



FINAL REPORT

**Foundation Investigation
Noise Barrier Wall Replacement
Highway 417 from Island Park Drive to Bronson Avenue
Ottawa, Ontario**

*Site No. 417-09, 417-10 & 417-22
G.W.P. 4173-15-00*

Submitted to:

WSP Canada Group Limited

300 - 2611 Queensview Drive
Ottawa, Ontario
K2B 8K2

Submitted by:

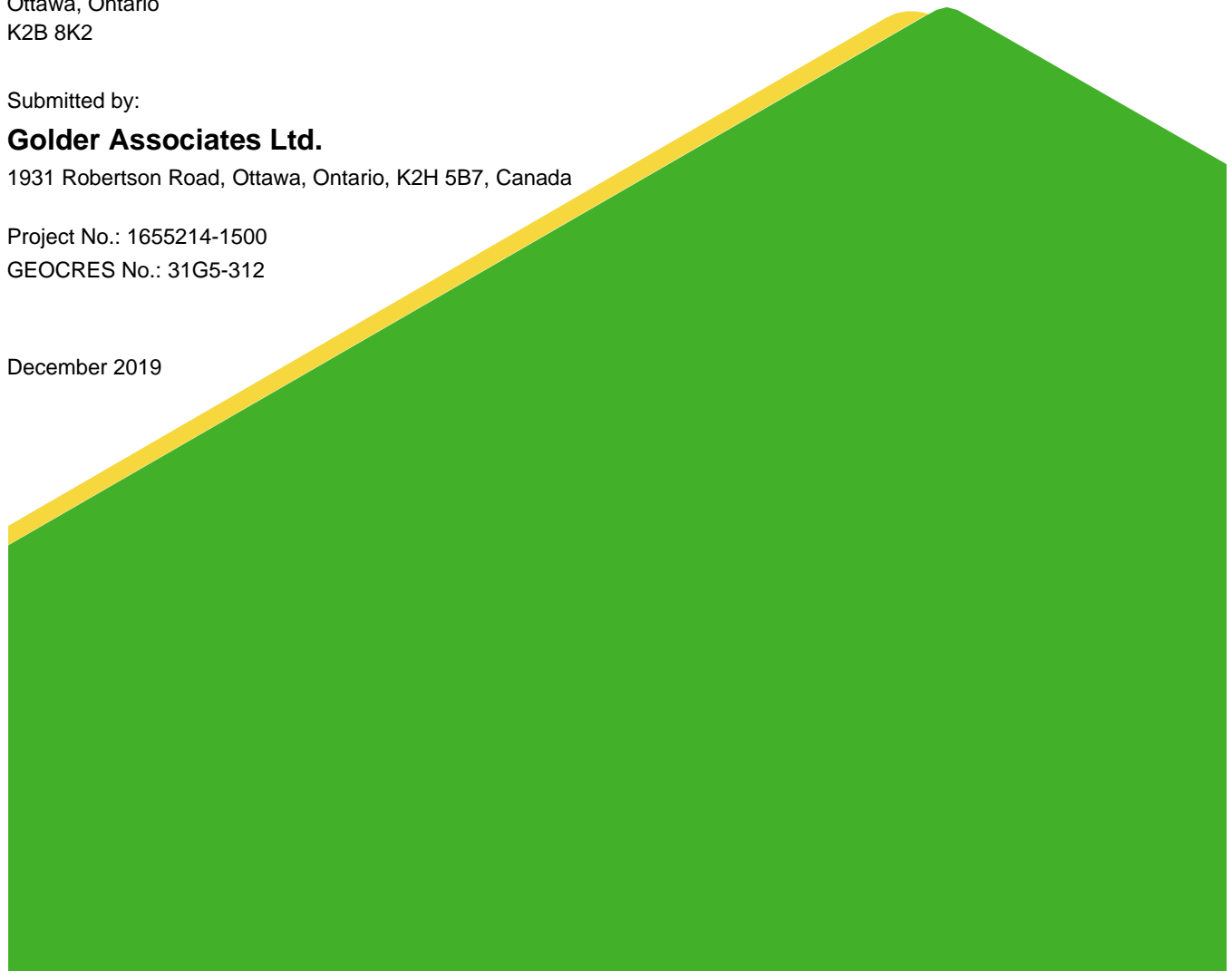
Golder Associates Ltd.

1931 Robertson Road, Ottawa, Ontario, K2H 5B7, Canada

Project No.: 1655214-1500

GEOCRES No.: 31G5-312

December 2019



Distribution List

2 copy - MTO

2 e-copies - MTO

1 e-copy - WSP Canada Group Limited

1 e-copy - Golder

Table of Contents

PART A – FOUNDATION INVESTIGATION

1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION AND GEOLOGY	1
2.1 Site Description	1
2.2 Regional Geology	2
3.0 INVESTIGATION PROCEDURES	2
4.0 DESCRIPTION OF SUBSURFACE CONDITIONS	6
4.1 General	6
4.2 Section 1: Highway 417, Station 24+700 to 26+000 (Sites 417-09 and 417-10)	7
4.2.1 Pavement Structure and Fill	7
4.2.2 Glacial Till	7
4.3 Section 2: Highway 417 Station 26+000 to 26+860 (Site Numbers 417-09 and 417-10)	8
4.3.1 Pavement Structure and Fill	8
4.3.2 Glacial Till	8
4.4 Section 3: Highway 417 Station 27+125 to 27+660 (Site Number 417-22)	9
4.4.1 Topsoil	9
4.4.2 Pavement Structure, and Fill	9
4.4.3 Void	9
4.4.4 Glacial Till	9
4.5 Auger Refusal	10
4.6 Groundwater Conditions	11
4.7 Steel Corrosion and Sulphate Attack, Chemical Analysis	12
5.0 CLOSURE	13

TABLES EMBEDDED WITHIN REPORT

Table 1: Summary of Borehole Locations North Side of Highway 417 Station 24+700 to 26+974.....	4
Table 2: Summary of Borehole Locations South Side of Highway 417 Station 24+750 to 26+860	5
Table 3: Summary of Borehole Locations North Side of Highway 417 Station 27+150 to 27+660.....	6
Table 4: Summary of Depths to Auger or Sampler (indicated with *) Refusal – Section 1	10
Table 5: Summary of Depths to Auger Refusal – Section 2.....	11
Table 6: Summary of Depths to Auger Refusal – Section 3.....	11
Table 7: Summary of Groundwater Conditions	12
Table 8: Steel Corrosion and Sulphate Attack, Chemical Analysis.....	12

DRAWINGS

Drawings 1 to 11 – Noise Barrier Wall Replacement – Borehole Locations and Soil Strata

APPENDICES

APPENDIX A

Record of Boreholes, Current Investigation

List of Abbreviations and Symbols

Lithological and Geotechnical Rock Description Terminology

Record of Boreholes 17-503 to 17-549, 17-551 to 17-557 and 19-1601

APPENDIX B

Laboratory Test Results – Current Investigation

Figure B1A – Grain Size Distribution Test Results – Section 1: Fill

Figure B1B – Grain Size Distribution Test Results – Section 1: Fill

Figure B2 – Grain Size Distribution Test Results – Section 1: Glacial Till

Figure B3 – Grain Size Distribution Test Results – Section 1: Glacial Till

Figure B4 – Plasticity Chart – Section 1: Glacial Till

Figure B5 – Grain Size Distribution Test Results – Section 2: Fill

Figure B6 – Plasticity Chart – Section 2: Clayey Silt to Clay Fill

Figure B7 – Grain Size Distribution Test Results – Section 2: Glacial Till

Figure B8 – Grain Size Distribution Test Results – Section 3: Fill

Figure B9 – Plasticity Chart – Section 3: Clayey Silt Fill

Figure B10 – Grain Size Distribution Test Results – Section 3: Glacial Till

APPENDIX C

Results of Chemical Analysis

Maxxam Job Number B7O7573

PART A

Foundation Investigation
Noise Barrier Wall Replacement
Highway 417 from Island Park Drive to Bronson Avenue
Ottawa, Ontario

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by WSP Canada Group Limited (WSP) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out foundation investigations associated with the detailed design of numerous bridge replacements, overhead signs, noise barrier walls, temporary roadway protection systems, replacement of storm sewers (including trenchless crossings) and a high fill embankment on Highway 417 between Island Park Drive and Kent Street in Ottawa, Ontario (Assignment number 4016-E-0001).

This report presents the results of the foundation investigations carried out for the replacement of the noise barrier walls (Sites Nos. 417-09, 417-10, and 417-22) located on Highway 417. The replacement of the structures is to be carried out in accordance with the current version of the Canadian Highway Bridge Design Code, S6-14 (CHBDC).

The terms of reference and scope of work for the foundation investigation are outlined in the MTO's Request for Proposal, dated May 2015, and subsequent addenda. Golder's scope of work for foundation engineering services associated with the noise walls is contained in Table 17.8.3 of WSP's Technical Proposal for this assignment dated June 28, 2016.

2.0 SITE DESCRIPTION AND GEOLOGY

2.1 Site Description

The noise barrier walls are located along the north and south sides of Highway 417 from Island Park Drive to Bronson Avenue. Noise walls are generally located where residential areas are present adjacent to Highway 417 and may not extend over interchanges.

This report provides geotechnical and foundation parameters for the noise walls at the following three site locations:

- Site 417-09 is located along the north side of Highway 417 from west of Island Park Drive to east of Parkdale Avenue (about 1.9 km)
- Site 417-10 is located along the south side of Highway 417 from west of Island Park Drive to west of the CPR/O-Train overpass (about 2.3 km)
- Site 417-22 is located on the north side of Highway 417 from the midpoint of the Rochester Street NS-W onramp to east of Bronson Avenue (about 0.5 km)

At these locations, Highway 417 is a divided highway with three or four lanes in each direction separated by a concrete median.

A total of seven noise barrier walls within Site 417-09 (designated NB2N to NB8N, inclusive, on the north side of Highway 417), nine noise barrier walls within Site 417-10 (designated NB1S to NB9S, inclusive, on the south side of Highway 417) and three noise barrier walls within Site 417-22 (designated NB10N, NB12N and NB14N) from Rochester Street to Bronson Avenue) required foundation investigation for the planned rehabilitation or replacement. The locations of the noise walls within each site were indicated on the drawing titled Site Overview, dated April 8, 2019, provided by WSP. The location of each noise barrier walls is shown on Drawings 1 to 11.

2.2 Regional Geology

As delineated in *The Physiography of Southern Ontario*¹, this section of Highway 417 lies within the minor physiographic region known as the Ottawa Valley Clay Plain, which lies within the major physiographic region of the Ottawa-St. Lawrence Lowland.

The Ottawa Valley Clay Plain region is characterized by relatively thick deposits of sensitive marine clay, silt and silty clay that were deposited within the former Champlain Sea basin. These deposits, known as the Champlain Sea clay or Leda clay, overlie relatively thin, commonly reworked glacial till and glaciofluvial deposits, that in turn overlie bedrock².

This region is underlain by a series of sedimentary rocks, consisting of sandstones, dolostones, limestones and shales that are, in turn, underlain at depth by igneous and metamorphic bedrock of the Precambrian Shield. Regional bedrock mapping indicates that the bedrock at this site is primarily limestone of the Verulam Formation.³ The limestone is described as interbedded bioclastic, sublithographic to fine crystalline, very thin to medium bedded, with shale interbeds up to 8 cm thick.

Highway 417 crosses two main faults striking southeast to northwest. The more prominent fault, the Gloucester fault, crosses Highway 417 at the approximate location of Preston Street⁴. The second fault crosses Highway 417 at the approximate location of Kent Street. Bedding which is normally sub-horizontal often dips steeply adjacent to and within fault zones.

The sites fall within the Western Québec (WQ) seismic zone according to the Geological Survey of Canada. The WQ zone constitutes a large area which encompasses the urban areas of Montreal, Ottawa-Hull and Cornwall. Within the WQ zone recent seismic activity has been concentrated in two subzones; one along the Ottawa River and another more active subzone along the Montreal-Maniwaki axis. The two major earthquakes that have recently occurred in the WQ zone are the 1935 Témiscaming event, which had a magnitude (i.e., a measure of the intensity of the earthquake) of 6.2, and the 1944 Cornwall-Massena event, which had a magnitude of 5.6.

3.0 INVESTIGATION PROCEDURES

The field work for the current investigation was carried out between April 10 and 25, 2017 and between July 30 and August 18, 2017 and included advancing a total of 54 boreholes designated 17-503 to 17-549, and 17-551 to 17-557, inclusive. In addition, Borehole 19-1601, which is part of the trenchless crossing investigation located along NB8N was advanced on August 2, 2019. The NAD83 CSRS CBNv6-2010.0 MTM Zone 9 locations and ground surface elevations of the boreholes are shown on Drawings 1 to 11. Table 1 below further outlines the location of the boreholes with respect to the current Highway 417 stationing.

¹ Chapman, L. J. and Putnam, D. F., 1984. *The Physiography of Southern Ontario*, Ontario Geological Survey. Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000. Ontario Ministry of Natural Resources.

² Belanger, J.R. "Urban Geology of Canada's National Capital Area", in *Urban Geology of Canadian Cities*, Geological Association of Canada Special Paper 42, Ed. P.F. Karrow and O.L. White, 1998.

³ Williams, D.A. Rae, A.M., and Wolf, R.R. 1984: Paleozoic Geology of the Ottawa Area, Southern Ontario, Ontario Geological Survey, Map P.2716. Geological Series-Preliminary Map, scale 1:50,000. Geology 1982.

⁴ MacDonald, G. and Harrison, J.E. 1976: Generalized Bedrock Geology, Ottawa-Hull, Ontario and Quebec, Geological Survey of Canada, Map 1508A, scale 1:125,000. Geology 1967.

The boreholes were drilled at an approximate spacing of between 60 and 75 m along Highway 417 on the north and south side of the highway. The boreholes were advanced using a truck-mounted hollow-stem auger drill rig supplied and operated by George Downing Estate Drilling of Grenville-sur-la-rouge, Québec. The boreholes were advanced to depths ranging from 1.0 to 10.9 m below the existing ground surface.

Soil samples in the boreholes were obtained at vertical intervals of about 0.8 to 1.5 m, using a 50 mm outer diameter split-spoon sampler in accordance with Standard Penetration Test (SPT) procedure (ASTM D1586).

Bedrock was not confirmed in any boreholes, but auger refusal was encountered in 43 of the 54 boreholes. Auger refusal was encountered in Borehole 17-528 at a depth of 3.1 m and two additional auger probes were advanced in the vicinity of this borehole, to confirm the refusal depth in the area. Boreholes 17-528A (located 1.2 m to the east) and 17-528B (located 1.5 m to the west) encountered auger refusal at 3.3 m and 2.9 m respectively. The location of the additional auger probes is shown on Drawing 7.

Monitoring wells were installed in Boreholes 17-504, 17-507A, 17-514, 17-523, 17-526, 17-533, 17-538, 17-543, 17-548 and 17-557 to observe the groundwater level at the sites and for groundwater sampling. The monitoring wells consist of 32 mm outside diameter PVC tubing with a 1.5 to 3.0 m long slotted screen. The groundwater levels were measured in the monitoring wells between October 16 and 19, 2017.

The boreholes were backfilled with a mixture of bentonite and soil cuttings and capped with asphaltic concrete cold patch. The site conditions were restored following completion of the field work. The boreholes were backfilled in general accordance with the intent of Ontario MOE Regulation 903, as amended. The site conditions were restored following completion of the field work.

The field work was supervised on a full-time basis by members of Golder's staff who located the boreholes in the field, directed the drilling, sampling, and in-situ testing operations, logged the boreholes and examined and cared for the samples. The soil samples were identified in the field, placed in labelled containers, and transported to Golder's laboratory in Ottawa for further examination and testing. Index and classification tests consisting of water content determinations, grain size distribution analyses and Atterberg Limits were carried out on selected soil samples at Golder's Ottawa laboratory. All geotechnical laboratory testing was completed to ASTM and/or MTO Standards, as applicable.

A total of six groundwater samples from Boreholes 17-507A, 17-514, 17-523, 17-526, 17-533, and 17-538 were submitted to Maxxam Analytics (Maxxam) for chemical analysis related to potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements (corrosion and sulphate attack).

The borehole locations and elevations were surveyed by Golder using a Trimble R8 GPS unit referenced to the NAD83 CSRS CBNv6-2010.0 MTM Zone 9 geodetic datum. The borehole locations, including, stationing, northing and easting coordinates, ground surface elevations, and drilled depths are summarized in Tables 1 to 3.

Table 1: Summary of Borehole Locations North Side of Highway 417 Station 24+700 to 26+974

Site	Approximate Highway 417 Stationing	Borehole	NAD83 CSRS CBNv6-2010.0 MTM Zone 9		Ground Surface Elevation (m)	Borehole Depth (m)
			Northing (m)	Easting (m)		
417-09	24+700	17-503	5028113.6	364781.6	77.1	7.5
417-09	24+770	17-505	5028175.4	364827.0	75.6	7.5
417-09	24+845	17-507A	5028237.0	364859.9	73.6	2.5
417-09	24+935	17-509	5028319.9	364903.8	72.2	1.3
417-09	25+015	17-511	5028389.0	364941.0	71.7	1.0
417-09	25+090	17-513	5028455.1	364977.1	71.3	4.1
417-09	25+170	17-515	5028526.6	365016.5	71.5	4.9
417-09	25+250	17-517	5028595.5	365054.5	72.5	6.4
417-09	25+325	17-519	5028662.6	365090.3	73.8	7.0
417-09	25+400	17-521	5028727.4	365133.4	74.9	8.9
417-09	25+495	17-523	5028797.4	365198.5	75.9	4.3
417-09	25+565	17-525	5028845.2	365250.3	76.2	8.7
417-09	25+625	17-527	5028884.4	365302.7	75.8	7.3
417-09	25+705	17-529	5028926.2	365364.4	74.8	4.5
417-09	25+780	17-531	5028970.1	365429.6	73.2	8.2
417-09	25+860	17-533	5029014.9	365495.7	71.1	5.2
417-09	25+935	17-535	5029055.5	365555.1	70.3	1.2
417-09	26+974	19-1601	5029516.4	366488.9	68.9	8.2

Table 2: Summary of Borehole Locations South Side of Highway 417 Station 24+750 to 26+860

Site	Approximate Highway 417 Stationing	Borehole	NAD83 CSRS CBNv6-2010.0 MTM Zone 9		Ground Surface Elevation (m)	Borehole Depth (m)
			Northing (m)	Easting (m)		
417-10	24+750	17-504	5028141.6	364843.8	76.2	5.9
417-10	24+825	17-506	5028206.3	364878.2	74.0	4.1
417-10	24+910	17-508	5028281.1	364917.8	72.5	2.3
417-10	24+995	17-510	5028354.4	364957.5	71.9	3.1
417-10	25+070	17-512	5028423.1	364995.9	71.4	3.8
417-10	25+135	17-514	5028480.3	365027.9	71.3	4.7
417-10	25+225	17-516	5028558.1	365070.2	72.1	4.7
417-10	25+300	17-518	5028623.9	365107.4	72.6	8.2
417-10	25+400	17-520	5028704.6	365162.6	73.3	8.2
417-10	25+470	17-522	5028753.7	365206.1	74.0	6.3
417-10	25+540	17-524	5028804.5	365252.7	74.8	6.7
417-10	25+620	17-526	5028852.7	365313.8	75.2	7.5
417-10	25+700	17-528	5028897.8	365380.6	74.9	3.1
417-10	25+701	17-528A	5028898.5	365381.8	74.9	3.3
417-10	25+699	17-528B	5028897.0	365379.6	74.9	2.9
417-10	25+770	17-530	5028925.6	365446.0	72.1	7.9
417-10	25+840	17-532	5028969.7	365503.8	71.6	2.2
417-10	25+930	17-534	5029022.8	365571.6	70.2	1.5
417-10	26+000	17-536	5029064.4	365629.8	70.3	1.5
417-10	26+015	17-537	5029105.1	365622.2	70.9	1.6
417-10	26+080	17-538	5029109.4	365696.9	70.9	10.5
417-10	26+160	17-539	5029149.7	365761.9	71.4	7.1
417-10	26+240	17-540	5029190.2	365830.7	72.2	7.5
417-10	26+315	17-541	5029228.0	365898.7	73.9	3.1
417-10	26+395	17-542	5029265.5	365969.9	75.6	6.7
417-10	26+475	17-543	5029300.2	366038.2	76.6	5.2
417-10	26+555	17-544	5029333.7	366110.4	76.9	5.8
417-10	26+600	17-545	5029366.8	366185.0	76.4	7.5
417-10	26+715	17-546	5029396.3	366255.8	75.3	7.3
417-10	26+790	17-547	5029423.0	366329.4	73.3	10.9
417-10	26+860	17-548	5029446.1	366393.7	71.3	8.6

Table 3: Summary of Borehole Locations North Side of Highway 417 Station 27+150 to 27+660

Site	Approximate Highway 417 Stationing	Borehole	NAD83 CSRS CBNv6-2010.0 MTM Zone 9		Ground Surface Elevation (m)	Borehole Depth (m)
			Northing (m)	Easting (m)		
417-22	27+150	17-549	5029564.8	366660.4	67.2	4.0/5.7 ¹
417-22	27+255	17-551	5029594.5	366761.2	70.0	6.2
417-22	27+310	17-552	5029609.0	366813.3	71.3	6.2
417-22	27+385	17-553	5029631.5	366886.6	72.4	6.2
417-22	27+435	17-554	5029647.1	366931.1	72.9	6.8
417-22	27+510	17-555	5029671.4	367001.9	73.6	5.7
417-22	27+600	17-556	5029701.1	367083.6	73.9	3.0
417-22	27+660	17-557	5029741.1	367138.6	72.8	2.0

Notes: ¹ A void was encountered during drilling in Borehole 17-549 at a depth of 4.0 m.

4.0 DESCRIPTION OF SUBSURFACE CONDITIONS

4.1 General

The subsurface soil, and groundwater conditions encountered in the boreholes and the results of in-situ testing from the current investigation are given on the Record of Borehole sheets presented in Appendix A. The results of the laboratory testing carried out during the current investigation are presented on the Record of Borehole sheets and on Figures B1A to B10, in Appendix B. The results of basic chemical analysis completed on select groundwater samples are provided in Appendix C. The borehole locations and the interpreted stratigraphic profiles projected along each noise wall are provided on Drawings 1 to 11.

The stratigraphic boundaries shown on the Record of Borehole sheets and Drawings 1 to 11 are inferred from observations of drilling progress and non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

In general, the subsurface conditions at the borehole locations consist of pavement structure and embankment fill, extending to depths ranging from about 0.8 to 8.9 m (Elevations 62.7 to 73.2 m), over a discontinuous deposit of glacial till proven to extend to depths ranging from about 3.1 to 10.9 m (Elevations 60.6 to 71.1 m). The thickness of fill varies significantly along the noise wall alignments.

The groundwater level was measured across the sites at depths ranging from 1.5 to 4.8 m (Elevations 66.1 to 73.0 m).

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

4.2 Section 1: Highway 417, Station 24+700 to 26+000 (Sites 417-09 and 417-10)

Boreholes 17-503, 17-505, 17-507, 17-509, 17-511, 17-513, 17-515, 17-517, 17-519, 17-521, 17-523, 17-525, 17-527, 17-529, 17-531, 17-533, 17-535 and 19-1601 were advanced along the right lane/shoulder of the WBL of Highway 417 for the noise barrier walls between Island Park Drive and west of Preston Street.

Boreholes 17-504, 17-506, 17-508, 17-510, 17-512, 17-514, 17-516, 17-518, 17-520, 17-522, 17-524, 17-526, 17-528 and 17-530, 17-532 and 17-534 were advanced along the right lane/shoulder of the EBL of Highway 417 for the noise barrier walls between Island Park Drive and east of Parkdale Avenue.

4.2.1 Pavement Structure and Fill

Asphaltic concrete, ranging in thickness from 0.1 to 0.5 m, was encountered at the ground surface at all the borehole locations along this section.

Portland Cement Concrete (PCC) was encountered below the asphaltic concrete at Boreholes 17-503, 17-516, 17-517, 17-519, 17-520, 17-521, 17-522, 17-525, 17-527, 17-530, 17-532, 17-534 and 19-1601 and ranges in thickness from 0.1 to 0.5 m.

The composition of the granular base/subbase varies from gravelly sand to sand with varying amounts of silt and gravel. The pavement structure extends to depths ranging from about 0.6 to 1.5 m.

The pavement structure is underlain by heterogeneous fill at all borehole locations, except at Boreholes 17-512 to 17-516. The composition of the fill is variable consisting of sand and gravel or silty clay, silty sand, sand, gravelly sand to sandy gravel with varying amounts of cobbles, and organic matter. The fill was proven to extend or extends to depths ranging from about 0.8 to 8.9 m (Elevations ranging from 71.8 to 65.7 m) below the existing ground surface, where encountered.

Standard Penetration Tests (SPT) carried out within the embankment fill gave SPT N values ranging from weight of hammer to greater than 100, indicating a very loose to very dense state of packing. The measured water content of 50 samples of the fill ranged from about 3 to 24 percent. The results of grain size distribution testing carried out on 14 selected samples of the fill are provided on Figures B1A and B1B in Appendix B.

Portland cement concrete was encountered below the fill in Borehole 17-519 at a depth of about 7 m below the ground surface.

4.2.2 Glacial Till

A discontinuous deposit of glacial till was encountered below the fill in Boreholes 17-503 to 17-506, 17-510, 17-512 to 17-518, 17-520, 17-522, 17-524 to 17-526, 17-530 and 17-531. The glacial till generally consists of a heterogeneous mixture of gravel, cobbles, and boulders in a soil matrix of silty sand to clayey silt. The glacial till extends to depths ranging from about 3.1 to 8.7 m below the existing ground surface (Elevations ranging from about 70.3 to 64.2 m). The SPT N values ranged from 2 to more than 100 indicating a very loose to very dense state of packing. Higher blow counts (i.e., greater than 50) likely indicate the underlying bedrock surface or the presence of cobbles or boulders within the till, rather than the state of packing of the soil matrix.

The measured water content of 32 samples of the glacial till ranged from approximately 2 to 36 percent. The results of grain size distribution testing carried out on eleven samples of the glacial till are provided on Figures B2 and B3 in Appendix B. The results of Atterberg Limits testing carried out on four samples indicate that the fines portion of this deposit consists of non-plastic to low plastic silt. Atterberg Limits analysis results are provided on Figure B4 in Appendix B.

4.3 Section 2: Highway 417 Station 26+000 to 26+860 (Site Numbers 417-09 and 417-10)

Boreholes 17-536 to 17-548, inclusive, were advanced along the right lane/shoulder of Highway 417 EBL for the noise barrier walls between Parkdale Avenue and CPR/O-Train overpass.

4.3.1 Pavement Structure and Fill

A surficial layer of asphaltic concrete was encountered at the ground surface of all the boreholes along this section, ranging in thickness from 100 to 300 mm.

A layer of PCC was encountered below the asphaltic concrete at Boreholes 17-536, 17-543, 17-547, and 17-548, ranging in thickness from 100 to 200 mm.

