



THURBER ENGINEERING LTD.

**FINAL
FOUNDATION INVESTIGATION REPORT
HIGHWAY 17 NON-STRUCTURAL CULVERT AT STATION 11+560
STABILITY ASSESSMENT OF TEMPORARY STAGING FILLS AND CUTS
INWOOD TOWNSHIP, ONTARIO
AGREEMENT NO.: 6022-E-0038, ASSIGNMENT NO.: 5**

GEOCRES NO.: 52G01-001

Location: Lat: 49.013360°, Long: -90.429037°

Client Name: Ministry of Transportation

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PART 1. FACTUAL INFORMATION

1. INTRODUCTION

This section of the report presents the factual findings obtained from a limited foundation investigation conducted by Thurber Engineering Ltd. (Thurber) for stability assessment of temporary staging fills and cuts during the replacement of a non-structural culvert on Highway 17 near Upsala at Sta. 11+560 in Inwood Township, Ontario. Thurber carried out the foundation investigation for the Ontario Ministry of Transportation (MTO) under Retainer Agreement No. 6022-E-0038, Assignment No. 5.

The purpose of the investigation was to explore the subsurface conditions in the vicinity of the staging fills and cuts at the site and based on this data obtained, provide a borehole location plan, record of boreholes, stratigraphic profile, laboratory test results and a written description of the subsurface conditions. The stratigraphic profile of the subsurface conditions was developed during the current investigation.

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

2. SITE DESCRIPTION

2.1 General

The existing culvert crosses Highway 17 approximately 3.1 km west of the junction between Highway 17 and Lac des Mille Lacs Road near Upsala. For project purposes, Highway 17 is herein described as oriented east-west, and the culvert is described as oriented north-south.

In the area of the culvert, Highway 17 is a two-lane highway and has a posted speed limit of 90 km/h. The road surface near the culvert is at approximate elevation 481.5 m. The shoulders to

the highway are partially paved and steel cable guiderails on wooden posts are present along both shoulders of the highway. The 2016 traffic volume for this section of Highway 17 is understood to be approximately 1,850 AADT.

The existing concrete box culvert is reported by MTO to be 0.91 m wide, 0.91 m high and 30.2 m long, with an alignment approximately perpendicular to the highway. The culvert has a relatively flat gradient with the invert of the culvert near elevations 475.7 m and 475.5 m at the inlet and outlet, respectively.

The cover above the existing culvert is approximately 5 m at the highway centreline. The embankment side slope at the culvert inlet (north side) is inclined at approximately 1.7H:1V. The embankment side slope at the culvert outlet (south side) is inclined at approximately 2H:1V for the upper 2.5 m of the embankment and 1.55H:1V for the lower 2.5 m of the embankment. The existing highway embankment side slopes at the culvert did not show any visible signs of global instability at the time of the investigation.

The site is in a rural setting and the area adjacent to the highway is undeveloped and densely vegetated with mixed forests of coniferous and some deciduous trees and shrubs. Upsala Lake is located north of the highway in the area of the existing culvert. Bedrock outcrops were visible along Highway 17 to the east and west of the existing culvert. Overhead utility lines were present along the south side of the highway.

Photographs of the project area are included in Appendix D. These photographs show the existing condition of the highway embankment and the culvert at the time of the field investigation.

2.2 Site Geology

According to Crins et al. 2009¹ the project area is described as Ecoregion 3W (Lake Nipigon Ecoregion) within the Ontario Shield Ecozone. According to Wester et al. 2018² the ecoregion is subdivided into Ecodistrict 3W-2 (Savanne Ecodistrict). The project area is located in the south part of the ecodistrict, which is characterized by discontinuous morainal materials of variable depths, typically separated by bedrock outcrops. Bedrock Geology Map (M2542)³ indicates the site is underlain by gneissic tonalite suite: tonalite to granodiorite – foliated to gneissic – with minor supracrustal inclusions.

