THURBER ENGINEERING LTD.

PRELIMINARY FOUNDATION INVESTIGATION REPORT
HIGHWAY 401 WIDENING, HIGHWAY 16 TO MAITLAND ROAD
MERWIN LANE UNDERPASS, SITE NO. 16X-0166
GWP 4024-20-00 / ASSIGNMENT NO. 4019-E-0010.2

SITE NO. 16X-0166/B0

Geocres No.: 31B-110

Report to:

MTO c/o AECOM Canada Ltd.

Latitude: 44.716807°
Longitude: -75.541920°

September 2023
Thurber File No.: 29381

104, 2460 Lancaster Road, Ottawa ON K1B 4S5 T. 613 247 2121 F. 613 247 2185
thurber.ca

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PART 1. FACTUAL INFORMATION

1 INTRODUCTION

Thurber Engineering Ltd. (Thurber) has been retained by AECOM Canada Ltd. (AECOM) on behalf of the Ministry of Transportation Ontario (MTO) under Assignment No. 4019-E-0010, Work Item No. 2, to carry out Foundation Investigations to support the Preliminary Design and Environmental Assessment for the widening of Highway 401 from Highway 16 to Maitland Road. The overall scope of work comprises replacement or rehabilitation of 14 existing structures, including 10 bridges and four structural culverts.

This report addresses the Highway 401 Underpass at Merwin Lane (Site 16X-0166/B0), located approximately 1.5 km west of the town of Prescott in the Township of Augusta within the Leeds and Grenville County, Ontario.

This section of the report presents the factual findings obtained from a foundation investigation completed at the site and was informed by existing subsurface information pertinent to the site, obtained from the MTO's Foundation Library (Geocres No. 31B00-002).

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, provide a borehole location plan, records of boreholes, a stratigraphic profile, laboratory test results, and a written description of the subsurface conditions. A model of the subsurface conditions influencing design and replacement of the structure was developed in the course of the current investigation.

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

2 BACKGROUND AND SITE DESCRIPTION

2.1 General

Merwin Lane crosses over Highway 401 approximately 1.5 km west of the community of Prescott, Ontario. For project orientation purposes, Merwin Lane will be described as oriented north-south and Highway 401 as oriented east-west.

The existing structure carries two through lanes of Merwin Lane traffic over Highway 401. Steel bridge railings integrated into concrete curbs are present along the east and west edges of the structure deck. W-beam guiderails supported on wooden posts are present at all four quadrants and extend up to 34 m behind the abutments. The embankment side slopes are inclined at approximately 2.0H:1V, and the forward slopes beneath the abutments are inclined at approximately 2.0H:1V to 2.2H:1V and are protected with concrete slope paving. All embankment side slopes are vegetated with grasses, shrubs, and small trees. No signs of instability of the embankments were noted during the field investigation.

At the site, Highway 401 consists of two through lanes in each direction. The outside and median shoulders are fully paved and delineated with jersey barriers and W-beam guiderails. In the area of the structure the Highway 401 median is more than 18 m wide from shoulder to shoulder. Beyond the site, approximately 80 m north and south of Merwin Lane, the eastbound and westbound lanes of Highway 401 are separated by a grass median.

The site is in a semi-rural setting, and the area directly adjacent is undeveloped land with a mix of cleared private properties and densely vegetated areas with deciduous trees and shrubs. Overhead utility lines parallel Merwin Lane near the southbound embankment toe, and a utility pole is also present at the southbound embankment approximately 20 m from the south abutment. The terrain along the ditch line is relatively rugged in the vicinity of the site. Storm water drainage in the area is to roadside ditches.

Photographs showing general conditions in the project area at the time of the field investigation are presented in Appendix D.

2.2 Site Geology

Based on published geological information in *The Physiography of Southern Ontario* by Chapman and Putnam (1984) and the Ontario Geological Survey maps (MRD228), the site lies on the border of the physiographic regions known as the Smith's Falls Limestone Plain and the Edwardsburg Sand Plain. The Smith's Falls Limestone Plain is characterized by typically shallow bedrock but includes a few localized deep areas of highly variable soils consisting of clays, sands, and gravels. The Edwardsburg Sand Plain is characterized by slightly undulating sand plain of glaciofluvial origin. The rock strata in both areas are generally composed of limestone, dolostone, and calcareous sandstone.

The Ontario Geological Survey maps (MRD126) suggest the site is underlain by dolostone and sandstone. Map P.2495[i] indicates that the bedrock in the project area is from the March Formation of the Beekmantown Group, and consists of interbedded sandstone, dolostone, sandy dolostone, and dolomitic sandstone.

2.3 Geocres Report 31B00-002

The historic foundation report for this site is based on a field investigation completed in 1964 prior to the construction of the existing underpass. The field investigation included a total of ten boreholes and four penetration tests. As bedrock was encountered at very shallow depth, no samples were taken, no laboratory tests were performed and no borehole logs were included in

the report. The stratigraphic plots indicate a compact sand and gravel fill over bedrock. The fill thickness was a maximum of 1.2 m.

Information from Geocres Report 31B00-002 has been utilized herein only to establish general context.

3 SITE INVESTIGATIONS AND FIELD TESTING

A site investigation and field-testing program was carried out between November 21 and December 7, 2022, and consisted of three boreholes: one behind each abutment on Merwin Lane (Boreholes 166-22-01 and 166-22-02), and one within the Highway 401 median (Borehole 166-22-03). The boreholes were advanced using a truck mounted CME 55 drill rig equipped with hollow stem augers, NW casing, and NQ coring equipment. Thurber contacted Ontario One Call in advance of the field investigation to obtain utility locates/clearances in the vicinity of the borehole locations. In addition, MTO was contacted to obtain the location of electrical and fibre optic utilities within the project limits.

The borehole coordinates, elevations, and termination depths are provided below in Table 3-1. The as-drilled elevations of all boreholes were surveyed by Thurber with a Trimble Catalyst DA1 antenna with centimeter accuracy. The elevations were surveyed relative to available MTO benchmarks and existing site features and were cross-referenced with elevations on the original design drawings. The borehole coordinates and elevations are shown on the Borehole Location and Soil Strata Drawings in Appendix A and on the individual Record of Borehole sheets included in Appendix B. The borehole coordinates are referenced to MTM Zone 9.

Table 3-1: Borehole Summary

Borehole No.	Drilled Location	Northing (Latitude)	Easting (Longitude)	Ground Surface Elevation (m)	Termination Depth (m)
162-22-01	South Abutment (Existing Alignment)	4 953 390.3 (44.716495º)	380 729.8 (-75.541615º)	100.3	9.5
162-22-02	North Abutment (Existing Alignment)	4 953 452.5 (44.717059º)	380 694.2 (-75.542054º)	101.0	10.8
162-22-03	Pier (Proposed)	4 953 424.4 (44.716803º)	380 726.7 (-75.541649º)	94.3	4.4

Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Tests (SPT) in general accordance with ASTM D 1586. The boreholes were advanced to depths ranging from 4.4 m to 10.8 m (base elevation 90.8 m to 89.8 m). Coring was required to advance the boreholes through cobbles and boulders in the glacial till and into the underlying bedrock. A standpipe piezometer was installed in Borehole 166-22-02 to allow for measurement of the groundwater level after drilling. The details for the standpipe piezometer are illustrated on the Record of Borehole sheet provided in Appendix B.

