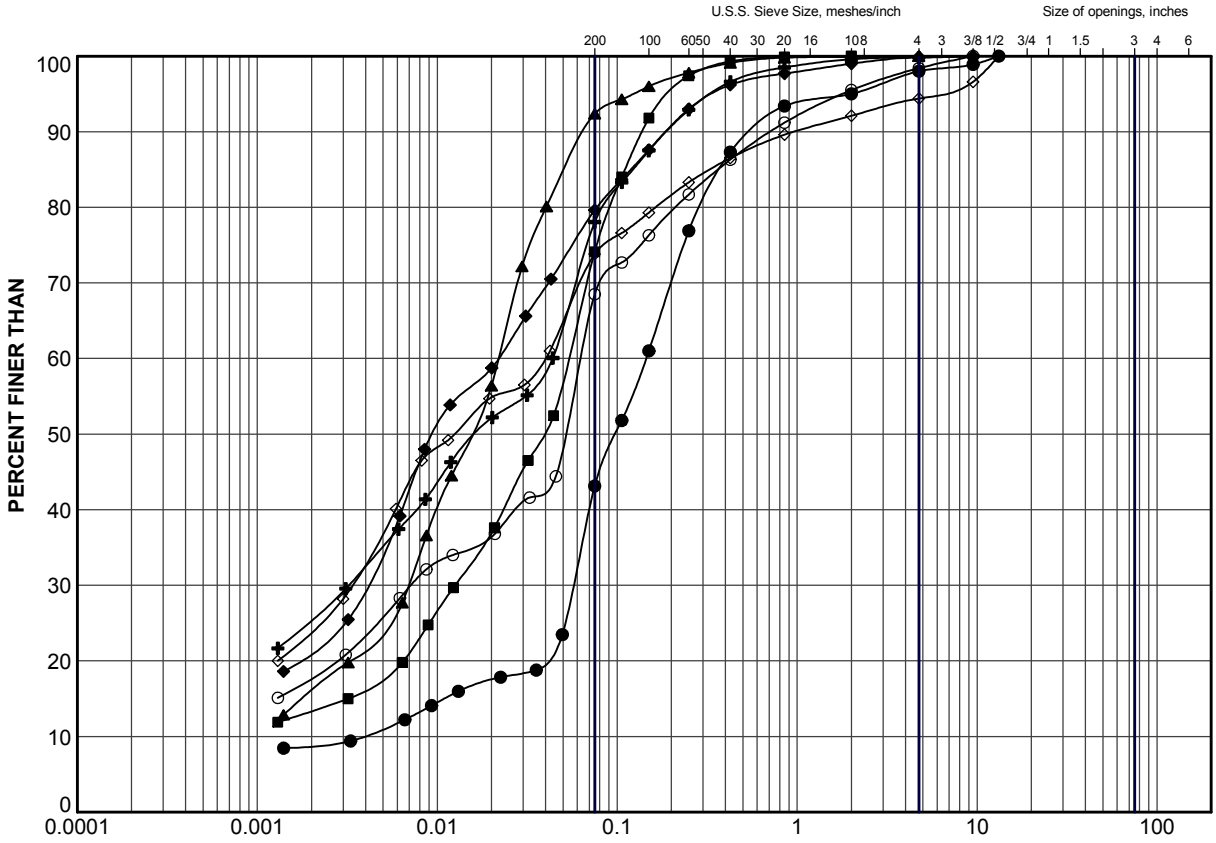
NO.	DATE	BY	REVISION

Geocres No. 40P8-186

HWY. 7/8		PROJECT NO. 08-1132-084-1	DIST.
SUBM'D. ML	CHKD.	DATE: Feb. 22/11	SITE:
DRAWN: WDF	CHKD.	APPD.	DWG. 1

APPENDIX A

Laboratory Test Data



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
✚	55	2	333.7
◆	56	2	333.1
◇	64	3	325.6
○	64	5	324.1
●	59	2	331.2
■	60	3	328.9
▲	65	2	326.8