¹ <https://files.ontario.ca/mnrf-ecosystemspart1-accessible-july2018-en-2020-01-16.pdf>

² <https://files.ontario.ca/ecosystems-ontario-part2-03262019.pdf>

³ <https://www.geologyontario.mndm.gov.on.ca/mndmfiles/pub/data/imaging/M2542/M2542.pdf>

2.3 Existing Information

A historical foundation investigation report was not available for the existing culvert at this site within the online Geocres Library.

Limited pavement borehole information was provided by MTO.

Base plan mapping was provided by MTO for the preparation of this report.

3. SITE INVESTIGATION AND FIELD TESTING

The foundation investigation and field-testing program was carried out on January 2, 2024, and consisted of one off-road borehole identified as 24-01 drilled near the culvert outlet at the toe of the south side of the existing highway embankment. The borehole was advanced using portable drilling equipment (tripod). Prior to commencement of drilling, utility clearances were obtained in the vicinity of the borehole location.

A summary of the borehole coordinates, elevation, and termination depth is provided in the table below. The as-drilled borehole elevation was estimated by Thurber following completion of the field program. Horizontal locations were measured by Thurber relative to existing site features. The elevation and borehole coordinates were reviewed and referenced to the survey data provided by MTO. The borehole coordinates and elevations are shown on the Borehole Location and Soil Strata drawing included in Appendix A and on the individual Record of Borehole sheet included in Appendix B. The borehole coordinates are referenced to MTM Zone 15.

Table 3-1 Borehole Summary

Borehole	Northing (m)	Easting (m)	Ground Surface Elevation (m)	Termination Depth Below Ground Surface (m)
24-01	5,430,646.8	273,404.6	476.1	4.2

Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in general accordance with ASTM D 1586. A half-weight hammer was used for SPT testing and a hammer weight correction has been applied for the N-values on the Record of Borehole sheet.

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 samples for transport to Thurber's Oakville laboratory for further examination and testing.

Following completion of the field investigation, the borehole was decommissioned in general accordance with O. Reg. 903, as amended.

4. LABORATORY TESTING

Laboratory testing was selected in general accordance with the current MTO Guideline for Foundation Engineering Services, Section 5. Geotechnical laboratory testing consisted of natural moisture content determination and visual identification of all retained soil samples. Selected soil samples were subjected to grain size distribution testing in accordance with MTO and ASTM standards. The results of these tests are summarized on the Record of Borehole sheets included in Appendix B.

One soil sample was selected and submitted for analytical testing of corrosivity parameters and sulphate content.

All laboratory test results from the field investigation are provided in Appendix C.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered subsurface conditions are presented on the Record of Borehole sheet included in Appendix B and on the Borehole Location and 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 sheet takes precedence over this general description for interpretation of the site conditions. It must be recognized that the soil, bedrock and groundwater conditions may vary between and beyond borehole locations.

The subsurface conditions encountered in the borehole generally consisted of granular fill overlying sand underlain by silty sand to sandy silt.

5.1 Organics

Organics with a thickness of 150 mm was encountered at ground surface in Borehole 24-01. The thickness of organics may vary in other areas of the site.

5.2 Gravelly Sand Fill

A fill layer consisting of gravelly sand was encountered below the organics in Borehole 24-01. The fill layer was 1.2 m thick (base elev. 474.6 m). SPT N-values in the gravelly sand fill ranged from 31 to 43 blows, indicating a dense relative density.

A moisture content of 7% was recorded in the gravelly sand fill.

5.3 Sand

A native layer of sand was encountered below the gravelly sand fill in Borehole 24-01. The sand had a thickness of 0.8 m and extended to a depth of 2.2 m (base elev. 473.9 m). A SPT N-value of 13 blows was recorded in this layer, indicating a compact relative density.

A moisture content of 12% was recorded in the sand.

5.4 Silty Sand to Sandy Silt

A layer of silty sand to sandy silt was encountered below the sand in Borehole 24-01. The layer was not fully penetrated in the borehole but was proven to have a thickness of at least 2.0 m and extended to the borehole termination depth of 4.2 m (base elev. 471.9 m). SPT N-values in the silty sand to sandy silt ranged from 51 blows to refusal, indicating a very dense relative density.

