THURBER ENGINEERING LTD.

FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH MAST LIGHT POLE SUPPORTS
HIGHWAY 400, STATIONS 10+145 TO 11+373
HIGHWAY 400 AND DUNLOP ST. E
CITY OF BARRIE, ONTARIO
G.W.P. 2128-18-00

GEOCRES NO. 31D-823

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Report

to

McIntosh Perry

Date: May 19, 2023
File: 22424

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted for the detailed design of eleven (11) proposed high mast lighting pole (HMLP) support structures along Highway 400 from approximately 250 m north to 980 m south of Dunlop Street in the City of Barrie, Ontario.

The purpose of this investigation was to explore the subsurface conditions near the HMLP locations along the highway median, and based on the data obtained, to provide a borehole location plan, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber was retained by McIntosh Perry (MP) to carry out this foundation investigation under the Ministry of Transportation Ontario (MTO) Assignment Number 2017-E-0032. The overall assignment includes replacement of three underpass structures on Highway 400: at Dunlop Street, at Anne Street and at Sunnidale Road. It also includes reconstruction of the Highway 400 and Dunlop Street interchange, noise barrier and retaining walls, pavement rehabilitation, culvert replacements, drainage improvements (sewers) and illumination (high mast lighting). This report addresses the proposed high mast lighting poles numbered P1 to P11 to be installed from approximate Stations 10+145 to 11+373.

It is a condition of this report that Thurber's performance of its professional services be subject to the attached Statement of Limitations and Conditions.

2 SITE DESCRIPTION

The eleven (11) HMLP support structures covered in this report are located along Highway 400 from approximately 250 m north to 980 m south of Dunlop Street in the City of Barrie, Ontario. The approximate locations of the proposed HMLP's are shown on the Borehole Location Plan drawing in Appendix C.

The overall surface topography in the vicinity of the site is relatively flat. The lands in this area largely consist of residential and commercial properties to the east and west sides of Highway 400. Within the area of investigation, the Highway 400 grade varies from south to north from approximate Elevations 240.8 to 230.9.

Based on published geological mapping, the study area is located within the Simcoe Lowlands physiographic region. This region borders Georgian Bay and Lake Simcoe and can generally be separated into two major divisions: the Nottawasaga basin to the west, consisting of plains draining into Nottawasaga Bay, and the Lake Simcoe basin to the east, consisting of the lowlands which surround Lake Simcoe. These two basins are connected at Barrie by a flat-floored valley which extends from the shores of Kempenfelt Bay. The Simcoe Lowlands region is generally comprised of sand, silt and clay deposits of deltaic and lacustrine origin.

3 SITE INVESTIGATION AND FIELD TESTING

The borehole investigation and field testing program for this project consisted of drilling eleven (11) boreholes (numbered HMLP21-01 to HMLP21-09, HMLP20-10 and HMLP21-11) to depths ranging from 12.8 m to 14.3 m (Elevations 217.8 to 228.0). Boreholes HMLP21-01 to HMLP21-09 were drilled from March 29 to April 22, 2021, Borehole HMLP20-10 on April 2, 2020, and Borehole HMLP21-11 on November 18, 2021.

The approximate locations of the boreholes are shown on the Borehole Locations Plan drawing in Appendix C and presented in Table 3.1.

Table 3.1 – HMLP locations

Borehole	HMPL	Approximate Station along Highway 400
HMLP 21-01	P1	10+145
HMLP 21-02	P2	10+304
HMLP 21-03	P3	10+455
HMLP 21-04	P4	10+615
HMLP 21-05	P5	10+820
HMLP 21-06	P6	SW quadrant of Hwy 400 and Dunlop St. interchange
HMLP 21-07	P7	10+920
HMLP 21-08	P8	11+062
HMLP 21-09	P9	11+225
HMLP 20-10	P10	11+373
HMLP 21-11	P11	NE quadrant of Hwy 400 and Dunlop St. interchange

The record of borehole sheets are provided in Appendix A.

Lane closures and traffic control were implemented during drilling of the boreholes for the investigation except for Borehole HMLP21-11. Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

The boreholes were advanced using a truck-mounted drill rig with hollow stem augers. Drilling mud was used in some boreholes to balance the hydrostatic head before reaching the desired depths. Soil samples were obtained at selected intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT) in general accordance with ASTM D1586.

Thurber obtained the borehole coordinates in the field using a handheld GPS, and McIntosh Perry provided the ground surface elevations. The horizontal and vertical accuracy of the coordinates and elevations meet the MTO terms of reference requirements of 0.5 m and 0.1m, respectively. The coordinates and elevations of the boreholes are given on the individual Record of Borehole Sheets and the Borehole Location Plan in Appendices A and C, respectively.

The field investigation was supervised on a full-time basis by a member of Thurber's technical staff who marked/staked the boreholes in the field, directed the drilling, sampling and in-situ testing operations, logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Boreholes were backfilled upon completion of drilling in general conformance with O.Reg. 903 as amended by O.Reg.128/03. Asphalt was reinstated in the boreholes drilled on the Highway 400 platform (Boreholes HMLP21-01 to HMLP21-05, HMLP21-07 to HMLP21-09 and HMLP20-10).

4 LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size analysis and Atterberg Limits testing. All the laboratory tests were carried out in accordance to MTO and/or ASTM Standards, as appropriate. Geotechnical laboratory testing results are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix A. A general description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It must be recognized and anticipated that soil conditions may vary between and beyond the borehole locations.

In general, the subsurface stratigraphy encountered at the site consists of pavement structure or topsoil overlying embankment fill which is underlain by layers of sand, silty sand, sandy silt, and sand and silt. Silt was encountered in some boreholes near the borehole termination depth. Interbedded layers of clayey silt and silty clay were contacted within the sands and silts in a few boreholes. During the field investigation, the groundwater levels were observed at approximately depths ranging from 1.1 m to 7.0 m below highway grade.

More detailed descriptions of the individual stratum are presented below.

5.1 Topsoil

A layer of topsoil with a measured thickness of 100 mm was encountered surficially in Borehole HMLP21-06, drilled at the southwest quadrant of the Highway 400 and Dunlop Street interchange.

The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.

5.2 Pavement Structure

Pavement structure consisting of approximately 165 mm to 450 mm of asphalt overlying granular (sand, some gravel) road base was encountered in the boreholes advanced through the Highway 400 platform, except in Borehole HMLP21-06. The granular fill ranged in thickness from 0.4 m to 1.3 m.

Borehole HMLP21-11, drilled within a parking lot located in a commercial plaza on the northeast quadrant of Highway 400 and Dunlop St. interchange, encountered 80 mm of asphalt over a 500mm thick layer of granular base (sand fill).

SPT 'N' values recorded in the granular base (sand fill) varied from 20 to 36 blows per 0.3 m of penetration indicating a compact condition. An SPT 'N' value of 56 blows per 0.15 m of penetration, indicating a very dense state, was measured in Borehole HMLP21-05. Moisture contents measured on samples of the road base fill ranged from 2 percent to 10 percent.

5.3 Embankment Fill

Embankment fill was encountered underlying the pavement structure in the boreholes advanced from Highway 400 grade, in the parking lot, and below the topsoil in Boreholes HMLP21-06. The embankment fill consisted of interlayers of cohesive and cohesionless soils.

The cohesive fill encountered in Borehole HMLP21-08, consisted of grey clayey silt containing some sand and trace gravel. The cohesionless fill consisted of layers of brown to grey silty sand, sand, to sand and gravel containing some silt, and occasional clay pockets and roots. Occasional woodchips were encountered in the silty sand fill in Borehole HMLP21-09. Layers of silty sand fill mixed with organics were noted within the fill in Borehole HMLP20-10. Interbedded layers of black silty sand were encountered within the sand fill in Borehole HMLP21-01. The thickness of the cohesionless fill typically ranged from 0.8 m to 2.3 m and was 6.8 m in Borehole HMLP21-01. In Borehole HMLP21-08, the cohesive fill layer was 1.5 m thick.

The depth to the base of the fill varied from 1.4 m to 4.1 m (Elevations 226.8 to 234.2) and was at 8.5 m (Elevation 232.3) in Borehole HMPL21-01.

The SPT 'N' values recorded in the cohesionless embankment fill ranged from 4 to 56 blows per 0.3 m of penetration indicating a loose to very dense condition. SPT 'N' values of 77 to 80 blows per 0.3 m of penetration, indicating a very dense state, were measured within the sand fill below Elevation 235 in Borehole HMPL21-01. An SPT 'N' value measured within the clayey silt fill in Borehole HMPL21-08 was 9 blows per 0.3 m of penetration indicating a stiff consistency.

The natural moisture contents measured on samples of the cohesionless fill generally ranged from 3 percent to 33 percent. A moisture content of 24 percent was measured in the clayey silt fill.

The results of a grain size analyses conducted on samples of the cohesionless and cohesive fills are provided on the Record of Borehole sheets in Appendix A, and illustrated on Figures B1 and B2 in Appendix B. The results are summarized as follows:

Soil Particle	Sands and Silts Fill (Percent)		Clayey Silt Fills (Percent)
Gravel	2 to 13		2
Sand	72 to 85		13
Silt	12 to 16	11	69
Clay	2 to 3		16

The results of Atterberg Limits tests conducted on a sample of the clayey silt fill are presented in Appendix A and in Figure B8 of Appendix B. The results are summarized as follows:

Index Property	Clayey Silt Fill Percentage (%)
Liquid Limit	26
Plastic Limit	16
Plasticity Index	10

The results of the Atterberg Limits testing indicate that the clayey silt fill is of low plasticity with a group symbol of CL.

5.4 Sand

Layers of native brown to grey sand containing trace to some gravel, trace to some silt and trace clay were encountered, below the fill and overlying sands and silts, at depths ranging from 2.2 m to 8.5 m in Boreholes HMLP21-01 to HMLP21-05. Where fully penetrated, the thickness of the sand layers varied from 1.5 m to 4.4 m. In Borehole HMLP21-11, the native sand was contacted at 1.4 m depth and had a thickness of 11.1 m.

The depth to the base of the sand varied from 4.9 m to 10.0 m (Elevations 222.3 to 231.6) in Boreholes HMLP21-02 to HMLP21-05 and was at 12.5 m (Elevation 218.2) in Borehole HMLP21-11. Borehole HMLP21-01 was terminated within the sand layer at 12.8 m depth (Elevation 228.0).

SPT ‘N’ values recorded in the sand layers typically ranged from 11 to 41 blows per 0.3 m of penetration indicating a compact to dense condition. SPT ‘N’ values of 5 and 9 blows per 0.3 m of

penetration, indicating loose zones, were measured in Borehole HMLP21-05 below about Elevation 226.5. These lower 'N' values could be due to possible disturbance during the drilling operations. The natural moisture contents measured on samples of sand ranged from 4 percent to 24 percent.

The results of grain size distribution analyses carried out on selected samples of the sand are presented on Figure B3 in Appendix B. The results are summarized as follows:

<table>
<tr><th>Soil Particle</th><th colspan="2">Sand (Percent)</th></tr>
<tr><td>Gravel</td><td colspan="2">0 to 10</td></tr>
<tr><td>Sand</td><td colspan="2">81 to 97</td></tr>
<tr><td>Silt</td><td>10 to 16</td><td rowspan="2">3 to 10</td></tr>
<tr><td>Clay</td><td>1</td></tr>
</table>

5.5 Clayey Silt to Silty Clay

Layers of brown to grey clayey silt to silty clay containing trace to some sand were contacted in Boreholes HMLP21-03, HMLP21-08 and HMLP21-09 at depths ranging from 4.1 m to 7.2 m. In Borehole HMLP20-10, these cohesive layers were contacted at 2.2 m and 10.0 m depths. Where fully penetrated, the thickness of the clayey silt to silty clay varied from 1.2 m to 4.5 m.