PROJECT

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

TITLE

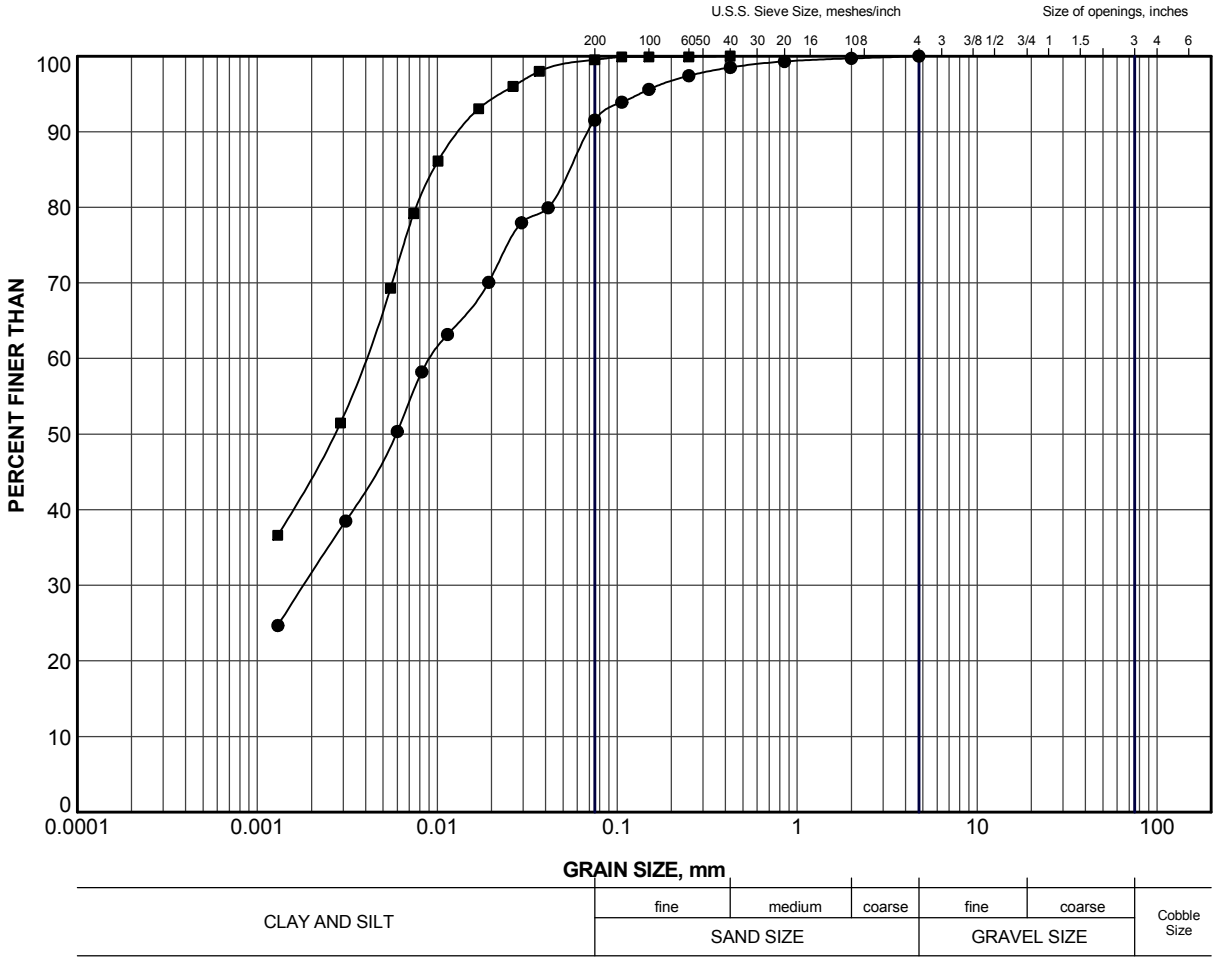
GRAIN SIZE DISTRIBUTION

FILL

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No.	0811320841-F11G0A1
			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)
●	56	3	332.4
■	57	3	331.4