The asphaltic concrete or PCC is underlain by granular base/subbase. The composition of the granular base/subbase varies from gravelly sand to sand. The pavement structure extends to depths ranging from 0.5 to 1.3 m. The measured water content of one sample of the granular base was approximately 7 percent.

The pavement structure is underlain by heterogeneous fill at all the borehole locations, with the exception of borehole 17-536. The composition of the fill ranges from clayey silt to clay, sand, silty sand with varying amounts of gravel and containing cobbles, boulders, concrete, wood, brick, asphalt and organic matter. The fill extends to depths ranging from 3.1 to 8.6 m (Elevations 73.2 to 62.7 m) below the existing ground surface. The SPT N values ranged from 2 to more than 50, indicating very loose to very dense state of packing for the cohesionless fill and firm to very stiff consistency for the cohesive fill.

The measured water contents of 22 samples of the fill ranged from 3 to 35 percent. The results of grain size distribution testing carried out on four samples of the fill are provided on Figure B5 in Appendix B. The results of Atterberg Limits testing carried out on three samples of the cohesive fill gave plasticity index values ranging from 14 to 39 percent and liquid limit values ranging from 25 to 54 percent. The Atterberg Limits testing results are provided on Figure B6 in Appendix B and indicate a clayey silt (CL) of low plasticity to a clay (CH) of high plasticity (CH).

4.3.2 Glacial Till

A deposit of glacial till was encountered below the fill in Boreholes 17-536, 17-538, 17-539, 17-542 and 17-544 to 17-547 at elevations ranging from 65.7 to 73.2 m. The glacial till generally consists of a heterogeneous mixture of clay, gravel, cobbles and boulders within a matrix of silty sand. The till was not fully penetrated but was proven to the depth of auger refusal ranging from 1.5 to 10.9 m, corresponding to elevations ranging from 60.6 and 71.1 m.

The SPT N values ranged from 7 to more than 50 indicating a loose to very dense state of packing. Higher blow counts (i.e., greater than 50) likely indicate the underlying bedrock surface or the presence of cobbles or boulders within the till, rather than the state of packing of the soil matrix.

The measured water contents of 13 samples of the glacial till ranged from about 6 to 18 percent. The results of grain size distribution testing carried out on three samples of the glacial till are provided on Figure B7 in Appendix B.

4.4 Section 3: Highway 417 Station 27+125 to 27+660 (Site Number 417-22)

Boreholes 17-549 and 17-551 to 17-557, inclusive, were advanced for the noise barrier walls along the right lane/shoulder of the WBL of Highway 417 and ramps between the midpoint of the Rochester Street NS-W on-ramp to Bronson Avenue.

4.4.1 Topsoil

Topsoil, about 200 mm in thickness, was encountered at the ground surface at Borehole 17-557.

4.4.2 Pavement Structure, and Fill

Asphaltic concrete, with a thickness ranging from 0.2 to 0.3 m, was encountered at the ground surface of all the boreholes along this section, except for Borehole 17-557.

PCC was encountered below the asphaltic concrete at all boreholes, except Boreholes 17-552 and 17-557, and ranged in thickness from 0.1 to 0.2 m.

The pavement structure fill extends to depths ranging from about 0.5 to 0.8 m. The composition of the granular base varies from gravelly sand to sand with varying amounts of silt and gravel.

The pavement structure fill and topsoil are underlain by heterogeneous fill at all the borehole locations. The fill consists of sand and gravel to silty sand and sand to silty clay and clayey silt and contains varying amounts of organic matter, wood, concrete, ash, metal, ceramic, brick fragments, cobbles and boulders. The fill extends to depths ranging from about 2.0 to 6.2 m (Elevations 63.2 to 70.9 m), below the existing ground surface.

The measured water contents of fifteen samples of the fill ranged from approximately 4 to 18 percent. The SPT N values ranged from 2 to more than 50 indicating a very loose to very dense state of packing for the cohesionless fill and a very stiff consistency for the cohesive fill. The results of grain size distribution testing carried out on three samples of the fill material are provided on Figure B8 in Appendix B.

The results of Atterberg Limits testing carried out on one sample of the cohesive fill gave a plasticity index value of 11 percent and a liquid limit value of 24 percent. The Atterberg Limits analysis results are provided on Figure B9 in Appendix B and indicate a clayey silt (CL) of low plasticity.

Portland cement concrete was encountered below the fill in Borehole 17-552 at a depth of about 6 m below the ground surface.

4.4.3 Void

A void was encountered in Borehole 17-549 during drilling at a depth of 4.0 m. The void extends to a depth of about 5.7 m below the existing ground surface or about 1.7 metres below the encountered bottom of the fill.

4.4.4 Glacial Till

A non-cohesive glacial till deposit was encountered below the fill material in Boreholes 17-554 and 17-555 at elevations of 67.6 and 68.6 m, respectively (i.e., depths of 5.3 and 5.0 metres below ground surface, respectively). The glacial till consists of gravelly sand with various amount of silt, and cobbles. The till was not fully penetrated but was proven to the depth of auger refusal at 5.7 and 6.8 m below the existing ground surface (Elevations 66.1 and 67.9 m). The SPT N values ranged from 15 to more than 50 indicating a compact to very dense state of packing. Higher blow counts (i.e., greater than 50) likely indicate the underlying bedrock surface or the presence of cobbles or boulders within the till, rather than the state of packing of the soil matrix.

The measured water contents of two samples of the glacial till were 5 and 7 percent. The results of grain size distribution testing carried out on a sample of the glacial till are provided on Figure B10 in Appendix B.

4.5 Auger Refusal

Bedrock was not proven by core drilling as part of the current investigation. Auger or sampler refusal was encountered in the boreholes, with the exception of Boreholes 17-504, 17-518, 17-520, 17-524, 17-525, 17-526, 17-531, 17-542, 17-545, 17-546 and 17-549, at depths ranging from about 1.0 to 10.9 m below the existing ground surface, corresponding to elevations ranging from about 60.4 to 71.8 m.

Based on boreholes from previous investigations along Highway 417, auger/sampler refusal could represent the presence of cobbles and boulders in the fill or glacial till, existing concrete footings, or the bedrock surface.

Tables 4 to 6 summarize the auger refusal depths and elevations as encountered at the borehole locations and outlined in Sections 4.2 to 4.4.

Table 4: Summary of Depths to Auger or Sampler (indicated with *) Refusal – Section 1

Borehole	Existing Ground Surface Elevation (m)	Auger Refusal Elevation (m)	Depth to Auger Refusal (m)
17-503	77.1	69.6	7.5
17-505	75.6	68.1	7.5
17-506	74.0	69.9	4.1
17-507A	73.6	71.1	2.5
17-508	72.5	70.2	2.3
17-509	72.2	70.9	1.3
17-510	71.9	68.8	3.1
17-511	71.7	70.7	1.0
17-512	71.4	67.6	3.8
17-513*	71.3	67.2	4.1
17-514	71.3	66.6	4.7
17-515	71.5	66.6	4.9
17-516	72.1	67.4	4.7
17-517	72.5	66.1	6.4
17-519	73.8	66.8	7.0
17-521	74.9	66.0	8.9
17-522	74.0	67.7	6.3
17-523	75.9	71.6	4.3
17-527	75.8	68.5	7.3
17-528	74.9	71.8	3.1
17-528A	74.9	71.6	3.3
17-528B	74.9	72.0	2.9
17-529	74.8	70.3	4.5
17-530	72.1	64.2	7.9
17-532	71.6	69.4	2.2
17-533	71.1	65.9	5.2
17-534	70.2	68.7	1.5
17-535	70.3	69.1	1.2
17-537	70.9	69.3	1.6

Table 5: Summary of Depths to Auger Refusal – Section 2

Borehole	Existing Ground Surface Elevation (m)	Auger Refusal Elevation (m)	Depth to Auger Refusal (m)
17-536	70.3	68.8	1.5
17-538	70.9	60.4	10.5
17-539	71.4	64.3	7.1
17-540	72.2	64.7	7.5
17-541	73.9	70.8	3.1
17-543	76.6	71.4	5.2
17-544	76.9	71.1	5.8
17-547	73.3	62.4	10.9
17-548	71.3	62.7	8.6

Table 6: Summary of Depths to Auger Refusal – Section 3

Borehole	Existing Ground Surface Elevation (m)	Auger Refusal Elevation (m)	Depth to Auger Refusal (m)
17-551	70.0	63.8	6.2
17-552	71.3	65.1	6.2
17-553	72.4	66.2	6.2
17-554	72.9	66.1	6.8
17-555	73.6	67.9	5.7
17-556	73.9	70.9	3.0
17-557	72.8	70.8	2.0

4.6 Groundwater Conditions

Monitoring wells were installed in Boreholes 17-504, 17-507, 17-514, 17-523, 17-526, 17-533, 17-538, 17-543, 17-548 and 17-557 to monitor the groundwater level across the sites.

Table 7 summarizes the depths to, and the elevations of, the water levels measured in the monitoring wells installed during the current investigation.

Table 7: Summary of Groundwater Conditions

Borehole	Screened Interval	Water Level Depth (m)	Water Level Elevation (m)	Date of Reading
17-504	Fill / Glacial Till	Dry	< 71.0	October 16, 2017
17-507A	Fill	1.5	72.1	October 19, 2017
17-514	Glacial Till	1.9	69.4	October 16, 2017
17-523	Fill / Glacial Till	3.5	72.4	October 19, 2017
17-526	Fill / Glacial Till	2.2	73.0	October 16, 2017
17-533	Fill / Glacial Till	3.8	67.3	October 19, 2017
17-538	Glacial Till	4.8	66.1	October 18, 2017
17-543	Fill	Dry	< 71.4	October 18, 2017
17-548	Fill	Dry	< 62.7	October 18, 2017
17-557	Fill	Dry	< 70.8	October 16, 2017

It should be expected that the water levels across the sites will fluctuate seasonally in response to changes in precipitation and snow melt and is expected to be higher during the spring and periods of precipitation.

4.7 Steel Corrosion and Sulphate Attack, Chemical Analysis

A total of six groundwater samples were submitted to Maxxam for chemical analysis related to potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements (corrosion and sulphate attack). The test results are provided in Appendix C and are summarized in Table 8.

Table 8: Steel Corrosion and Sulphate Attack, Chemical Analysis

Borehole	Screened Interval (m)	Resistivity (ohm-cm)	Electrical Conductivity (µS/cm)	pH	Sulphate (mg/L)	Chloride (mg/L)
17-507A	0.3 – 2.5	750	1,300	8.9	45	140
17-514	2.7 – 4.7	160	6,300	7.9	130	1,800
17-523	2.5 – 4.3	58	17,000	7.6	220	5,500
17-526	5.4 – 7.5	160	6,300	7.9	120	1,700
17-533	1.8 – 5.2	70	14,000	7.9	190	4,400
17-538	7.0 – 10.5	70	14,000	7.9	310	4,300

5.0 CLOSURE

This report was prepared by Mr. Kenton Power, P.Eng. It was reviewed by Mr. Bill Cavers, P.Eng., a Senior Geotechnical Engineer and Associate of Golder. Mr. Fintan Heffernan, P.Eng. a Senior Consultant with Golder and the Designated MTO Foundations Contact for this project, carried out an independent quality control review of this report.

Golder Associates Ltd.



Kenton C. Power, P.Eng., M.A.Sc.
Geotechnical Engineer

William Cavers, P.Eng.
Associate, Senior Geotechnical Engineer

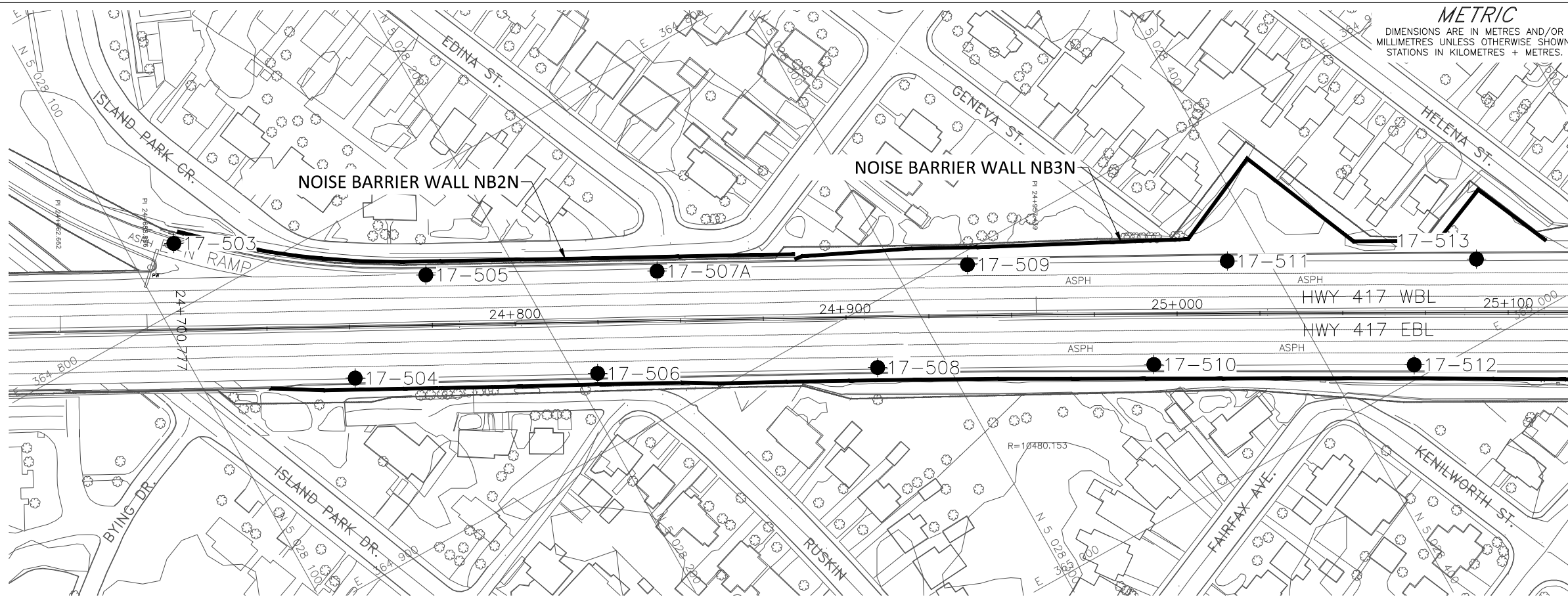
Fintan J. Heffernan, P.Eng.
Designated MTO Foundations Contact



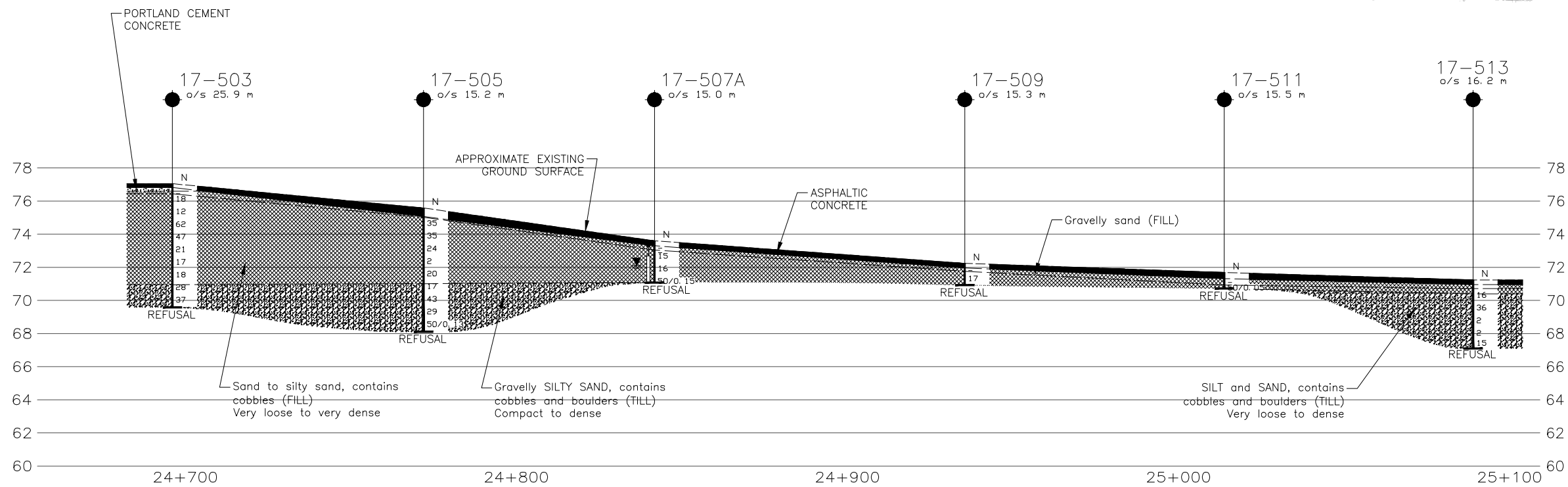
KP/WC/FJH/hdw

<https://golderassociates.sharepoint.com/sites/18579g/foundations/6-reports/1500-noise-wall/3-final-nbw/1655214-1500-001-rev0-final-noise-walls2019-12-06.docx>

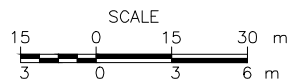
Golder and the G logo are trademarks of Golder Associates Corporation



PLAN



PROFILE ALONG CENTRE-LINE HIGHWAY 417



NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

CONT No.
GWP No. 4173-15-00



NOISE BARRIER WALL REPLACEMENT
NB1N, NB2N AND NB3N
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469

SHEET



KEY PLAN
SCALE
500 0 500 1000 m

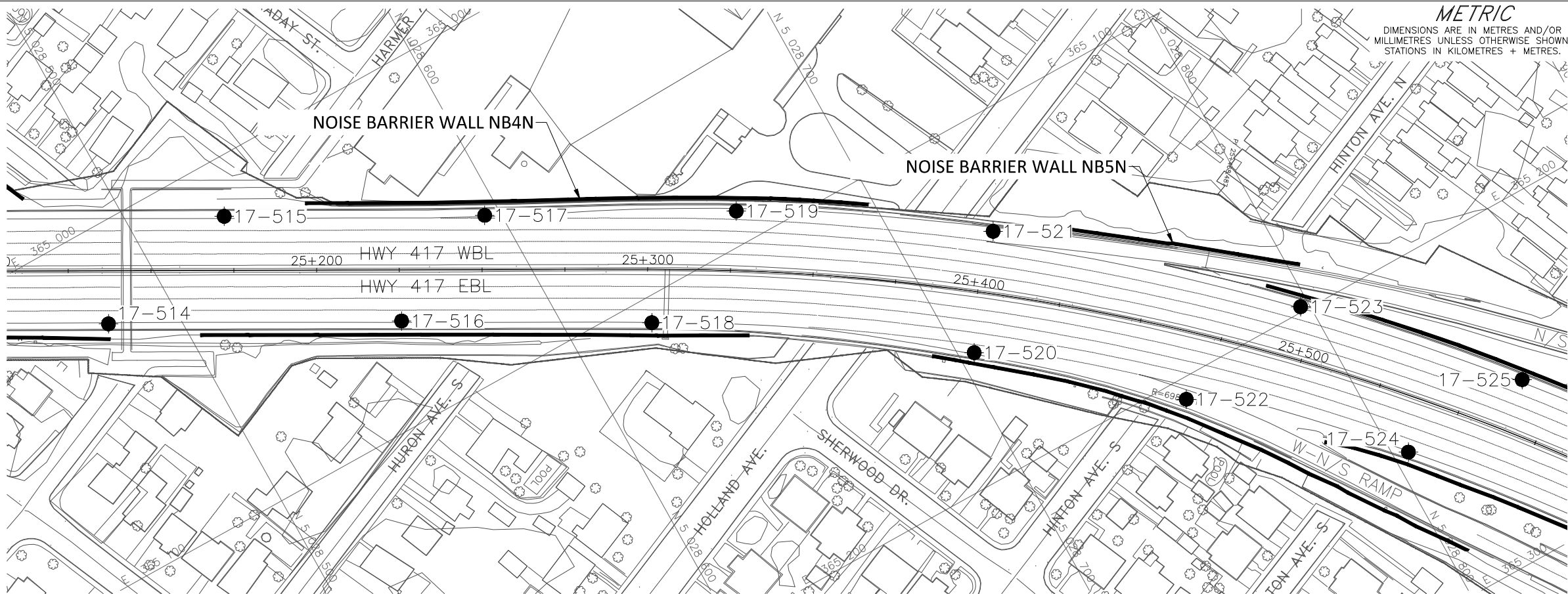
LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ▼ WL in piezometer, measured on OCTOBER 19, 2017
- Noise Barrier (NB) Walls

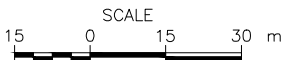
BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9

No.	ELEVATION	NORTHING	EASTING
17-503	77.1	5028113.6	364781.6
17-504	76.2	5028141.6	364843.8
17-505	75.6	5028175.4	364827.0
17-506	74.0	5028206.3	364878.2
17-507A	73.6	5028237.0	364859.9
17-508	72.5	5028281.1	364917.8
17-509	72.2	5028319.9	364903.8
17-510	71.9	5028354.4	364957.5
17-511	71.7	5028389.0	364941.0
17-512	71.4	5028423.1	364995.9
17-513	71.3	5028455.1	364977.1

NO.	DATE	BY	REVISION
0			
Geocres No. 31G5-312			
HWY. 417		PROJECT NO. 1655214-1500	
SUBM'D. SS		DATE: 12/11/2019	
DRAWN: JM		APPD: FJH	
CHKD: KP		DIST. EASTERN	
		SITE: 417-09 & 417-10	
		DWG. 1	



PLAN



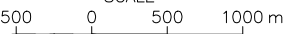
CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB4N AND NB5N
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469

SHEET

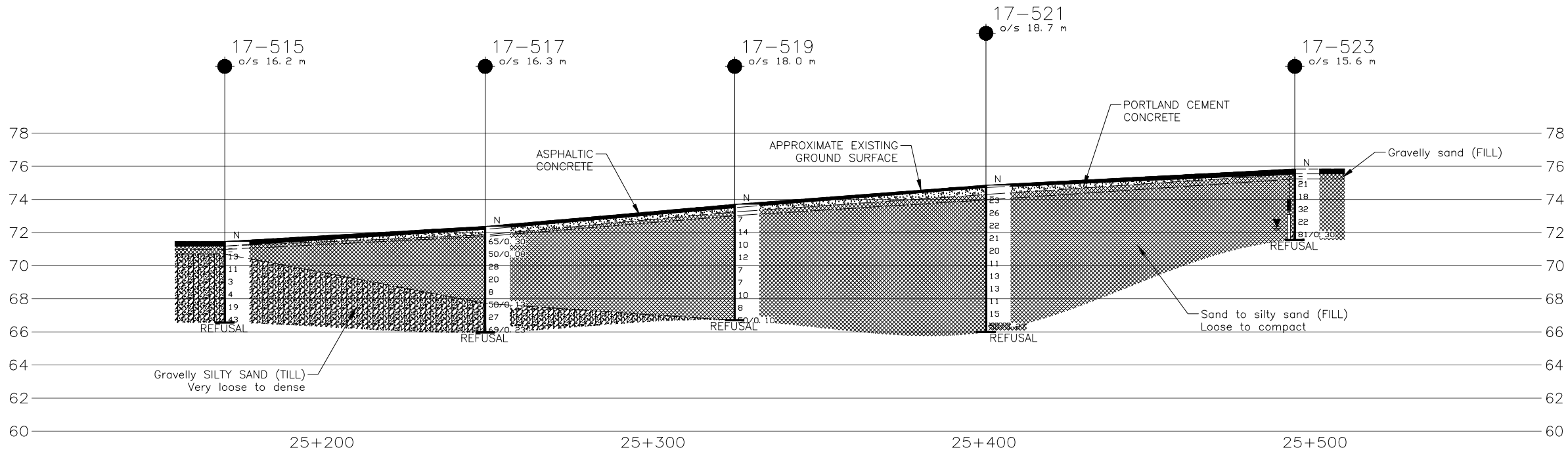


KEY PLAN

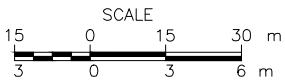


LEGEND

- Borehole - Current Investigation
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on OCTOBER 19, 2017
- Noise Barrier (NB) Walls



PROFILE ALONG CENTRE-LINE HIGHWAY 417



NOTES

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

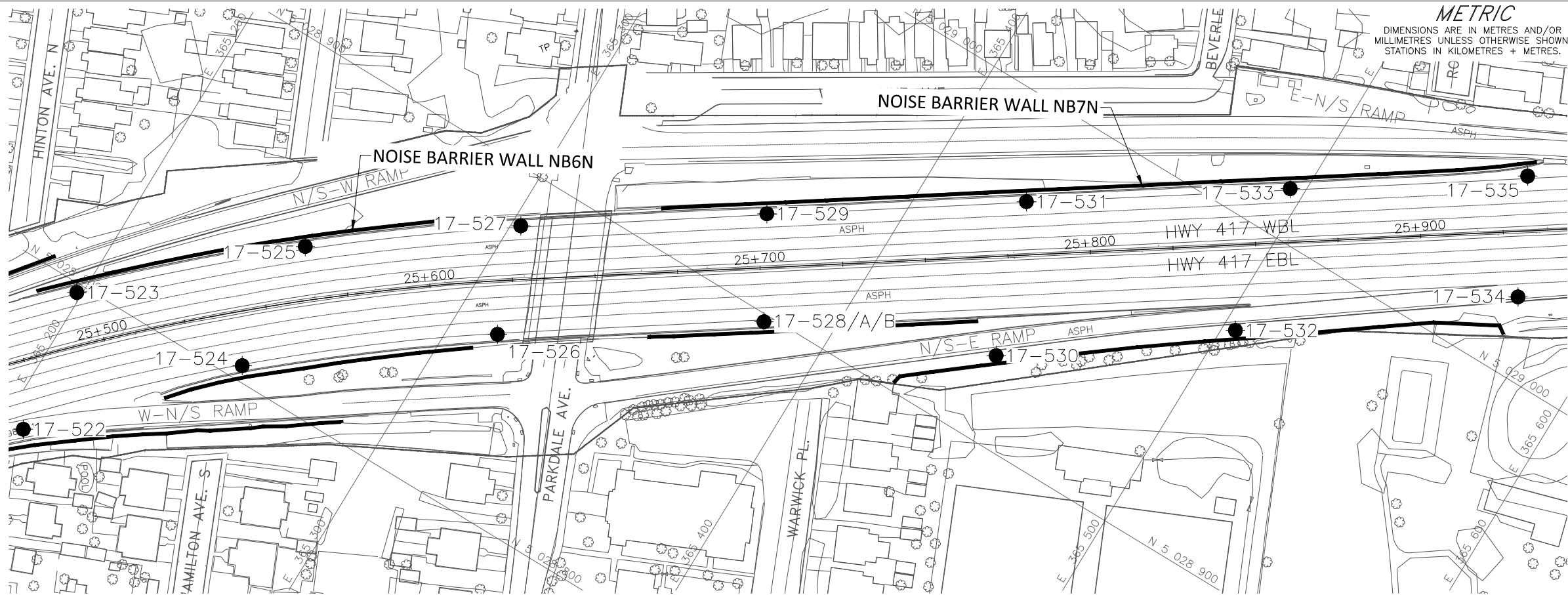
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