Moisture contents ranging from 17 to 23% were recorded in the silty sand to sandy silt. The results of a gradation analysis completed on a sample of the silty sand are illustrated on Figure C1 of Appendix C. The results of the test are summarized in the table below and on the Record of Borehole sheet in Appendix B.

Soil Particle	Percentage (%)
Gravel	12
Sand	50
Silt	36
Clay	2

5.5 Groundwater Level

The recorded groundwater level from the open borehole is summarized in the table below.

Table 5-1 Groundwater Level Measurements

Borehole	Groundwater Level		Date of Reading	Note
	Depth (m)	Elevation (m)		
24-01	0.8	475.3	January 2, 2024	Open Borehole

It should be noted that the above value is considered a short-term reading and may not reflect the groundwater level at the time of construction. 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.

5.6 Analytical Testing

One soil sample was submitted for analytical testing of corrosivity parameters and sulphate content. The analytical results are included in Appendix C and are summarized in the table below.

Table 5-2 Analytical Test Results

Borehole	Sample	Sample Depth (m)	Conductivity (µS/cm)	pH	Resistivity (ohm-cm)	Chloride (µg/g)	Sulphate (µg/g)	Sulphide (%)
24-01	SS2 – SS4	0.76 – 2.90	161	6.62	6210	46	12	< 0.01

6. MISCELLANEOUS

The borehole location reflects existing site features and access constraints. The as-drilled borehole location and ground surface elevation were estimated by Thurber following completion of the field program. RPM Drilling of Thunder Bay, Ontario, supplied and operated the portable drilling equipment used to drill, test, sample, and decommission the borehole. Traffic control was performed in accordance with Ontario Book 7 and was provided by RPM Drilling of Thunder Bay, Ontario. The field investigation was supervised on a full-time basis by Mr. L. Scalena, EIT. Overall supervision of the field investigation program was provided by Mr. M. Eastman, P.Eng.

Routine geotechnical laboratory testing was completed by Thurber's laboratory in Oakville.

Interpretation of the factual data and preparation of this report was completed by Mr. M. Eastman, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundation Projects.



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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.

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- 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