PROJECT

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

TITLE

GRAIN SIZE DISTRIBUTION

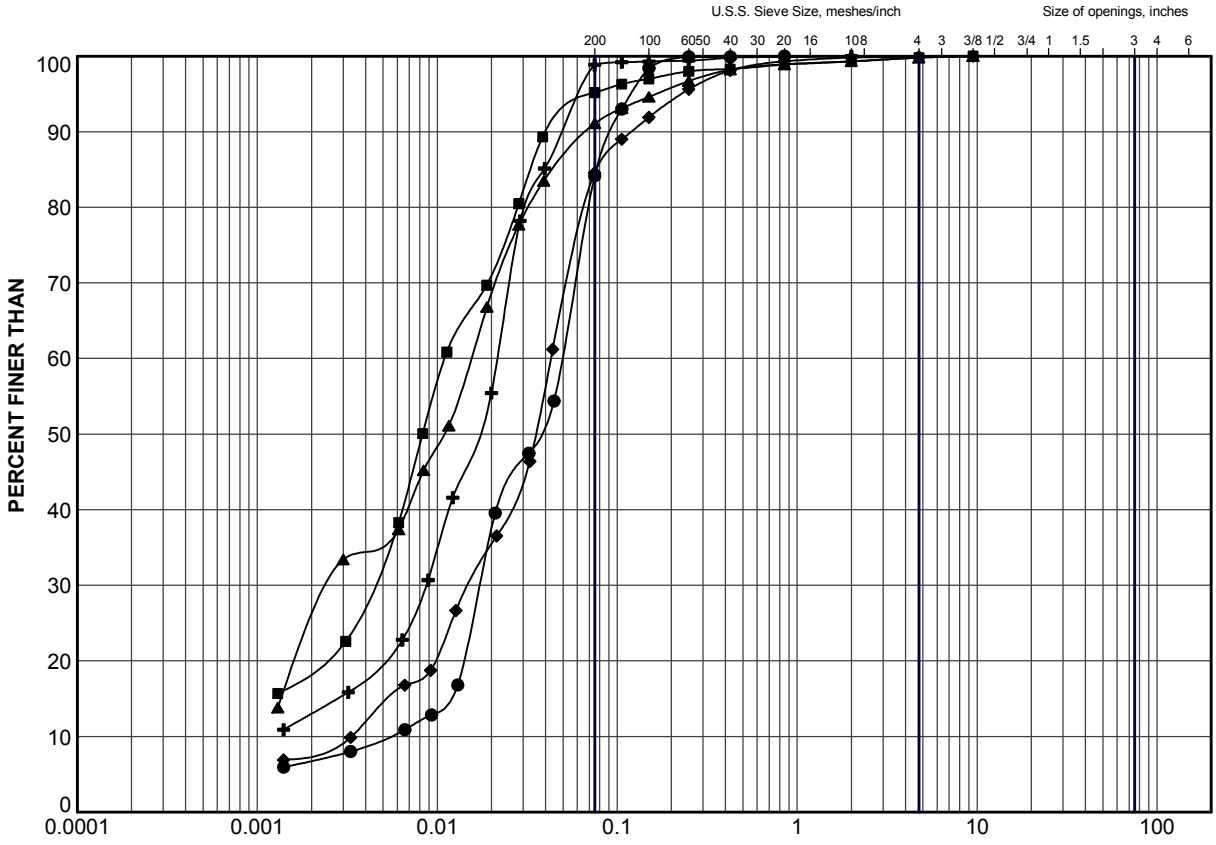
CLAYEY SILT

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11G0A2
			SCALE	N/A
DRAWN	LMK	Feb. 22/11	REV.	
CHECK				

FIGURE A-2

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	55	4	332.2
■	58	2	331.5
▲	64	6	323.3
✚	65	4	325.3
◆	66	4	326.0