The depth to the base of the clayey silt was at 6.1 m and 11.7 m (Elevations 229.0 and 220.0) in Boreholes HMLP21-03 and HMLP21-09. In Borehole HMLP20-10, the depth to the base of the cohesive layers were at 3.7 m to 11.7 m (Elevations 228.6 and 220.6). Borehole HMLP21-08 was terminated within the clayey silt at 12.8 m depth (Elevation 218.1).

SPT 'N' values in the clayey silt and silty clay ranged from 6 to 41 blows per 0.3 m of penetration indicating a firm to hard consistency. Moisture contents measured in the clayey silt and silty clay ranged from 13 percent to 22 percent.

The results of grain size distribution analyses carried out on selected samples of the clayey silt to silty clay are presented on the Record of Borehole sheets included in Appendix A. Grain size distribution curves of samples tested are presented on Figure B4 Appendix B. The results of the grain size distribution analyses are summarized below:

Soil Particle	Clayey Silt to Silty Clay (Percent)
Gravel	0
Sand	1 to 29
Silt	57 to 80
Clay	13 to 20

The results of Atterberg Limits tests conducted on samples of the clayey silt to silty clay are presented on the Record of Borehole sheets in Appendix A, and illustrated in Figure B9 of Appendix B. The results are summarized as follows:

Index Property	Clayey Silt to Silty Clay Percentage (%)
Liquid Limit	16 to 29
Plasticity Index	4 to 11

The results of the Atterberg Limits testing indicate that the clayey silt to silty clay is of low to slight plasticity with group symbols of CL and CL-ML.

5.6 Silty Sand, Sandy Silt to Sand and Silt

Layers of brown to grey silty sand, sandy silt to sand and silt containing trace gravel and trace to some clay were encountered at depths ranging from 2.2 m to 6.1 m in Boreholes HMLP21-02 to HMLP21-07, HMLP21-09 and HMLP20-10. The combined thickness of these sand and silt layers ranged from 1.1 m to 7.8 m.

Lower layers of grey silty sand were contacted at depths ranging from 7.8 m to 13.3 m in Boreholes HMLP21-02, HMLP21-04 and HMLP21-05.

Where fully penetrated, the depth to the base of these sands and silts varied from 4.1 m to 11.6 m (Elevations 220.6 to 233.1). Boreholes HMLP21-02, HMLP21-04, HMLP21-05 and HMLP21-07 were terminated within the silty sand to sand and silt at depths ranging from 12.8 m to 14.3 m (Elevations 218.6 to 222.9).

The SPT ‘N’ values recorded in the silty sand, sandy silt to sand and silt layers typically ranged from 10 to 43 blows per 0.3 m of penetration indicating a compact to dense condition. SPT ‘N’ values varying from 4 to 9 blows per 0.3 m of penetration, indicating a loose state, were measured in

Boreholes HMLP21-02, HMLP21-05 andHMLP21-07. Low SPT 'N' values may be due to possible disturbance during drilling operations. The natural moisture contents measured on samples of silty sand, sandy silt to sand and silt ranged from 4 percent to 27 percent.

The results of grain size distribution analyses carried out on selected samples of the silty sand, sandy silt to sand and silt are shown on Figures B5 and B6 in Appendix B. The results are summarized as follows:

Soil Particle	Silty Sand, Sandy Silt, Sand and Silt (Percent)
Gravel	0 to 3
Sand	27 to 66
Silt	31 to 66
Clay	1 to 14

5.7 Silt

Grey silt containing trace sand and trace to some clay was contacted at depths varying from 10.0m to 12.5 m in Boreholes HMLP21-02, HMLP21-03, HMLP21-06, HMLP21-09, and HMLP21-11, and at 7.2 m and 11.7 m depths in Borehole HMLP20-10. Where fully penetrated in Boreholes HMLP21-02 and HMLP20-10, the thickness of the silt was 1.7 m and 2.8 m, respectively.

The depth to the base of the silt was at 13.3 m and 10.0 m (Elevations 223.9 and 222.3) in Boreholes HMLP21-02 and HMLP20-10, respectively. Boreholes HMLP21-03, HMLP21-06, HMLP21-09 and HMLP21-11 were terminated within the silt at 12.8 m depth (Elevations 217.8 to 222.3), and Borehole HMLP20-10 at 14.3 m depth (Elevation 218.0).

The SPT 'N' values recorded in the silt layers ranged from 11 to 42 blows per 0.3 m of penetration, indicating a compact to dense condition. Loose zones were noted in the silt in Boreholes HMLP21-02 and HMLP21-03, where SPT 'N' values of 6 and 9 blows per 0.3 m of penetration were measured. Lower SPT 'N' values may be due to possible disturbance during drilling operations. The natural moisture content measured on samples of the silt ranged from 14 percent to 22 percent.

The results of grain size distribution analyses carried out on selected silt samples are shown on Figure B7 in Appendix B. The results are summarized as follows:

Soil Particle	Silt (Percent)
Gravel	0
Sand	2 to 9
Silt	80 to 90
Clay	7 to 11

The results of Atterberg Limits tests conducted on a sample of the silt are presented on the Record of Borehole sheets in Appendix A and illustrated in Figure B10 of Appendix B. The results are summarized as follows:

Index Property	Silt Percentage (%)
Liquid Limit	17
Plastic Limit	13
Plasticity Index	4

The results of the Atterberg Limits testing indicate that the silt is of slight plasticity with a group symbol of CL-ML.

5.8 Groundwater Conditions

Groundwater levels in the boreholes were observed during the drilling operations and measured upon completion of drilling. Water levels recorded in the open boreholes during the investigation are presented in Table 5.2 below.

Table 5.2 - Groundwater Level Measurements

HMLP #	Borehole	Date	Groundwater Level		Comments
			Depth (m)	Elev. (m)	
P1	HMLP21-01	April 14, 2021	7.0	233.8	Upon completion
P2	HMLP21-02	April 13, 2021	6.1	231.1	Upon completion
P3	HMLP21-03	April 13, 2021	4.0	231.1	During drilling
P4	HMLP21-04	April 13, 2021	3.5	230.7	Upon completion
P5	HMLP21-05	March 29, 2021	2.4	229.9	Upon completion
P6	HMLP21-06	April 22, 2021	3.0	227.6	Upon completion
P7	HMLP21-07	March 30, 2021	3.8	227.6	Upon completion
P8	HMLP21-08	April 6, 2021	Dry	-	Upon completion
P9	HMLP21-09	April 6, 2021	2.4	229.3	Upon completion
P10	HMLP20-10	April 2, 2020	3.8	228.5	During drilling (borehole caved in to 8.5 m upon completion)
P11	HMLP21-11	November 18, 2021	1.1	229.6	Upon completion

The values shown in Table 5.2 are short term readings, and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant or prolonged precipitation.

6 MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. Thurber obtained the borehole coordinates in the field using an in-house GPS unit and McIntosh Perry provided the ground surface elevations.

Walker Drilling of Utopia, Ontario supplied and operated the drilling and sampling equipment for the field program.

Full time supervision of the field activities was carried out by Mr. Greg Forest and Ms. Eckie Sui of Thurber. Overall supervision of the field program was performed by Mr. Stephane Loranger, C.E.T.

and Ms. Rocio Palomeque Reyna of Thurber.

Interpretation of the field data and preparation of the report were carried out by Ms. Rocio Palomeque Reyna, P.Eng. The report was reviewed by Dr. Sydney Pang, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

THURBER ENGINEERING LTD.

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PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

7 GENERAL

This section of the report provides interpretation of the geotechnical data presented in Part 1 Factual Information and provides foundation recommendations for the detail design of eleven (11) High Mast Lighting Pole (HMLP) support structures along Highway 400 from approximately 250 m north to 980 m south of Dunlop Street (Stations 10+145 to 11+373) in the City of Barrie, Ontario.

The Borehole Location Plan drawing in Appendix C and the attached Table 1 present the approximate locations of boreholes near each HMLP location.

Information on the proposed locations of the HMLP supports was provided to Thurber by McIntosh Perry (MP). Based on the proposed HMLP layout, boreholes were drilled as close as possible to each proposed HMLP location to provide subsurface information for foundation design. The Record of Borehole sheets for these boreholes are presented in Appendix A. Table 1 immediately following the text of this report provides foundation design parameters for each HMLP support locations.

This foundation investigation and design report with the interpretation and recommendations are intended for the use of the Ministry of Transportation and McIntosh Perry, and shall not be used or relied upon for any other purposes or by any other parties including the construction contractor. The contractor must make their own interpretation based on the factual data in Part 1 of the report. Where comments are made on construction, they are provided only in order to highlight those aspects which could affect the design of the project. Contractors must make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction methods and scheduling.

The discussion and recommendations presented in this report are based on information provided

by McIntosh Perry to Thurber, and on the factual data obtained during the course of this investigation.

7.1 Foundation Design Parameters

Design of the HMLP support foundations should be carried out in accordance with the following document.

- Ministry of Transportation, Ontario (2004) “Guidelines for the Design of High Mast Pole Foundations”, Fourth Edition, BRO-009, Engineering Standards Branch, Bridge Office (Reference 1).

Reference should also be made to the following documents.

- Canadian Highway Bridge Design Code and Commentary (2019). CAN/CSA S6-19 and S6.1-19 (Reference 2).

A typical HMLP support consists of a single conventional augered caisson (drilled shaft). Table 1 following the text of this report presents the recommended parameters for foundation design of such caissons.

In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of a caisson within the upper 1.5 m below final grade should be neglected in the foundation design. It is recommended that any topsoil and organics, if present, be neglected in determining lateral resistance.

Where downward sloping fill or native soil exists in front of a caisson, reduction of lateral passive resistance should be taken into consideration during design. For foundation design at the caissons, it should be assumed that full lateral resistance can only be mobilized where the width of the soil in front of or behind the caisson is equal to or greater than approximately four (4) times the diameter of the caissons. For sloping ground in front of a caisson, the magnitude of the mobilized passive resistance can be estimated by interpolating between zero passive resistance at the level where the slope face intersects the caisson, and full passive resistance at the level where the slope face is at a horizontal distance equal to or greater than four (4) times the diameter of the caisson.

Where an unconfined compressive strength, q_u, ($q_u = 2 \times C_u$, undrained shear strength) is provided for cohesive soils (native clayey silt to silty clay), the ultimate lateral passive resistance should be calculated in conjunction with the total soil unit weight. When designing for portions of the caissons below the groundwater level in cohesionless sands and silts, the submerged soil unit weight, γ', should be used. The required depth of the caisson will be governed by lateral loads, including wind loads, acting on the pole. The length of the caisson should also be sufficient to counteract frost jacking (upward) forces.

An equivalent caisson width equal to two (2) times the caisson diameter may be assumed for lateral resistance calculations. Appropriate load and resistance factors should be applied for caisson design.

7.2 Caisson Installation

Caisson installation should generally be carried out in accordance with OPSS.PROV 903.

The contract documents should contain an NSSP alerting the contract bidders of the specific aspects relating to caisson construction for HMLP foundation supports at this site. Suggested wordings for this NSSP are provided in Appendix D.

Caisson installation equipment must be able to dislodge, handle, remove and penetrate possible obstructions within the fill and native soils, and to drill through hard or dense layers where encountered.

The design groundwater levels are within typical caisson depths for HMLP supports (see Table 1). Groundwater levels may be higher during construction. Soil sloughing and water seepage will occur in unsupported holes especially in sands and silts below the groundwater level. Caving of cohesionless soils were noted during drilling in some boreholes. The cohesionless soils will also be susceptible to disturbance (basal and sidewall instability) under conditions of unbalanced hydrostatic head. Temporary liners must be used to support the caisson sidewalls and to provide partial seepage cut-off during caisson installation. A balancing water/synthetic slurry head should be used inside the caisson hole in cases where the caisson base is within water-bearing sands and silts. Any accumulated water may have to be pumped out from the hole prior to placing concrete. Should it be considered impractical to remove the accumulated water/slurry inside the hole, it is recommended that the concrete be placed by the pumped tremie method. Suggested wording for an NSSP to cover the above aspects are provided in Appendix D.