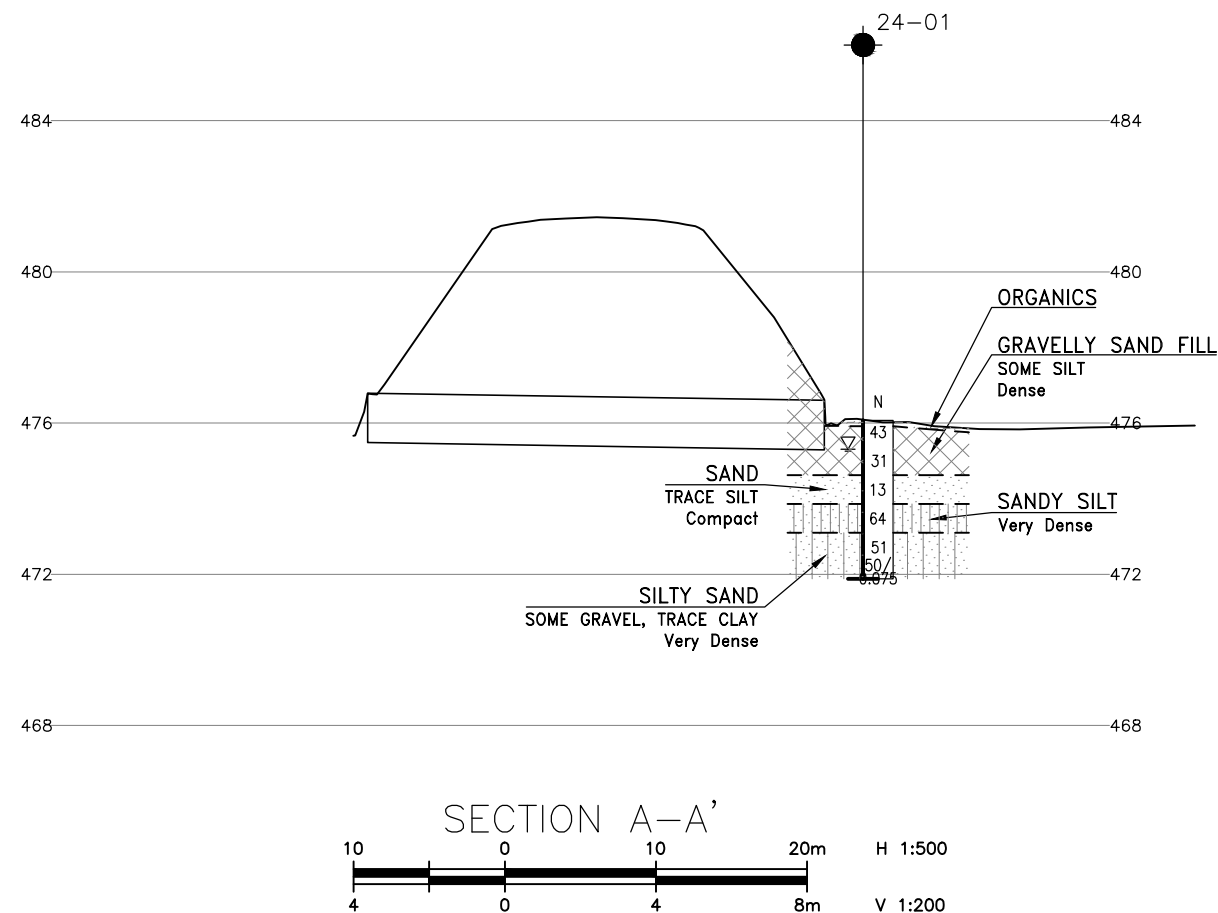
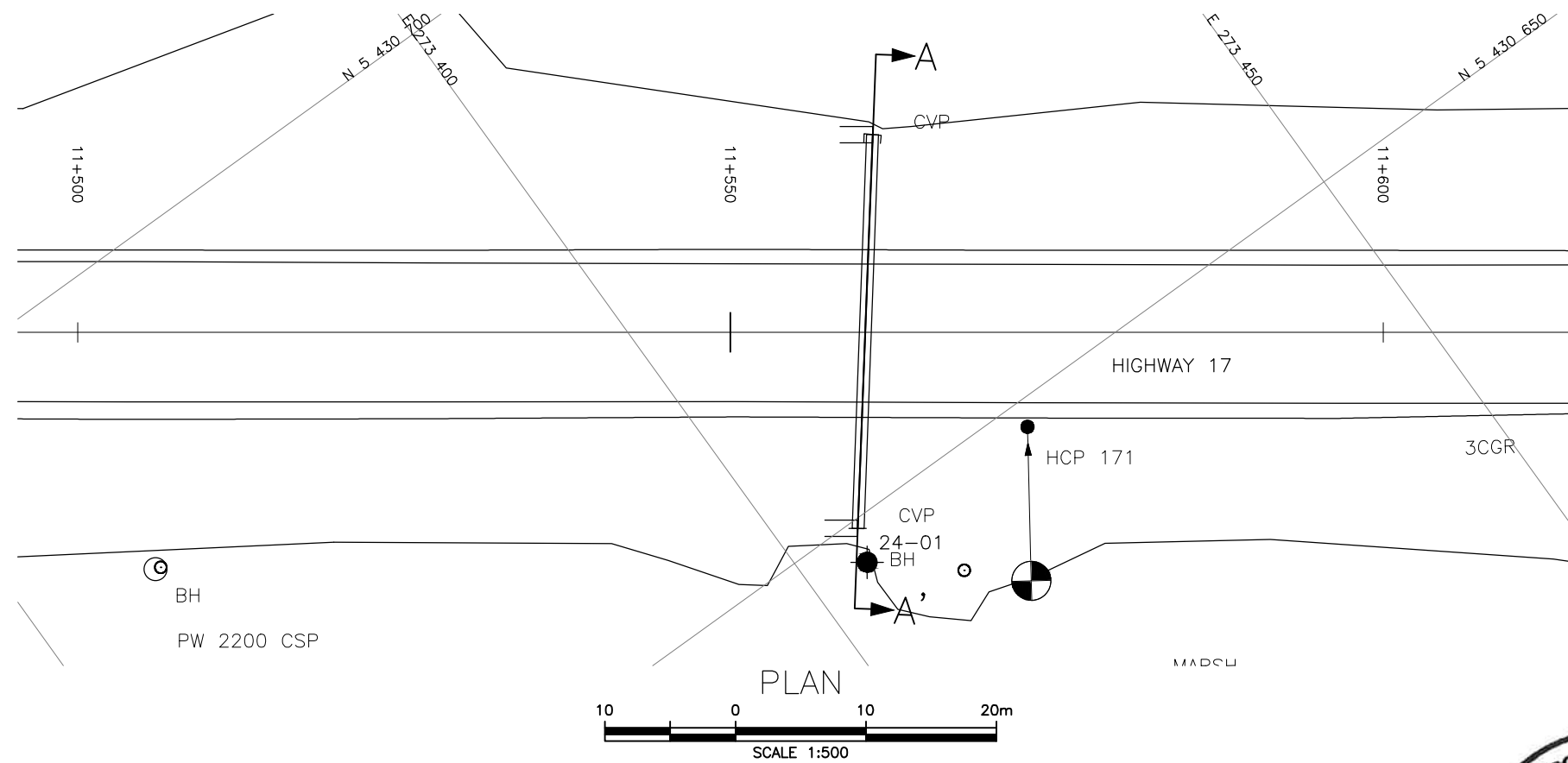
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, 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.