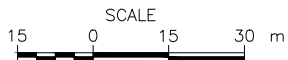
Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9			
No.	ELEVATION	NORTHING	EASTING
17-514	71.3	5028480.3	365027.9
17-515	71.5	5028526.6	365016.5
17-516	72.1	5028558.1	365070.2
17-517	72.5	5028595.5	365054.5
17-518	72.6	5028623.9	365107.4
17-519	73.8	5028662.6	365090.3
17-520	73.3	5028704.6	365162.6
17-521	74.9	5028727.4	365133.4
17-522	74.0	5028753.7	365206.1
17-523	75.9	5028797.4	365198.5
17-524	74.8	5028804.5	365252.7
17-525	76.2	5028845.2	365250.3

0			
NO.	DATE	BY	REVISION
Geocres No. 31G5-312			
HWY. 417		PROJECT NO. 1655214-1500	
SUBM'D. SS		CHKD. KP	DATE: 12/11/2019
DRAWN: ZS		CHKD. KP	APPD. FJH
		DIST. EASTERN	
		SITE: 417-09 & 417-10	
		DWG. 2	



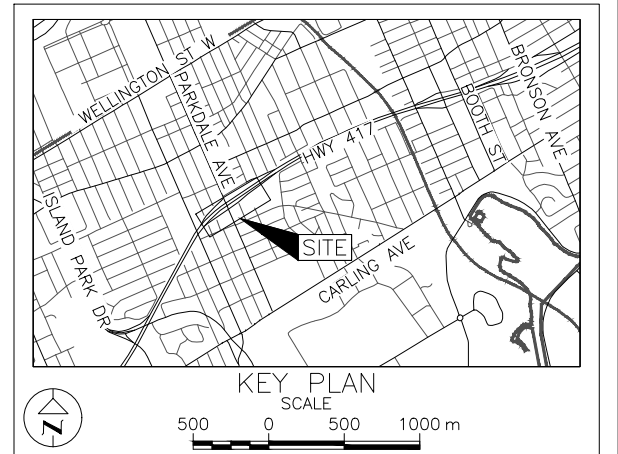
PLAN



CONT No.
GWP No. 4173-15-00

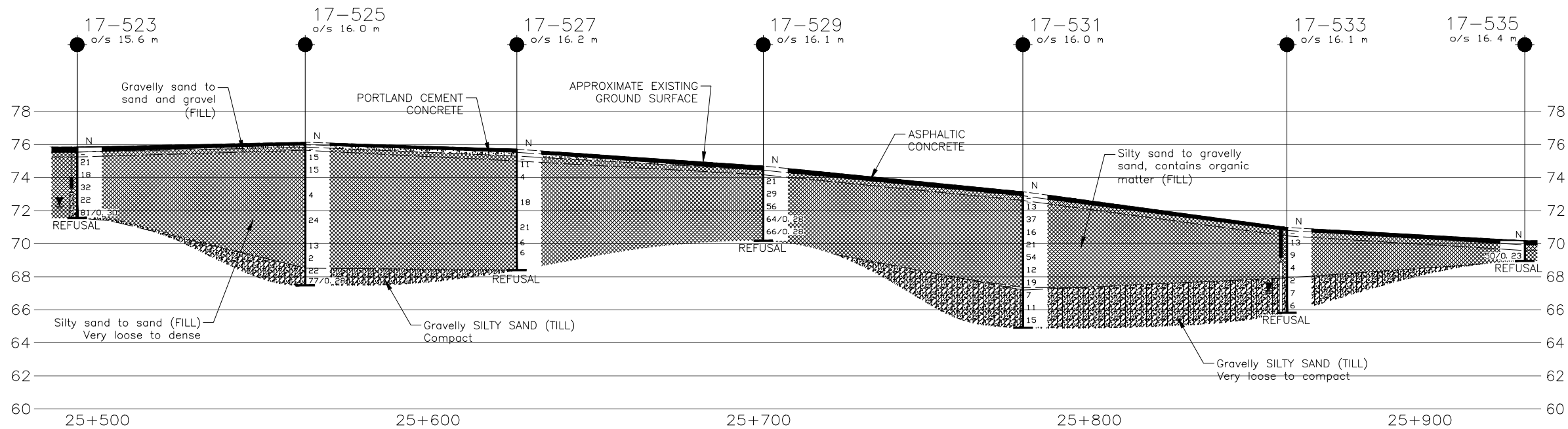
NOISE BARRIER WALL REPLACEMENT
NB6N AND NB7N
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469

SHEET

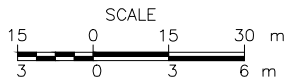


LEGEND

- Borehole - Current Investigation
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on OCTOBER 19, 2017
- Noise Barrier (NB) Walls



PROFILE ALONG CENTRE-LINE HIGHWAY 417



REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

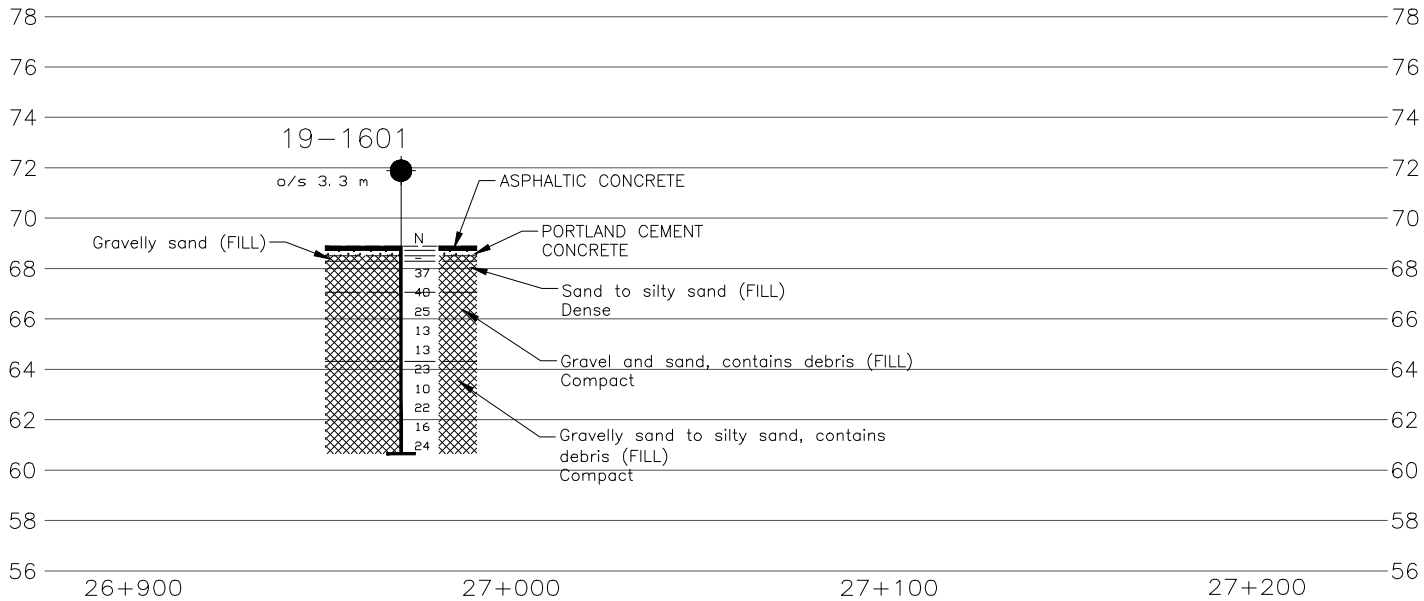
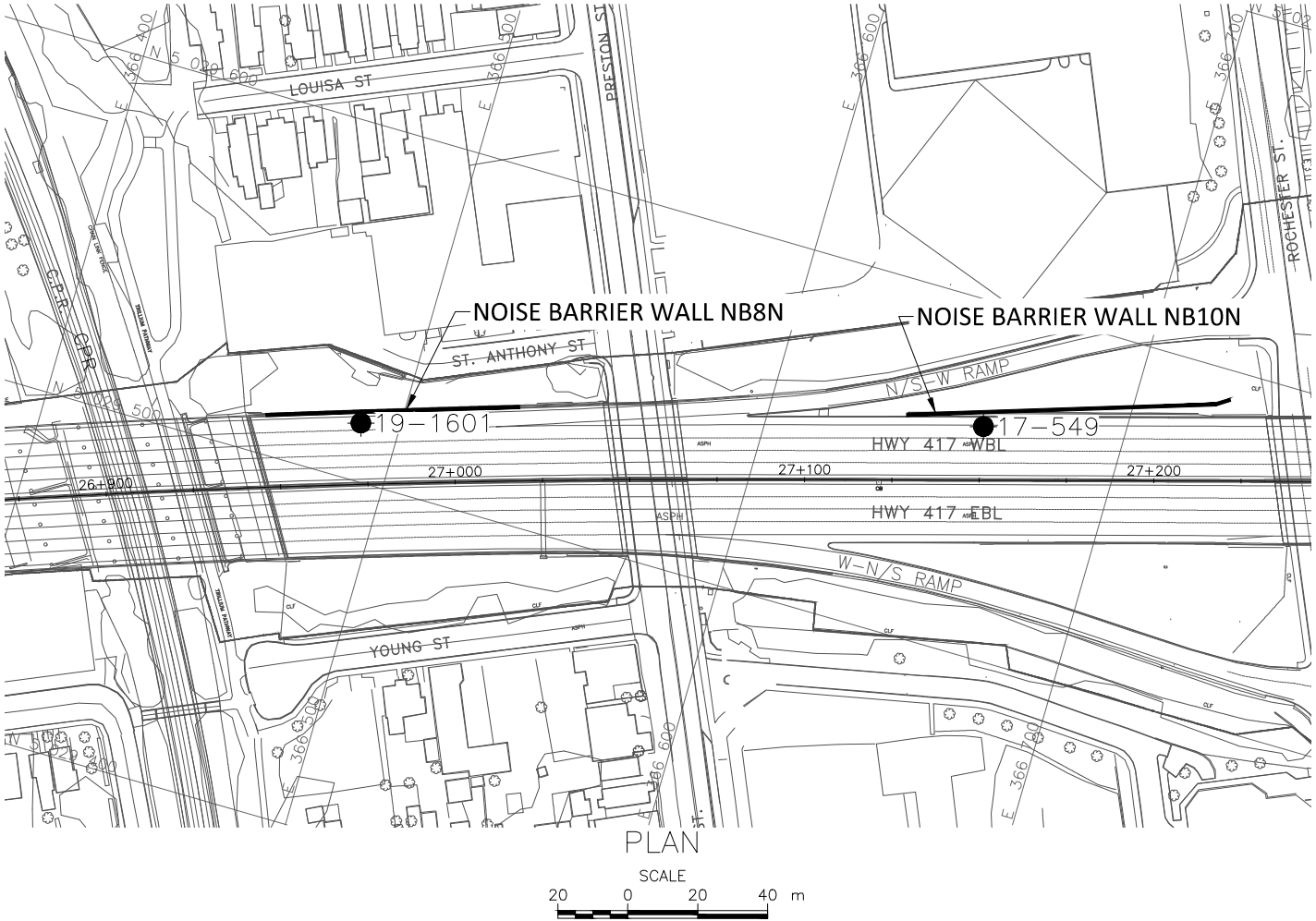
BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9			
No.	ELEVATION	NORTHING	EASTING
17-522	74.0	5028753.7	365206.1
17-523	75.9	5028797.4	365198.5
17-524	74.8	5028804.5	365252.7
17-525	76.2	5028845.2	365250.3
17-526	75.2	5028852.7	365313.8
17-527	75.8	5028884.4	365302.7
17-528	74.9	5028897.8	365380.6
17-529	74.8	5028926.2	365364.4
17-530	72.1	5028925.6	365446.0
17-531	73.2	5028970.1	365429.6
17-532	71.6	5028969.7	365503.8
17-533	71.1	5029014.9	365495.7
17-534	70.2	5029022.8	365571.6
17-535	70.3	5029055.5	365555.1

NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

0			
NO.	DATE	BY	REVISION
Geocres No. 31G5-312			
HWY.	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 3



NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

PROFILE ALONG CENTRE-LINE HIGHWAY 417

REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

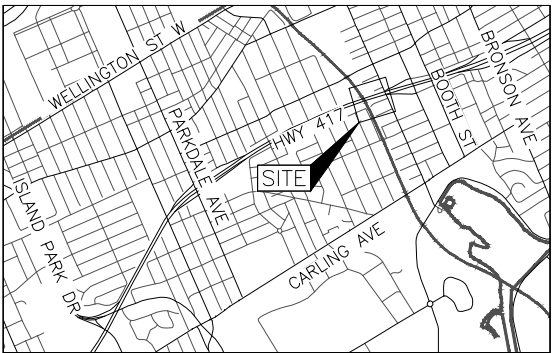
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB8N
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.402876 LONG. -75.711993



SHEET



KEY PLAN
SCALE
500 0 500 1000 m

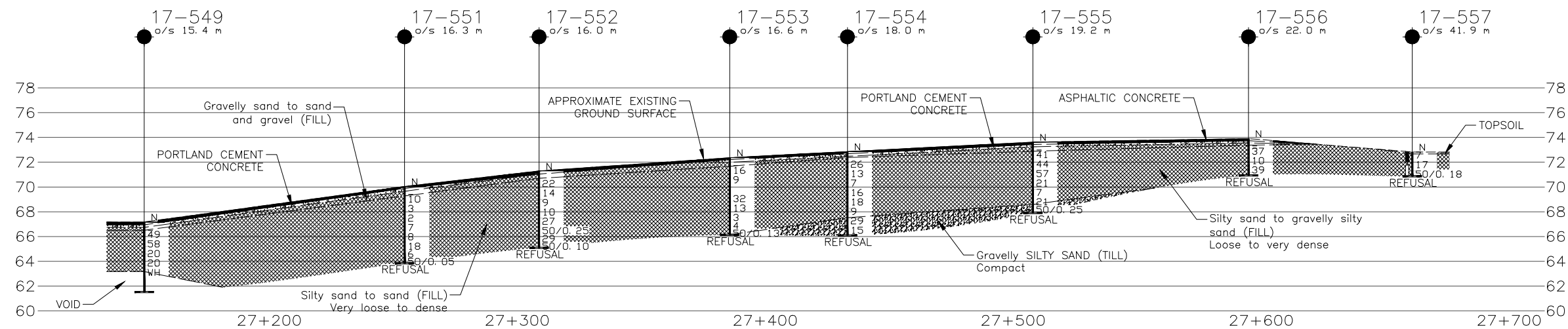
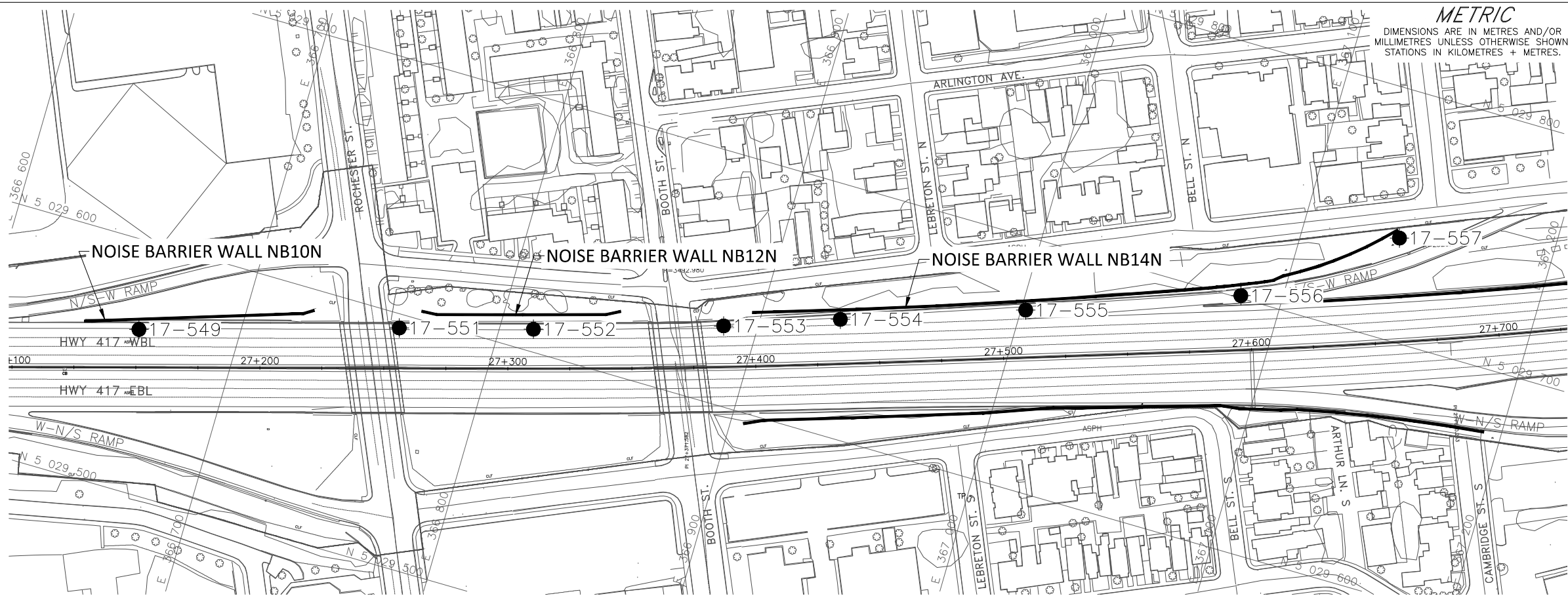
LEGEND

- Borehole - Current Investigation
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)
- Noise Barrier (NB) Walls

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9			
No.	ELEVATION	NORTHING	EASTING
19-1601	68.9	5029516.4	366488.9
17-549	67.2	5029564.8	366660.4



NO.	DATE	BY	REVISION
0			
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 4

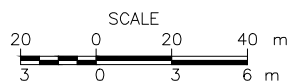


NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

PROFILE ALONG CENTRE-LINE HIGHWAY 417



REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB10N, NB11N, NB12N, NB13N AND NB14N
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469



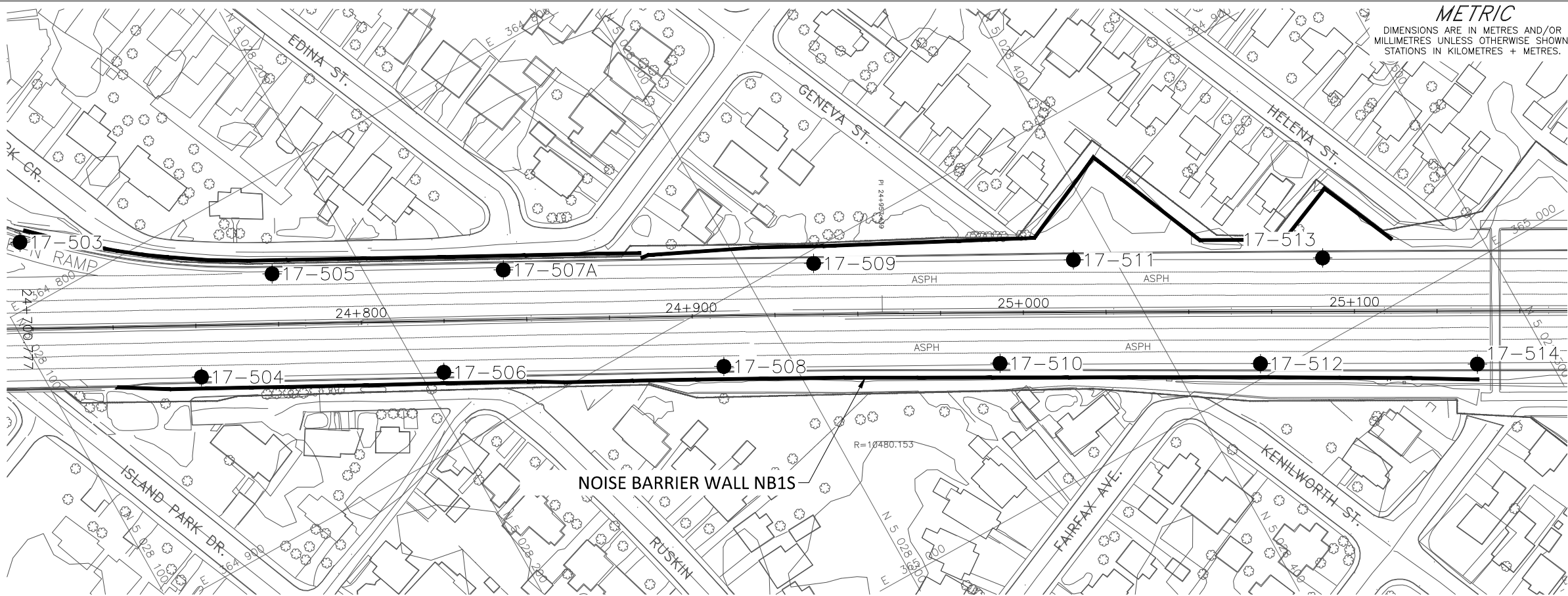
LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on OCTOBER 19, 2017
- Noise Barrier (NB) Walls

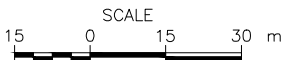
BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9

No.	ELEVATION	NORTHING	EASTING
17-549	67.2	5029564.8	366660.4
17-551	70.0	5029594.5	366761.2
17-552	71.3	5029609.0	366813.3
17-553	72.4	5029631.5	366886.6
17-554	72.9	5029647.1	366931.1
17-555	73.6	5029671.4	367001.9
17-556	73.9	5029701.1	367083.6
17-557	72.8	5029741.1	367138.6

NO.	DATE	BY	REVISION
0			
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-22
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 5



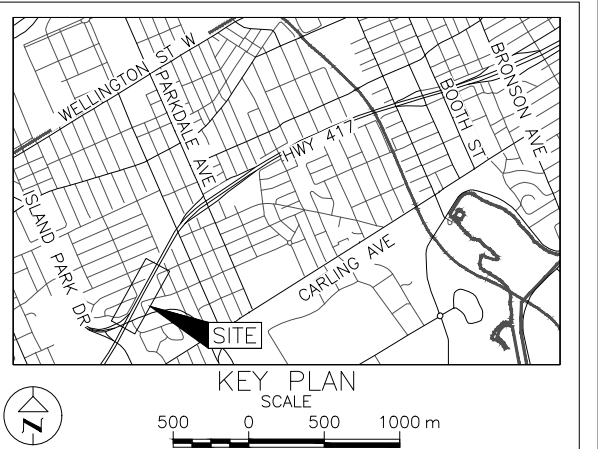
PLAN



CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB1S
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469

SHEET



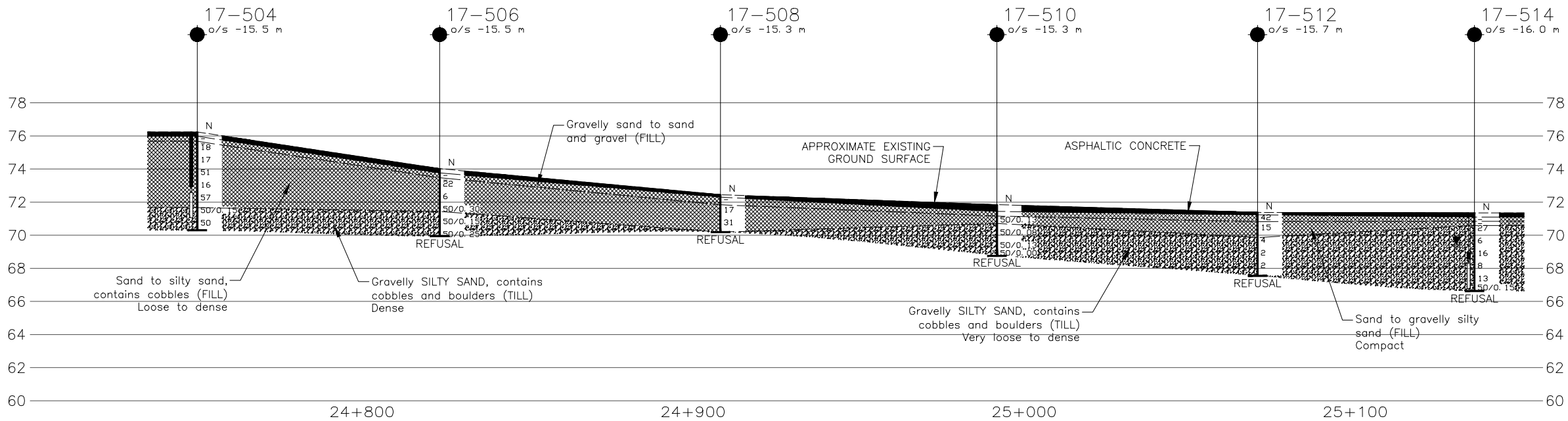
KEY PLAN

SCALE

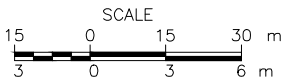


LEGEND

- Borehole - Current Investigation
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on OCTOBER 16, 2017
- Noise Barrier (NB) Walls



PROFILE ALONG CENTRE-LINE HIGHWAY 417



NOTES

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

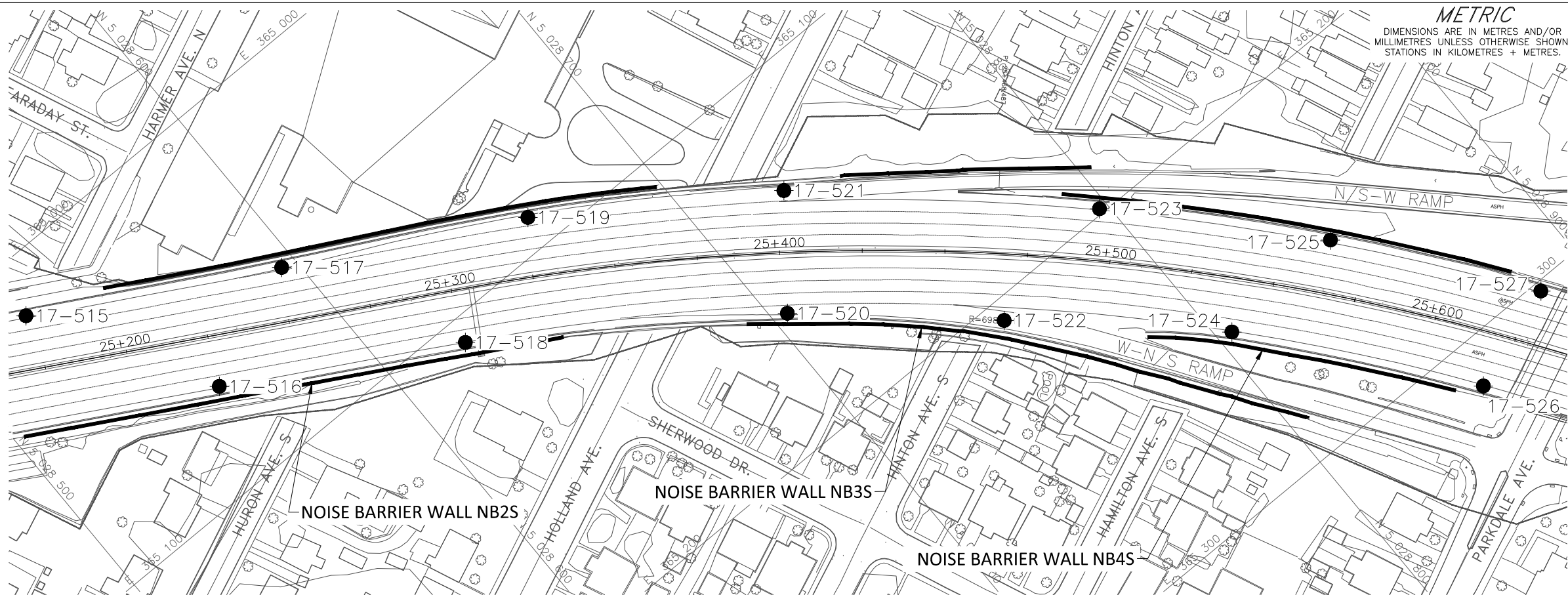
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