7.3 Construction Concerns

Concerns during caisson construction mainly involve the handling and removal of obstructions in the fill and native soils, drilling through hard/ dense soils, soil sloughing and water seepage from caisson sidewalls, and basal instability due to unbalanced hydrostatic head. Recommendations on how to address these issues have been outlined in the previous section.

7.4 Construction Inspection and Testing

Caisson construction should be monitored by qualified geotechnical personnel as per OPSS.PROV 903 to verify the soil and groundwater conditions, and to confirm that those conditions are consistent with the design assumptions in this report.

8 CLOSURE

Engineering analysis and preparation of this foundation design report were carried out by Ms. Rocio Palomeque Reyna, P.Eng. The report was reviewed by Dr. Sydney Pang, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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Associate, Senior Geotechnical Engineer

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TABLE 1
FOUNDATION INVESTIGATION AND DESIGN REPORT
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HMLP Station	Reference Boreholes	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q_u (kPa)	ϕ' (deg.)	n_h (kN/m^3)	K_P	γ (kN/m^3)	γ' (kN/m^3)	Design Groundwater Depth (m)
P1 10+145	HMLP 21-01	Compact to dense sand fill Very dense sand fill Compact to dense sand	1.5 – 6.0 6.0 – 8.5 8.5 – 12.8	- - -	31 32 32	4,000 4,000 4,000	3.1 3.2 3.2	20 - -	- 11 11	6 (below existing grade)
P2 10+304	HMLP 21-02	Dense to Very dense sand and gravel fill Compact silty sand fill Dense silty sand to sand Loose to compact sandy silt to silt Dense silty sand	1.5 – 2.2 2.2 – 3.0 3.0 – 5.5 5.5 – 13.3 13.3 – 14.3	- - - - 	32 31 31 30 32	5,000 4,000 4,000 2,500 4,000	3.2 3.1 3.1 3.0 3.2	21 20 21 - -	- - - 10 11	5.5 (below existing grade)
P3 10+455	HMLP 21-03	Compact to dense silty sand fill Dense to compact sand Stiff clayey silt Dense to compact sandy silt	1.5 – 2.2 2.2 – 5.0 5.0 – 6.0 6.0 – 12.8	- - 100 -	31 31 - 30	4,000 4,500 - 2,500	3.1 3.2 - 3.0	20 21 20 -	- - - 10	4 (below existing grade)

Notes: 1. This table must be read in conjunction with the text of this report.
2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.5 m below final grade should be neglected in the foundation design.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HMLP Station	Reference Boreholes	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q_u (kPa)	ϕ' (deg.)	n_h (kN/m^3)	K_P	γ (kN/m^3)	γ' (kN/m^3)	Design Groundwater Depth (m)
P4 10+615	HMLP 21-04	Compact sand fill Dense silty sand to sand Compact to dense silty sand	1.5 –3.5 3.5 – 10.0 10.0 – 12.8	- - - -	30 32 31	3,000 4,000 3,000	3.0 3.2 3.1	20 - -	- 11 11	3.5 (below existing grade)
P5 10+820	HMLP 21-05	Dense silty sand fill Loose to compact sand and silt Loose to compact sand/silty sand	1.5 – 2.3 2.3 – 5.6 5.6 –13.7	- - -	31 30 30	4,000 2,500 2,500	3.1 3.0 3.0	21 - -	- 10 10	2 (below existing grade)
P6 SW quadrant of Hwy 400 and Dunlop interchange	HMLP 21-06	Loose sand fill Compact sand and silt/silty sand Compact silt	1.5 – 2.2 2.2 – 10.0 10.0 – 12.5	- - - -	30 30 30	3,000 2,500 2,500	3.0 3.0 3.0	19 - -	- 10 10	2 (below existing grade)
P7 10+920	HMLP 21-07	Compact silty sand fill Compact to loose sand and silt Compact to loose sand and silt Dense sand and silt	1.5 – 2.2 2.2 – 3.0 3.0 – 12.0 12.0 – 12.8	- - - -	30 30 30 32	3,000 3,000 2,500 4,000	3.0 3.0 3.0 3.2	20 20 - -	- - 10 11	3 (below existing grade)
P8 11+062	HMLP 21-08	Compact silty sand fill Stiff clayey silt fill Hard clayey silt Stiff clayey silt Very stiff to hard clayey silt	1.5 – 2.5 2.5 – 4.0 4.0 – 6.0 6.0 – 7.5 7.5 – 12.8	- 100 350 100 250	30 - - - -	3,000 - - - -	3.0 - - - -	20 20 20 20 21	- - - - -	2.5 (assumed below existing grade)

Notes: 1. This table must be read in conjunction with the text of this report.
2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.5 m below final grade should be neglected in the foundation design.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HMLP Station	Reference Boreholes	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q_u (kPa)	ϕ' (deg.)	n_h (kN/m^3)	K_P	γ (kN/m^3)	γ' (kN/m^3)	Design Groundwater Depth (m)
P9 11+225	HMLP 21-09	Compact silty sand fill Compact sand and silt Stiff to very stiff clayey silt Dense silt	1.5 – 3.0 3.0 – 7.2 7.2 – 11.7 11.7 – 12.8	- - 250 -	30 30 - 32	3,000 2,500 - 4,000	3.0 3.0 - 3.2	20 - 20 -	10 10 - 10	2 (below existing grade)
P10 11+373	HMLP 20-10	Compact silty sand fill Firm clayey silt Compact sand and silt Compact silt Stiff clayey silt Compact silt	1.5 – 2.2 2.2 – 3.7 3.7 – 7.2 7.2 – 10.0 10.0 – 11.7 11.7 – 12.8	- 100 - - 120 -	30 - 30 30 - 30	3,000 - 2,500 2,500 - 2,500	3.0 - 3.0 3.0 - 3.0	20 19 - - 20 -	- - 10 10 - 10	3.5 (below existing grade)
P11 NE quadrant of Hwy 400 and Dunlop St. interchange	HMLP 21-11	Compact to dense sand Dense sand Compact silt	1.5 – 10.0 10.0 – 12.5 12.5– 12.8	- - -	31 33 30	3,000 5,000 2,500	3.1 3.4 3.0	- - -	11 11 10	1 (below existing grade)
-	New Fill (see Note 3)	Variable height above ground surface	-	-	30	3,000	3.0	20	-	Below base of new fill

Notes: 1. This table must be read in conjunction with the text of this report.
2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.5 m below final grade should be neglected in the foundation design.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

LEGEND

q_u	=	Unconfined Compressive Strength (= 2 x C_u, undrained shear strength) (kPa)
ϕ'	=	Angle of Internal Friction (degrees)
n_h	=	Coefficient related to Soil Density (MN/m^3 or x 10^3 kN/m^3)
K_p	=	Coefficient of Passive Earth Pressure
γ	=	Soil Unit Weight (kN/m^3)
γ'	=	Submerged Soil Unit Weight (kN/m^3) – to be used only for cohesionless soils below the groundwater table

Notes: 1. This table must be read in conjunction with the text of this report.
2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.5 m below final grade should be neglected in the foundation design.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

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STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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Appendix A

Record of Borehole Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT[(1)] 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

1) Laboratory Triaxial Testing
2) Field Insitu Vane Testing
3) Laboratory Vane Testing
4) SPT value
5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample		TP Thin Wall Piston Sample
	PH Sampler Advanced by Hydraulic Pressure		PM Sampler Advanced by Manual Pressure
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

▼ Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

(1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.

(2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

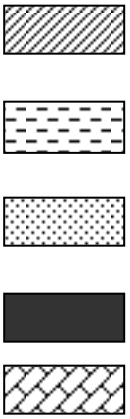
MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

SYMBOLS



CLAYSTONE

SILTSTONE

SANDSTONE

COAL

Bedrock (general)

DISCONTINUITY SPACING

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

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)	(psi)	Field Estimation of Hardness*
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

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RECORD OF BOREHOLE No HMLP21-01 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 914 665.9 E 288 169.2 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.14 - 2021.04.14 LATITUDE 44.371809 LONGITUDE -79.708679 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
240.8	GROUND SURFACE							20 40 60 80 100	20 40 60		
0.0 240.4	**ASPHALT:** (400mm)										
0.4	**SAND**, some gravel, trace to some silt, trace clay, occasional geogrid pieces Compact Brown Moist (FILL)		1	SS	27		240		○		
239.1											
1.7	**SAND**, some gravel, some silt, trace clay Compact to Dense Brown Moist (FILL)		2	SS	24		239		○		
			3	SS	33				○		
	Layer of black silty sand, occasional rootlets (25mm)		4	SS	27		238		○		13 72 12 3
	Brown to Grey Moist to Wet		5	SS	18		237		○		Drilling mud used below 4.8m depth
	Very Dense		6	SS	77	▽	236		○		
	Layer of black sand at 7.8m, occasional roots		7	SS	80		235		○		
232.3							234				
8.5	**SAND**, some silt, trace clay Compact Brown to Grey Moist to Wet		8	SS	19		233		○		
							232		○		
							231				

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+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No HMLP21-01 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 914 665.9 E 288 169.2 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.14 - 2021.04.14 LATITUDE 44.371809 LONGITUDE -79.708679 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page							20 40 60 80 100	20 40 60		
	SAND, some silt, trace clay Dense to Compact Brown to Grey Moist to Wet										
			9	SS	38		230				0 88 11 1
							229				
228.0	Grey Wet		10	SS	28		228				
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN AND WATER LEVEL AT 7.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.4m, THEN ASPHALT COLD PATCH TO SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No HMLP21-02 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 914 788.8 E 288 068.4 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.13 - 2021.04.13 LATITUDE 44.372912 LONGITUDE -79.709948 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
237.2	GROUND SURFACE						237				
0.0 / 236.9	**ASPHALT:** (260mm)										
0.3	**SAND**, some silt, some gravel Compact Brown Moist (FILL)		1	SS	30		236		○		
235.8											
1.4	**SAND** and **GRAVEL**, some silt Very Dense Brown Moist		2	SS	56		235		○		
235.0	(FILL)										
2.2	Silty **SAND**, some gravel Compact Grey Moist		3	SS	29		234		○		
234.2	(FILL)										
3.0	Silty **SAND**, some gravel, trace clay Dense Brown Moist		4	SS	30		233		○ ○		
233.1											
4.1	**SAND**, some gravel, trace silt and clay Dense Brown Moist		5	SS	38		232		○		10 82 8 (SI+CL)
231.6											
5.6	Sandy **SILT**, trace clay Loose to Compact Grey Wet		6	SS	9	▽	231		○		
			7	SS	23		230		○		0 27 66 7
	Dense		8	SS	43		229		○ ○		
							228				

Continued Next Page

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

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No HMLP21-02 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 914 788.8 E 288 068.4 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.13 - 2021.04.13 LATITUDE 44.372912 LONGITUDE -79.709948 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page							20 40 60 80 100	20 40 60		
	Sandy **SILT**, trace clay Compact Grey Wet						227				
			9	SS	15				○		
225.6							226				
11.6	**SILT**, trace sand, trace to some clay Loose Grey Wet										
			10	SS	9		225		H ⊕		0 7 83 10
223.9							224				
13.3	Silty **SAND**, trace clay Dense Grey Wet										
			11	SS	43				○		
222.9							223				
14.3	END OF BOREHOLE AT 14.3m. WATER LEVEL AT 6.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.										