PROJECT

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

TITLE

GRAIN SIZE DISTRIBUTION

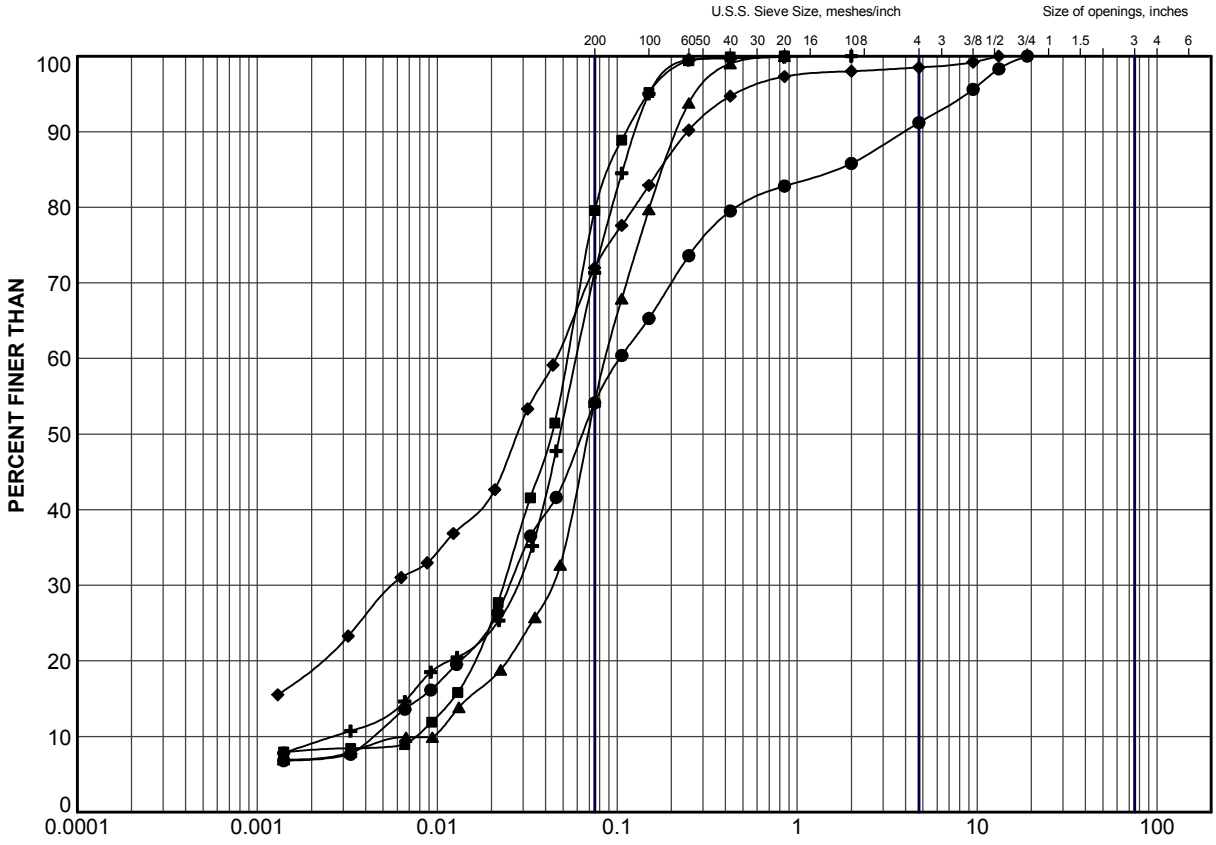
SILT

Golder Associates
LONDON, ONTARIO

PROJECT No.	08-1132-084-1		FILE No.	0811320841-F11G0A3
			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)
●	59	4	329.6
■	60	6	326.5
▲	61	4	327.8
✚	62	2	328.9
◆	67	3	326.5