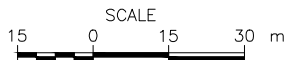
Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9			
No.	ELEVATION	NORTHING	EASTING
17-503	77.0	5028113.6	364781.6
17-504	76.2	5028141.6	364843.8
17-505	75.6	5028175.4	364827.0
17-506	74.0	5028206.3	364878.2
17-507A	73.6	5028237.0	364859.9
17-508	72.5	5028281.1	364917.8
17-509	72.2	5028319.9	364903.8
17-510	71.8	5028354.4	364957.5
17-511	71.7	5028389.0	364941.0
17-512	71.4	5028423.1	364995.9
17-513	71.3	5028455.1	364977.1
17-514	71.3	5028480.3	365027.9

NO.	DATE	BY	REVISION
0			
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 6



PLAN



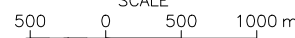
CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB2S, NB3S AND NB4S
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469

SHEET

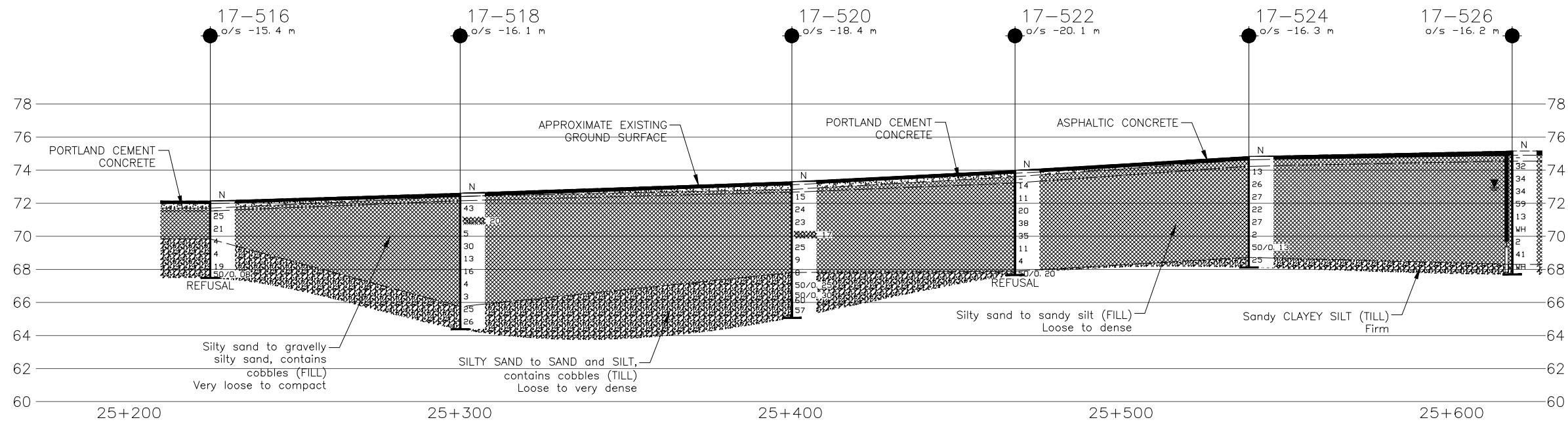


KEY PLAN

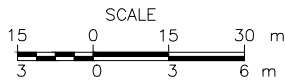


LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on OCTOBER 16, 2017
- Noise Barrier (NB) Walls



PROFILE ALONG CENTRE-LINE HIGHWAY 417



NOTES

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

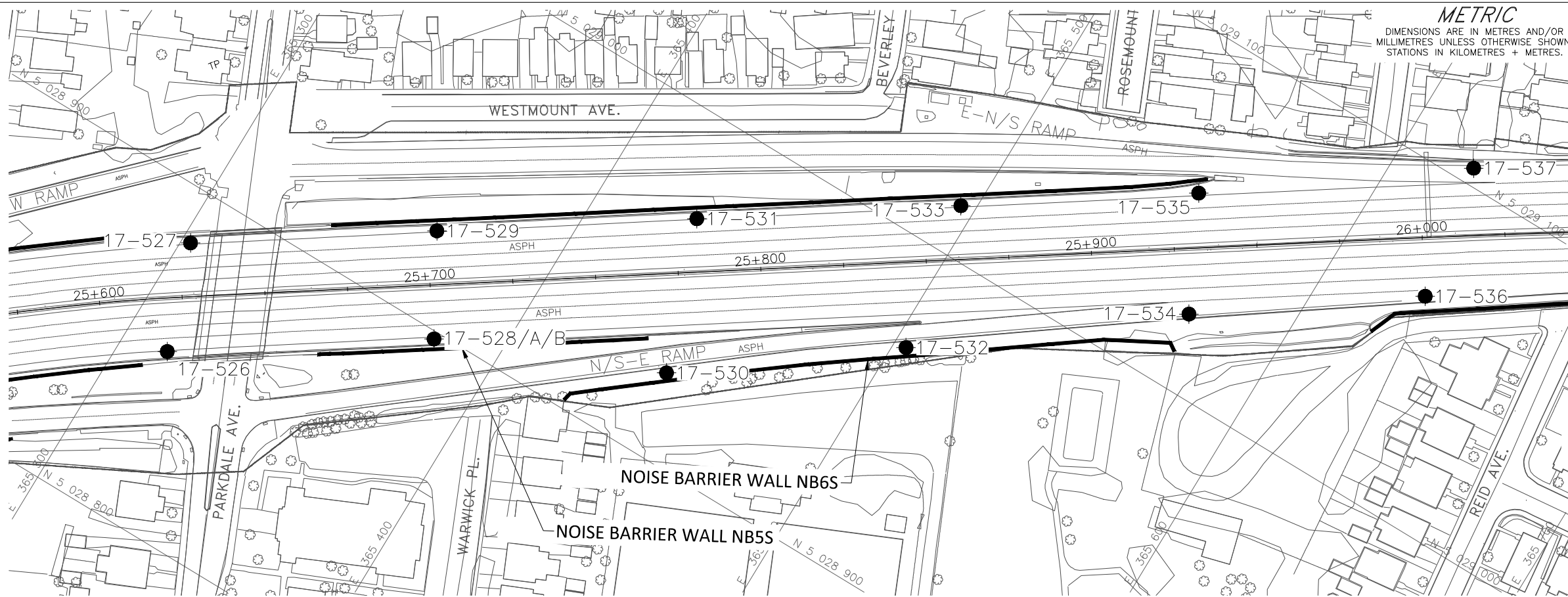
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

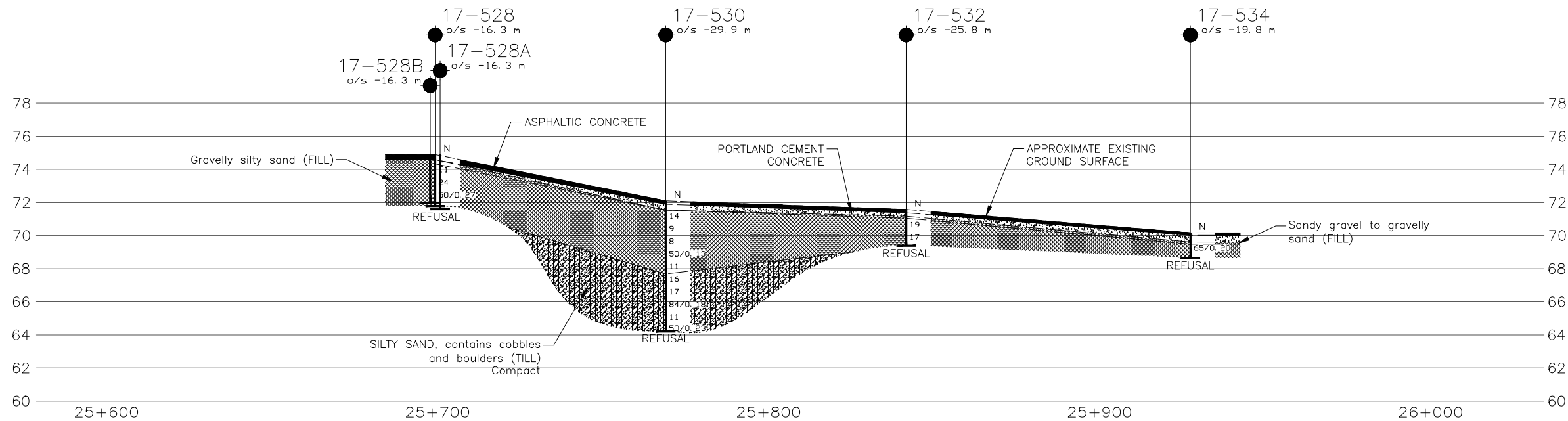
Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9			
No.	ELEVATION	NORTHING	EASTING
17-515	71.5	5028526.6	365016.5
17-516	72.1	5028558.1	365070.2
17-517	72.5	5028595.5	365054.5
17-518	72.6	5028623.9	365107.4
17-519	73.8	5028662.6	365090.3
17-520	73.3	5028704.6	365162.6
17-521	74.9	5028727.4	365133.4
17-522	74.0	5028753.7	365206.1
17-523	75.9	5028797.4	365198.5
17-524	74.8	5028804.5	365252.7
17-525	76.2	5028845.2	365250.3
17-526	75.2	5028852.7	365313.8
17-527	75.8	5028884.4	365302.7

0			
NO.	DATE	BY	REVISION
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 7



PLAN
SCALE
15 0 15 30 m



NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

PROFILE ALONG CENTRE-LINE HIGHWAY 417

SCALE
15 0 15 30 m
3 0 3 6 m

REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB5S AND NB6S
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469



SHEET



KEY PLAN
SCALE
500 0 500 1000 m

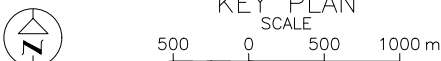
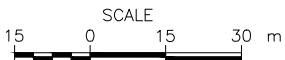
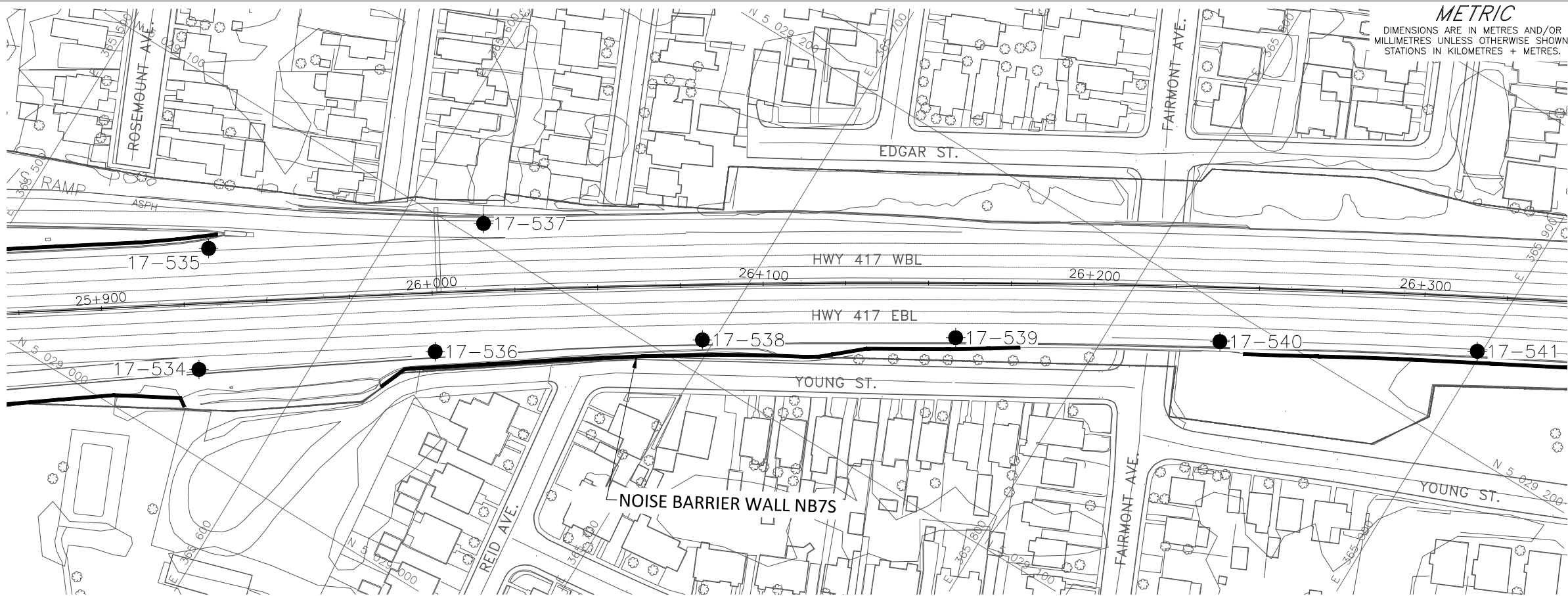
LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- Noise Barrier (NB) Walls

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9

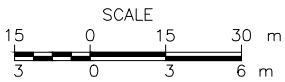
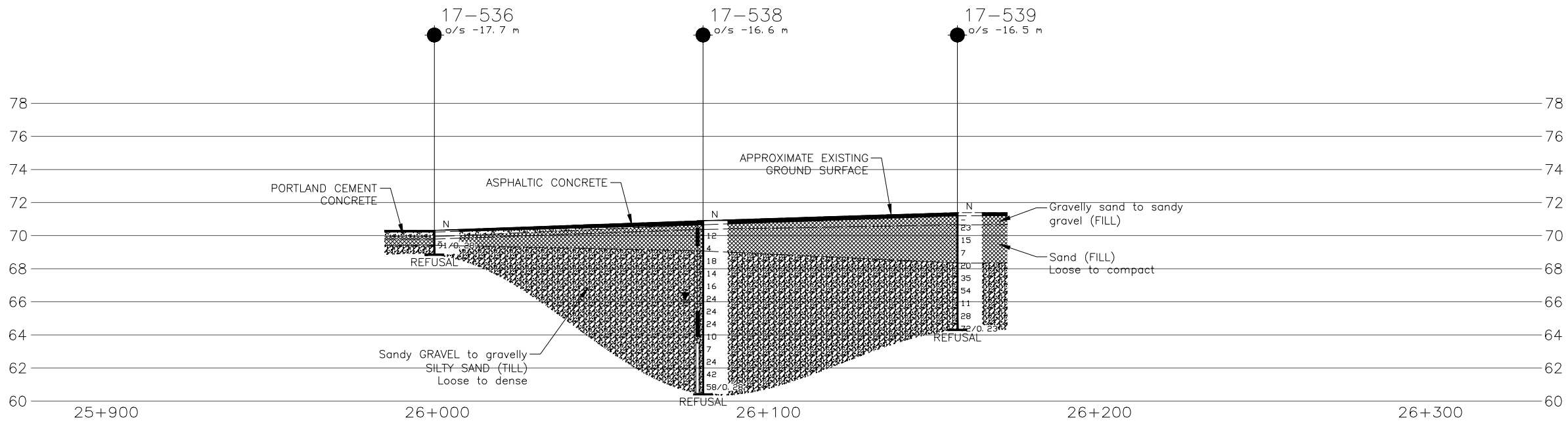
No.	ELEVATION	NORTHING	EASTING
17-526	75.2	5028852.7	365313.8
17-527	75.8	5028884.4	365302.7
17-528	74.9	5028897.8	365380.6
17-529	74.8	5028926.2	365364.4
17-530	72.1	5028925.6	365446.0
17-531	73.2	5028970.1	365429.6
17-532	71.6	5028969.7	365503.8
17-533	71.1	5029014.9	365495.7
17-534	70.2	5029022.8	365571.6
17-535	70.3	5029055.5	365555.1
17-536	70.3	5029064.4	365629.8
17-537	70.9	5029105.1	365622.2

NO.	DATE	BY	REVISION
0			
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 8



LEGEND

- Borehole – Current Investigation
- ⬮ Seal
- ⬮ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on OCTOBER 18, 2017
- Noise Barrier (NB) Walls



NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

PROFILE ALONG CENTRE-LINE HIGHWAY 417

REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB7S
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469



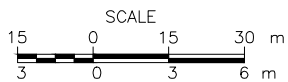
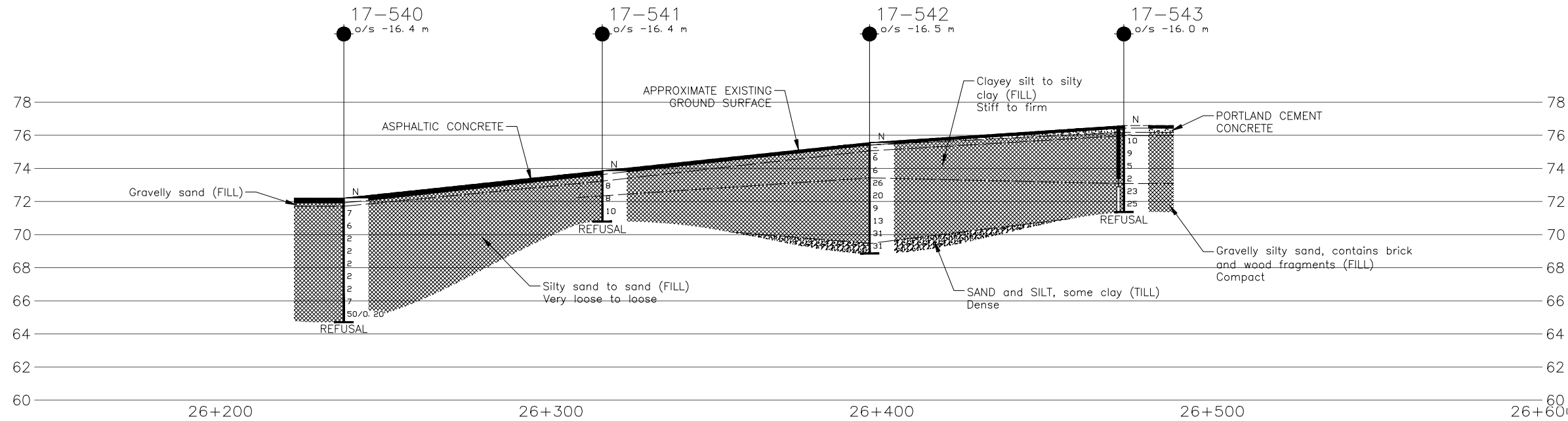
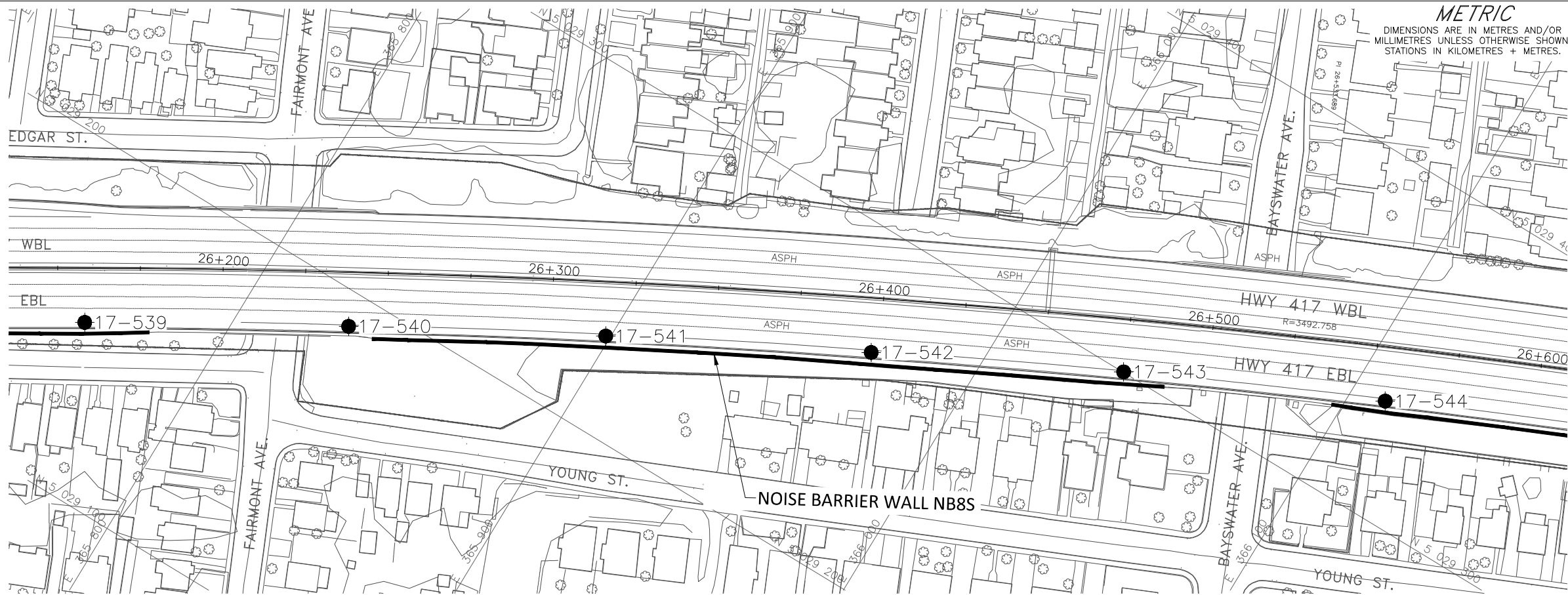
SHEET



BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9

No.	ELEVATION	NORTHING	EASTING
17-534	70.2	5029022.8	365571.6
17-535	70.3	5029055.5	365555.1
17-536	70.3	5029064.4	365629.8
17-537	70.9	5029105.1	365622.2
17-538	70.9	5029109.4	365696.9
17-539	71.4	5029149.7	365761.9
17-540	72.2	5029190.2	365830.7
17-541	73.9	5029228.0	365898.7

0			
NO.	DATE	BY	REVISION
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 9



NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

PROFILE ALONG CENTRE-LINE HIGHWAY 417

REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

CONT No.
GWP No. 4173-15-00

NOISE BARRIER WALL REPLACEMENT
NB8S
HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469



SHEET



KEY PLAN
SCALE
500 0 500 1000 m

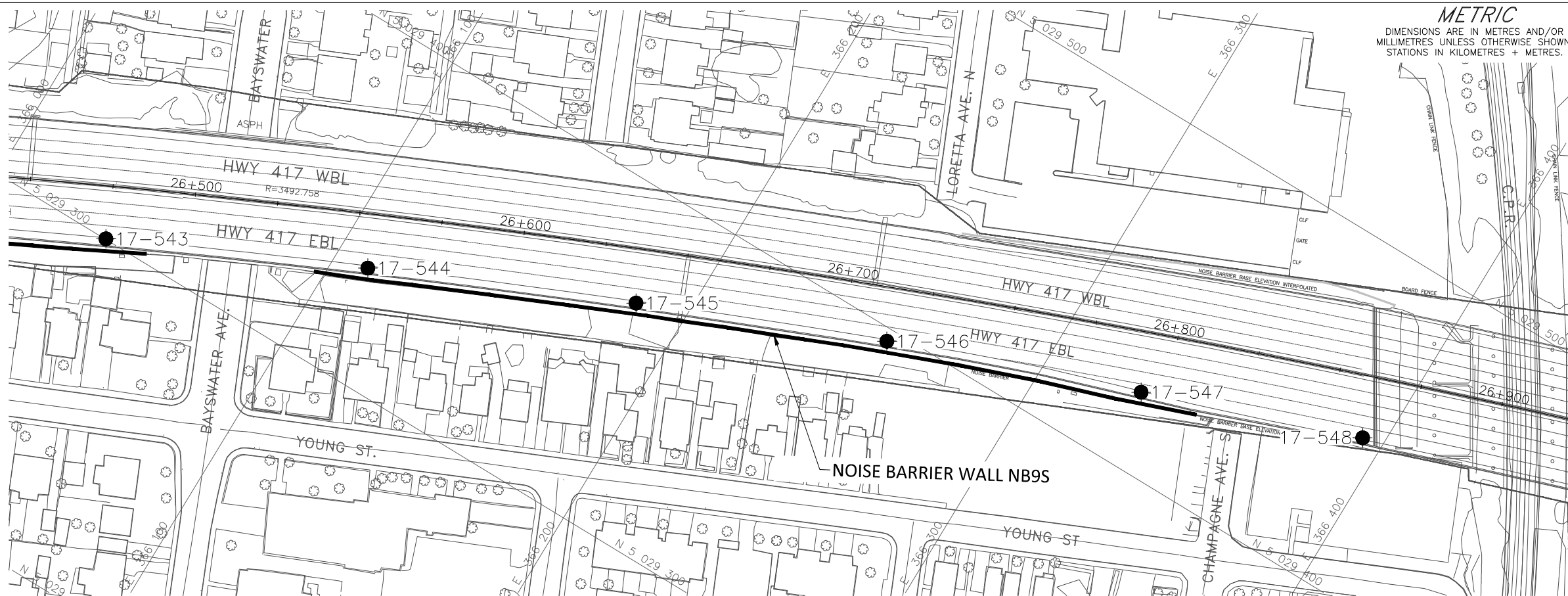
LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on OCTOBER 18, 2017
- Noise Barrier (NB) Walls

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9

No.	ELEVATION	NORTHING	EASTING
17-539	71.4	5029149.7	365761.9
17-540	72.2	5029190.2	365830.7
17-541	73.9	5029228.0	365898.7
17-542	75.6	5029265.5	365969.9
17-543	76.6	5029300.2	366038.2
17-544	76.9	5029333.7	366110.4

0			
NO.	DATE	BY	REVISION
Geocres No. 31G5-312			
HWY. 417		PROJECT NO. 1655214-1500	
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	DIST. EASTERN
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 10



PLAN



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

CONT No.
GWP No. 4173-15-00



NOISE BARRIER WALL REPLACEMENT
NB9S

SHEET

HIGHWAY 417
BOREHOLE LOCATIONS AND SOIL STRATA
LAT. 45.391846 LONG. -75.732469



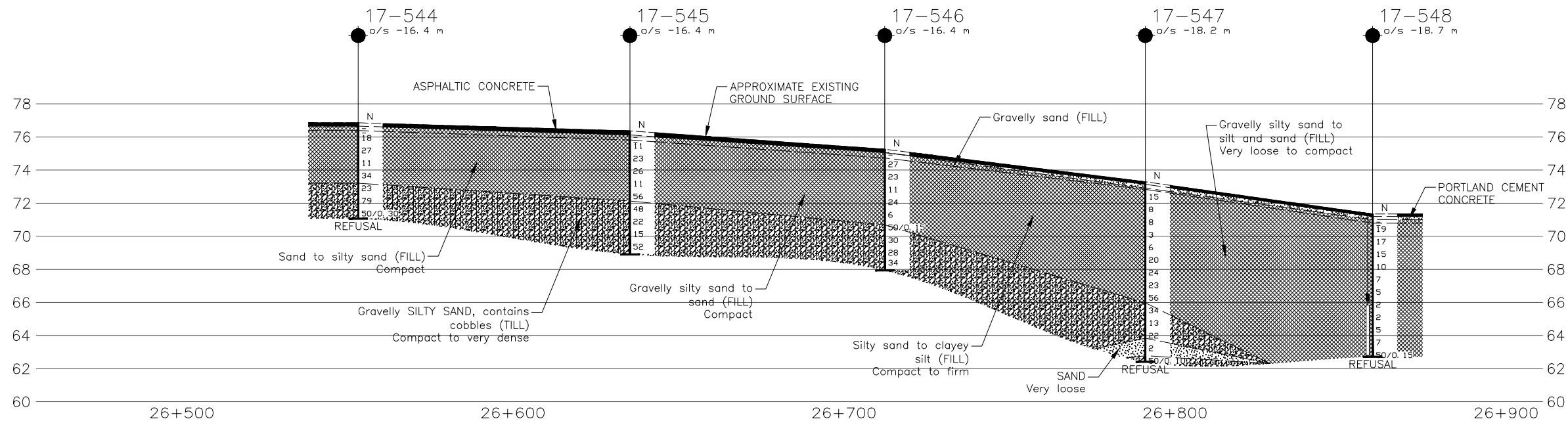
KEY PLAN

SCALE

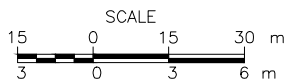
500 0 500 1000 m

LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on OCTOBER 18, 2017
- Noise Barrier (NB) Walls



PROFILE ALONG CENTRE-LINE HIGHWAY 417



NOTES

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

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

Base plans provided in digital format by WSP, drawing file no. 3416024-Noise and Retaining wall overview.dwg, received MAR. 18, 2019.