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

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
$\frac{}{10}$

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-03 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 914 919.2 E 287 991.8 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.13 - 2021.04.13 LATITUDE 44.374085 LONGITUDE -79.710913 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
235.1	GROUND SURFACE					
0.0 / 234.8	**ASPHALT:** (260mm)					
0.3 / 234.3	**SAND**, some gravel Grey Moist (FILL)		1	GS		
0.8 / 232.9	Silty **SAND**, trace gravel, trace clay, occasional clay pockets, occasional roots Compact to Dense Brown Moist (FILL)		1	SS	23	
			2	SS	46	
2.2 / 230.2	**SAND**, trace gravel, trace to some silt and clay Dense to Compact Brown Moist		3	SS	36	
			4	SS	23	▽
4.9 / 229.0	Clayey **SILT**, some sand Stiff Grey Wet		5	SS	8	
6.1 / 225.1	Sandy **SILT**, trace to some clay Dense to Compact Grey Wet		6	SS	40	
			7	SS	37	
			8	SS	24	

ELEVATION SCALE: 235, 234, 233, 232, 231, 230, 229, 228, 227, 226

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

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

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

WATER CONTENT (%) (20 40 60)

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	9	81	10	(SI+CL)
Drilling mud used below 5.4m depth				

Continued Next Page

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-03 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 914 919.2 E 287 991.8 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.13 - 2021.04.13 LATITUDE 44.374085 LONGITUDE -79.710913 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page							20 40 60 80 100	20 40 60		
10.0	**SILT**, trace sand, trace clay Loose to Compact Grey Wet Interbedded layers of clayey silt from 10.4m to 11.6m						225				
			9	SS	6		224		○		0 2 90 8 Possible disturbance due to drilling
							223				
222.3			10	SS	27				○		
12.8	END OF BOREHOLE AT 12.8m. WATER LEVEL AT 4.0m DURING DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS, THEN ASPHALT COLD PATCH TO SURFACE.										

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

$\frac{20}{15 \quad 5}$ (%) STRAIN AT FAILURE
$\frac{10}{}$

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Ministry of Transportation
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RECORD OF BOREHOLE No HMLP21-04 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 069.3 E 287 934.5 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.07 - 2021.04.07 LATITUDE 44.375434 LONGITUDE -79.711637 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
234.2	GROUND SURFACE										
0.0	**ASPHALT:** (240mm)						234				
0.2	**SAND**, some gravel Dense Brown Moist (FILL)		1	SS	32				○		
233.0							233		○		
1.2	**SAND**, trace gravel, some silt and clay Compact Brown Moist (FILL)		2	SS	23				○		
			3	SS	19		232		○		4 85 11 (SI+CL)
230.7	Loose		4	SS	8	▽	231		○		
3.5	Silty **SAND**, trace gravel, trace clay Dense Brown Wet										
229.3			5	SS	31		230		○		1 60 37 2
4.9	**SAND**, some silt Dense Brown to Grey Wet						229		○		
226.4			6	SS	35		228		○		
7.8	Silty **SAND**, trace gravel, some clay Dense Grey Moist		7	SS	40		227		○		
			8	SS	42		226		○		3 52 31 14
							225		○		

Continued Next Page

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-04 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 069.3 E 287 934.5 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.07 - 2021.04.07 LATITUDE 44.375434 LONGITUDE -79.711637 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page									
	Silty **SAND**, trace gravel, trace to some clay Compact to Dense Grey Wet						224			
			9	SS	13		223			
							222			
221.4			10	SS	37					
12.8	END OF BOREHOLE AT 12.8m. WATER LEVEL AT 3.5m DURING DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.									

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

$\frac{20}{15 \quad 5}$ (%) STRAIN AT FAILURE
$\frac{10}{}$

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Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No HMLP21-05 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 272.7 E 287 919.2 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.03.29 - 2021.03.29 LATITUDE 44.377264 LONGITUDE -79.711835 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
232.3	GROUND SURFACE										
0.0 / 231.8	**ASPHALT:** (450mm)						232				
0.5 / 231.2	**SAND**, some gravel, some silt Very Dense Brown Moist (FILL)		1	SS	56/ 0.150				○		
1.1	Silty **SAND**, trace gravel Dense Brown Moist (FILL)		2	SS	35		231		○		
230.0											
2.3	**SAND** and **SILT**, trace clay Loose to Compact Brown Wet		3	SS	4	▽	230		○		0 48 46 6
			4	SS	12		229		○		
			5	SS	24		228		○ ○		
226.7							227				
5.6	**SAND**, trace silt and clay Loose to Compact Brown to Grey Wet Augers grinding at 6.1m		6	SS	9		226		○		
			7	SS	5		225		○		0 97 3 (SI+CL) Possible disturbance due to drilling
			8	SS	14		224				Wet sand and blowback at 9.1m
222.3							223		○		

Continued Next Page

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-05 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 272.7 E 287 919.2 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.03.29 - 2021.03.29 LATITUDE 44.377264 LONGITUDE -79.711835 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
10.0	Silty **SAND**, trace clay Compact Grey Wet						222				
			9	SS	12		221		○		
			10	SS	10		220		○		
218.6							219				
13.7	END OF BOREHOLE AT 13.7m. BOREHOLE OPEN AND WATER LEVEL AT 2.4m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.5m, THEN ASPHALT COLD PATCH TO SURFACE.										

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No HMLP21-06 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 397.3 E 287 831.5 ORIGINATED BY OA

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.22 - 2021.04.22 LATITUDE 44.378384 LONGITUDE -79.712940 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.6	GROUND SURFACE										
0.0	**TOPSOIL:** (100mm)										
0.1	**SAND**, some silt, some gravel Loose Dark Brown Moist (FILL)		1	SS	8		230		○		
			2	SS	5				○		
	Grey Wet		3	SS	4		229		○		
228.4											
2.2	**SAND** and **SILT**, trace clay Compact Grey Wet		4	SS	12	▽	228		○		
			5	SS	15		227		○		0 48 51 1
226.5											
4.1	Silty **SAND**, trace clay Compact Grey Wet		6	SS	12		226		○		
			7	SS	12		225		○		
			8	SS	11		224		○		Drilling mud used below 7.0m 0 66 33 1
			9	SS	20		223		○		
220.6							222				
							221				

Continued Next Page

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

$\frac{20}{15}$ 5 $\frac{}{10}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-06 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 397.3 E 287 831.5 ORIGINATED BY OA

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.22 - 2021.04.22 LATITUDE 44.378384 LONGITUDE -79.712940 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
10.0	Continued From Previous Page										
	SILT, some clay, trace sand Compact Grey Wet						220				
			10	SS	11				○		0 9 80 11
							219				
217.8			11	SS	14		218		○		
12.8	END OF BOREHOLE AT 12.8m. WATER LEVEL AT 3.0m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.										

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

$\overset{20}{15\oplus 5}$ (%) STRAIN AT FAILURE
10

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THURBER

RECORD OF BOREHOLE No HMLP21-07 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 372.6 E 287 926.1 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.03.30 - 2021.03.30 LATITUDE 44.378163 LONGITUDE -79.711753 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
231.4	GROUND SURFACE								
0.0 / 231.1	**ASPHALT:** (320mm)								
0.3 / 230.0	**SAND**, some gravel Dense Brown Moist (FILL)		1	SS	36		231 230		
1.4 / 229.2	Silty **SAND**, some gravel Compact Brown Moist to Wet (FILL)		2	SS	16				
2.2 / 228.4	**SAND** and **SILT**, trace clay Compact Brown Moist to Wet		3	SS	22		229		
3.0 / 227.3	Loose		4	SS	8	▽	228		0 38 57 5
4.1			5	SS	17		227 226		Drilling mud used to advance the borehole
			6	SS	19		225 224		
			7	SS	13		223		Wet sand and blowback below 7.6m
			8	SS	4		222		Possible disturbance due to drilling

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-07 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 372.6 E 287 926.1 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.03.30 - 2021.03.30 LATITUDE 44.378163 LONGITUDE -79.711753 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SAND and **SILT**, trace clay Compact to Dense Grey Wet						221				
			9	SS	17				○		0 65 34 1
							220				
218.6			10	SS	35		219		○		
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN AND WATER LEVEL AT 3.8m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.										

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

$\frac{20}{15 \quad 5}$ (%) STRAIN AT FAILURE
$\frac{10}{}$

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Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No HMLP21-08 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 511.0 E 287 959.6 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.06 - 2021.04.06 LATITUDE 44.379410 LONGITUDE -79.711336 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.9	GROUND SURFACE										
0.0 / 230.6	**ASPHALT:** (250mm)										
0.3 / 229.5	**SAND**, some gravel, trace to some silt Compact Brown Moist (FILL)		1	SS	20		230	○	○		
1.4 / 228.3	Silty **SAND**, some gravel, trace clay Compact Brown to Grey Moist to Wet (FILL) Layer of topsoil and organics at 2.4m (100mm thick)		2 3	SS SS	12 10		229	○	○		
2.6 / 226.8	Clayey **SILT**, some sand, trace gravel, occasional rootlets Stiff Grey Wet (FILL)		4	SS	9		228	⊢○⊣			2 13 69 16
4.1	Clayey **SILT**, trace sand Hard Grey Wet		5	SS	33		227 226	○			
	Occasional interbedded sand layers		6	SS	31		225 224	○			
	Stiff		7	SS	9		223	○			
	Very Stiff		8	SS	26		222 221	○			0 4 80 16

Continued Next Page

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

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-08 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 511.0 E 287 959.6 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.06 - 2021.04.06 LATITUDE 44.379410 LONGITUDE -79.711336 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	Clayey **SILT**, sandy Hard to Very Stiff Grey Wet										
			9	SS	41		220		○		
							219				
218.1			10	SS	17				⊣		0 29 57 14
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.										

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-09 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 665.1 E 288 012.4 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.06 - 2021.04.06 LATITUDE 44.380798 LONGITUDE -79.710678 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
231.7	GROUND SURFACE										
0.0	**ASPHALT:** (165mm)										
0.2	**SAND**, some gravel, some silt Compact Brown Moist (FILL)		1	SS	24		231		○		
230.3											
1.4	Silty **SAND** Compact Grey Wet (FILL)		2	SS	25		230		○		
			3	SS	28	▽	229		○		
228.8	Occasional woodchips										
2.9	**SAND** and **SILT**, trace clay Compact Grey Wet		4	SS	15		228		○		
			5	SS	11		227		○		
			6	SS	20		226		○		0 53 45 2
224.5							225				Drilling mud used below 7.0m depth
7.2	Clayey **SILT**, some sand Stiff to Very Stiff Grey Wet		7	SS	15		224		○		No sample recovery
	Interbedded layer of sand and silt		8	SS	26		223		○		
							222				

Continued Next Page

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

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-09 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 665.1 E 288 012.4 ORIGINATED BY GF

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.04.06 - 2021.04.06 LATITUDE 44.380798 LONGITUDE -79.710678 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Clayey **SILT**, trace to some sand Very Stiff Grey Wet										
			9	SS	23		221		○		
220.0											
11.7	**SILT**, trace sand, trace clay Dense Grey Wet						220				
			10	SS	42				○		0 4 89 7
218.9							219				
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN AND WATER LEVEL AT 2.4m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.2m THEN ASPHALT COLD PATCH TO SURFACE.										