PROJECT

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

TITLE

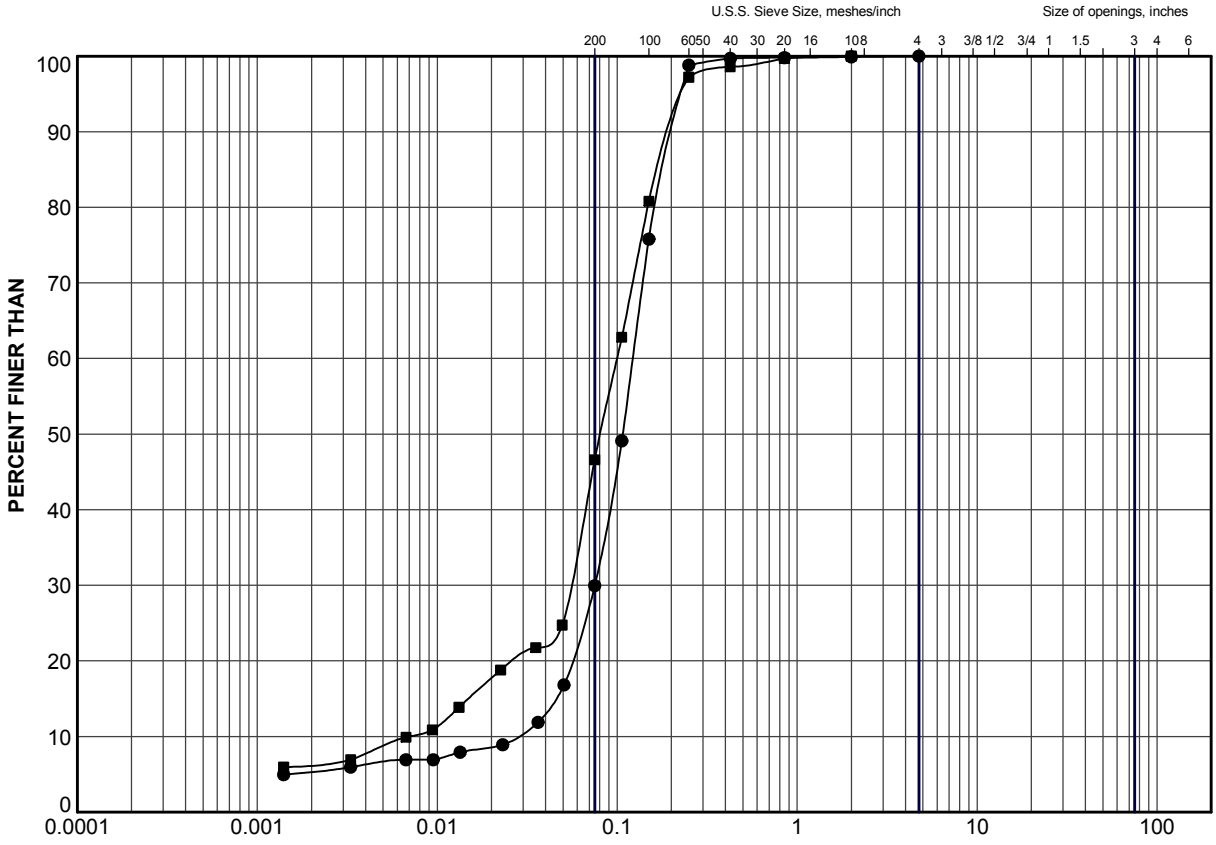
GRAIN SIZE DISTRIBUTION

SANDY SILT

Golder Associates
LONDON, ONTARIO

PROJECT No.			08-1132-084-1	FILE No.	0811320841-F11G0A4
				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)
●	58	4	330.0
■	63	3	327.4