The drilling and sampling operations were supervised on a full-time basis by a member of Thurber's technical staff. The drilling supervisor logged the boreholes and processed the recovered soil and rock samples for transport to the Thurber's Ottawa laboratory for further examination and testing.

Following completion of the field investigation, Boreholes 166-22-01 and 166-22-03 were decommissioned in general accordance with MOE requirements (O.Reg. 903, as amended) and capped with cold patch asphalt to reinstate the pavement surface. The standpipe piezometer at Borehole 166-22-02 was decommissioned in accordance with MOE requirements on April 26, 2023.

4 LABORATORY TESTING

Geotechnical laboratory testing carried out as part of the current investigation included natural moisture content determination and visual identification of all retained soil samples. Testing for grain size distribution and Atterberg Limits was also carried out on selected samples to MTO and ASTM standards. All rock cores were photographed and their total core recovery (TCR), solid core recovery (SCR) and rock quality designation (RQD) were measured. One Unconfined Compressive Strength (UCS) Test was conducted on a recovered core sample from Borehole 166-22-02.

The results of the geotechnical tests are summarized on the Record of Borehole sheets included in Appendix B and all laboratory test results are presented on the figures included in Appendix C.

5 GENERAL DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix B and on the Borehole Location and Soil Strata Drawing included in Appendix A. A general description of the stratigraphy, based on the conditions encountered in the boreholes, is given in the following sections. However, the factual data presented on the Record of Borehole sheets takes precedence over this general description for interpretation of the site conditions. It must be recognized that the soil and groundwater conditions will vary between and beyond borehole locations. Soil classification is in accordance with ASTM D2487. Description of cohesive soils and secondary components are described as outlined in the MTO Guideline for Foundation Engineering Services Manual (April 2022).

In general, the encountered stratigraphy consisted of granular fill over a native deposit of glacial till composed of silty sand to sandy silt. The glacial till is, in turn, underlain by dolostone bedrock.

5.1 Surficial Pavement

Boreholes 166-22-01 and 166-22-02 were advanced through the Merwin Lane road surface and encountered 100 mm of asphalt overlying 100 mm to 150 mm of concrete. Borehole 166-22-03 was advanced through the Highway 401 median and encountered 150 mm of asphalt.

5.2 Fill

Upper Sand and Gravel Fill

Sand and gravel fill containing some fines was encountered beneath the pavement structure at all borehole locations. The granular fill layer ranged in thickness from about 0.8 m at the Highway 401 median (Borehole 166-23-03) to between 1.3 m and 1.4 m along the existing Merwin Lane (Boreholes 166-23-01 and 166-23-02). SPT N-values in the sand and gravel ranged from 31 to greater than 100 blows per 0.3 m of penetration, indicating a generally dense relative density.

The recorded moisture content of three samples of the sand and gravel fill ranged from 3 to 11%. The results of gradation analyses completed on two samples of the sand and gavel fill are illustrated on Figure C1 of Appendix C. The results of the test are summarized below and on the Record of Borehole sheets in Appendix B.

Soil Particle	Percentage (%)
Gravel	36 – 44
Sand	41 – 48
Silt	15 – 16
Clay	

Embankment Fill

Beneath the sand and gravel fill in Borehole 166-22-02, a layer of sand fill containing some fines and approximately 3.8 m thick was encountered (base elevation 95.5 m). SPT N-values in the sand fill ranged from 20 to 54 blows per 0.3 m of penetration, indicating a compact to very dense relative density.

The recorded moisture content of samples of the sand fill ranged from 5 to 14%. The results of a gradation analysis completed on a sample of the sand fill are illustrated on Figure C2 of Appendix C. The results of the test are summarized below and on the Record of Borehole sheets in Appendix B.

Soil Particle	Percentage (%)
Gravel	0
Sand	89
Silt	11
Clay	

Beneath the sand and gravel fill in Borehole 166-22-01, a layer of silty sand fill containing some gravel and plastic fines was encountered. The silty sand fill was 2.3 m thick (base elevation 96.5 m). SPT N-values in the silty sand fill ranged from 11 to 36 blows per 0.3 m of penetration,

indicating a compact to dense relative density. The recorded moisture content of samples of the silty sand fill ranged from 8 to 10%.

5.3 Silty Sand (SC-SM) to Sandy Silt (ML) Glacial Till

A native deposit of glacial till was encountered below the embankment fill in Boreholes 166-22-01 and 166-22-02. The glacial till consists of silty sand to sandy silt with varying amounts of gravel and plastic fines. Cobbles and boulders were encountered within the deposit. The layer ranged in thickness from 1.9 m at Borehole 166-22-02 near the north abutment to about 2.1 m at Borehole 166-22-01 near the south abutment (base elevations of 93.6 m and 94.4 m, respectively). SPT N-values measured in the glacial till ranged from 18 to greater than 100 blows per 0.3 m of penetration, indicating a compact to dense relative density. SPTs met refusal in the deposit in Borehole 166-22-01 and could represent a cobble or a boulder within the layer. Coring was required to advance through the deposit at this location.

The recorded moisture content of samples of the glacial till ranged from 8 to 21%. The results of gradation analyses completed on two samples of the glacial till are illustrated on Figure C3 of Appendix C. The results of the tests are summarized below and on the Record of Borehole sheets in Appendix B.

Soil Particle	Percentage (%)	
Gravel	9 – 10	
Sand	24 – 45	
Silt	45	54
Clay		13

5.4 Bedrock

Bedrock was proven by coring in all three boreholes. At the boreholes put down through the existing Merwin Lane embankments, the depth to bedrock was 7.4 m and 5.9 m near the north and south abutments (elevations 93.6 m and 94.4 m), respectively. At the pier, the bedrock was encountered at a depth of 1.0 m below the existing Highway 401 median grade (elevation 93.3 m).

Bedrock outcrops near the existing right-of-way limits (likely exposed during the construction of Highway 401 and the existing Merwin Lane underpass) are visible in the vicinity of the proposed replacement structure abutment footprints. Point elevations of the exposed bedrock outcrop surfaces were obtained by Thurber personnel with a Trimble Catalyst DA1 antenna with centimeter accuracy during a site visit in April 2023.

South of Highway 401, the exposed bedrock was observed at elevations as high as 95.0 m, near the existing south abutment, and generally sloped nominally down to the east to elevations in the order of 93.1 m. North of Highway 401, the exposed bedrock was observed at elevations as high as 94.9 m, near the existing north abutment, and generally sloped nominally down to the east.

The natural bedrock surface may have been lowered, where exposed, during construction of the existing Highway 401 corridor.