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP20-10 1 OF 2 METRIC

GWP# 2504-17-00 LOCATION N 4 915 802.5 E 288 066.4 ORIGINATED BY JM

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2020.04.02 - 2020.04.02 LATITUDE 44.382036 LONGITUDE -79.710005 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
232.3	GROUND SURFACE										
0.0	**ASPHALT:** (200mm)										
0.2 / 231.7	**SAND**, trace to some silt, trace to some gravel Brown Moist (FILL)		1	GS			232				
0.6	Silty **SAND**, some gravel, trace clay Compact Brown Moist (FILL)		2	SS	25		231				
230.1	Layer of silty sand fill mixed with organics at 1.9m (250mm)		3	SS	27						
2.2	Silty **CLAY**, trace sand Firm Brown Moist		4	SS	7		230				
228.6			5	SS	6		229				0 1 79 20
3.7	**SAND** and **SILT**, trace clay Compact Grey Wet		6	SS	11	▽	228				
			7	SS	19						Drilling mud used below 4.6m depth 0 53 44 3
	Clayey zone		8	SS	12		227				
225.1							226				
7.2	**SILT**, some clay, trace to some sand Compact Grey Wet		9	SS	14		225				
							224				
			10	SS	11		223				
222.3											

Continued Next Page

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

15 20 10 5 (%) STRAIN AT FAILURE

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Ontario

THURBER

RECORD OF BOREHOLE No HMLP20-10 2 OF 2 METRIC

GWP# 2504-17-00 LOCATION N 4 915 802.5 E 288 066.4 ORIGINATED BY JM

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2020.04.02 - 2020.04.02 LATITUDE 44.382036 LONGITUDE -79.710005 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
10.0	Clayey **SILT**, some sand Stiff Grey Wet						222				
			11	SS	9				⊳|		0 16 71 13
220.6							221				
11.7	**SILT**, some sand, some clay Compact Grey Wet						220		○		
			12	SS	14						
							219				
			13	SS	17				○		
218.0							218				
14.3	END OF BOREHOLE AT 14.3m. BOREHOLE CAVED-IN TO 8.5 m. WATER LEVEL OBSERVED AT 3.8 m DURING DRILLING. BOREHOLE BACKFILLED WITH AUGER CUTTINGS TO 2.3 m, BENTONITE HOLEPLUG TO 0.5 m, CEMENT TO 0.15m, THEN ASPHALT PATCH TO SURFACE.										

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

$\frac{20}{15 \quad 5}$ (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No HMLP21-11 1 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 879.9 E 288 159.5 ORIGINATED BY ES

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.11.18 - 2021.11.18 LATITUDE 44.382735 LONGITUDE -79.708840 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
230.7	GROUND SURFACE										
0.0	**ASPHALT:** (80mm)										
0.1	**SAND**, some gravel Compact Brown Moist (FILL)		1	SS	24		230		○		
230.1 0.6	**SAND**, some silt, trace gravel, trace clay Dense Brown Moist (FILL)		2	SS	33	▽			○		2 80 16 2
229.3 1.4	**SAND**, some silt, trace clay Compact to Dense Brown Moist		3	SS	26		229		○		
	Wet		4	SS	33		228		○		
			5	SS	11		227		○		Wet sand and blowback inside the augers at 3.0m
			6	SS	24		226		○		0 89 10 1
			7	SS	36		225		○		
			8	SS	18		224		○		
			9	SS	31		223		○		0 83 16 1
							222				
							221				

Continued Next Page

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

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HMLP21-11 2 OF 2 METRIC

GWP# 2128-18-00 LOCATION High Mast Lighting Pole, NAD83-10 N 4 915 879.9 E 288 159.5 ORIGINATED BY ES

DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2021.11.18 - 2021.11.18 LATITUDE 44.382735 LONGITUDE -79.708840 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page							20 40 60 80 100	20 40 60		
	SAND, some silt, trace clay Dense Grey Moist						220		○		
			10	SS	41				○		
							219				
218.2			11	SS	21				○		
12.5 217.9	**SILT**, trace sand Compact Grey Moist						218				
12.8	END OF BOREHOLE AT 12.8m. WATER LEVEL AT 1.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.2m, THEN ASPHALT TO SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

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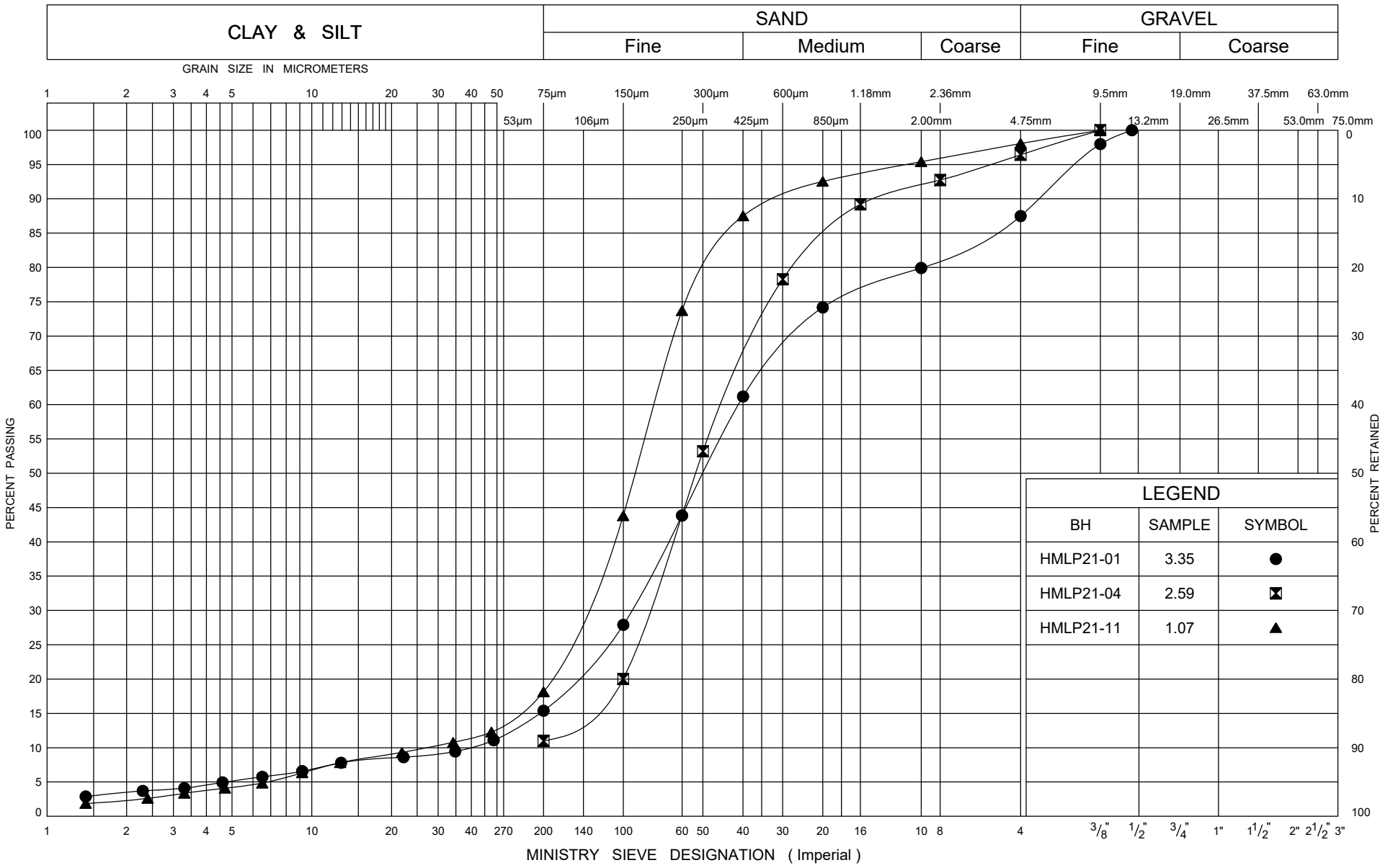
Appendix B