BOREHOLE CO-ORDINATES NAD83 (CSRS)/MTM ZONE 9

No.	ELEVATION	NORTHING	EASTING
17-543	76.6	5029300.2	366038.2
17-544	76.9	5029333.7	366110.4
17-545	76.4	5029366.8	366185.0
17-546	75.3	5029396.3	366255.8
17-547	73.3	5029423.0	366329.4
17-548	71.3	5029446.1	366393.7

NO.	DATE	BY	REVISION
0			
Geocres No. 31G5-312			
HWY. 417	PROJECT NO. 1655214-1500		DIST. EASTERN
SUBM'D. SS	CHKD. KP	DATE: 12/11/2019	SITE: 417-09 & 417-10
DRAWN: ZS	CHKD. KP	APPD. FJH	DWG. 11

APPENDIX A

Record of Boreholes, Current Investigation

List of Abbreviations and Symbols

Lithological and Geotechnical Rock Description Terminology

Record of Boreholes 17-503 to 17-549, 17-551 to 17-557, and
19-1601

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL		(a) Index Properties (continued)	
π	3.1416	w	water content
$\ln x$,	natural logarithm of x	w_l or LL	liquid limit
\log_{10}	x or log x, logarithm of x to base 10	w_p or PL	plastic limit
g	acceleration due to gravity	I_p or PI	plasticity index = $(w_l - w_p)$
t	time	w_s	shrinkage limit
FoS	factor of safety	I_L	liquidity index = $(w - w_p) / I_p$
		Ic	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)
II. STRESS AND STRAIN		(b) Hydraulic Properties	
γ	shear strain	h	hydraulic head or potential
Δ	change in, e.g. in stress: $\Delta \sigma$	q	rate of flow
ε	linear strain	v	velocity of flow
ε_v	volumetric strain	i	hydraulic gradient
η	coefficient of viscosity	k	hydraulic conductivity (coefficient of permeability)
ν	Poisson's ratio	j	seepage force per unit volume
	total stress		
σ'	effective stress ($\sigma' = \sigma - u$)	(c) Consolidation (one-dimensional)	
σ'_{vo}	initial effective overburden stress	C	compression index (normally consolidated range)
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, minor)	C_r	recompression index (over-consolidated range)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3) / 3$	C_s	swelling index
τ	shear stress	C_α	secondary compression index
u	porewater pressure	m_v	coefficient of volume change
E	modulus of deformation	C_v	coefficient of consolidation (vertical direction)
G	shear modulus of deformation	C_h	coefficient of consolidation (horizontal direction)
K	bulk modulus of compressibility	T_v	time factor (vertical direction)
		U	degree of consolidation
III. SOIL PROPERTIES		σ'_p	pre-consolidation stress
(a) Index Properties		OCR	over-consolidation ratio = σ'_p / σ'_{vo}
$\rho(\gamma)$	bulk density (bulk unit weight)*	(d) Shear Strength	
$\rho_d(\gamma_d)$	dry density (dry unit weight)	τ_p, τ_r	peak and residual shear strength
$\rho_w(\gamma_w)$	density (unit weight) of water	ϕ'	effective angle of internal friction
$\rho_s(\gamma_s)$	density (unit weight) of solid particles	δ	angle of interface friction
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)	μ	coefficient of friction = $\tan \delta$
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)	c'	effective cohesion
e	void ratio	c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
n	porosity	p	mean total stress $(\sigma_1 + \sigma_3) / 2$
S	degree of saturation	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

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

Notes: 1
2

$\tau = c' + \sigma' \tan \phi'$
shear strength = (compressive strength)/2

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
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split-spoon
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.) drive open 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, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Non-Cohesive (Cohesionless) Soils

Condition	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	kPa	psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

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.

V. MINOR SOIL CONSTITUENTS

Per cent by Weight	Modifier	Example
0 to 10	Trace	Trace sand
10 to 20	Some	Some sand
20 to 35	(ey) or (y)	Sandy
over 35	And	Sand and Gravel

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of weathering

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

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

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

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

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

BEDDING THICKNESS

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

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

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

CORE CONDITION

Total Core Recovery (TCR)

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

Solid Core Recovery (SCR)

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

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid segments.

DISCONTINUITY DATA

Fracture Index

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

Dip with Respect to Core Axis

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

Description and Notes

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

Abbreviations

JN Joint	PL Planar
FLT Fault	CU Curved
SH Shear	UN Undulating
VN Vein	IR Irregular
FR Fracture	K Slickensided
SY Stylolite	PO Polished
BD Bedding	SM Smooth
FO Foliation	SR Slightly Rough
CO Contact	RO Rough
AXJ Axial Joint	VR Very Rough
KV Karstic Void	
MB Mechanical Break	

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-503		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028113.6; E 364781.6 NAD 83 MTM ZONE 9 (LAT. 45.390402; LONG. -75.733970)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 16, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W _p	W		W _L			
77.1	GROUND SURFACE																		
0.0	ASPHALTIC CONCRETE																		
76.9																			
76.6	PORTLAND CEMENT CONCRETE																		
0.6	(SP) Gravelly sand (FILL) Grey Dry		1	GRAB	-														
	(SP) Sand, trace gravel and silt (FILL) Compact to very dense Brown Moist to wet		2	SS	18														
			3	SS	12														
			4	SS	62														
			5	SS	47														
			6	SS	21														
71.8																			
5.3	(SM) Gravelly silty sand, contains organic matter and concrete pieces (FILL) Compact Grey brown Moist to wet		8	SS	18														
71.0																			
6.1	(SM) Gravelly SILTY SAND, trace clay, contains cobbles and boulders (TILL) Compact to dense Grey brown Moist		9	SS	28														
69.6																			
			10	SS	37														
7.5	END OF BOREHOLE AUGER REFUSAL																		

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-504		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5028141.6; E 364843.8 NAD 83 MTM ZONE 9 (LAT. 45.390649; LONG. -75.733173)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		August 1, 2017		CHECKED BY									
								KP									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
76.2	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
75.9																	
0.3	(SP) Gravelly sand (FILL)		1	GRAB	-												
75.6	Grey Dry																
75.4	(SP) Sand (FILL)		2	GRAB	-												
0.8	Brown Dry																
	(SM) Silty sand, some gravel and clay (FILL)		3	SS	18												
74.8	Compact Grey brown Dry																
1.4	(SM/CL) Silty sand to silty clay, some gravel, contains cobbles (FILL)		4	SS	17												
	Compact to very dense Grey brown Moist																
			5	SS	51												
73.1																	
3.1	(SM/ML) Silty sand to sandy silt (FILL)		6	SS	16												
72.5	Compact Grey brown Moist																
3.7	(SP) Sand, some gravel (FILL)		7	SS	57												
	Very dense Brown Moist																
71.6																	
4.6	(SM) Gravelly SILTY SAND, trace clay, contains cobbles and boulders (TILL)		8	SS	50/0.15												
	Very dense Grey brown Moist																
70.3			9	SS	50												
5.9	END OF BOREHOLE																
NOTES:																	
1. Well screen was dry on October 16, 2017																	

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-505		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028175.4; E 364827.0 NAD 83 MTM ZONE 9 (LAT. 45.390955; LONG. -75.733383)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 1, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					w _p w w _L				
75.6	GROUND SURFACE							20	40	60	80	100					
0.0	ASPHALTIC CONCRETE							20	40	60	80	100		25	50	75	
75.1																	
0.6	(SP) Gravelly sand (FILL) Grey						75										
	(SM) Sand, some gravel, some silt, contains sandy silt layers (FILL) Dense to compact Brown Moist		1	SS	35												
			2	SS	35									○			
			3	SS	24		73										
72.5																	
3.1	(SM) Silty sand, trace gravel, contains silty clay layers (FILL) Very loose Brown Wet		4	SS	2		72							○			
71.8																	
3.8	(SM) Gravelly silty sand, contains concrete and asphalt pieces (FILL) Compact Dark grey Moist		5	SS	20												
71.0																	
4.6	(SM) Gravelly SILTY SAND, contains cobbles and boulders (TILL) Compact to dense Grey brown Moist to wet		6	SS	17		71										
			7	SS	43		70							○			
			8	SS	29												
			9	SS	50/0.13		69										
68.1																	
7.5	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTD\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-506		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028206.3; E 364878.2 NAD 83 MTM ZONE 9 (LAT. 45.391228; LONG. -75.732726)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 2, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × REMOULDED											
74.0	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
73.7																				
0.3	(SP) Gravelly sand (FILL)		1	GRAB	-															
73.5	Grey Dry																			
73.2	(SP) Sand (FILL)		2	GRAB	-															
0.8	Brown Dry																			
72.6	(SP) Sand, some gravel (FILL)		3	SS	22															
1.4	Compact Brown Moist																			
71.9	(SM-ML) Silty sand to sandy silt, some gravel (FILL)		4	SS	6															
2.1	Loose Grey brown Moist																			
71.4	(SP) Gravelly sand (FILL)		5	SS	50/0.30															
2.6	Brown Moist																			
71.4	(SM) Gravelly SILTY SAND, contains cobbles and boulders (TILL)		6	SS	50/0.15															
2.6	Grey brown Moist																			
69.9																				
4.1	END OF BOREHOLE AUGER REFUSAL		7	SS	50/0.25															

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-507A		SHEET 1 OF 1		METRIC										
G.W.P.		4173-15-00		LOCATION		N 5028237.0; E 364859.9 NAD 83 MTM ZONE 9 (LAT. 45.391506; LONG. -75.732955)		ORIGINATED BY										
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY										
DATUM		Geodetic		DATE		August 16, 2017		CHECKED BY										
KP																		
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L	
73.6	GROUND SURFACE						20	40	60	80	100							
0.0	ASPHALTIC CONCRETE																	
73.3																		
73.0	(SP) Gravelly sand (FILL) Grey		1	GRAB	-													
0.6	(SM) Sand, some silt, trace gravel (FILL) Compact Brown Moist to wet		2	GRAB	-													
			3	SS	15													
			4	SS	16													
71.1			5	SS	50/0.15													
2.5	END OF BOREHOLE AUGER REFUSAL																	
NOTES:																		
1. Water level observed in well screen at a depth of 1.5 m below ground surface (Elev. 72.1 m), measured on October 19, 2017																		

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-508		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5028281.1; E 364917.8 NAD 83 MTM ZONE 9 (LAT. 45.391898; LONG. -75.732211)</u>		ORIGINATED BY <u>DG</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 10, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P W W _L							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)							
72.5	GROUND SURFACE							20	40	60	80	100								
0.0	ASPHALTIC CONCRETE																			
0.2	(GP) Sandy gravel (FILL) Grey Moist		1	GRAB	-		72													
71.9																				
0.6	(SM/ML) Silty sand, some clay (FILL) Compact to dense Grey brown Moist		2	SS	17															
							71													
70.4			3	SS	31															
	Weathered Bedrock																			
2.3	END OF BOREHOLE AUGER REFUSAL																			

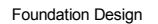
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-509		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028319.9; E 364903.8 NAD 83 MTM ZONE 9 (LAT. 45.392248; LONG. -75.732385)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 15, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20	40	60	80	100	W _p	W		W _L			
72.2	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
71.9																				
71.7	(SP) Gravelly sand (FILL) Grey brown Moist		1	GRAB	-															
0.5																				
71.2	(SP) Sand (FILL) Compact Brown Moist		2	SS	17															
71.0	(CL) Sandy silty clay, contains organic matter (FILL) Brown Moist																			
1.3	(GP) Sandy gravel (FILL) Grey brown Moist END OF BOREHOLE AUGER REFUSAL																			

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMT\HWHY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM



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

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-511		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5028389.0; E 364941.0 NAD 83 MTM ZONE 9 (LAT. 45.392867; LONG. -75.731901)</u>		ORIGINATED BY <u>RI</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 24, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P	W	W _L		GR	SA	SI	CL
								20	40	60	80	100								
71.7	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
71.3																				
0.4	(SM) Sand, some silt (FILL) Brown Moist		1	GRAB	-													1 84 12 3		
70.9																				
70.7	(SM) Gravelly silty sand (FILL) Dark brown-brown Moist		2	SS	50/0.05															
1.0	END OF BOREHOLE AUGER REFUSAL																			

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-512		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028423.1; E 364995.9 NAD 83 MTM ZONE 9 (LAT. 45.393169; LONG. -75.731197)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 10, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
							20	40	60	80	100						
71.4	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
0.2	(GP) Sandy gravel (FILL)																
70.8	Dense Grey Moist		1	SS	42												
0.6	(SM) Silty sand (FILL)																
	Compact Grey brown Moist		2	SS	15												
69.9																	
1.5	(SM/ML) SILTY SAND, some clay, trace gravel (TILL)																
	Loose to very loose Grey Wet		3	SS	4												
			4	SS	2												
			5	SS	2												
67.6	END OF BOREHOLE AUGER REFUSAL																
3.8																	

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

GTA-MTO 001 N:\ACTIVE\SPATIAL_IM\MTOWHY417REHAB&WIDENING02_DATA\GINT1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-513		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028455.1; E 364977.1 NAD 83 MTM ZONE 9 (LAT. 45.393458; LONG. -75.731432)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		April 24, 2017		CHECKED BY								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
71.3	GROUND SURFACE															
0.0	ASPHALTIC CONCRETE															
71.0																
70.8	(SP) Gravelly sand (FILL) Grey															
0.5	(SP) Sand (FILL) Brown															
70.5	Moist															
0.8	(SM) SILTY SAND, some gravel, some clay, contains cobbles (TILL) Very loose to dense Grey brown Moist to wet		1	SS	16											
			2	SS	36											
			3	SS	2											
			4	SS	2											
			5	SS	15											
67.2																
4.1	END OF BOREHOLE SAMPLER REFUSAL															

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-514		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028480.3; E 365027.9 NAD 83 MTM ZONE 9 (LAT. 45.393681; LONG. -75.730781)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		July 30, 2017		CHECKED BY								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
71.3	GROUND SURFACE						20	40	60	80	100	25	50	75		
0.0	ASPHALTIC CONCRETE															
71.1	(SP) Gravelly sand (FILL) Grey Moist		1A	GRAB	-											
70.8	(SM) Silty sand, trace gravel (FILL) Grey brown Moist		1B	GRAB	-											
70.5	(SM) Gravelly SILTY SAND, trace clay, contains cobbles (TILL) Compact to loose Wet		2	SS	27											
0.8																
			3	SS	6											
			4	SS	16											
			5	SS	8											
			6	SS	13											
			7	SS	50/0.15											
66.6	END OF BOREHOLE AUGER REFUSAL															
4.7	NOTES: 1. Water level observed in well screen at a depth of 1.9 m below ground surface (Elev. 69.4 m), measured on October 16, 2017															

PROJECT		1655214-1500				RECORD OF BOREHOLE No 17-515				SHEET 1 OF 1				METRIC					
G.W.P.		4173-15-00		LOCATION		N 5028526.6; E 365016.5 NAD 83 MTM ZONE 9 (LAT. 45.394099; LONG. -75.730921)				ORIGINATED BY				DG					
DIST		Eastern		HWY		417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)				COMPILED BY		ZS			
DATUM		Geodetic		DATE		August 15, 2017				CHECKED BY		KP							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p W W _L						
71.5	GROUND SURFACE																		
0.0	ASPHALTIC CONCRETE																		
71.2	(SP) Gravelly sand (FILL) Grey Dry		1	GRAB	-														
71.0	(SM) Silty sand (FILL) Brown Moist		2	GRAB	-														
70.7	(SM) Gravelly SILTY SAND, trace clay, contains cobbles (TILL) Very loose to dense Brown to grey Moist to wet		3	SS	13														
0.8																			
			4	SS	11														
			5	SS	3														
			6	SS	4														
			7	SS	19														
			8	SS	43														
66.6	END OF BOREHOLE AUGER REFUSAL																		
4.9																			

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-516				SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028558.1; E 365070.2 NAD 83 MTM ZONE 9 (LAT. 45.394377; LONG. -75.730231)				ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)				COMPILED BY ZS			
DATUM Geodetic		DATE July 30, 2017				CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
							20	40	60	80	100						
72.1	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
0.2	PORTLAND CEMENT CONCRETE																
71.7																	
	(SP) Gravelly sand (FILL) Grey Dry		1A	GRAB	-												
0.6			1B	GRAB	-												
	(SP) Sand (FILL) Brown Moist		2	SS	25												
			3	SS	21												
69.8																	
2.3	(SM) Gravelly SILTY SAND, trace clay, contains cobbles (TILL) Loose to compact Grey brown to grey Moist to wet		4	SS	4												
			5	SS	4												
			6	SS	19												
67.4			7	SS	50/0.08												
4.7	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-517		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028595.5; E 365054.5 NAD 83 MTM ZONE 9 (LAT. 45.394715; LONG. -75.730427)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 25, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × REMOULDED								
72.5	GROUND SURFACE							20	40	60	80	100					
72.0	ASPHALTIC CONCRETE																
0.2	PORTLAND CEMENT CONCRETE																
72.0																	
0.6	(SP) Gravelly sand (FILL) Grey Moist																
	(SP) Sand, trace silt, contains cobbles and boulders (FILL) Compact Brown Moist		1	SS	65/0.30												
			2	SS	50/0.08												
			3	SS	28												
69.4																	
3.1	(SP) Sand, trace silt, contains wood fragments (FILL) Compact to loose Brown Moist		4	SS	20												
			5	SS	8												
67.8																	
4.7	(SM/ML) SILTY SAND, trace gravel, contains cobbles and boulders (TILL) Compact Grey Wet		6	SS	50/0.13												
			7	SS	27												
66.1																	
6.4	END OF BOREHOLE AUGER REFUSAL		8	SS	69/0.23												

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-518		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028623.9; E 365107.4 NAD 83 MTM ZONE 9 (LAT. 45.394966; LONG. -75.729748)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		July 30, 2017		CHECKED BY								
KP																
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
72.6	GROUND SURFACE															
72.4	ASPHALTIC CONCRETE															
72.1	(SP) Gravelly sand (FILL) Grey															
71.3	(SP) Sand, trace silt and gravel (FILL) Dense Brown Moist		1	SS	43											
71.3	(SM) Silty sand, some gravel, trace clay, contains cobbles (FILL) Dense to very loose Grey brown Moist		2	SS	50/0.20											
			3	SS	5											
			4	SS	30											
			5	SS	13											
			6	SS	16											
			7	SS	4											
			8	SS	3											
65.7	(SM/ML) SAND and SILT, trace clay (TILL) Compact Grey Wet		9	SS	25											
64.4	END OF BOREHOLE		10	SS	26											
NOTES: 1. Borehole dry upon completion of drilling.																

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-519		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028662.6; E 365090.3 NAD 83 MTM ZONE 9 (LAT. 45.395315; LONG. -75.729962)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 23, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20	40	60	80	100	W _p	W		
73.8	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
73.6																	
73.3	PORTLAND CEMENT CONCRETE																
73.1	(SP) Gravelly sand (FILL)																
0.7	Grey Moist																
72.7	(SP) Sand (FILL)																
1.1	Loose Brown Moist		1	SS	7												
72.4	(CL) Sandy silty clay, trace gravel (FILL)																
1.4	Stiff Grey brown Moist																
	(SP-SM) Sand, trace silt, contains silty sand seams (FILL)		2	SS	14												
	Compact to loose Brown Moist to wet																
			3	SS	10												
			4	SS	12												
			5	SS	7												
			6	SS	7												
			7	SS	10												
			8	SS	8												
67.2																	
6.6	(SM) Silty sand, trace gravel (FILL)																
66.8	Grey brown Moist		9	SS	50/0.10												
7.0	PORTLAND CEMENT CONCRETE																
	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-520		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028704.6; E 365162.6 NAD 83 MTM ZONE 9 (LAT. 45.395687; LONG. -75.729032)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		July 31, 2017		CHECKED BY								
KP																
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
73.3	GROUND SURFACE															
73.0	ASPHALTIC CONCRETE															
72.8	PORTLAND CEMENT CONCRETE															
72.8	(SP) Gravelly sand (FILL) Grey															
71.9	(SP) Sand, trace gravel, contains organic matter (FILL) Compact Brown Moist		1	SS	15											
71.9	(SM) Gravelly silty sand, contains organic matter and cobbles (FILL) Compact Brown Moist		2	SS	24											
71.9																
71.9			3	SS	23											
71.9			4	SS	50/0.17											
71.9																
71.9			5	SS	25											
68.9	(SM) Silty sand, trace gravel, contains organic matter and brick fragments (FILL)		6	SS	9											
68.9																
68.0	(CL/CI) Silty clay, trace sand (FILL) Stiff Grey brown Moist		7	SS	8											
68.0	(SM) SILTY SAND, some gravel, contains silty clay and sand seams (TILL) Loose to very dense Grey brown Moist to wet		8	SS	50/0.25											
68.0			9	SS	50/0.30											
68.0			10	SS	60											
68.0			11	SS	57											
65.1	END OF BOREHOLE															
8.2																

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-521		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028727.4; E 365133.4 NAD 83 MTM ZONE 9 (LAT. 45.395895; LONG. -75.729403)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 15, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W _p	W	W _L					
74.9	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
0.1	PORTLAND CEMENT CONCRETE																			
74.3																				
0.6	(SP) Gravelly sand (FILL) Grey		1	GRAB	-															
74.0																				
0.9	(SP) Sand, trace silt (FILL) Compact Brown Moist		2	SS	23															
			3	SS	26															
			4	SS	22															
			5	SS	21															
			6	SS	20															
			7	SS	11															
			8	SS	13															
			9	SS	13															
			10	SS	11															
			11	SS	15															
			12	SS	50/0.27															
66.0																				
8.9	END OF BOREHOLE AUGER REFUSAL																			

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-522		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5028753.7; E 365206.1 NAD 83 MTM ZONE 9 (LAT. 45.396125; LONG. -75.728471)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		July 31, 2017		CHECKED BY									
KP																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
74.0	GROUND SURFACE																
73.8	ASPHALTIC CONCRETE																
73.6	PORTLAND CEMENT CONCRETE																
0.4	(SP) Gravelly sand (FILL) Grey Dry		1	GRAB	-												
73.2	(SM) Silty sand, some gravel, contains silt seams (FILL) Compact Grey brown Moist		2	SS	14												
72.5	(SM) Silty sand, contains wood pieces, concrete fragments and clayey silt seams (FILL) Compact Moist		3	SS	11												
1.5	(SM) Silty sand, some clay, contains cobbles (FILL) Dense Grey brown Moist		4	SS	20												
71.0	(SM) Silty sand, some clay, contains cobbles (FILL) Dense Grey brown Moist		5	SS	38												
3.0	(SM) Silty sand, some clay, contains cobbles (FILL) Dense Grey brown Moist		6	SS	35												
69.4	(ML) Sandy silt (FILL) Compact Grey Moist		7	SS	11												
4.6	(ML) Sandy silt (FILL) Compact Grey Moist		8	SS	4												
68.7	(SM) Gravelly silty sand (FILL) Loose Brown Moist		9	SS	50/0.20												
5.3	(SM) Gravelly silty sand (FILL) Loose Brown Moist																
67.9	(SM) Gravelly SILTY SAND (TILL)																
67.7	(SM) Gravelly SILTY SAND (TILL)																
6.3	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMT\Hwy417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-523		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028797.4; E 365198.5 NAD 83 MTM ZONE 9 (LAT. 45.396520; LONG. -75.728564)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		August 15, 2017		CHECKED BY								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
75.9	GROUND SURFACE						20	40	60	80	100	25	50	75		
0.0	ASPHALTIC CONCRETE															
75.6																
0.3	(SP) Gravelly sand (FILL)		1	GRAB	-											
75.3	Grey Moist		2	GRAB	-											
0.8	(SM) Sand, some silt (FILL)															
	Brown Moist		3	SS	21											
	(SM) Silty sand, contains silty clay seams (FILL)															
	Compact															
74.4	Grey brown Moist		4	SS	18											
1.5	(CL/SM) Silty clay to silty sand, some gravel (FILL)															
	Compact															
73.6	Grey brown Moist		5	SS	32											
2.3	(SP) Sand (FILL)															
73.2	Dense Brown Moist		6	SS	22											
2.7	(CL) Silty clay, some sand, trace gravel (FILL)															
72.9	Stiff Grey brown Moist		7	SS	81/0.30											
3.0	(SM/CL) Silty sand, some gravel, contains cobbles (FILL)															
	Compact															
72.1	Grey brown Wet															
3.8	(SM) Silty sand, some gravel, contains clayey silt seams (FILL)															
71.6	Grey Moist															
4.3	END OF BOREHOLE AUGER REFUSAL															
NOTES: 1. Water level in well screen at a depth of 3.5 m below ground surface (Elev. 72.4 m), measured on October 19, 2017																

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-524		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5028804.5; E 365252.7 NAD 83 MTM ZONE 9 (LAT. 45.396579; LONG. -75.727870)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		July 31, 2017		CHECKED BY									
KP																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
74.8	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
74.6																	
0.2	(SP) Gravelly sand (FILL) Grey																
74.2																	
0.6	(SP) Sand (FILL) Brown Moist																
73.9																	
0.9	(SM) Gravelly silty sand, trace clay, contains organic matter, cobbles and asphalt pieces (FILL) Compact Brown Moist to wet		1	SS	13												
			2	SS	26												
			3	SS	27												
			4	SS	22												
			5	SS	27												
70.4																	
4.4	(SM) Silty sand, trace gravel, contains organic matter (FILL) Very loose Dark brown to black Moist		6	SS	2												
69.5																	
5.3	(SM) Silty sand, trace gravel, contains organic matter, cobbles and boulders (FILL) Dense Dark brown to black Wet		7	SS	50/0.13												
68.7																	
6.1	(SM) SILTY SAND (TILL) Compact Grey Moist		8	SS	25												
68.1																	
6.7	END OF BOREHOLE																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTD\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT 1655214-1500			RECORD OF BOREHOLE No 17-525			SHEET 1 OF 1			METRIC								
G.W.P. 4173-15-00			LOCATION N 5028845.2; E 365250.3 NAD 83 MTM ZONE 9 (LAT. 45.396945; LONG. -75.727896)			ORIGINATED BY DG											
DIST Eastern HWY 417			BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)			COMPILED BY ZS											
DATUM Geodetic			DATE April 24, 2017			CHECKED BY KP											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
76.2	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
	PORTLAND CEMENT CONCRETE																
75.7	(SP) Gravelly sand (FILL) Grey Moist		1	GRAB	-												
0.5	(SM) Gravelly silty sand (FILL) Compact to very loose Brown Moist		2	SS	15												
			3	SS	15												
			4	SS	4												
			5	SS	24												
			6	SS	13												
			7	SS	2												
68.6	(GP) Sandy GRAVEL (TILL) Compact Grey Moist		8	SS	22												
68.0	(SP) SAND, trace silt (TILL) Grey brown Moist		9	SS	77/0.28												
67.5	END OF BOREHOLE																
8.7	NOTES: 1. Hole cannot continue due to auger out of alignment. 2. Borehole dry on completion of drilling.																