The bedrock encountered consists of moderately weathered to fresh, fine- to medium-grained, grey dolostone interbedded with sandstone. In general, the discontinuities were rough, undulating bedding joints. Bedrock logs are provided in Appendix B and photographs of the bedrock cores are provided in Appendix C. The rock core quality and strength are summarized in Table 5-1.

Based on the RQD, the bedrock quality is classified as very poor to excellent (CFEM, 2006). The result of an unconfined compressive strength test (UCS) was 193 MPa, indicating that the tested sample of bedrock is very strong (CFEM, 2006). The results of the UCS testing are included in Appendix C.

Table 5-1: Bedrock Details

Parameter	Range
Total Core Recovery (TCR), %	45 – 100
Solid Core Recovery (SCR), %	21 – 91
Rock Quality Designation (RQD), %	13 – 91
Fracture Index (fractures per 0.3 m)(1)	0 – >10
Unconfined Compressive Strength (UCS)(2), MPa	193

Notes: (1) Indicated as "FI" on Borehole Logs
(2) Samples tested from Boreholes 166-22-02

5.5 Groundwater

A standpipe piezometer was installed in Borehole 166-22-02 to allow for measurement of the stabilized groundwater level. The measured groundwater levels are summarized in Table 5-2.

Table 5-2: Groundwater Level Observations

Borehole No.	Bottom of Screen Elev. (m)	Screened Unit	Depth (mbgs)[1]	Groundwater Elevation (m)	Date of Measurement
166-22-02	93.8	Glacial Till	6.2	94.8	December 18, 2022
			7.2	93.8	April 26, 2023

It should be noted that the values shown above are considered short-term readings and may not reflect groundwater levels at the time of construction, 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 and/or prolonged precipitation events.

6 MISCELLANEOUS

The borehole locations were selected by Thurber relative to existing site features. The as-drilled locations and ground surface elevations of the boreholes were surveyed by Thurber following completion of the field program. The elevation survey of the boreholes was carried out with reference to geodetic elevation benchmarks provided by the MTO or relative to structure feature elevations provided on as-built drawings. Eastern Ontario Diamond Drilling of Hawkesbury, Ontario supplied and operated the drilling equipment and carried out the drilling, soil sampling, in-situ testing, and borehole decommissioning. Traffic control and water supply were provided by T.G. Carroll Cartage Limited of Carp, Ontario.

The field work was supervised on a full-time basis by Ibrahim Khan, E.I.T., under the direction of Katya Walker, P.Eng. Routine geotechnical laboratory testing was completed by Thurber's laboratory in Ottawa, Ontario. Unconfined Compressive Strength Testing of the bedrock was carried out by Stantec's laboratory in Ottawa.

Overall project management and direction of the field investigation was provided by Matt Kennedy, P.Eng. Interpretation of the factual data and preparation of this report was carried out by A. de Oliveira, E.I.T and Matt Kennedy, P.Eng. The report was reviewed by Paul Carnaffan, P.Eng. and Fred Griffiths, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Anderson de Oliveira, EIT
Engineering Intern

LICENSED PROFESSIONAL ENGINEER
M. J. KENNEDY
100188946
Sept 8, 2023
PROVINCE OF ONTARIO

Matt Kennedy, M.Sc.(Eng.), P.Eng.
Senior Geotechnical Engineer

Paul Carnaffan, M.Eng., P.Eng.
Principal, Senior Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
F. J. GRIFFITHS
90360280
Sept 8, 2023
PROVINCE OF ONTARIO

Fred Griffiths, Ph.D., P.Eng.
MTO Review Principal,
Senior Geotechnical Engineer

REFERENCES

[i] http://www.geologyontario.mndm.gov.on.ca/index.html

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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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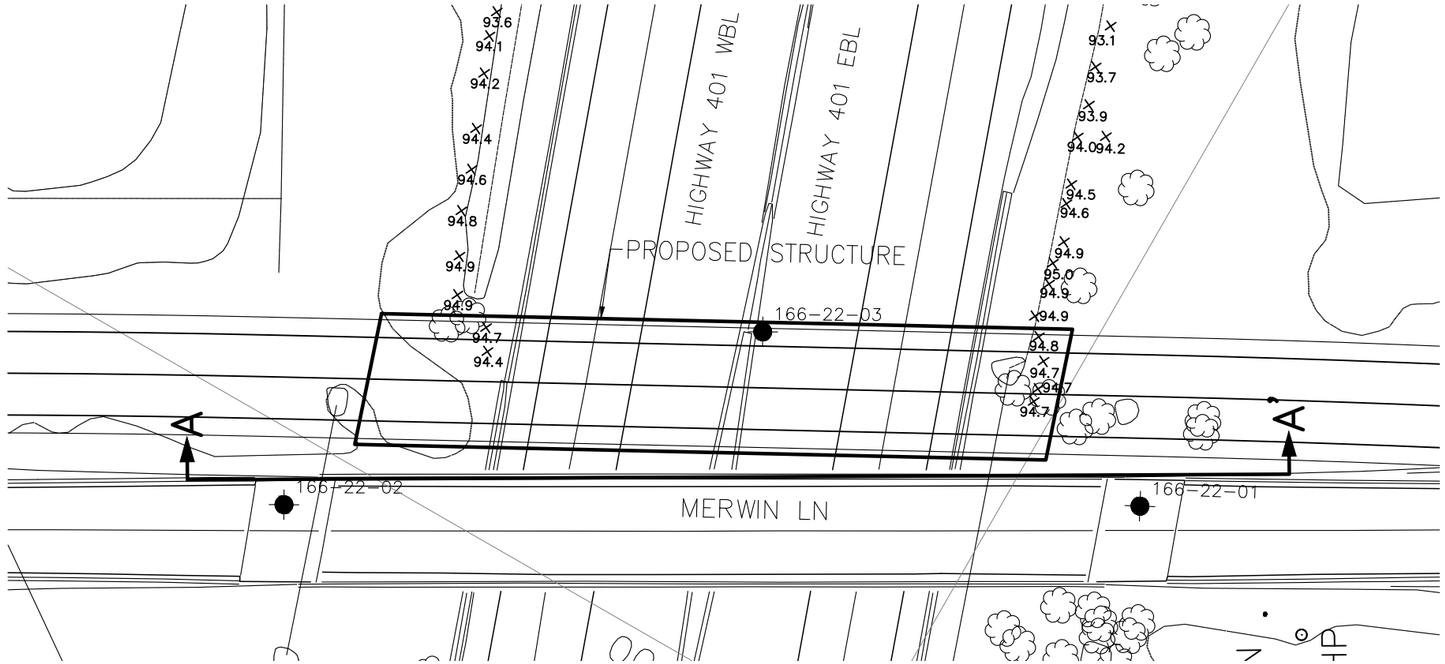
Appendix A.