Geotechnical Laboratory Test Results



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Ontario

GRAIN SIZE DISTRIBUTION

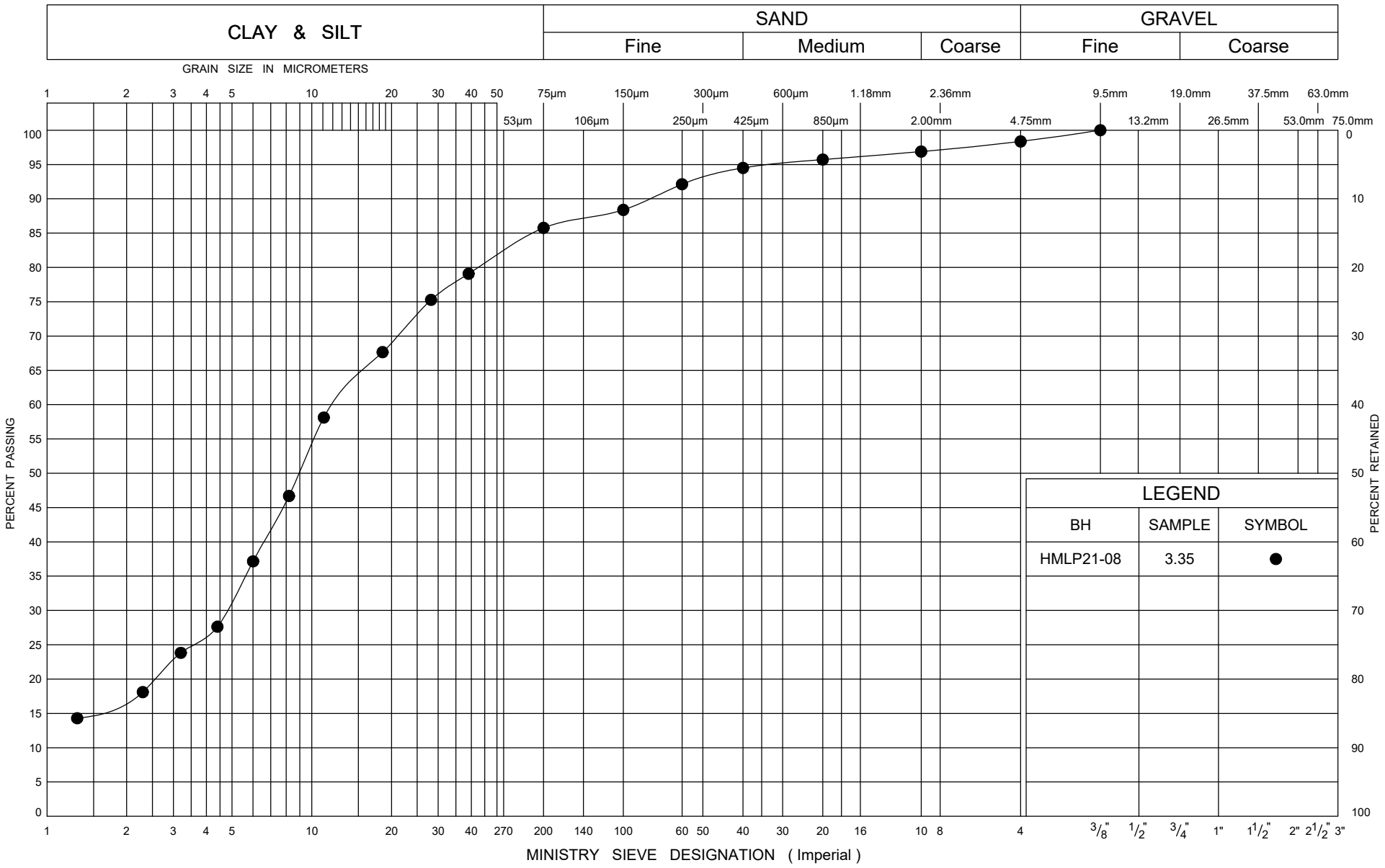
SAND to SAND and SILT FILL

FIG No B1

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22



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GRAIN SIZE DISTRIBUTION

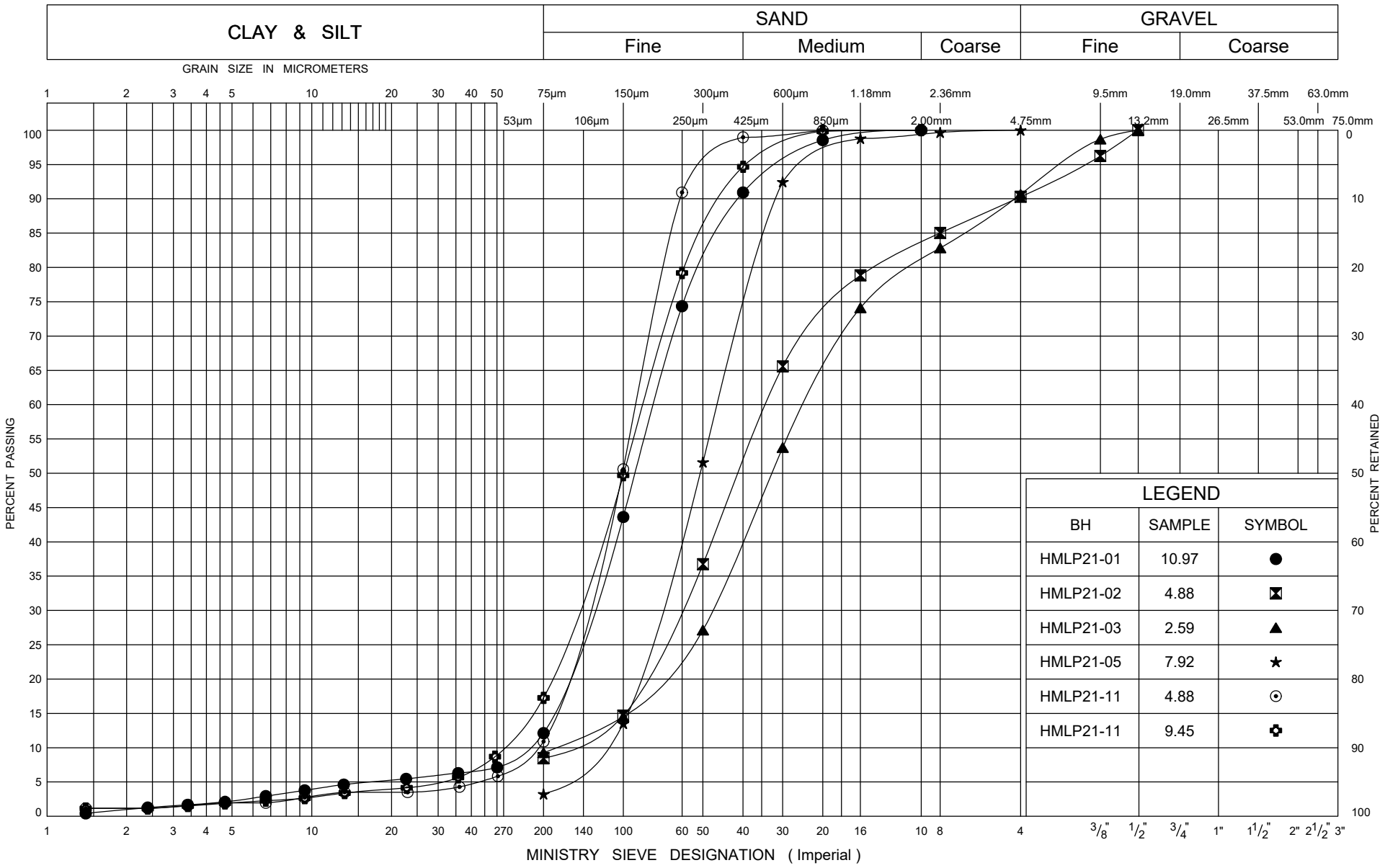
Clayey SILT FILL

FIG No B2

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 6/21/21



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GRAIN SIZE DISTRIBUTION

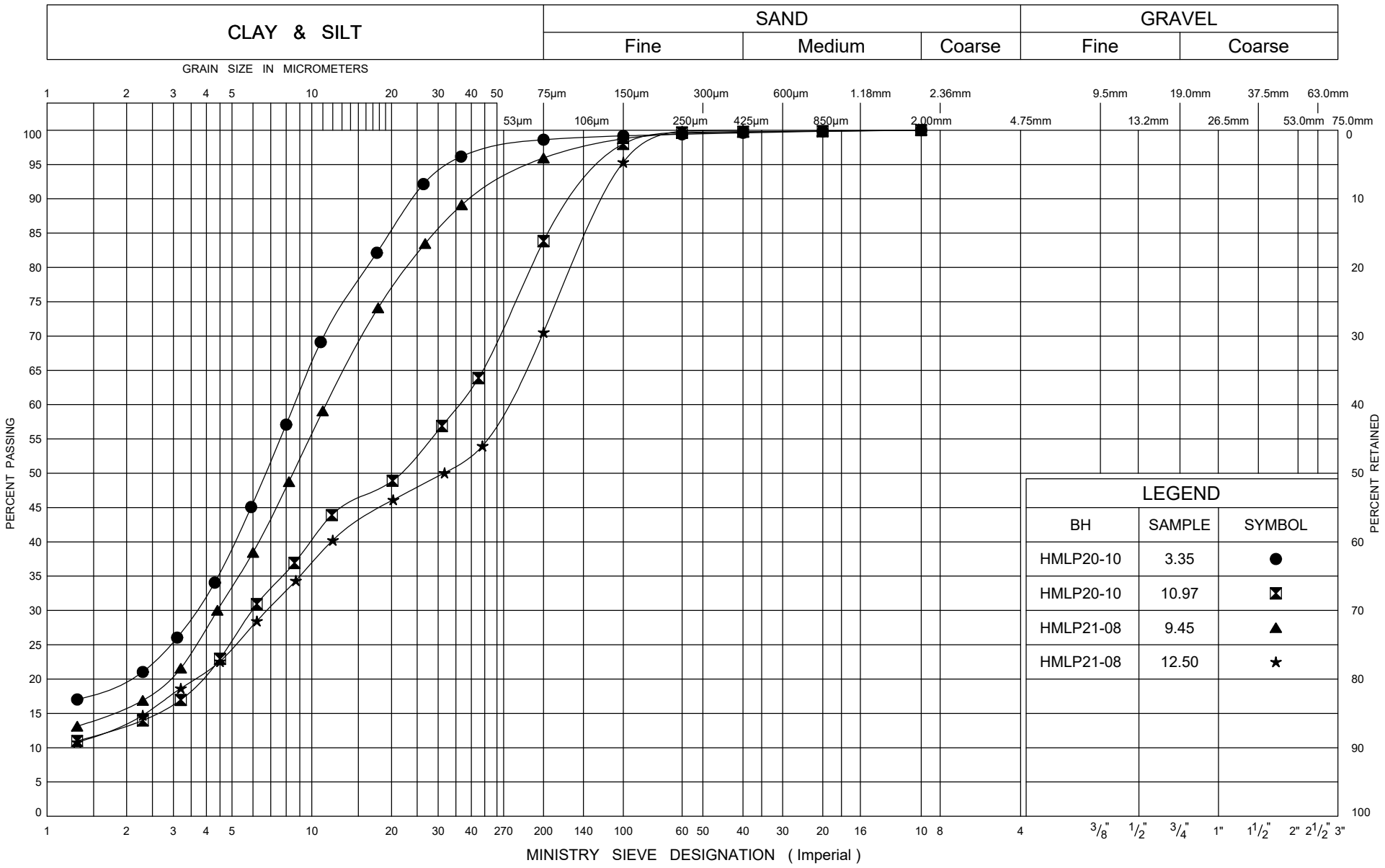
SAND

FIG No B3

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22



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GRAIN SIZE DISTRIBUTION

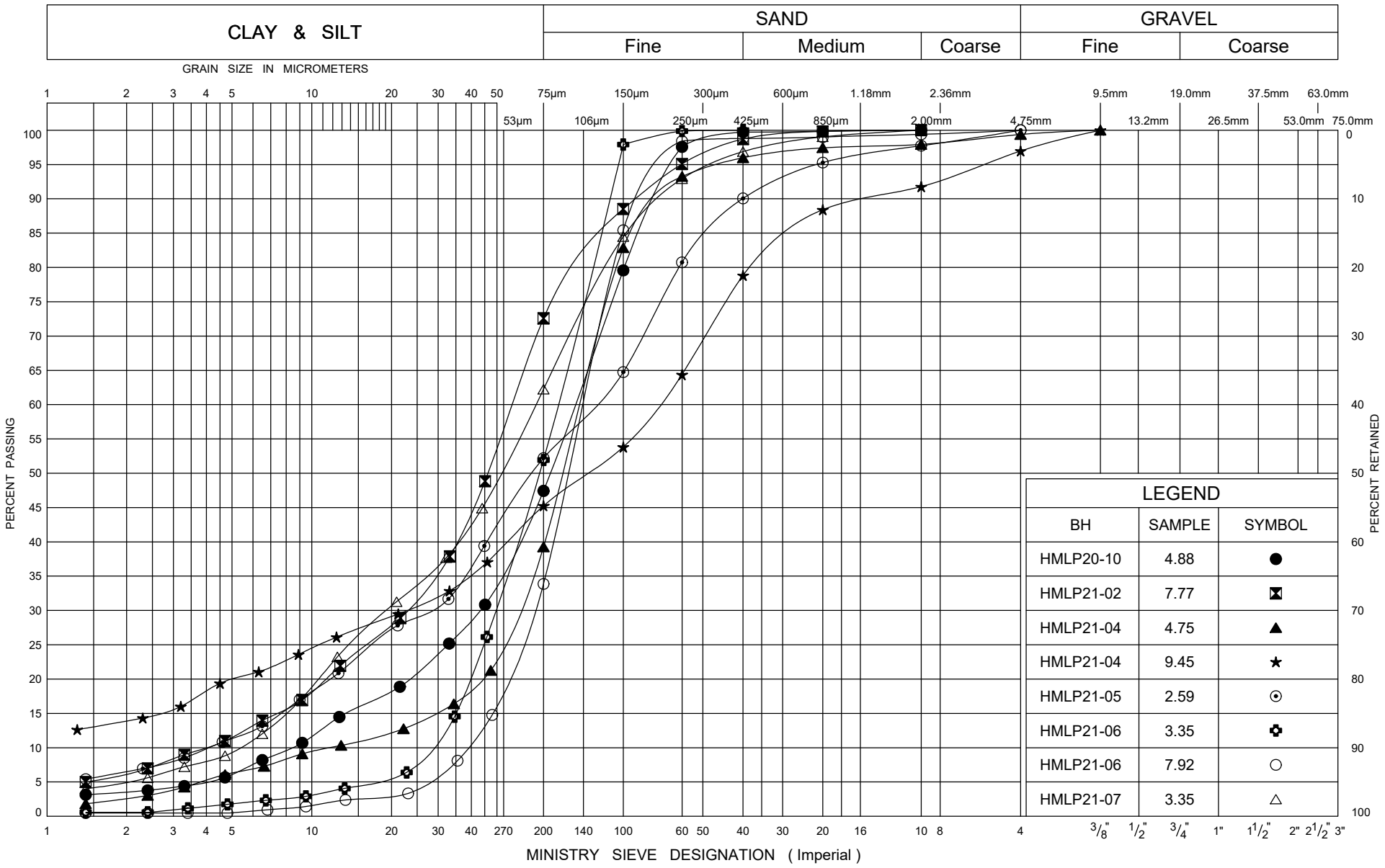
Clayey SILT / Silty CLAY