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-526		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028852.7; E 365313.8 NAD 83 MTM ZONE 9 (LAT. 45.397007; LONG. -75.727084)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		July 31, 2017		CHECKED BY								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
75.2	GROUND SURFACE						20	40	60	80	100	25	50	75		
0.0	ASPHALTIC CONCRETE															
74.9																
0.3	(SP) Gravelly sand (FILL) Grey		1A	GRAB	-											
74.6																
0.6	(SP) Sand, some gravel (FILL) Compact to very dense Brown Moist		1B	GRAB	-											
			2	SS	32											
			3	SS	34											
			4	SS	34											
			5	SS	59											
			6	SS	13											
70.6																
4.6	(SP) Sand, some gravel (FILL) Very loose Brown Moist		7	SS	WH											
			8	SS	2											
69.1																
6.1	(SP) Sand, some gravel (FILL) Dense Brown Wet		9	SS	41											
68.3																
6.9	(ML) Sandy CLAYEY SILT, trace gravel (TILL) Firm Dark grey Wet		10	SS	WH											
67.7																
7.5	END OF BOREHOLE															
NOTES:																
1. Water level in well screen at a depth of 2.2 m below ground surface (Elev. 73.0 m), measured on October 16, 2017.																

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-527		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028884.4; E 365302.7 NAD 83 MTM ZONE 9 (LAT. 45.397293; LONG. -75.727221)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 24, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE	20	40	60	80	100								
								● QUICK TRIAXIAL × REMOULDED	20	40	60	80	100								
75.8	GROUND SURFACE																				
75.6	ASPHALTIC CONCRETE																				
75.4	PORTLAND CEMENT CONCRETE																				
0.4	(SP) Gravelly sand (FILL)		1	GRAB	-																
75.1	Moist																				
0.7	(SP) Sand, some silt and gravel (FILL) Loose to compact Brown Moist		2	SS	11																
			3	SS	4																
			4	SS	18																
			5	SS	21																
			6	SS	6																
			7	SS	6																
68.5	END OF BOREHOLE																				
7.3	AUGER REFUSAL																				

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-528		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5028897.8; E 365380.6 NAD 83 MTM ZONE 9 (LAT. 45.397407; LONG. -75.726225)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 2, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL		
								20	40	60	80	100	20	40	60		80	100	25	50	75	
74.9	GROUND SURFACE																					
0.0	ASPHALTIC CONCRETE																					
74.6																						
74.3	(SP) Gravelly sand (FILL) Grey Moist		1	GRAB	-																	
0.6	(SP) Sand, trace gravel (FILL) Brown Moist		2	GRAB	-																	
73.9																						
1.0	(SM) Gravelly silty sand, contains organic matter (FILL) Compact Grey brown Moist		3	SS	11																	
			4	SS	24																	
			5	SS	50/0.27																	
71.8																						
3.1	END OF BOREHOLE AUGER REFUSAL																					

GTA-MTO 001 N:\ACTIVE\SPATIAL_IM\MTOWHY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		RECORD OF BOREHOLE				No 17-528A		SHEET 1 OF 1		METRIC							
G.W.P. 1655214-1500		LOCATION		N 5028898.5; E 365381.8 NAD 83 MTM ZONE 9 (LAT. 45.397413; LONG. -75.726209)				ORIGINATED BY RI									
DIST Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)				COMPILED BY JM									
DATUM Geodetic		DATE		August 2, 2017				CHECKED BY KP									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
74.9 0.0	GROUND SURFACE ASPHALTIC CONCRETE							20	40	60	80	100					
74.6 0.3	FILL Auger advanced to refusal without sampling. See Record of Borehole 17-528 for sampling record.						74										
							73										
							72										
71.6 3.3	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITOHWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-528B		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5028897.0; E 365379.6 NAD 83 MTM ZONE 9 (LAT. 45.397399; LONG. -75.726238)</u>		ORIGINATED BY <u>RI</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>JM</u>			
DATUM <u>Geodetic</u>		DATE <u>August 2, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		GR	SA	SI	CL
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×	REMOULDED	WATER CONTENT (%)						
74.9	GROUND SURFACE						20	40	60	80	100									
0.0	ASPHALTIC CONCRETE																			
74.6																				
0.3	FILL Auger advanced to refusal without sampling. See Record of Borehole 17-528 for sampling record.																			
72.0																				
2.9	END OF BOREHOLE AUGER REFUSAL																			

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-529		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5028926.2; E 365364.4 NAD 83 MTM ZONE 9 (LAT. 45.397664; LONG. -75.726428)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		April 23-24, 2017		CHECKED BY									
KP																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
74.8	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
74.5																	
74.3	(SP) Gravelly sand (FILL) Grey Moist																
74.1	(SP) Sand (FILL) Brown Moist																
0.7	(SM) Silty sand, some clay, trace gravel, contains concrete fragments and asphalt pieces (FILL) Compact to very dense Brown to dark brown Moist		1	SS	21												
			2	SS	29												
			3	SS	56												
71.7																	
3.1	(SM) Gravelly silty sand, contains asphalt and shale fragments, cobbles and boulders (FILL) Brown to dark brown Moist		4	SS	64/0.28												
			5	SS	66/0.28												
70.3																	
4.5	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-530		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5028925.6; E 365446.0 NAD 83 MTM ZONE 9 (LAT. 45.397651; LONG. -75.725387)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		April 11, 2017		CHECKED BY								
KP																
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
72.1	GROUND SURFACE						20	40	60	80	100	25	50	75		
0.0	ASPHALTIC CONCRETE															
0.2	PORTLAND CEMENT CONCRETE															
71.9																
0.6	(SM) Silty sand, trace gravel, contains cobbles (FILL) Loose to dense Brown to grey Moist		1	SS	14											
			2	SS	9											
			3	SS	8											
			4	SS	50/0.13											
			5	SS	11											
67.7	(SM) SILTY SAND, trace gravel, contains cobbles and boulders (TILL) Compact Grey Wet		6	SS	16											
4.4																
			7	SS	17											
			8	SS	84/0.18											
			9	SS	11											
64.2			.28	SS	50/0.23											
7.9	END OF BOREHOLE AUGER REFUSAL															

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

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-532		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5028969.7; E 365503.8 NAD 83 MTM ZONE 9 (LAT. 45.398043; LONG. -75.724642)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		April 11, 2017		CHECKED BY									
KP																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
71.6	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
71.2	PORTLAND CEMENT CONCRETE																
0.5	(SP) Gravelly sand (FILL) Grey Moist																
70.6	(SM) Silty sand, trace gravel (FILL) Brown Moist		1	SS	19												
1.0	(SM) Gravelly silty sand, contains asphalt pieces and brick fragments (FILL) Compact Brown Moist		2	SS	17												
69.4	END OF BOREHOLE AUGER REFUSAL																
2.2																	

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-533		SHEET 1 OF 1		METRIC										
G.W.P.		4173-15-00		LOCATION		N 5029014.9; E 365495.7 NAD 83 MTM ZONE 9 (LAT. 45.398451; LONG. -75.724740)		ORIGINATED BY										
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY										
DATUM		Geodetic		DATE		April 20, 2017		CHECKED BY										
								KP										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
71.1	GROUND SURFACE							20	40	60	80	100						
70.8	ASPHALTIC CONCRETE																	
0.2	(SP) Gravelly sand (FILL) Grey Moist		1	GRAB	-													
70.6	(SM) Silty sand, trace gravel (FILL) Compact Brown Moist		2	SS	13													
0.5																		
69.6	(SM) Sand, some gravel and silt, trace clay (FILL) Loose Grey brown Wet		3	SS	9													
1.5																		
			4	SS	4													
68.0	Gravelly SILTY SAND (TILL) Very loose to loose Grey Wet		5	SS	2													
3.1																		
			6	SS	7													
			7	SS	6													
65.9	END OF BOREHOLE AUGER REFUSAL																	
5.2	NOTES: 1. Water level in well screen at a depth of 3.8 m below ground surface (Elev. 67.3 m), measured on October 19, 2017.																	

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-534		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029022.8; E 365571.6 NAD 83 MTM ZONE 9 (LAT. 45.398515; LONG. -75.723770)</u>		ORIGINATED BY <u>DG</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 11, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P	W	W _L					
								○ UNCONFINED + FIELD VANE					WATER CONTENT (%)							
						● QUICK TRIAXIAL × REMOULDED	20	40	60	80	100	25	50	75	kN/m ³					
70.2	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
0.2	PORTLAND CEMENT CONCRETE																			
69.6																				
0.7	(GP) Sandy gravel (FILL) Brown Moist		1	SS	65/0.20															
68.7	(SM) Silty sand, some gravel, contains cobbles and boulders (FILL) Grey brown Moist																			
1.5	END OF BOREHOLE AUGER REFUSAL																			

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-535		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029055.5; E 365555.1 NAD 83 MTM ZONE 9 (LAT. 45.398811; LONG. -75.723977)</u>		ORIGINATED BY <u>RI</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 19, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P W W _L				kN/m ³	GR	SA	SI	CL
								20 40 60 80 100	○ UNCONFINED + FIELD VANE			● QUICK TRIAXIAL × REMOULDED			WATER CONTENT (%)						
70.3	GROUND SURFACE																				
0.0	ASPHALTIC CONCRETE																				
70.1																					
0.3	(SP) Gravelly sand (FILL) Grey Moist																				
69.7																					
0.6	(SP) Sand (FILL) Brown Moist																				
69.4																					
0.9	(SM) Silty sand, trace to some gravel (FILL) Brown Moist		1	SS	50/0.23																
69.1																					
1.2	END OF BOREHOLE AUGER REFUSAL																				

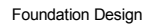
PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-536		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029064.4; E 365629.8 NAD 83 MTM ZONE 9 (LAT. 45.398884; LONG. -75.723022)</u>		ORIGINATED BY <u>RI</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 11, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P	W	W _L					
								○ UNCONFINED + FIELD VANE					WATER CONTENT (%)							
						● QUICK TRIAXIAL × REMOULDED														
						20 40 60 80 100					25 50 75									
70.3	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
0.1	PORTLAND CEMENT CONCRETE																			
69.9	(SP) Gravelly sand (FILL) Grey Moist		1	GRAB	-		70													
69.4	(SP) Sand (FILL) Brown Moist		2	SS	91/0.28															
68.8	(SM) Gravelly SILTY SAND (TILL) Brown Moist						69													
1.5	END OF BOREHOLE AUGER REFUSAL																			



PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-537		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029105.1; E 365622.2 NAD 83 MTM ZONE 9 (LAT. 45.399251; LONG. -75.723114)</u>		ORIGINATED BY <u>DG</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 20, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p W W _L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)				
70.9	GROUND SURFACE							20	40	60	80	100					
0.0	ASPHALTIC CONCRETE																
70.5	(SP) Gravelly sand (FILL) Grey Moist																
0.4	(SP/GP) Sand and gravel, trace silt, contains asphaltic concrete pieces (FILL) Compact Brown Moist		1	SS	16												38 53 6 3
69.3			2	SS	50/0.08												
1.6	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM



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

PROJECT		RECORD OF BOREHOLE No 17-538				SHEET 2 OF 2		METRIC									
1655214-1500		G.W.P. 4173-15-00		LOCATION N 5029109.4; E 365696.9 NAD 83 MTM ZONE 9 (LAT. 45.399283; LONG. -75.722159)		ORIGINATED BY RI											
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS													
DATUM Geodetic		DATE April 11, 2017		CHECKED BY KP													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)	25 50 75	γ	GR SA SI CL				
60.6	Probable Weathered Bedrock		13	SS	58/0.28												
10.5	END OF BOREHOLE AUGER REFUSAL																
NOTES: 1. Water level in well screen at 4.8 m below ground surface (Elev. 66.1 m), measured on October 18, 2017.																	

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-539		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029149.7; E 365761.9 NAD 83 MTM ZONE 9 (LAT. 45.399640; LONG. -75.721324)</u>		ORIGINATED BY <u>DG</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 12, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	w _p	w	w _L					
71.4	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
71.2																				
0.2	(GP) Sandy gravel (FILL) Grey Moist		1	GRAB	-															
70.7																				
0.7	(SM) Sand, some silt, trace gravel and clay (FILL) Compact to loose Brown Moist		2	SS	23															
68.3																				
3.1	(GP) Sandy GRAVEL, trace silt (TILL) Compact to very dense Grey brown Moist		5	SS	20															
66.3																				
5.1	(SM) SILTY SAND, some gravel, contains cobbles and boulders (TILL) Compact Grey brown Moist		6	SS	35															
			7	SS	54															
												</								

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

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-540		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5029190.2; E 365830.7 NAD 83 MTM ZONE 9 (LAT. 45.399998; LONG. -75.720440)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		April 12, 2017		CHECKED BY									
								KP									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
72.2	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
71.9																	
71.7	(SP) Gravelly sand (FILL) Grey Moist																
0.5	(SM) Silty sand (FILL) Loose Brown Moist		1	SS	7												
			2	SS	6												
69.9																	
2.3	(SP) Sand (FILL) Very loose to loose Brown Moist		3	SS	2												
			4	SS	2												
			5	SS	2												
			6	SS	2												
			7	SS	2												
			8	SS	7												
			9	SS	50/0.20												
64.7																	
7.5	END OF BOREHOLE AUGER REFUSAL																

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-541		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5029228.0; E 365898.7 NAD 83 MTM ZONE 9 (LAT. 45.400333; LONG. -75.719567)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 12, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W _p	W	W _L					
73.9	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
73.7																				
0.2	(SP) Gravelly sand (FILL) Grey Moist																			
73.3																				
0.6	(SM) Silty sand, trace gravel (FILL) Loose Brown Moist		1	SS	8															
72.4																				
1.5	(CL/SM) Silty clay to silty sand (FILL) Loose Grey brown Moist		2	SS	8															
71.8																				
2.1	(SM) Silty sand, trace gravel (FILL) Compact Brown Moist		3	SS	10															
70.8																				
3.1	END OF BOREHOLE AUGER REFUSAL																			

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-542		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5029265.5; E 365969.9 NAD 83 MTM ZONE 9 (LAT. 45.400664; LONG. -75.718654)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		August 2, 2017		CHECKED BY								
								KP								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
75.6	GROUND SURFACE															
0.0	ASPHALTIC CONCRETE															
0.2	(SP) Gravelly sand (FILL)		1	GRAB	-											
75.1	Grey Moist															
74.8	(SM) Silty sand (FILL)		2	GRAB	-											
0.8	Brown Moist															
	(CI) Silty clay, some sand (FILL)		3	SS	6											
	Stiff Grey brown Moist															
			4	SS	6											
73.5																
2.1	(SM) Silty sand, some gravel, contains cobbles (FILL)		5	SS	26											
	Loose to dense Grey brown Moist to wet															
			6	SS	20											
			7	SS	9											
			8	SS	13											
			9	SS	31											
69.5																
6.1	(SM/ML) SAND and SILT, some clay, trace gravel (TILL)		10	SS	31											
	Dense Grey Moist															
68.9																
6.7	END OF BOREHOLE															

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-543		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5029300.2; E 366038.2 NAD 83 MTM ZONE 9 (LAT. 45.400970; LONG. -75.717777)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		August 2/3, 2017		CHECKED BY								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
76.6	GROUND SURFACE						20	40	60	80	100	25	50	75		
0.0	ASPHALTIC CONCRETE															
76.2	PORTLAND CEMENT CONCRETE															
76.0	(SP) Gravelly sand (FILL)		1	GRAB	-											
0.6	Grey Moist															
75.4	(SM) Sand, some silt (FILL)		2	SS	10											
1.2	Loose Brown Moist															
	(CL) Clayey silt and sand (FILL)		3	SS	9											
	Grey brown Moist															
			4	SS	5											
73.1			5	SS	2											
3.5	(SM) Gravelly silty sand, contains brick fragments and wood pieces (FILL)															
	Compact Dark brown to brown Moist		6	SS	23											
			7	SS	25											
71.4																
5.2	END OF BOREHOLE AUGER REFUSAL															
	NOTES:															
	1. Well screen dry on October 18, 2017.															

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-544		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5029333.7; E 366110.4 NAD 83 MTM ZONE 9 (LAT. 45.401266; LONG. -75.716851)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 3, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%) W _P W W _L				GR	SA	SI	CL
76.9	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
76.7																				
76.4	(SP) Gravelly sand (FILL) Grey Dry		1	GRAB	-															
0.5																				
76.1	(SP) Sand, trace clay (FILL) Brown Dry		2	GRAB	-															
0.8																				
	(SM) Sand, some silt (FILL) Compact to dense Brown Moist		3	SS	18															
			4	SS	27															
			5	SS	11															
			6	SS	34															
73.2																				
3.7	(GM/SM) GRAVEL and SAND, some silt, trace clay, contains cobbles and clayey silt seams (TILL) Compact to very dense Grey brown Moist		7	SS	23															
			8	SS	79															
			9	SS	50/0.30															
71.1																				
5.8	END OF BOREHOLE AUGER REFUSAL																			

PROJECT		1655214-1500				RECORD OF BOREHOLE No 17-545				SHEET 1 OF 1				METRIC							
G.W.P.		4173-15-00				LOCATION				N 5029366.8; E 366185.0 NAD 83 MTM ZONE 9 (LAT. 45.401557; LONG. -75.715893)				ORIGINATED BY				DG			
DIST		Eastern HWY 417				BOREHOLE TYPE				Power Auger, 200 mm Diam. (Hollow Stem)				COMPILED BY				ZS			
DATUM		Geodetic				DATE				August 3, 2017				CHECKED BY				KP			
SOIL PROFILE						SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION					STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x REMOULDED									
76.4	GROUND SURFACE										20 40 60 80 100						PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
0.0	ASPHALTIC CONCRETE										20 40 60 80 100						25 50 75				
76.1																					
0.3	(SP) Gravelly sand (FILL)						1	GRAB	-		76										
75.8	Grey Dry																				
0.6	(SM) Sand, some silt (FILL)						2	GRAB	-												
75.3	Compact Brown Dry																				
1.1	(CL/CI) Silty clay (FILL)						3	SS	11												
75.0	Grey brown Moist										75										
1.4	(SP) Sand (FILL)																				
74.3	Compact Brown Moist						4	SS	23												
2.1	(SM) Silty sand, contains clayey silt seams (FILL)																				
73.5	Compact Grey Moist						5	SS	26		74										
2.9	(CH) Clay (FILL)																				
72.7	Grey brown Stiff Moist						6	SS	11		73										
3.7	(SM) Silty sand, some gravel, contains cobbles and boulders (FILL)																				
71.8	Very dense Grey Moist						7	SS	56		72										
4.6	(SM/ML) SAND and SILT, some clay, trace gravel, contains clayey silt seams, contains cobbles (TILL)																				
	Compact to very dense Grey brown Wet						8	SS	48												
							9	SS	22		71										
							10	SS	15		70										
							11	SS	52		69										
68.9																					
7.5	END OF BOREHOLE																				



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



PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-547		SHEET 1 OF 2		METRIC	
G.W.P. 4173-15-00		LOCATION N 5029423.0; E 366329.4 NAD 83 MTM ZONE 9 (LAT. 45.402050; LONG. -75.714042)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 3, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20	40	60	80	100	25	50		75				
73.3	GROUND SURFACE																				
0.0	ASPHALTIC CONCRETE																				
72.9	PORTLAND CEMENT CONCRETE																				
0.5	(SP) Gravelly sand (FILL) Grey																				
	(SP) Sand (FILL) Compact to loose Brown Moist		1	SS	15																
			2	SS	8																
71.2																					
2.1	(SM) Gravelly silty sand, contains organic matter (FILL) Loose to very loose Grey brown Moist		3	SS	8																
			4	SS	3																
69.2			5	SS	6																
4.1	(SM) Gravelly silty sand, contains ash and wood fragments (FILL) Loose Dark brown Moist																				
68.7																					
4.6	(SM/ML) Sand and silt, some gravel, trace clay (FILL) Compact to very dense Grey brown Moist to wet		6	SS	20																
			7	SS	24																
			8	SS	23																
			9	SS	56																
65.7																					
7.6	(SM) Gravelly SILTY SAND, contains cobbles (TILL) Dense to compact Grey brown Wet		10	SS	34																
			11	SS	13																
63.8			12	SS	22																
9.5	(SP) SAND Very loose Grey brown Wet																				

Continued Next Page

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

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITOHWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		RECORD OF BOREHOLE No 17-547				SHEET 2 OF 2		METRIC									
G.W.P. 1655214-1500		LOCATION N 5029423.0; E 366329.4 NAD 83 MTM ZONE 9 (LAT. 45.402050; LONG. -75.714042)				ORIGINATED BY RI											
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)				COMPILED BY ZS											
DATUM Geodetic		DATE August 3, 2017				CHECKED BY KP											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100					
62.8	(SP) SAND Very loose Grey brown Wet		13	SS	2		63										
10.5	(SM) Gravelly SILTY SAND, contains cobbles and boulders (TILL)		14	SS	50/0.10												
62.4	Grey Wet																
10.9	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-548		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5029446.1; E 366393.7 NAD 83 MTM ZONE 9 (LAT. 45.402252; LONG. -75.713217)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		August 7, 2017		CHECKED BY								
								KP								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
71.3	GROUND SURFACE															
0.0	ASPHALTIC CONCRETE															
71.0	PORTLAND CEMENT CONCRETE															
70.8	(SP) Gravelly sand (FILL) Grey		1	GRAB	-											
70.5	Dry		2	GRAB	-											
0.8	(SP) Sand, some gravel (FILL) Dark brown		3	SS	19											
	Dry															
	(SP) Sand (FILL) Compact to very loose															
	Brown															
	Moist															
			4	SS	17											
			5	SS	15											
			6	SS	10											
			7	SS	7											
			8	SS	5											
			9	SS	2											
65.2																
6.1	(SP) Sand, contains wood fragments (FILL) Very loose		10	SS	2											
	Brown															
	Moist															
64.4																
6.9	(SP) Sand, some gravel (FILL) Loose		11	SS	5											
	Brown															
	Moist															
			12	SS	7											
62.7			13	SS	50/0.15											
8.6	END OF BOREHOLE AUGER REFUSAL															
	NOTES:															
	1. Well screen dry on October 18, 2017.															

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-549		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5029564.8; E 366660.4 NAD 83 MTM ZONE 9 (LAT. 45.403297; LONG. -75.709796)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		August 14, 2017		CHECKED BY									
								KP									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
67.2	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
67.0																	
66.8	PORTLAND CEMENT CONCRETE																
66.5	(SP) Gravelly sand (FILL)		1	GRAB	-												
0.7	Grey Moist																
	(SP) Sand, trace gravel, trace silt (FILL)		2	SS	49												
	Dense to very dense																
	Brown Moist																
65.2			3	SS	58												
2.0	(SM) Silty sand, some gravel (FILL)																
	Compact																
	Brown Moist																
64.6			4	SS	20												
2.6	(CL) Clayey silt (FILL)																
	Very stiff																
	Grey brown Moist																
63.7			5	SS	20												
3.5	(SM) Gravelly silty sand (FILL)																
	Brown Moist																
63.4																	
63.2	(SM) Silty sand, trace to some gravel, contains asphaltic concrete pieces (FILL)		6	SS	WH												
4.0	Dark brown Moist																
	Void																
61.5																	
5.7	END OF BOREHOLE																
NOTES:																	
1. Void encountered during drilling at a depth of 4.0 m.																	

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-551		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029594.5; E 366761.2 NAD 83 MTM ZONE 9 (LAT. 45.403555; LONG. -75.708506)</u>		ORIGINATED BY <u>DG</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 18, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W _p	W	W _L					
70.0	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
69.6	PORTLAND CEMENT CONCRETE																			
0.4	(SP) Gravelly sand (FILL) Grey Moist		1	GRAB	-															
69.2																				
0.8	(SP) Sand, some silt (FILL) Very loose to compact Moist		2	SS	10															
			3	SS	3															
			4	SS	2															
			5	SS	7															
			6	SS	8															
			7	SS	18															
			8	SS	6															
63.8			9	SS	50/0.05															
6.2	END OF BOREHOLE AUGER REFUSAL																			
	NOTES: 1. Borehole dry on completion fo drilling.																			

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-552		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5029609.0; E 366813.3 NAD 83 MTM ZONE 9 (LAT. 45.403681; LONG. -75.707838)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 13, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20 40 60 80 100	25 50 75	W _p W W _L						
71.3	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
71.0																	
0.3	(SP) Gravelly sand (FILL) Grey Moist																
70.7																	
0.6	(SM) Gravelly sand, some silt, contains wood fragments and cobbles (FILL) Compact Brown Moist		1	SS	22												
			2	SS	14					○				30 52 16 2			
69.0																	
2.3	(SM) Silty sand, some gravel, contains organic matter, brick fragments (FILL) Loose to compact Brown Moist		3	SS	9												
			4	SS	10												
67.5																	
3.8	(SM) Gravelly silty sand, contains organic matter, concrete, cobbles and boulders (FILL) Compact Brown Moist to wet		5	SS	27					○							
			6	SS	50/0.25												
			7	SS	29												
65.2																	
6.2	PORTLAND CEMENT CONCRETE		8	SS	50/0.10					○							
	END OF BOREHOLE AUGER REFUSAL																
	NOTES: 1. Borehole dry upon completion of drilling.																