Borehole Location Plan and Stratigraphic Drawing

MINISTRY OF TRANSPORTATION, ONTARIO



PLAN

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

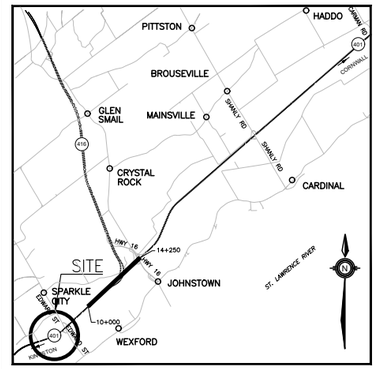
CONT No
GWP No 4024-20-00

SHEET

HIGHWAY 401
MERWIN LANE UNDERPASS
BRIDGE REPLACEMENT
BOREHOLE LOCATIONS AND SOIL STRATA

Ontario

THURBER ENGINEERING LTD.



KEYPLAN

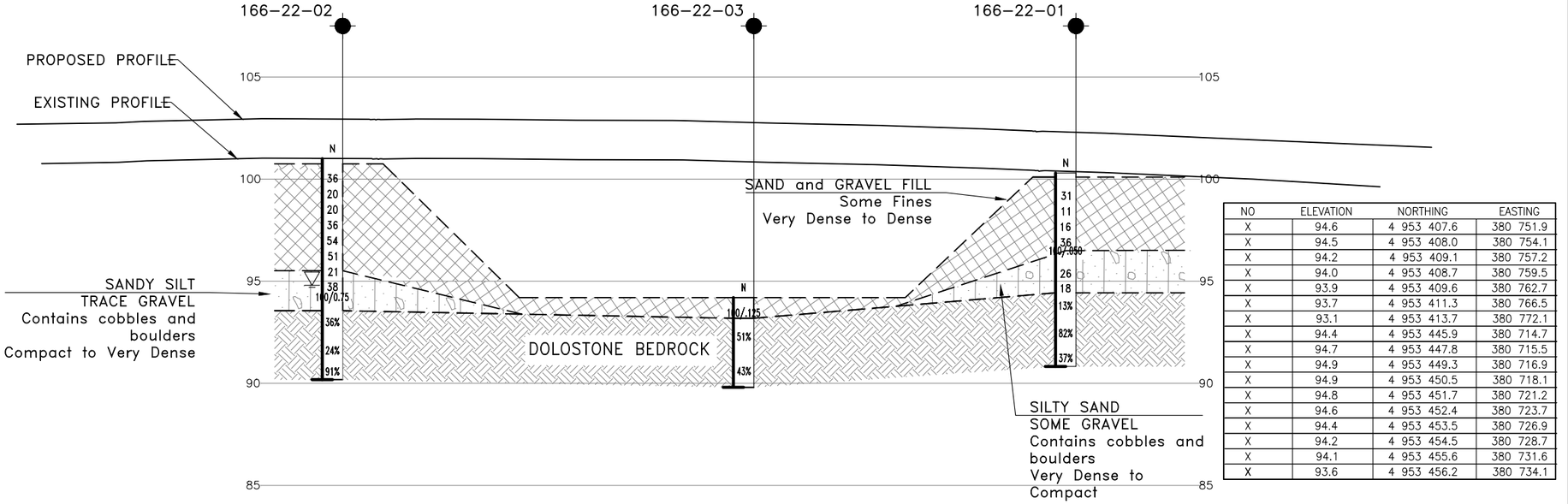
LEGEND	
●	Borehole (Current Investigation)
⊕	Borehole (Previous Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level
▼	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
X	Exposed Bedrock Surface Point Elevation

NO	ELEVATION	NORTHING	EASTING
166-22-01	100.3	4 953 390.3	380 729.8
166-22-02	101.0	4 953 452.5	380 694.2
166-22-03	94.2	4 953 424.4	380 726.7
X	94.7	4 953 403.2	380 735.4
X	94.7	4 953 402.9	380 736.7
X	94.7	4 953 403.0	380 738.9
X	94.8	4 953 403.4	380 740.6
X	94.9	4 953 404.2	380 742.5
X	94.9	4 953 404.9	380 745.1
X	95.0	4 953 405.5	380 746.7
X	94.9	4 953 406.4	380 749.1

-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 9.

GEOCRES No. 31B-110



PROFILE ALONG ℄ OF MERWIN LANE (A-A)

10 0 10 20m H 1:500
5 5 10m V 1:250

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	AO	CHK	MJK	CODE	LOAD
DRAWN	JW	CHK	AO	SITE 16X-0166	STRUCT

DATE JUNE 2023
DWG 1

FILENAME: T:\Drafting\29000\29381\TED-29381-BHPP(166).dwg
PLOTDATE: 8/23/2023 9:51 AM

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Appendix B.

Record of Borehole Sheets

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SYMBOLS, ABBREVIATIONS AND TERMS USED ON TEST HOLE RECORDS

TERMINOLOGY DESCRIBING COMMON SOIL GENESIS

Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of fragments of decayed organic matter
Till	unstratified glacial deposit which may include particles ranging in sizes from clay to boulder
Fill	material below the surface identified as placed by humans (excluding buried services)

TERMINOLOGY DESCRIBING SOIL STRUCTURE:

Desiccated	having visible signs of weathering by oxidization of clay materials, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	> 75 mm in thickness
Seam	2 mm to 75 mm in thickness
Parting	< 2 mm in thickness

RECOVERY:

For soil samples, the recovery is recorded as the length of the soil sample recovered.

N-VALUE:

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 63.5 kg hammer falling 0.76 m, required to drive a 50 mm O.D. split spoon sampler 0.3 m into undisturbed soil. For samples where insufficient penetration was achieved and N-value cannot be presented, the number of blows are reported over the sampler penetration in millimetres (e.g. 50/75).

DYNAMIC CONE PENETRATION TEST (DCPT):

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to an “A” size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone 0.3 m into the soil. The DCPT is used as a probe to assess soil variability.

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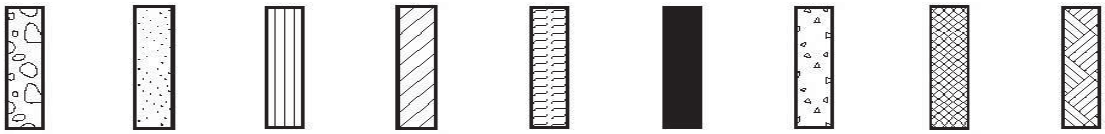
STRATA PLOT:
Strata plots symbolize the soil and bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders
Cobbles
Gravel

Sand

Silt

Clay

Organics

Asphalt

Concrete

Fill

Bedrock

TEXTURING CLASSIFICATION OF SOILS

Classification	Particle Size
Boulders	Greater than 200 mm
Cobbles	75 – 200 mm
Gravel	4.75 – 75 mm
Sand	0.075 – 4.75 mm
Silt	0.002 – 0.075 mm
Clay	Less than 0.002 mm

TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

Descriptive Term	Undrained Shear Strength (kPa)
Very Soft	12 or less
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	100 – 200
Hard	Greater than 200

NOTE: Clay sensitivity is defined as the ratio of the undisturbed strength over the remolded strength.