FIG No B4

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22



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GRAIN SIZE DISTRIBUTION

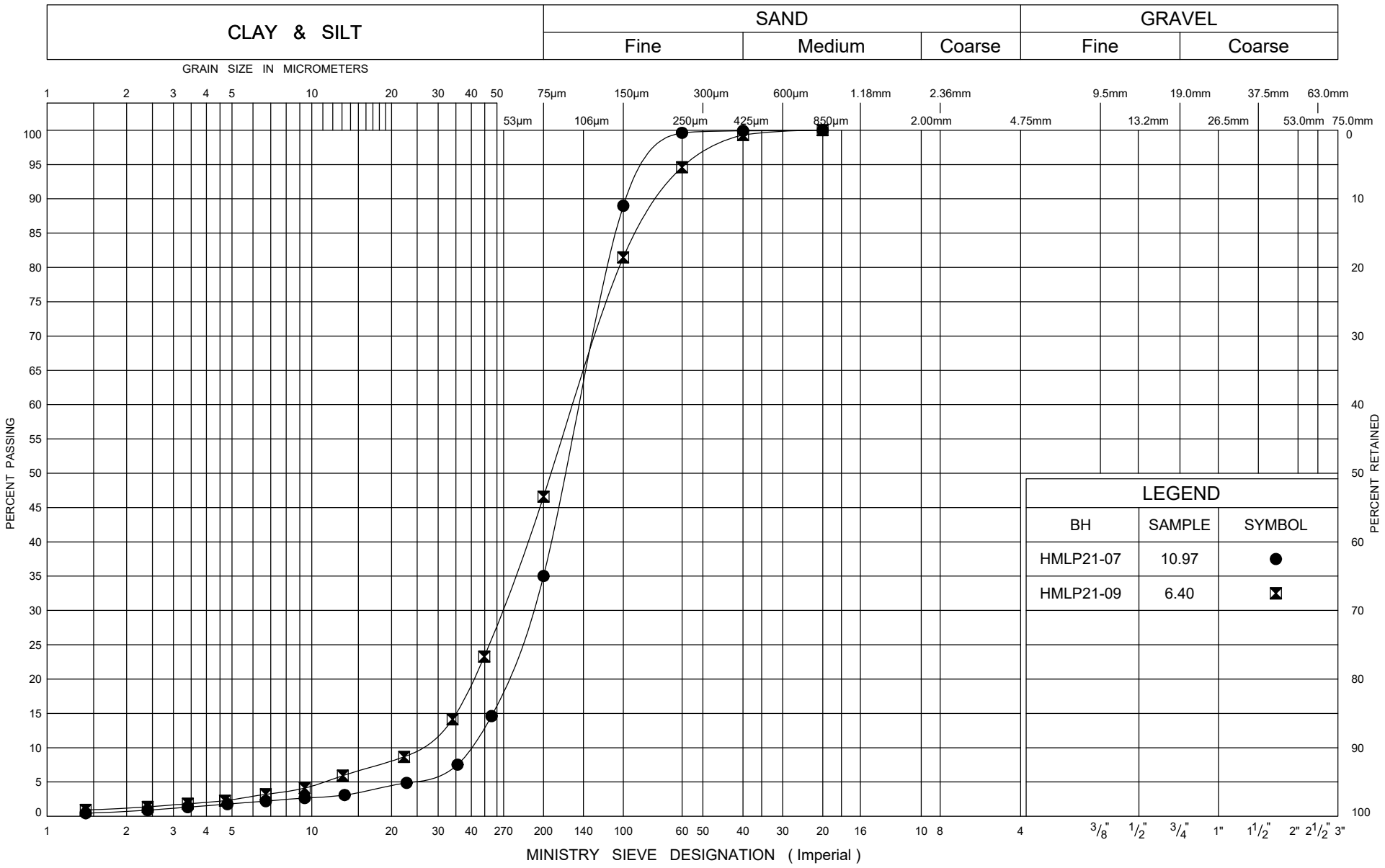
Silty SAND / SAND and SILT

FIG No B5

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22



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GRAIN SIZE DISTRIBUTION

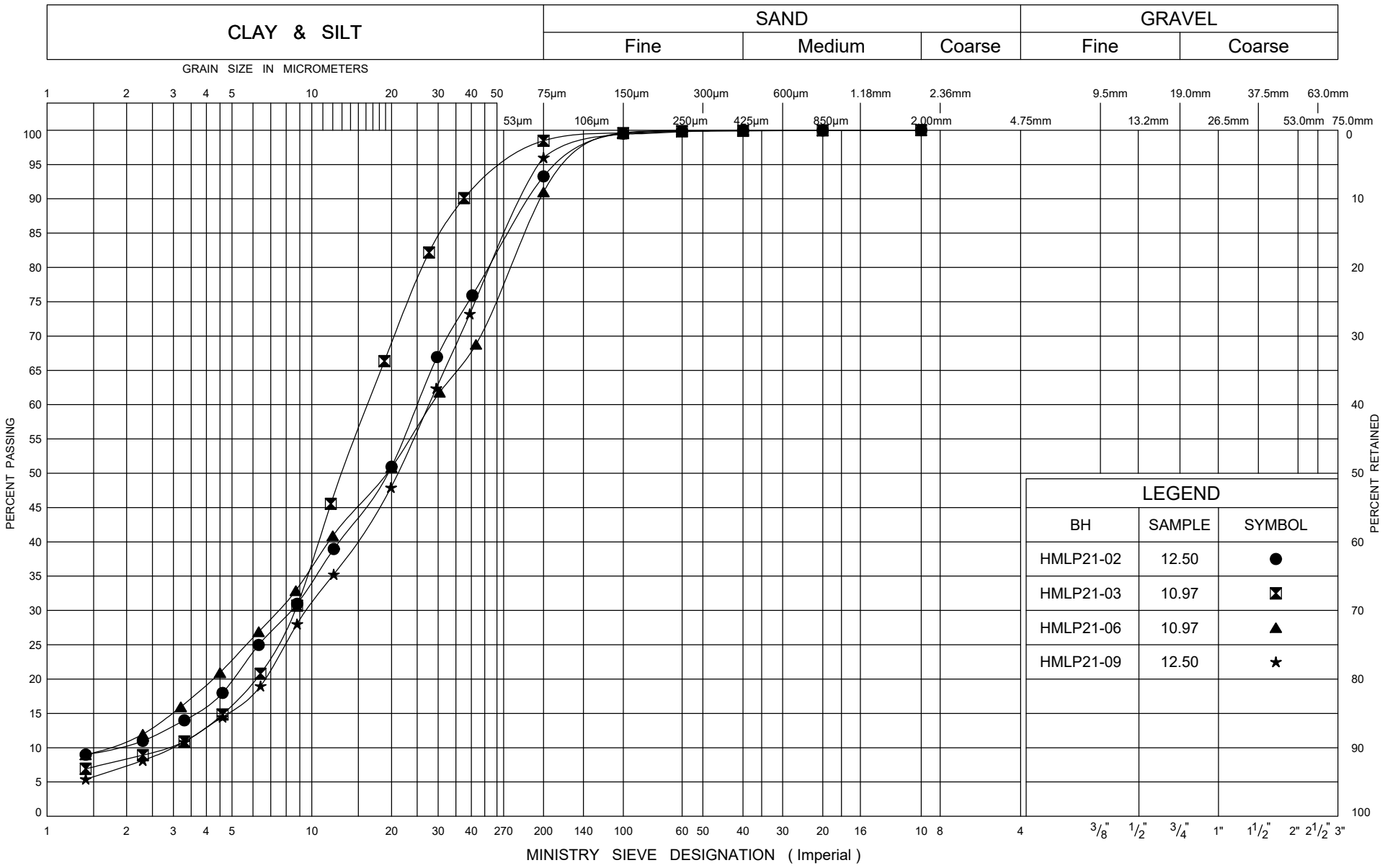
Silty SAND / SAND and SILT

FIG No B6

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22



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Ontario

GRAIN SIZE DISTRIBUTION

SILT

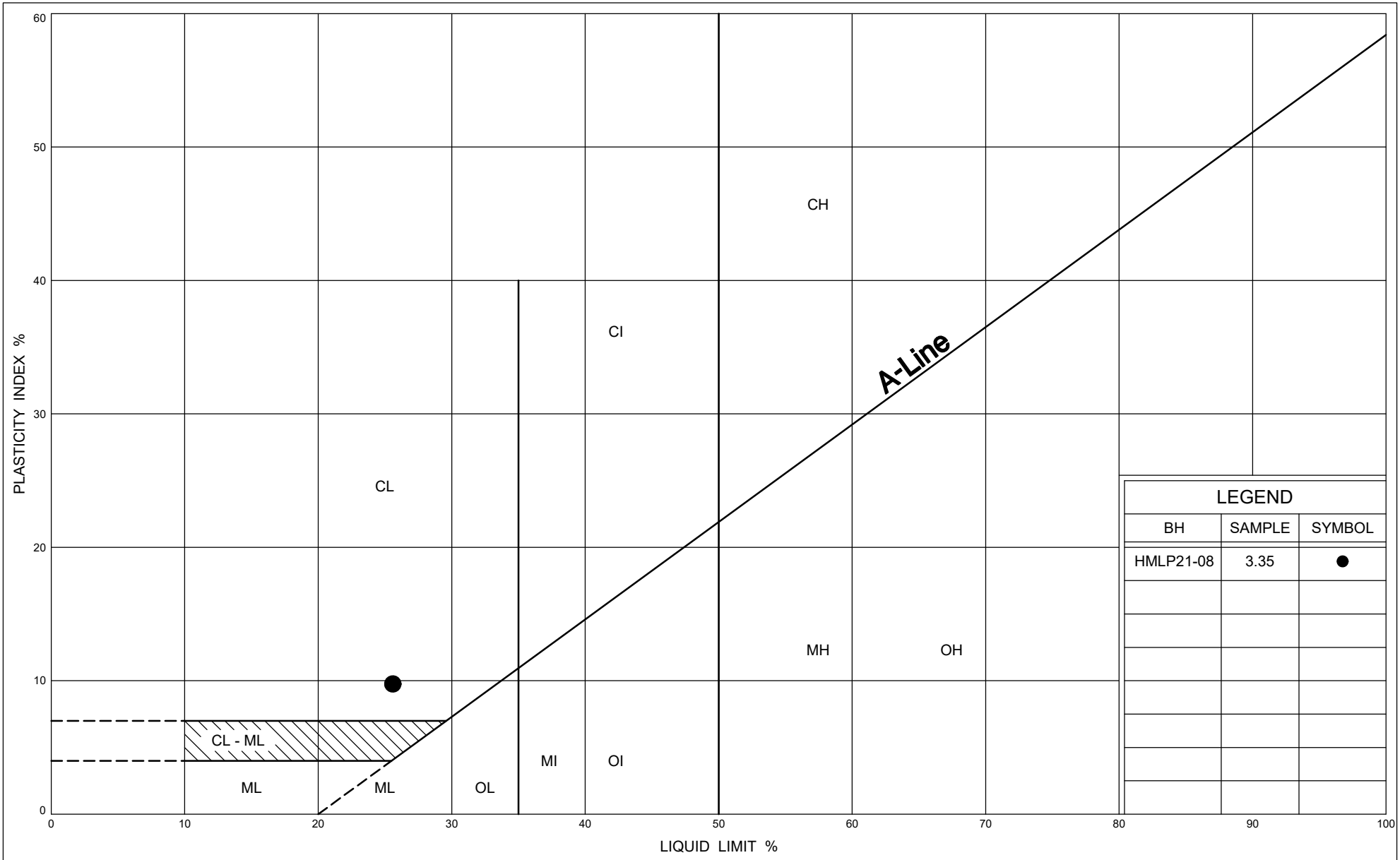
FIG No B7

W P 2128-18-00

High Mast Lighting Pole

ONTARIO MOT GRAIN SIZE 3 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART 2 MTO-22424.GPJ ONTARIO MOT.GDT 6/24/21