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-553		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5029631.5; E 366886.6 NAD 83 MTM ZONE 9 (LAT. 45.403877; LONG. -75.706899)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		April 18, 2017		CHECKED BY									
								KP									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
72.4	GROUND SURFACE																
0.0	ASPHALTIC CONCRETE																
72.0	PORTLAND CEMENT CONCRETE																
0.4	(SP) Gravelly sand (FILL)		1	GRAB	-												
71.7	Grey Moist																
0.7	(SM) Sand, some silt, contains silty clay seams (FILL) Very loose to dense Brown Moist		2	SS	16												
			3	SS	9												
			4	SS	32												
			5	SS	13												
			6	SS	3												
			7	SS	4												
66.2	END OF BOREHOLE AUGER REFUSAL		8	SS	50/0.13												
6.2	NOTES: 1. Borehole dry upon completion of drilling.																

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-554		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5029647.1; E 366931.1 NAD 83 MTM ZONE 9 (LAT. 45.404013; LONG. -75.706329)		ORIGINATED BY RI			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE April 18, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					w _p w w _L							
72.9	GROUND SURFACE																			
72.7	ASPHALTIC CONCRETE																			
72.5	PORTLAND CEMENT CONCRETE																			
0.5	(SP) Gravelly sand (FILL) Brown to grey brown (SM) Sand, trace silt, contains silty clay seams (FILL) Compact to loose Brown Moist		1	SS	26															
			2	SS	13															
			3	SS	7															
			4	SS	16															
			5	SS	18															
68.3			6	SS	9															
4.6	(SM) Silty sand, trace gravel, contains ash, metal, wood, ceramic, and organic matter (FILL) Loose Black Moist		7	SS	29															
67.6	(SM) Gravelly SAND, some silt, contains cobbles (TILL) Compact Grey brown to grey Moist to wet		8	SS	15															
66.1																				
6.8	END OF BOREHOLE AUGER REFUSAL																			

PROJECT		1655214-1500		RECORD OF BOREHOLE No 17-555		SHEET 1 OF 1		METRIC									
G.W.P.		4173-15-00		LOCATION		N 5029671.4; E 367001.9 NAD 83 MTM ZONE 9 (LAT. 45.404226; LONG. -75.705422)		ORIGINATED BY									
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY									
DATUM		Geodetic		DATE		August 13, 2017		CHECKED BY									
KP																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
73.6	GROUND SURFACE																
73.4	ASPHALTIC CONCRETE																
73.2	PORTLAND CEMENT CONCRETE																
0.4	(SP) Gravelly sand (FILL)		1	GRAB	-												
72.9	Grey Moist																
0.7	(SP) Sand, trace silt, contains organic matter and brick fragments (FILL) Compact to very dense Brown to dark brown Moist		2	SS	41												
			3	SS	44												
			4	SS	57												
			5	SS	21												
69.8	(SM) Gravelly silty sand, contains organic matter and sand seams (FILL) Loose to compact Brown to dark brown Moist to wet		6	SS	7												
3.8																	
			7	SS	21												
68.6	(SM) Gravelly SILTY SAND, contains cobbles and boulders (TILL) Compact Grey brown to grey Wet																
5.0			8	SS	50/0.25												
67.9																	
5.7	END OF BOREHOLE AUGER REFUSAL																

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMITO\HWY417REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT 1655214-1500		RECORD OF BOREHOLE No 17-556		SHEET 1 OF 1		METRIC	
G.W.P. 4173-15-00		LOCATION N 5029701.1; E 367083.6 NAD 83 MTM ZONE 9 (LAT. 45.404485; LONG. -75.704374)		ORIGINATED BY DG			
DIST Eastern HWY 417		BOREHOLE TYPE Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY ZS			
DATUM Geodetic		DATE August 13, 2017		CHECKED BY KP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		GR	SA	SI	CL
								20	40	60	80	100								
73.9	GROUND SURFACE																			
0.0	ASPHALTIC CONCRETE																			
73.6	PORTLAND CEMENT CONCRETE																			
0.5	(SM) Gravelly sand (FILL) Grey Dry		1	GRAB	-															
			2	GRAB	-															
	(SM) Sand, some silt (FILL) Dense to compact Dry		3	SS	37															
			4	SS	10															
71.2			5	SS	39															
70.9	(SP) Gravelly sand (FILL) Grey brown Moist																			
3.0	END OF BOREHOLE AUGER REFUSAL																			
	NOTES: 1. Borehole dry upon completion of drilling.																			

PROJECT <u>1655214-1500</u>		RECORD OF BOREHOLE No 17-557		SHEET 1 OF 1		METRIC	
G.W.P. <u>4173-15-00</u>		LOCATION <u>N 5029741.1; E 367138.6 NAD 83 MTM ZONE 9 (LAT. 45.404840; LONG. -75.703666)</u>		ORIGINATED BY <u>DG</u>			
DIST <u>Eastern</u> HWY <u>417</u>		BOREHOLE TYPE <u>Power Auger, 200 mm Diam. (Hollow Stem)</u>		COMPILED BY <u>ZS</u>			
DATUM <u>Geodetic</u>		DATE <u>April 18, 2017</u>		CHECKED BY <u>KP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P	W	W _L						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)								
72.8	GROUND SURFACE							20	40	60	80	100									
0.0	(SM) Silty sand (TOPSOIL)																				
0.2	Dark brown Moist (SP) Sand, trace silt, contains asphaltic concrete pieces (FILL) Loose to compact Dark grey Moist		1	SS	7																
			2	SS	17																
71.3																					
1.5	(ML) Sandy silt (FILL) Dark grey Moist		3	SS	50/0.18																
70.8																					
2.0	END OF BOREHOLE AUGER REFUSAL																				
	NOTES: 1. Well screen dry on October 16, 2017.																				

GTA-MTO 001 N:\ACTIVE\SPATIAL_IMMTO\HWY417\REHAB&WIDENING\02_DATA\GINT\1655214.GPJ GAL-GTA.GDT 12/3/19 JM

PROJECT		1655214-1600		RECORD OF BOREHOLE No 19-1601		SHEET 1 OF 1		METRIC								
G.W.P.		4173-15-00		LOCATION		N 5029516.4; E 366488.9 NAD 83 MTM ZONE 9 (LAT. 45.402876; LONG. -75.711993)		ORIGINATED BY								
DIST		Eastern HWY 417		BOREHOLE TYPE		Power Auger, 200 mm Diam. (Hollow Stem)		COMPILED BY								
DATUM		Geodetic		DATE		August 1-2, 2019		CHECKED BY								
KCP																
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
68.9	GROUND SURFACE															
0.0	ASPHALTIC CONCRETE															
68.5	PORTLAND CEMENT CONCRETE															
68.3	(SW) Gravelly sand (FILL)		1	GS	-											
0.6	Grey Dry															
	(SW) Sand (FILL)		2	SS	37											
	Dense Brown Moist															
67.1			3	SS	40											
1.8	(GM/SM) Gravel and sand, some silt, contains brick fragments (FILL)															
	Compact Dark brown to black		4	SS	25											
			5	SS	13											
			6	SS	13											
64.3			7	SS	23											
4.6	(SM/GM) Gravelly sand, some silt and clay, contains seams of sandy silty clay, brick, mortar, ash, wood and coal (FILL)															
	Compact Dark brown to black Moist		8	SS	10											
			9	SS	22											
			10	SS	16											
			11	SS	24											
60.7	END OF BOREHOLE															
8.2	NOTE															
	1. Borehole dry upon completion of drilling.															

Laboratory Test Results, Current Investigation

Figure B1A – Grain Size Distribution Test Results – Section 1: Fill

Figure B1B – Grain Size Distribution Test Results – Section 1: Fill

Figure B2 – Grain Size Distribution Test Results – Section 1: Glacial Till

Figure B3 – Grain Size Distribution Test Results – Section 1: Glacial Till

Figure B4 – Plasticity Chart – Section 1: Glacial Till

Figure B5 – Grain Size Distribution Test Results – Section 2: Fill

Figure B6 – Plasticity Chart – Section 2: Clayey Silt to Clay Fill

Figure B7 – Grain Size Distribution Test Results – Section 2: Glacial Till

Figure B8 – Grain Size Distribution Test Results – Section 3: Fill

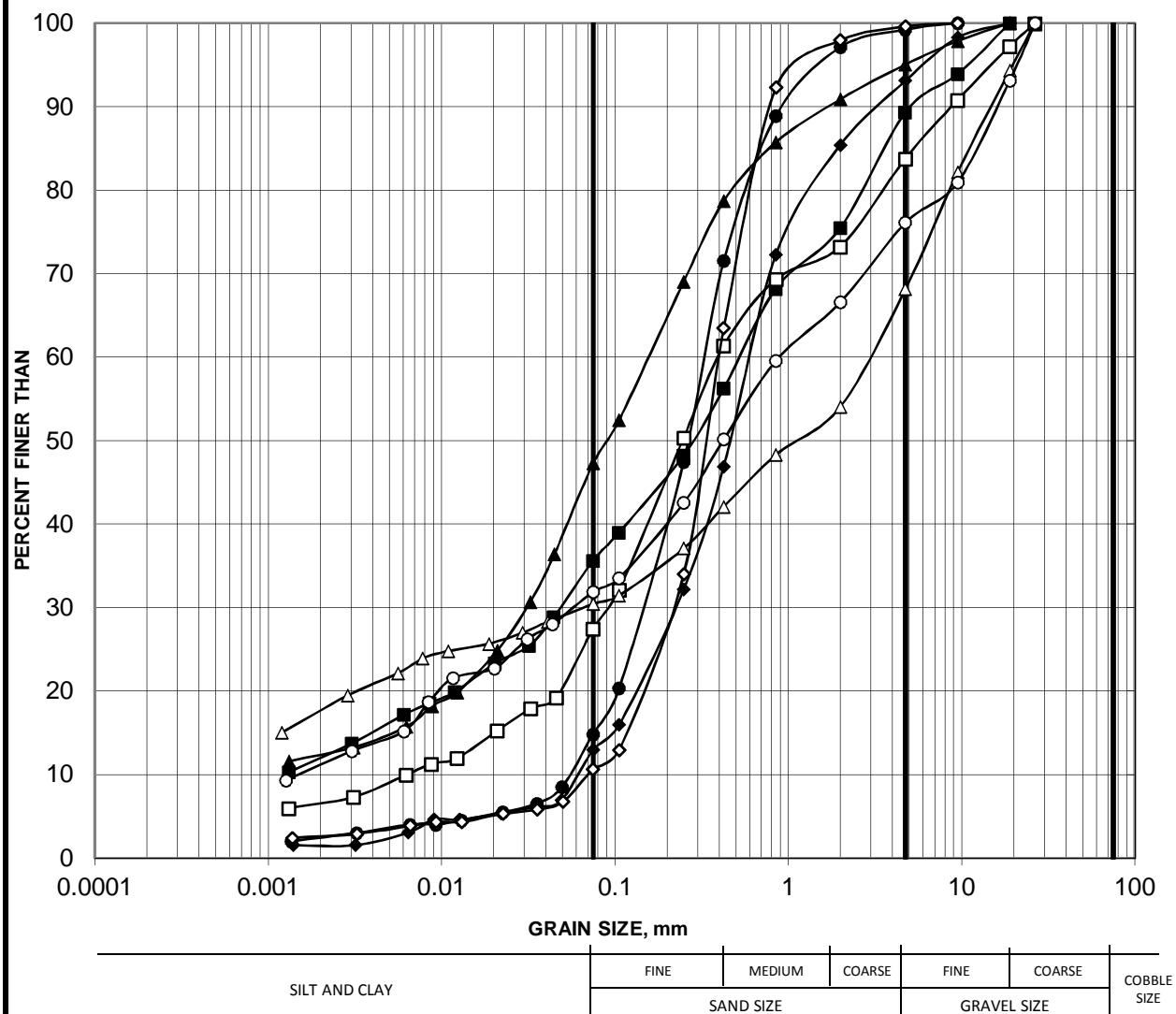
Figure B9 – Plasticity Chart – Section 3: Clayey Silt Fill

Figure B10 – Grain Size Distribution Test Results – Section 3: Glacial Till

GRAIN SIZE DISTRIBUTION

FIGURE B1A

SECTION 1: FILL

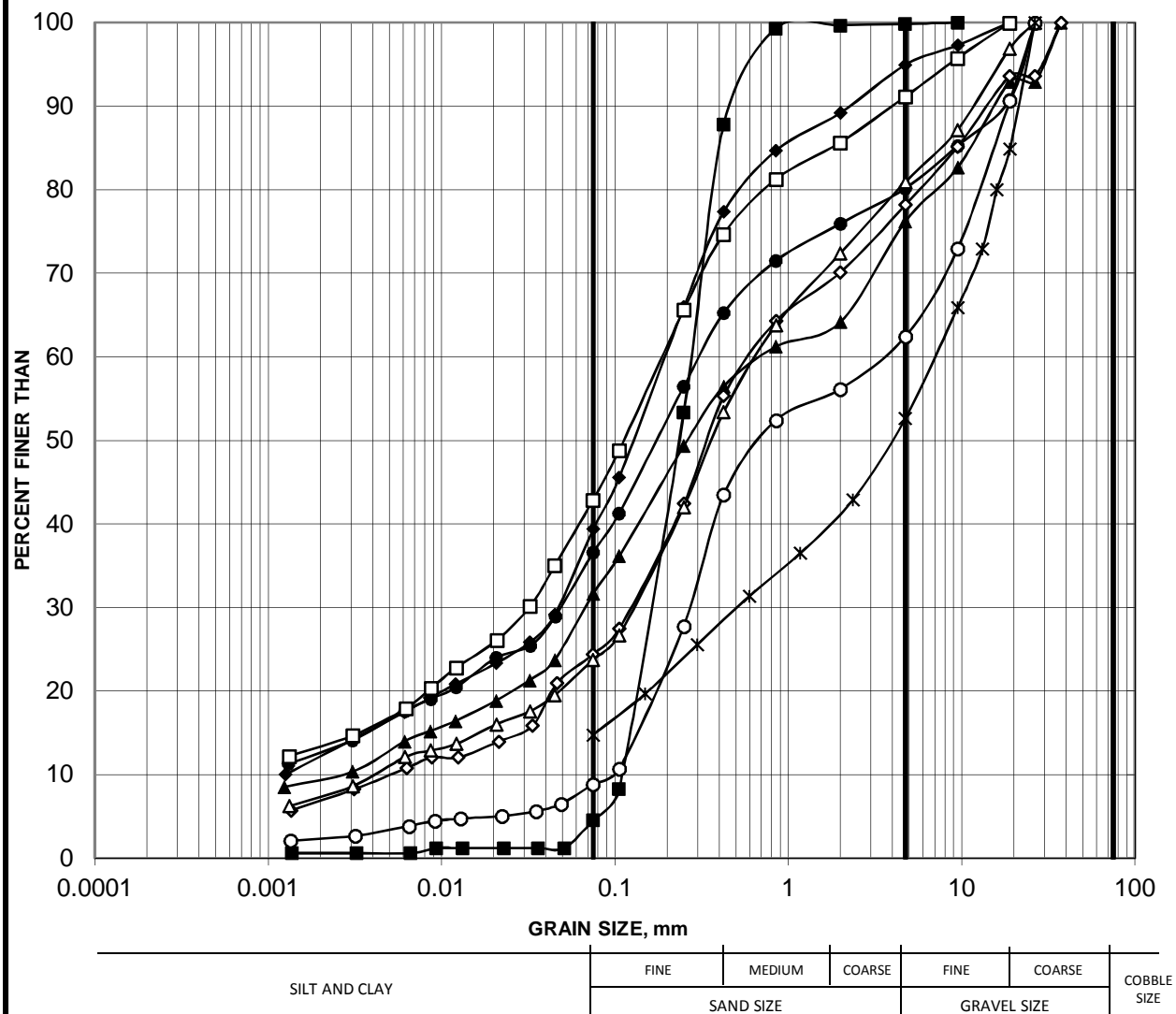


Borehole	Sample	Depth (m)
■ 17-504	3	0.76-1.37
◆ 17-507	4	1.52-2.13
▲ 17-508	2	0.76-1.37
● 17-511	1	0.46-0.61
□ 17-518	4	3.05-3.66
◇ 17-519	5	3.81-4.42
△ 19-1601	7	4.57-5.18
○ 19-1601	11	7.62-8.23

GRAIN SIZE DISTRIBUTION

FIGURE B1B

SECTION 1: FILL

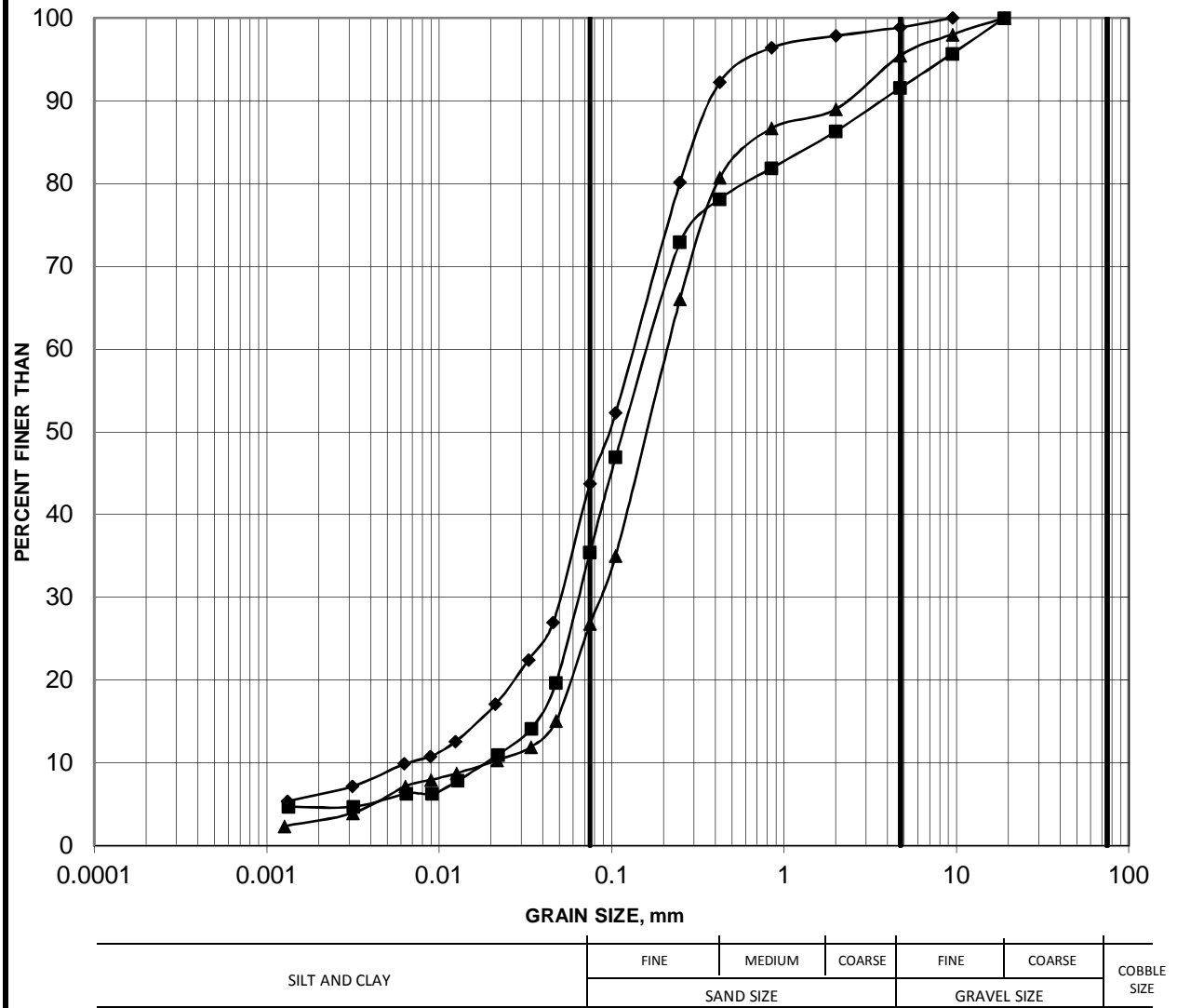


Borehole	Sample	Depth (m)
17-521	6	3.81-4.42
17-522	6	3.81-4.42
17-524	3	2.29-2.90
17-525	5	4.57-5.18
17-529	2	1.52-2.13
17-531	4	3.05-3.66
17-533	4	2.29-2.90
17-537	1	0.76-1.37
19-1601	4	2.29-2.90

GRAIN SIZE DISTRIBUTION

FIGURE B2

SECTION 1: GLACIAL TILL

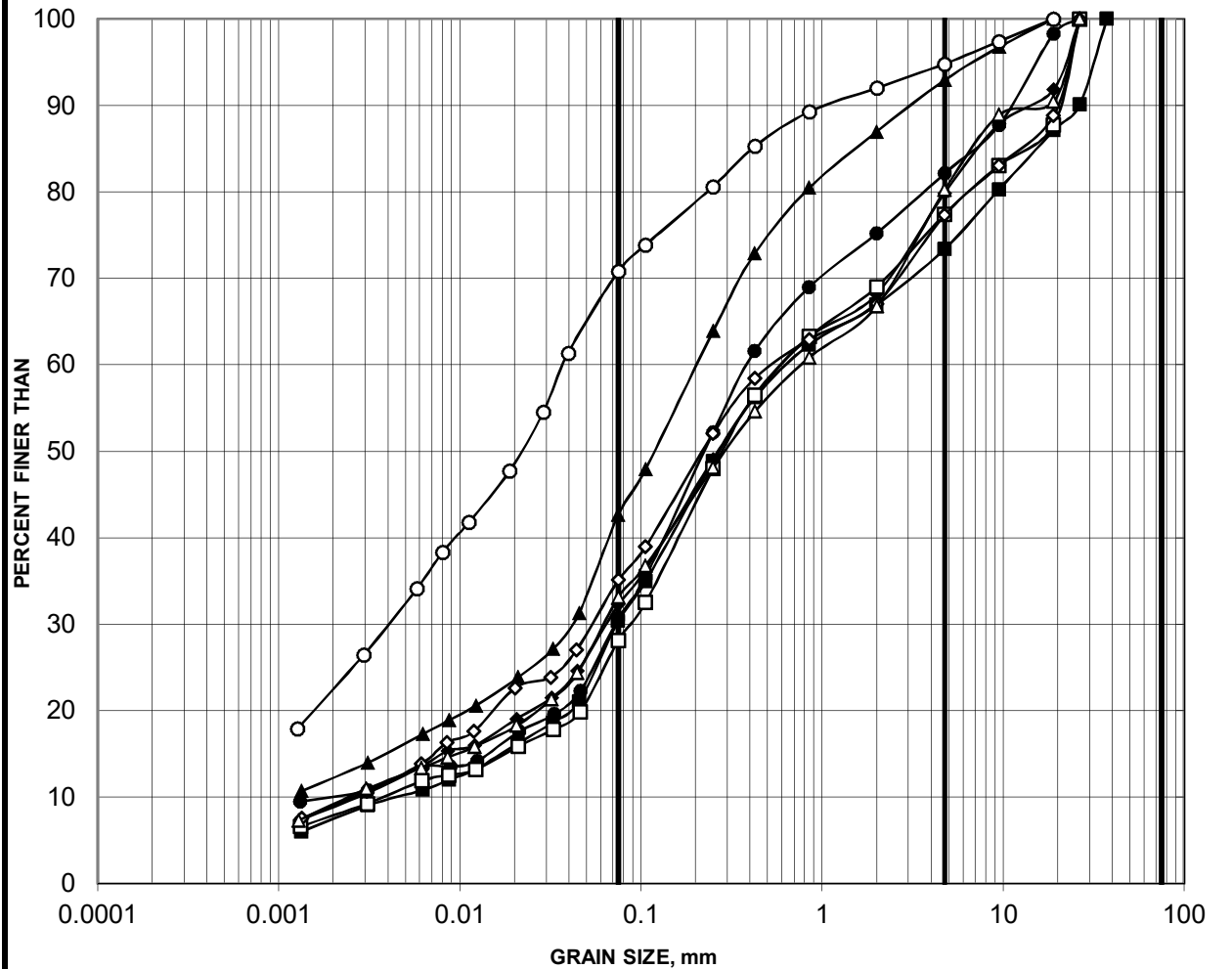


Borehole	Sample	Depth (m)
17-517	7	5.33-5.94
17-518	9	6.86-7.47
17-524	8	6.10-6.71

GRAIN SIZE DISTRIBUTION

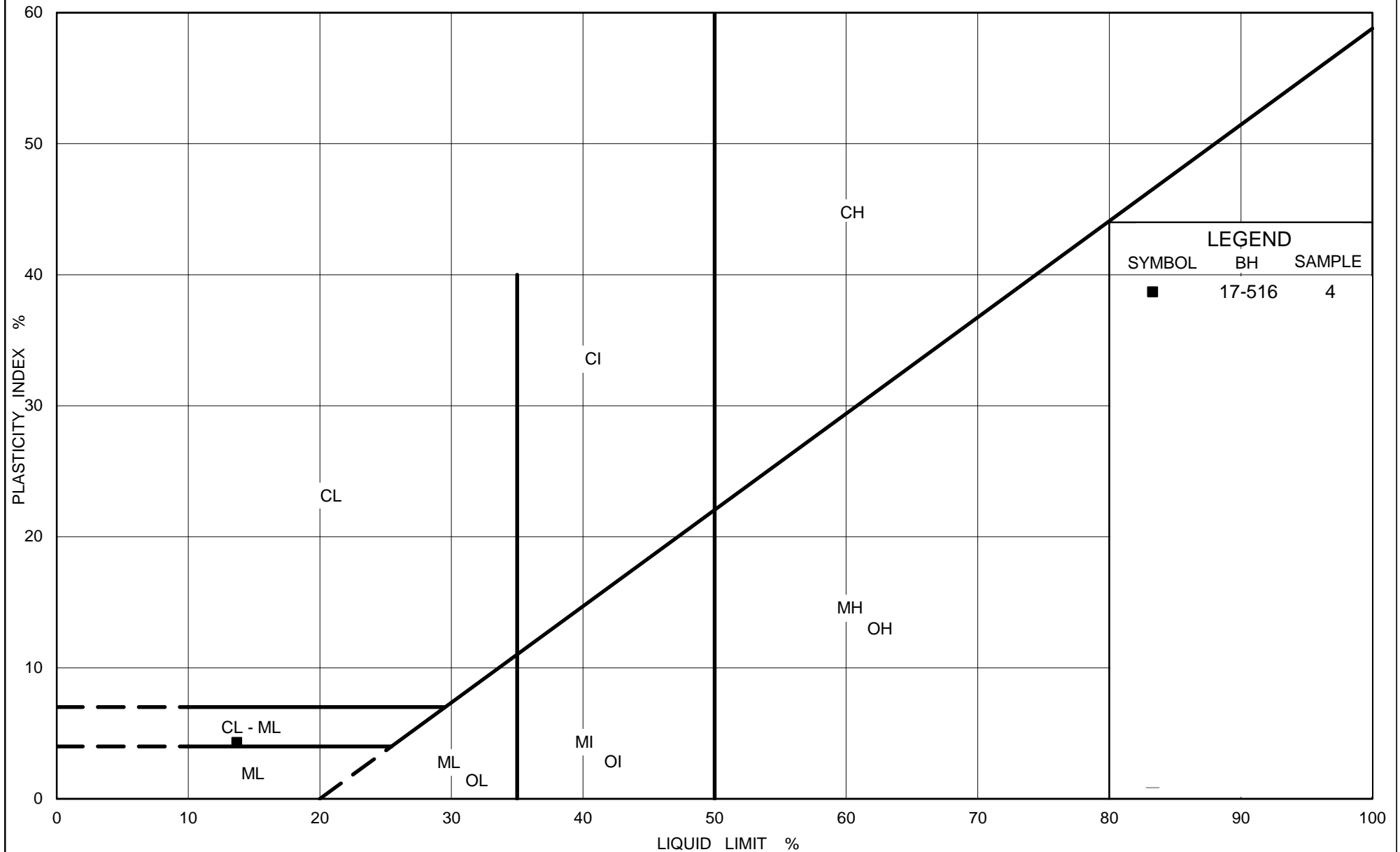
FIGURE B3

SECTION 1: GLACIAL TILL



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

Borehole	Sample	Depth (m)
17-503	9	6.10-6.71
17-504	9	5.33-5.94
17-512	4	2.29-2.90
17-513	4	3.05-3.66
17-514	4	1.52-2.13
17-515	8	4.57-5.18
17-516	5	3.05-3.66
17-526	10	6.86-7.47