SAMPLE TYPES

SS	Split spoon samples
ST	Shelby tube or thin wall tube
DP	Direct push sample
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ etc.	Rock core sample obtained with the use of standard size diamond coring equipment

TERMS DESCRIBING CONSISTENCY (COHESIONLESS SOILS ONLY)

Descriptive Term	SPT "N" Value
Very Loose	Less than 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	Greater than 50

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MODIFIED UNIFIED SOIL CLASSIFICATION

Major Divisions		Group Symbol	Typical Description
COARSE GRAINED SOIL	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	SILT AND CLAY SOILS $W_L < 35\%$	ML	Inorganic silts, 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.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILT AND CLAY SOILS $35\% < W_L < 50\%$	MI	Inorganic compressible fine sandy silt with clay of medium plasticity, clayey silts.
		CI	Inorganic clays of medium plasticity, silty clays.
		OI	Organic silty clays of medium plasticity.
	SILT AND CLAY SOILS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy of silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other organic soils.

Note - W_L= Liquid Limit

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EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock materials.
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 structures are preserved.

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 0.1 m in length or larger, as a percentage of total core length
Unconfined Compressive Strength: (UCS)	Axial stress required to break the specimen.
Fracture Index: (FI)	Frequency of natural fractures per 0.3 m of core run.

DISCONTINUITY SPACING

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

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)
Extremely Strong	Greater than 250
Very Strong	100 – 250
Strong	50 – 100
Medium Strong	25 – 50
Weak	5 – 25
Very Weak	1 – 5
Extremely Weak	0.25 – 1

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RECORD OF BOREHOLE No 166-22-01 1 OF 2 METRIC

GWP# 4024-20-00 LOCATION Lat: 44.716495°, Long: -75.541615° Merwin Lane, Augusta, MTM z9: N 4 953 390.3 E 380 729.8 ORIGINATED BY IK

HWY 401 BOREHOLE TYPE CME 55 Truck Mount / NW Casing / NQ Coring COMPILED BY AO

DATUM Geodetic DATE 2022.11.21 - 2022.11.21 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + 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
100.3	**Ground Surface**										
0.0	**ASPHALT (100 mm)**		1	NQ	-						
0.1	**CONCRETE (100 mm)**										
0.2	SAND and GRAVEL, some fines Dense Brown **FILL**		1	SS	31		100		○		36 48 16 (SI+CL)
98.8							99				
1.5	SILTY SAND, some gravel Contains plastic fines Compact to dense Brown **FILL**		2	SS	11				○		
			3	SS	16		98		○		
			4	SS	36		97		○		
96.5			5	SS	100/50mm						
3.8	**SILTY SAND (SC-SM)**, some gravel to gravelly Contains cobbles and boulders Contains plastic fines Very dense to compact Brown **GLACIAL TILL**		2	NQ	-		96				
			6	SS	26				○		10 45 45 (SI+CL)
94.4			7	SS	18		95		○		
5.9	**DOLOSTONE BEDROCK** Interbedded with Sandstone Contains quartz inclusions Slightly weathered to fresh Fine to medium grained Grey Medium bedded Very strong		1	RUN	-		94			FI >10 >10 5 2	RUN #1 TCR=45% SCR=21% RQD=13%
			2	RUN	-		93			4 5 3 2	RUN #2 TCR=100% SCR=82% RQD=82%
			3	RUN	-		92			1 2 2	RUN #3 TCR=100% SCR=70% RQD=37%
90.8							91			4	
9.5	**End of Borehole**										

Continued Next Page

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

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

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THURBER

RECORD OF BOREHOLE No 166-22-01 2 OF 2 METRIC

GWP# 4024-20-00 LOCATION Lat: 44.716495°, Long: -75.541615° Merwin Lane, Augusta, MTM z9: N 4 953 390.3 E 380 729.8 ORIGINATED BY IK

HWY 401 BOREHOLE TYPE CME 55 Truck Mount / NW Casing / NQ Coring COMPILED BY AO

DATUM Geodetic DATE 2022.11.21 - 2022.11.21 CHECKED BY

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										
	A representative open-hole groundwater level measurement was not obtained due to the introduction of water during drilling.										

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

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

DOUBLE LINE 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 2012TEMPLATE(MTO).GDT 9-5-23

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THURBER

RECORD OF BOREHOLE No 166-22-02 1 OF 2 METRIC

GWP# 4024-20-00 LOCATION Lat: 44.717059°, Long: -75.542054° Merwin Lane, Augusta, MTM z9: N 4 953 452.5 E 380 694.2 ORIGINATED BY IK

HWY 401 BOREHOLE TYPE CME 55 Truck Mount / NW Casing / NQ Coring COMPILED BY AO

DATUM Geodetic DATE 2022.11.22 - 2022.11.22 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + 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
101.0	**Ground Surface**										
0.0 / 100.7	**ASPHALT (100 mm)**		1	NQ	-						
0.3	**CONCRETE (150 mm)**										
	SAND and GRAVEL, some fines Dense to compact Brown **FILL**		1	SS	36		100		○		
99.3			2	SS	20		99		○		
1.7	SAND, some fines Compact to very dense Brown **FILL**		3	SS	20		98		○		
			4	SS	36		97		○		
			5	SS	54		96		○		0 89 11 (SI+CL)
			6	SS	51		95		○		
95.5	- Gravelly below a depth of 5.3 m						94		○		
5.5	**SANDY SILT (ML)**, trace gravel Contains plastic fines Inferred cobbles and boulders Compact to very dense Grey **GLACIAL TILL**		7	SS	21		93		○		
			8	SS	38		92		○		9 24 54 13
93.6			9	SS	100/ 75mm				○	FI	
7.4	**DOLOSTONE BEDROCK** Interbedded with Sandstone Moderatelly weathered to fresh Fine to medium grained Grey Medium bedded Very strong		1	RUN	-					3 5 4 4	RUN #1 TCR=100% SCR=76% RQD=36%
			2	RUN	-					1 6 6 6 4	RUN #2 TCR=100% SCR=82% RQD=24%

Continued Next Page

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

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

DOUBLE LINE 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 2012TEMPLATE(MTO).GDT 9-5-23

Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No 166-22-02 2 OF 2 METRIC

GWP# 4024-20-00 LOCATION Lat: 44.717059°, Long: -75.542054° Merwin Lane, Augusta, MTM z9: N 4 953 452.5 E 380 694.2 ORIGINATED BY IK

HWY 401 BOREHOLE TYPE CME 55 Truck Mount / NW Casing / NQ Coring COMPILED BY AO

DATUM Geodetic DATE 2022.11.22 - 2022.11.22 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
90.2	**DOLOSTONE BEDROCK** Interbedded with Sandstone Moderatelly weathered to fresh Fine to medium grained Grey Medium bedded Very strong		3	RUN	-					4 1 0	RUN #3 TCR=100% SCR=91% RQD=91% UCS=193MPa
10.8	**End of Borehole** Flushmount standpipe piezometer consists of a 19 mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen. **Water level readings:** DATE DEPTH (m) ELEV. (m) 2022.12.18 6.2 94.8 2023.04.26 7.2 93.8										

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

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

DOUBLE LINE 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 2012TEMPLATE(MTO).GDT 9-5-23