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PLASTICITY CHART

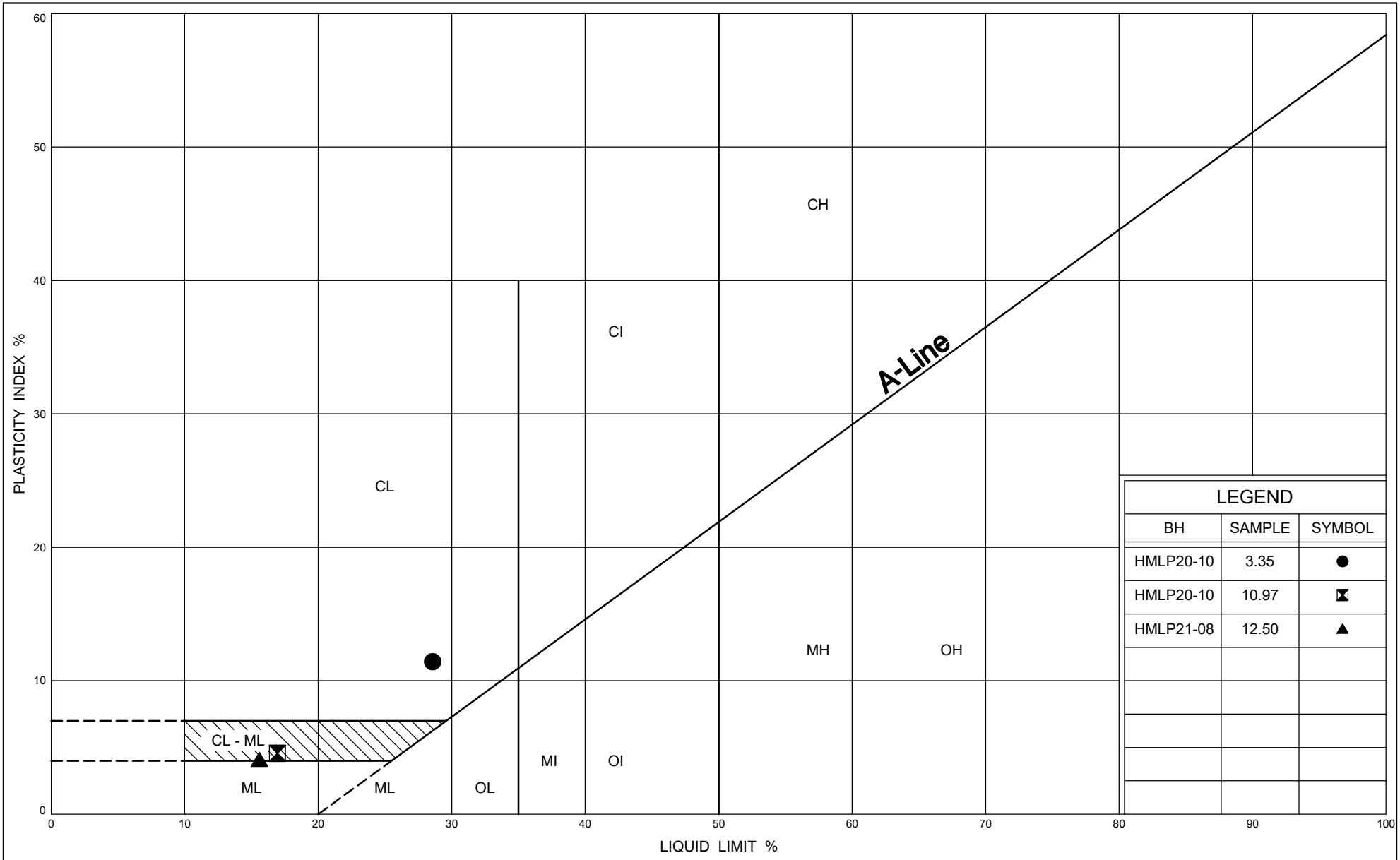
Clayey SILT FILL

FIG No B8

W P 2128-18-00

High Mast Lighting Pole

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART 2 MTO-22424.GPJ ONTARIO MOT.GDT 4/21/22

Ministry of Transportation
Ontario

PLASTICITY CHART

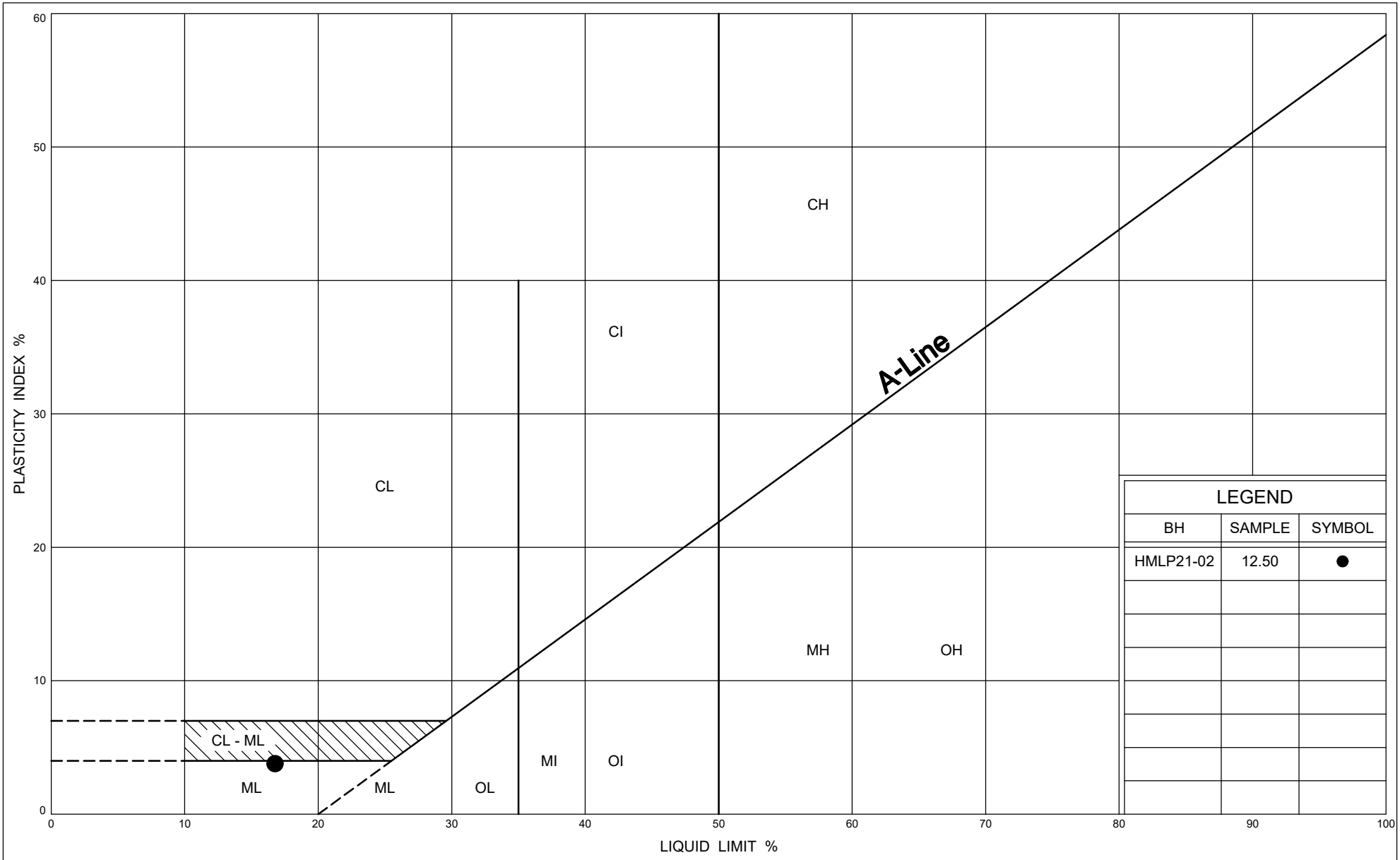
Clayey SILT / Silty CLAY

FIG No B9

W P 2128-18-00

High Mast Lighting Pole

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART 2 MTO-22424.GPJ ONTARIO MOT.GDT 7/6/21

Ministry of Transportation
Ontario

PLASTICITY CHART

SILT

FIG No B10

W P 2128-18-00

High Mast Lighting Pole

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Appendix C

Borehole Locations Drawing

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 2128-18-00

SHEET

HIGHWAY 400
HIGH MAST LIGHTING POLES
NEAR DUNLOP STREET WEST
BOREHOLE LOCATIONS

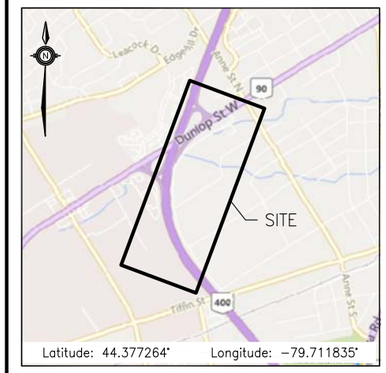
McINTOSH PERRY

THURBER ENGINEERING LTD.

PLAN

80 0 80 160m

SCALE 1:4000



Latitude: 44.377264° Longitude: -79.711835°

KEYPLAN

	LEGEND
	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
HMLP20-10	232.3	4 915 802.5	288 066.4
HMLP21-01	240.8	4 914 665.9	288 169.2
HMLP21-02	237.2	4 914 788.8	288 068.4
HMLP21-03	235.1	4 914 919.2	287 991.8
HMLP21-04	234.2	4 915 069.3	287 934.5
HMLP21-05	232.3	4 915 272.7	287 919.2
HMLP21-06	230.6	4 915 397.3	287 831.5
HMLP21-07	231.4	4 915 372.6	287 926.1
HMLP21-08	230.9	4 915 511.0	287 959.6
HMLP21-09	231.7	4 915 665.1	288 012.4
HMLP21-11	230.7	4 915 879.9	288 159.5

-NOTES-

1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
3) Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 31D-823

LICENSED PROFESSIONAL ENGINEER
S. PANG
35314509
2023/05/19
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
2023/05/19
PROVINCE OF ONTARIO

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	RPR	CHK	SKP	CODE	LOAD
DRAWN	AN	CHK	RPR	SITE	STRUCT

DATE MAY 2023
DWG 1

FILENAME: H:\Drafting\22000\22424\TES-22424-PLPP-HMLP21.dwg
PLOTDATE: 5/23/2023 1:16 PM

THURBER

Appendix D

List of Special Provisions
and
Suggested Text for NSSP

THURBER

List of Special Provisions Referenced in this Report

- OPSS.PROV 903 (Construction Specification for Deep Foundations)

Suggested Text for NSSP on:

"Augered Caisson Construction for High Mast Lighting Pole Support Foundations"

The Contractor is advised that variable types of subsurface materials may be encountered at the locations of the HMLP support foundations. For additional information regarding subsurface conditions, the Contractor is referred to the Foundation Investigation Report.

For bidding purposes, the Contractor shall assume the following:

1. The subsurface conditions at an augered caisson location are the same as those encountered in the borehole closest to the subject caisson location.

2. Obstructions including rubble, possible cobbles and boulders may be present within the embankment fills, where very dense conditions were noted at some locations. The native soil deposits generally increase in strength with depth and contain dense zones. Augering through these deposits will be difficult.

   Caisson installation equipment must be able to dislodge, handle, remove or otherwise penetrate any obstructions and hard/dense layers.

3. Water seepage and/or soil sloughing into the caisson hole will occur from existing fill and cohesionless soils. The cohesionless soils will be susceptible to instability (basal and sidewall) under conditions of unbalanced hydrostatic head, and therefore water supply shall be made available on site to maintain a balancing water/synthetic slurry head inside the caisson hole. Temporary liners shall be available on site to support the caisson sidewalls and provide partial seepage cut-off. If a cave-in or basal instability condition is encountered, consideration should be given to advancing the temporary liner ahead of excavating/augering and using the water/synthetic slurry method to minimize disturbance at the base and the sides of the caisson foundation. Should it be impractical to remove accumulated water/slurry in the caisson hole, the pumped tremie technique should be used to place the concrete.

The Contractor is responsible for constructing all the HMLP support foundations without disturbing the materials at the sides or bases of the foundations.