PROJECT

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

TITLE

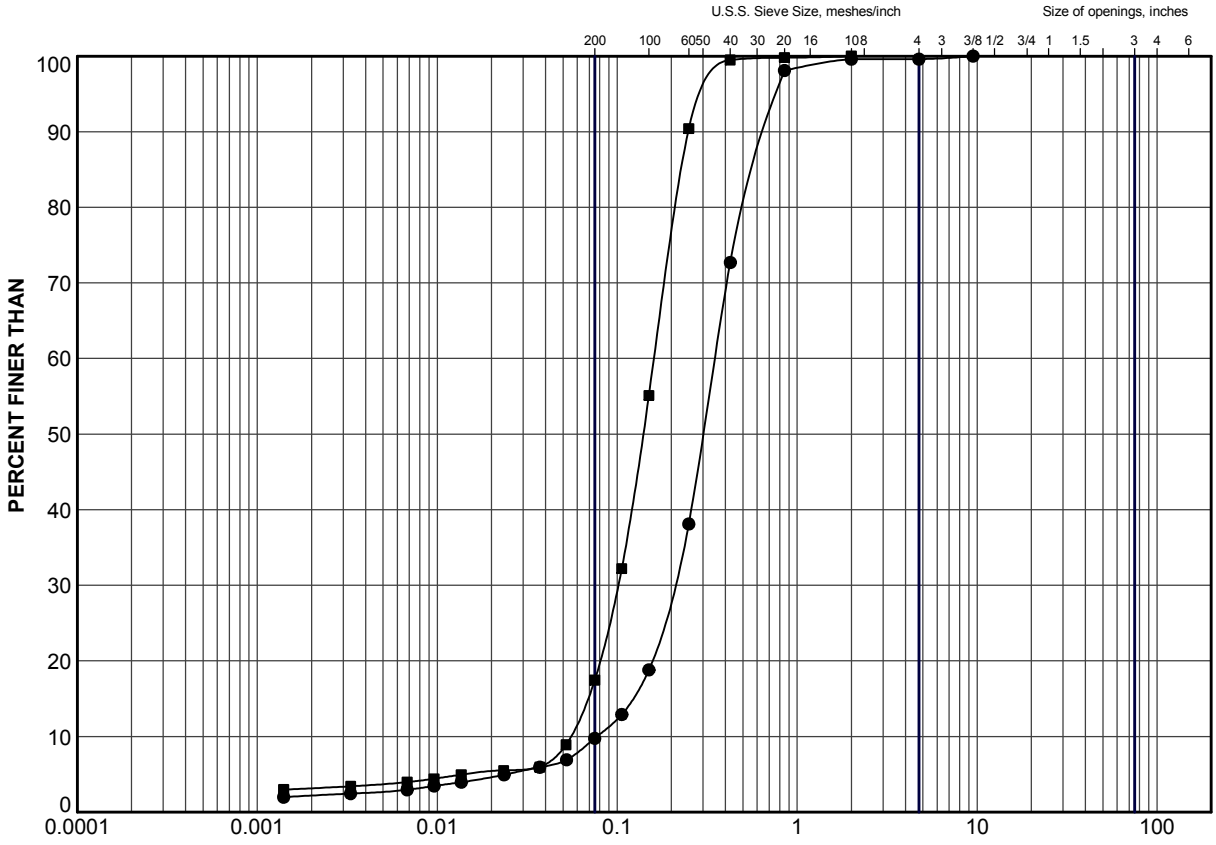
GRAIN SIZE DISTRIBUTION

SILTY SAND

Golder Associates
LONDON, ONTARIO

PROJECT No.		08-1132-084-1	FILE No. 0811320841-F11G0A5
			SCALE N/A REV.
DRAWN	WDF	Feb. 22/11	
CHECK			**FIGURE A-5**

LDN_MTO_NEW GLDR_LDN.GDT



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	61	2	329.4
■	62	4	327.4

PROJECT

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

TITLE

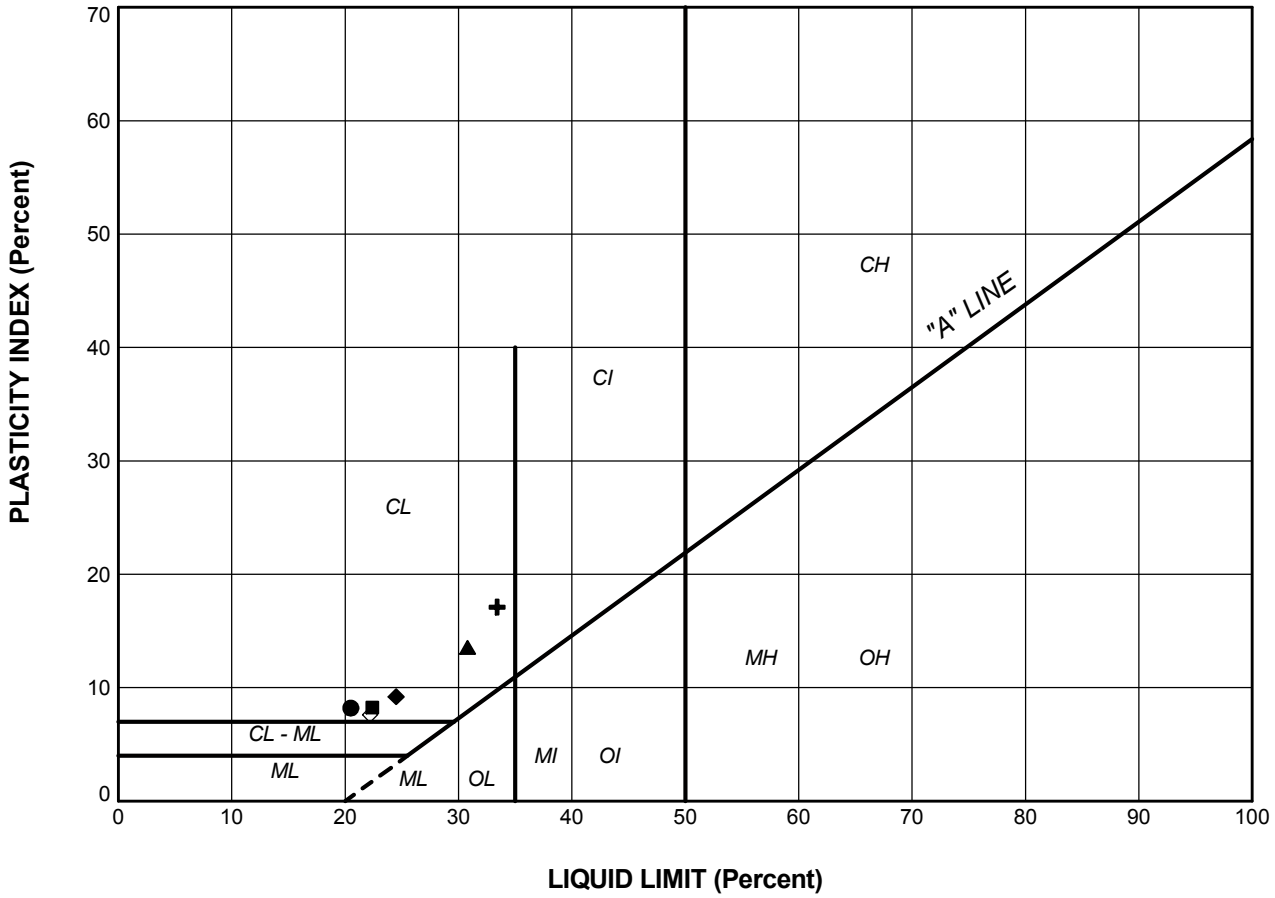
GRAIN SIZE DISTRIBUTION

SAND

Golder Associates
LONDON, ONTARIO

PROJECT No. 08-1132-084-1			FILE No. 0811320841-F11G0A6	
			SCALE N/A	REV.
DRAWN	WDF	Feb. 22/11	FIGURE A-6	
CHECK				

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
CLAYEY SILT					
▲	56	3	30.8	17.3	13.6
✚	57	3	33.4	16.3	17.1
FILL (Cohesive)					
●	55	2	20.5	12.3	8.2
■	56	2	22.4	14.2	8.3
◆	64	3	24.5	15.3	9.2
◇	64	5	22.2	14.6	7.6

PROJECT

PROPOSED 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-F11G0A7
			SCALE	N/A
DRAWN	LMK	Feb. 22/11	REV.	
CHECK				

FIGURE A-7

MTO_PI GLDR_LDN.GDT

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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