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THURBER

RECORD OF BOREHOLE No 166-22-03 1 OF 1 METRIC

GWP# 4024-20-00 LOCATION Lat: 44.716803°, Long: -75.541649° Merwin Lane, Augusta, MTM z9: N 4 953 424.4 E 380 726.7 ORIGINATED BY IK

HWY 401 BOREHOLE TYPE CME 55 Truck Mount / HSA/ NW Casing / NQ Coring COMPILED BY AO

DATUM Geodetic DATE 2022.12.07 - 2022.12.07 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (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
94.3	**Ground Surface**										
0.0	**ASPHALT (150 mm)**										
0.2 / 93.9	GRAVELLY SAND, some fines Brown **FILL (BASE)**						94				
0.4	SAND and GRAVEL, some fines Very dense Brown **FILL**		1	SS	100/ 125mm				○	FI	44 41 15 (SI+CL)
93.3 / 1.0	**DOLOSTONE BEDROCK** Interbedded with Sandstone Moderatelly weathered to fresh Fine to medium grained Grey Medium bedded Very strong		1	RUN	-		93			>10 >10 4 4	RUN #1 TCR=89% SCR=67% RQD=51%
							92			2 4	
			2	RUN	-		91			>10 3 3	RUN #2 TCR=93% SCR=48% RQD=43%
89.9							90			6 5	
4.4	**End of Borehole** A representative open-hole groundwater level measurement was not obtained due to the introduction of water during drilling.										

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

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

DOUBLE LINE 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 2012TEMPLATE(MTO).GDT 9-5-23

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Appendix C.

Laboratory Testing

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Appendix C.1

Particle Size Analysis Figures

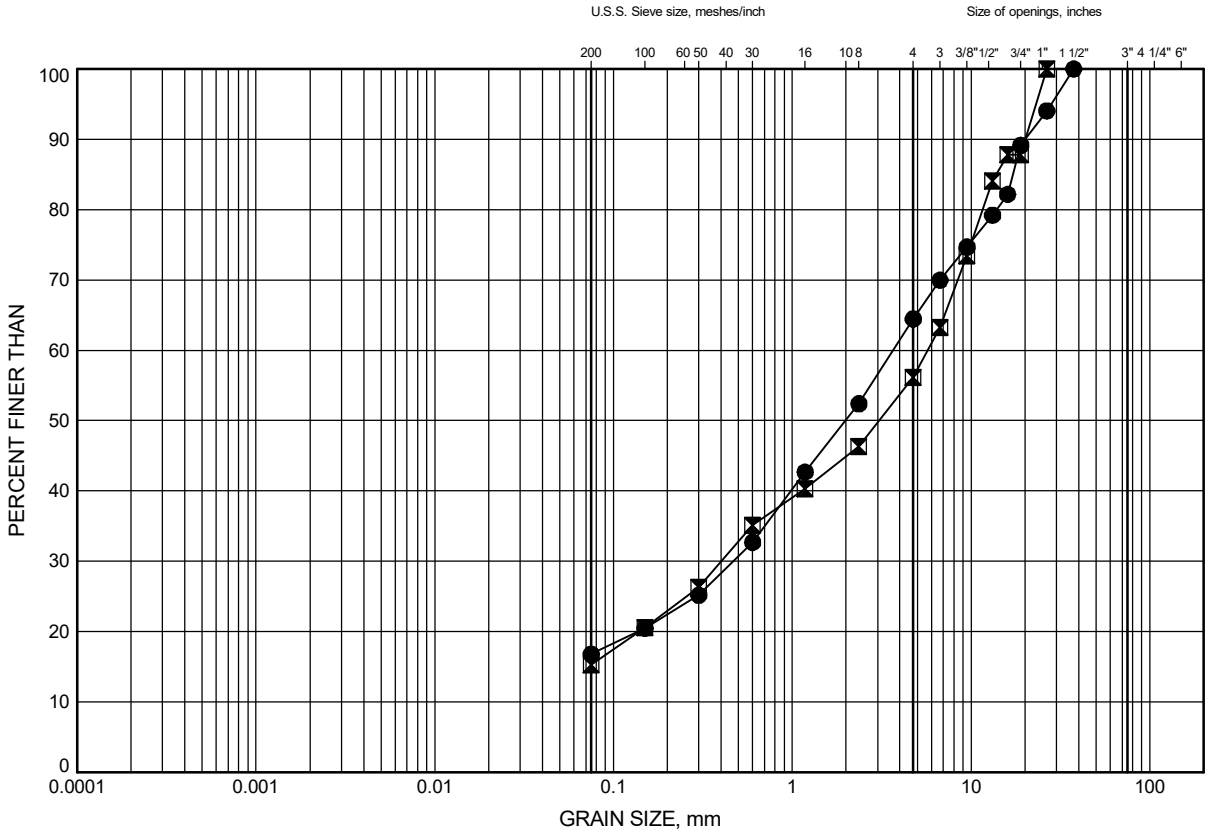
Atterberg Limit Test Results

Highway 401 Underpass at Merwin Lane (Site No. 16X-0166)

GRAIN SIZE DISTRIBUTION

FIGURE C1

FILL: Sand and Gravel



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	166-22-01	1.1	99.2
⊠	166-22-03	0.9	93.3

Date March 2023

GWP# 4024-20-00

THURBER

Prep'd RH

Chkd. AO

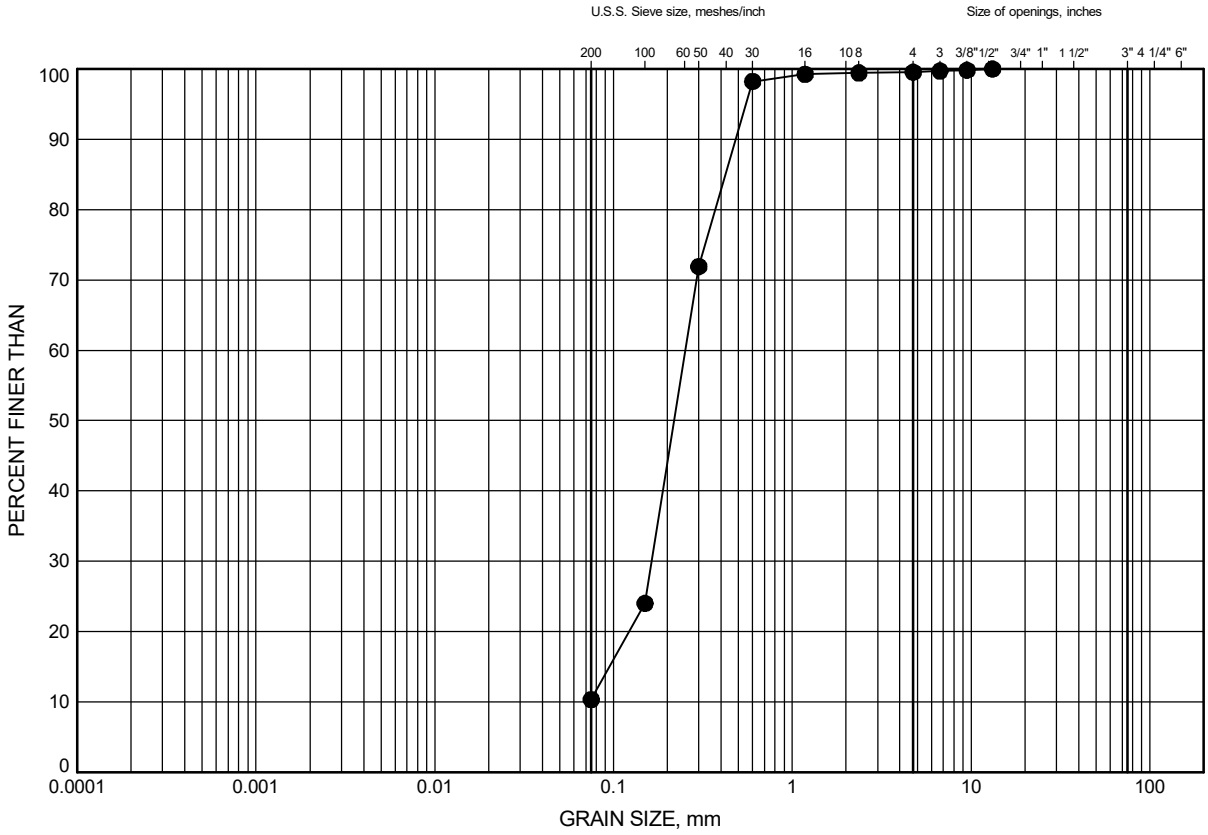
GRAIN SIZE DISTRIBUTION - THURBER 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 3-3-23