Ontario

Ministry of Transportation

PLASTICITY CHART GLACIAL TILL

FIG No. B4

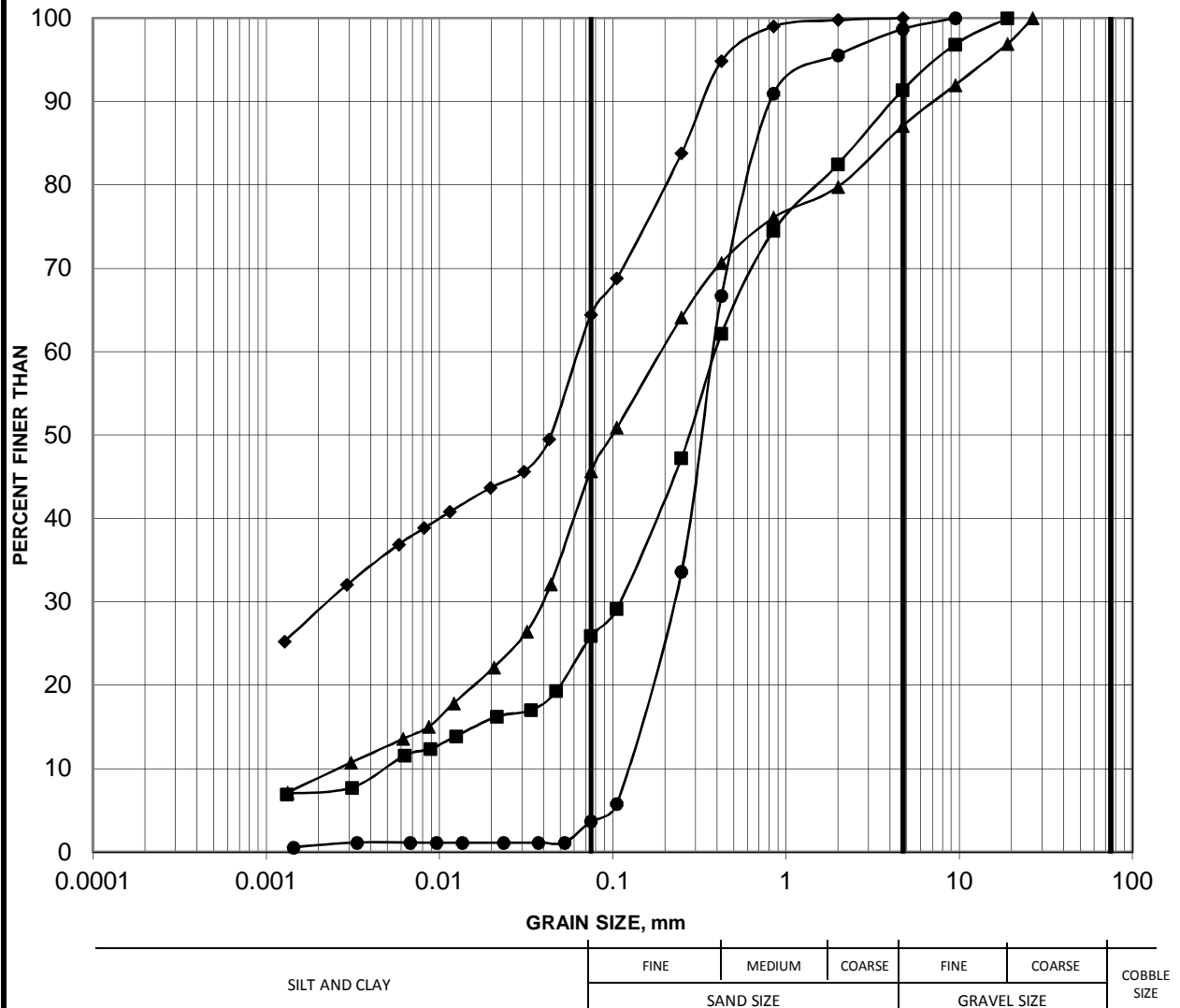
Project No. 1655214/1500

Compiled By : MI Checked By : CW

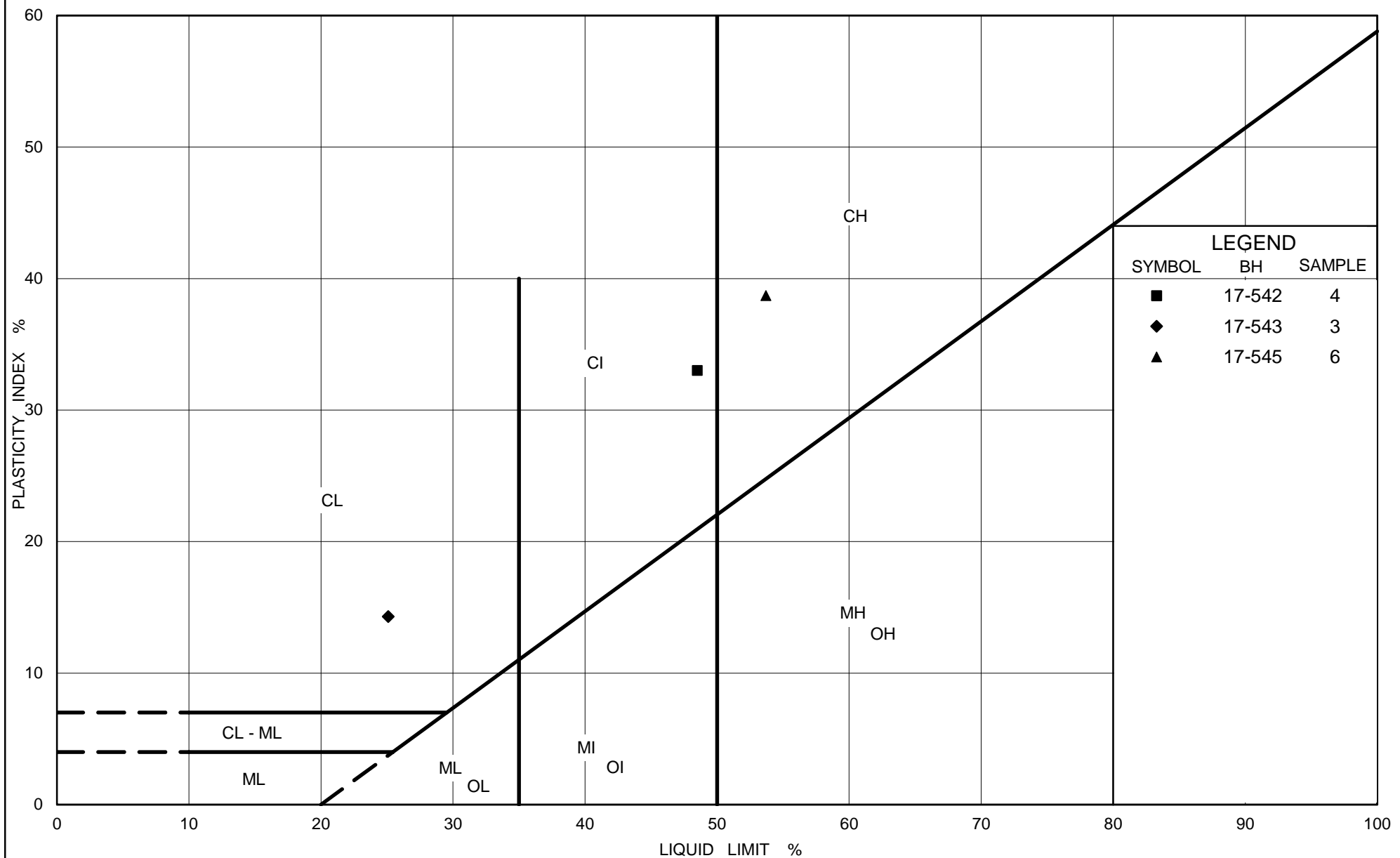
GRAIN SIZE DISTRIBUTION

FIGURE B5

SECTION 2: FILL



Borehole	Sample	Depth (m)
17-539	2	0.76-1.37
17-543	3	1.52-2.13
17-547	7	5.33-5.94
17-548	9	5.33-5.94



Ontario

Ministry of Transportation

PLASTICITY CHART CLAYEY SILT TO SILTY CLAY FILL

FIG No. B6

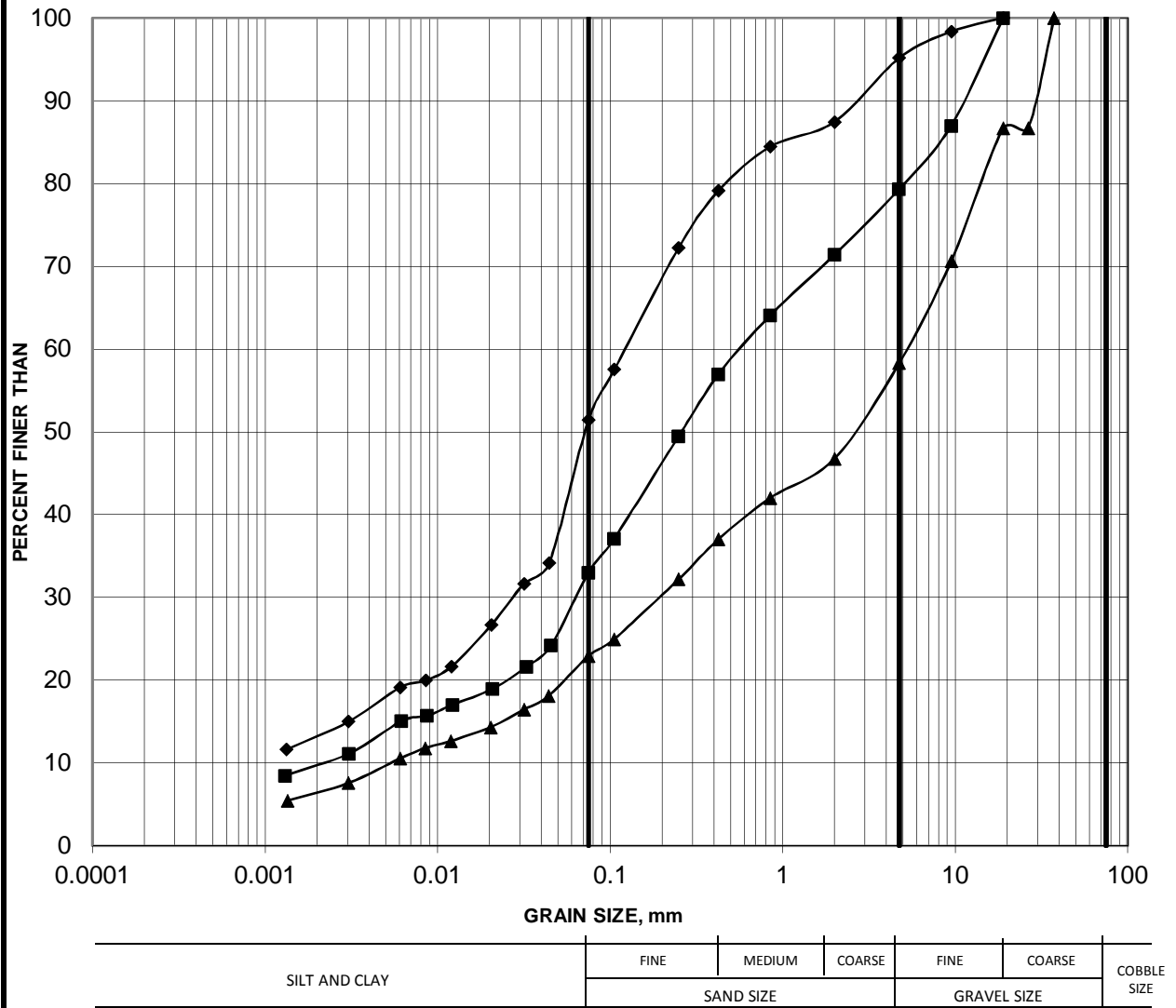
Project No. 1655214/1500

Compiled By : MI Checked By : CW

GRAIN SIZE DISTRIBUTION

FIGURE B7

SECTION 2: GLACIAL TILL

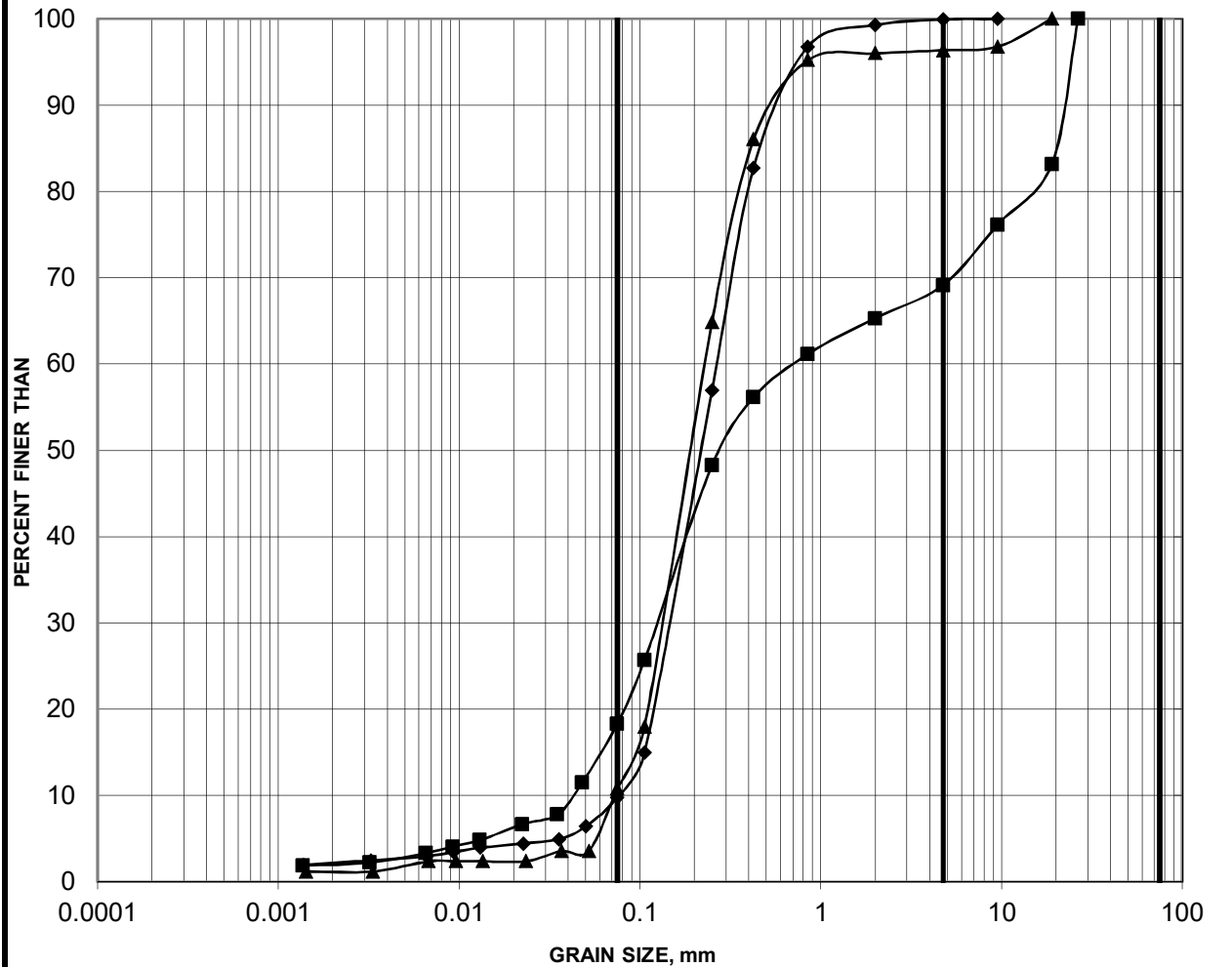


Borehole	Sample	Depth (m)
17-538	6	4.57-5.18
17-542	10	6.10-6.71
17-544	9	5.33-5.79

GRAIN SIZE DISTRIBUTION

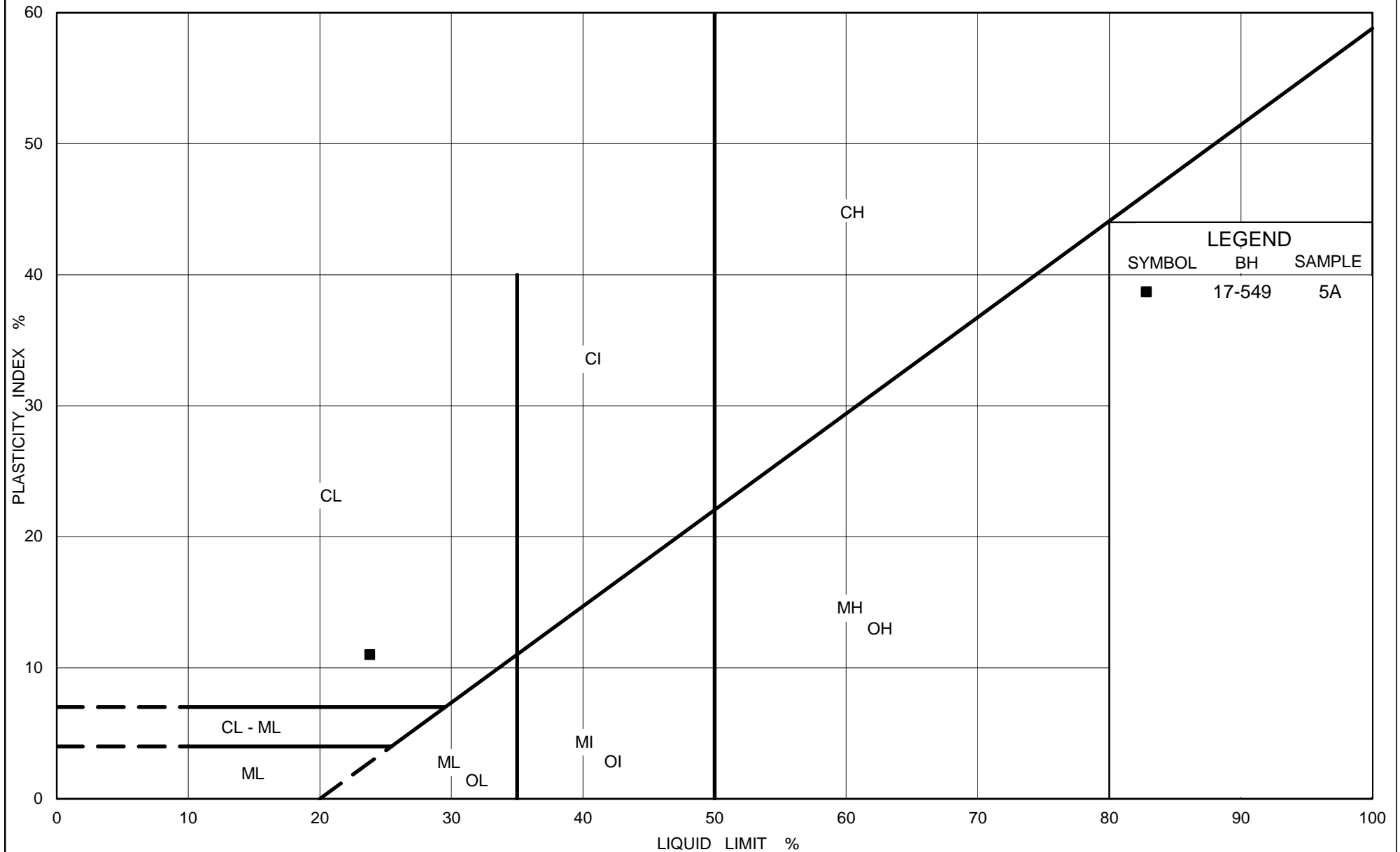
FIGURE B8

SECTION 3: FILL



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

Borehole	Sample	Depth (m)
17-552	2	1.52-2.13
17-554	4	3.05-3.66
17-556	5	2.29-2.74



Ontario

Ministry of Transportation

PLASTICITY CHART FILL CLAYEY SILT

FIG No. B9

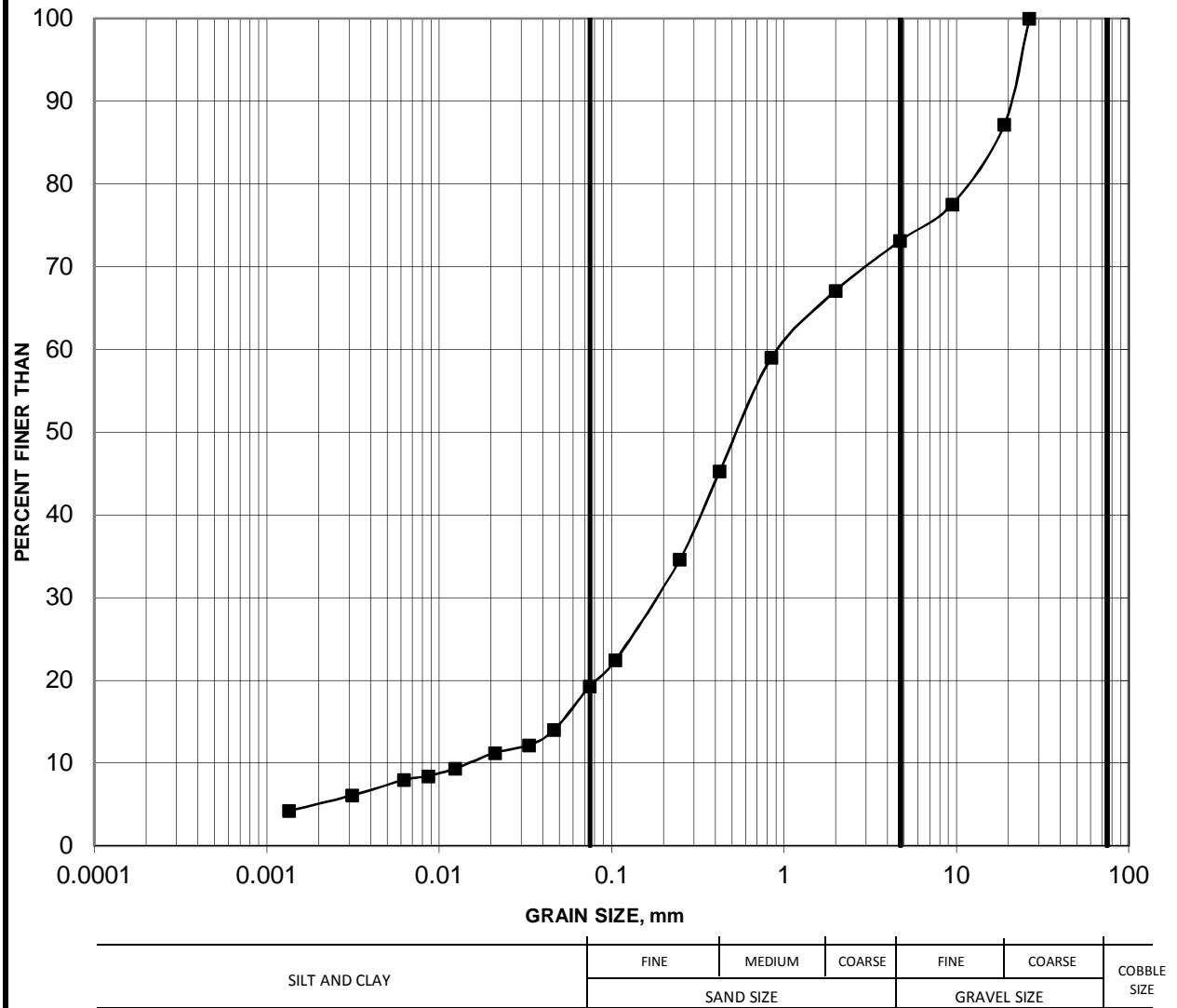
Project No. 1655214/1500

Compiled By : MI Checked By : CW

GRAIN SIZE DISTRIBUTION

FIGURE B10

SECTION 3: GLACIAL TILL



Borehole	Sample	Depth (m)
17-554	7	5.33-5.94

APPENDIX C

Results of Chemical Analysis

Maxxam Job Number B7O7573

RESULTS OF ANALYSES OF WATER

Maxxam ID		FMG077			FMG078		FMG079		FMG080		
Sampling Date		2017/10/19			2017/10/19		2017/10/19		2017/10/19		
COC Number		n/a			n/a		n/a		n/a		
	UNITS	17-507A	RDL	QC Batch	17-514	RDL	17-523	RDL	17-526	RDL	QC Batch
Calculated Parameters											
Resistivity	ohm-cm	750		5250327	160		58		160		5250327
Inorganics											
Conductivity	umho/cm	1300	1.0	5252193	6300	1.0	17000	1.0	6300	1.0	5252193
pH	pH	8.88		5252195	7.85		7.58		7.87		5252195
Dissolved Sulphate (SO4)	mg/L	45	1.0	5254040	130	1.0	220	1.0	120	1.0	5251398
Dissolved Chloride (Cl)	mg/L	140	2.0	5254037	1800	15	5500	50	1700	15	5251390
RDL = Reportable Detection Limit											
QC Batch = Quality Control Batch											

Maxxam ID		FMG081	FMG082		
Sampling Date		2017/10/19	2017/10/19		
COC Number		n/a	n/a		
	UNITS	17-533	17-538	RDL	QC Batch
Calculated Parameters					
Resistivity	ohm-cm	70	70		5250327
Inorganics					
Conductivity	umho/cm	14000	14000	1.0	5252193
pH	pH	7.89	7.88		5252195
Dissolved Sulphate (SO4)	mg/L	190	310	1.0	5251398
Dissolved Chloride (Cl)	mg/L	4400	4300	40	5251390
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



golder.com