Highway 401 Underpass at Merwin Lane (Site No. 16X-0166)

GRAIN SIZE DISTRIBUTION

FIGURE C2

FILL: Sand



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	166-22-02	4.1	96.9

Date March 2023

GWP# 4024-20-00

THURBER

Prep'd RH

Chkd. AO

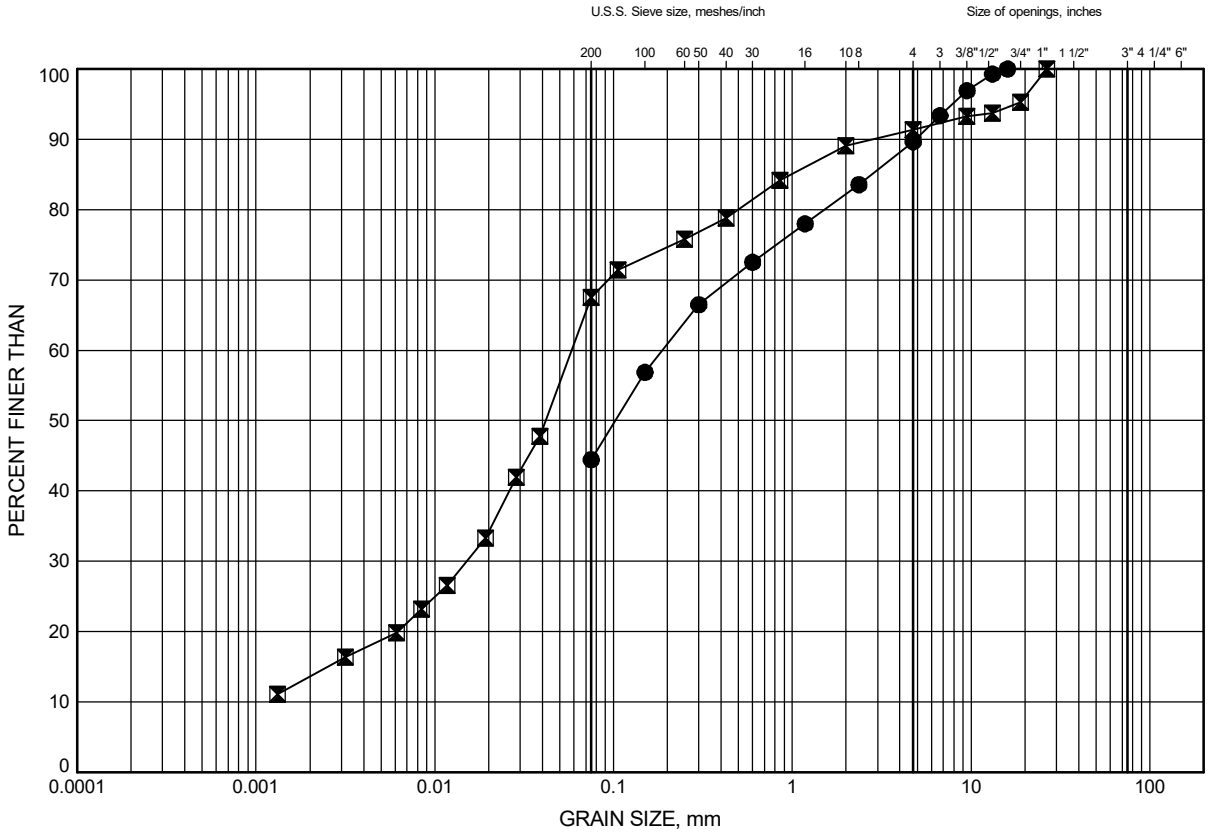
GRAIN SIZE DISTRIBUTION - THURBER 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 3-3-23

Highway 401 Underpass at Merwin Lane (Site No. 16X-0166)

GRAIN SIZE DISTRIBUTION

FIGURE C3

GLACIAL TILL: Silty Sand (SC-SM) to Sandy Silt (ML)



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	166-22-01	4.9	95.4
⊠	166-22-02	6.5	94.5

Date March 2023

GWP# 4024-20-00

THURBER

Prep'd RH

Chkd. AO

GRAIN SIZE DISTRIBUTION - THURBER 29381 BOREHOLE LOGS REPLACEMENT SITES.GPJ 3-3-23

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Appendix C.2

UCS Test Results

Stantec Consulting Ltd.
2781 Lancaster Rd, Suite 100 A&B, Ottawa ON K1B 1A7

May 2, 2023
File: 122410864

Client: Thurber Engineering, File #29381

Reference: ASTM D7012, Method C, Unconfined Compressive Strength of Intact Rock Core

The following table summarizes unconfined compressive strength results for five intact rock cores.

Location	Sample Depth	Compressive Strength (MPa)	Description of Break
BH129-22-1 Run-1	88'7''-89'3''	212.5	Well-formed cones at both ends
BH129-22-2 Run-1	85'9''-86'3''	224.3	Well-formed cones at both ends.
BH130-22-1 Run-3	86'6''-87'4''	196.3	Vertical cracking throughout, no cones formed
BH131-22-2 Run-2	77'1''-77'10''	237.2	Vertical cracking throughout, no cones formed
BH166-22-2 Run-3	33'8''-34'2''	192.6	Well-formed cones at both ends

Sincerely,

Stantec Consulting Ltd.

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

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Appendix C.3

Bedrock Core Photographs

Borehole 166-22-01

RUNS 1 and 2

Depth 5.9 m to 8.6 m

Elevation 94.4 m to 91.7 m

Dry Sample

Run 1 Start
elev. 94.4 m

Run 1 End
elev. 93.3 m

Run 2 Start
elev. 93.3 m

Run 2 End
elev. 91.7 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-01
Project No.: 29381

Borehole 166-22-01

RUNS 1 and 2
Depth 5.9 m to 8.6 m
Elevation 94.4 m to 91.7 m
Wet Sample

Run 1 Start
elev. 94.4 m

Run 1 End
elev. 93.3 m

Run 2 Start
elev. 93.3 m

Run 2 End
elev. 91.7 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-01
Project No.: 29381

Borehole 166-22-01

RUN 3

Depth 8.6 m to 9.5 m

Elevation 91.7 m to 90.8 m

Dry Sample

Run 3 Start
elev. 91.7 m

Run 3 End
elev. 90.8 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-01
Project No.: 29381

Borehole 166-22-01

RUN 3

Depth 8.6 m to 9.5 m

Elevation 91.7 m to 90.8 m

Dry Sample

Run 3 Start
elev. 91.7 m

Run 3 End
elev. 90.8 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-01
Project No.: 29381

Borehole 166-22-02

RUN 1

Depth 7.4 m to 8.8 m

Elevation 93.6 m to 92.2 m

Dry Sample

Run 1 Start
elev. 93.6 m

Run 1 End
elev. 92.2 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-02
Project No.: 29381

Borehole 166-22-02

RUN 1

Depth 7.4 m to 8.8 m

Elevation 93.6 m to 92.2 m

Wet Sample

Run 1 Start
elev. 93.6 m

Run 1 End
elev. 92.2 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-02
Project No.: 29381

Borehole 166-22-02

RUNS 2 and 3

Depth 8.8 m to 10.8 m

Elevation 92.2 m to 90.2 m

Dry Sample

Run 1 Start
elev. 92.2 m

Run 1 End
elev. 90.8 m

Run 2 Start
elev. 90.8 m

Run 2 End
elev. 90.2 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-02
Project No.: 29381

Borehole 166-22-02

RUNS 2 and 3

Depth 8.8 m to 10.8 m

Elevation 92.2 m to 90.2 m

Dry Sample

Run 1 Start
elev. 92.2 m

Run 1 End
elev. 90.8 m

Run 2 Start
elev. 90.8 m

Run 2 End
elev. 90.2 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-02
Project No.: 29381

Borehole 166-22-03

RUN 1

Depth 1.0 m to 2.8 m

Elevation 93.3 m to 91.5 m

Dry Sample

Run 1 Start
elev. 93.3 m

Run 1 End
elev. 91.5 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-03
Project No.: 29381

Borehole 166-22-03

RUN 1

Depth 1.0 m to 2.8 m

Elevation 93.3 m to 91.5 m

Wet Sample

Run 1 Start
elev. 93.3 m

Run 1 End
elev. 91.5 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-03
Project No.: 29381

Borehole 166-22-03

RUN 2

Depth 2.8 m to 4.4 m

Elevation 91.5 m to 89.9 m

Dry Sample

Run 1 Start
elev. 91.5 m

Run 1 End
elev. 89.9 m

THURBER ENGINEERING LTD.

Highway 401 Underpass at Merwin Lane
(Site No. 16X-0166)
Assignment No. 4019-E-0010.2, GWP 4024-20-00

BH 166-22-03
Project No.: 29381

Borehole 166-22-03

RUN 2

Depth 2.8 m to 4.4 m

Elevation 91.5 m to 89.9 m

Wet Sample

Run 1 Start
elev. 91.5 m

Run 1 End
elev. 89.9 m

THURBER ENGINEERING LTD.

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THURBER

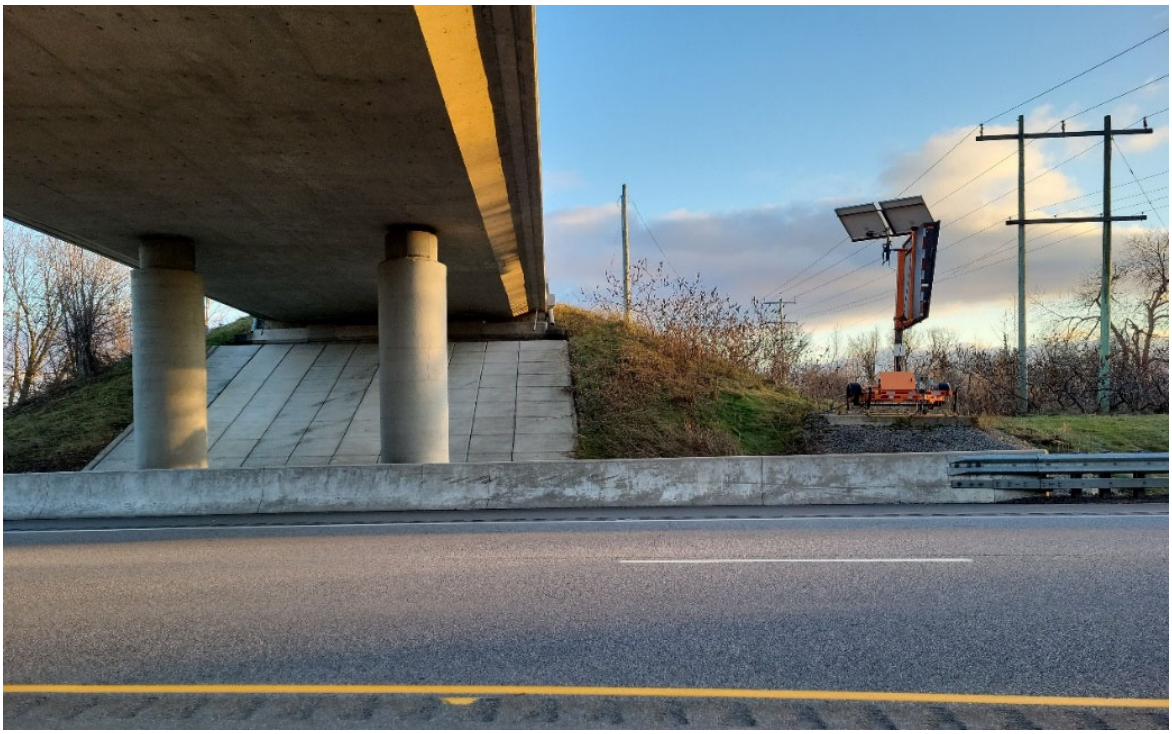
Appendix D.

Site Photographs

Photograph 1: Looking north at south abutment along Merwin Lane
[taken on December 08, 2022]

Photograph 2: Looking south from south abutment along Merwin Lane
[taken on November 22, 2022]

Photograph 3: Looking west along Highway 401
[taken on December 07, 2022]


Photograph 4: Looking south underside of south abutment
[taken on December 08, 2022]

Photograph 5: Looking north at the southern approach
[taken on December 08, 2022]