APPENDIX A

Borehole Location and Strata Drawing



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No



SHEET

HIGHWAY 17
NON-STRUCTURAL CULVERT
INWOOD TOWNSHIP
BOREHOLE LOCATIONS AND SOIL STRATA








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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 Upon Completion of Drilling
	Water Level in Monitoring Well/Piezometer
	Monitoring Well/Piezometer Screen
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

[illegible]

-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 15.

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APPENDIX B

Record of Borehole Sheet

RECORD OF BOREHOLE No 24-01

1 OF 1

METRIC

WP# 6022-E-0038 LOCATION N 5 430 646.8 E 273 404.6 ORIGINATED BY LS
DIST Thunder Bay HWY 17 BOREHOLE TYPE Tripod COMPILED BY AN
DATUM Geodetic DATE 2024.01.02 - 0204.01.02 LATITUDE 49.013250 LONGITUDE -90.429222 CHECKED BY MKE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									WATER CONTENT (%)
476.1	GROUND SURFACE					▽	476										
0.0	ORGANICS: (150mm)																
0.2	Gravelly SAND, some silt Dense Brown Wet (FILL)		1	SS	43												
			2	SS	31												
474.6																	
1.4	SAND, trace silt Compact Grey Wet		3	SS	13												
473.9							474										
2.2	Sandy SILT Very Dense Brown Wet		4	SS	64												
473.1																	
3.0	Silty SAND, some gravel, trace clay Very Dense Grey Wet		5	SS	51		473										
			6	SS	50/ 0.075												
471.9							472									12 50 36 2	
4.2	END OF BOREHOLE AT 4.2m. BOREHOLE CAVED TO 0.8m AND WATER LEVEL AT 0.8m UPON COMPLETION.																

+³, ×³: Numbers refer to Sensitivity
20
15
10
(%) STRAIN AT FAILURE

APPENDIX C

Laboratory Test Results



FIG No C1
WP# 6022-E-0038



FINAL REPORT

CA40021-JAN24 R1

46407, Two Non-Structural Culverts, Upsala, ON

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

Client Thurber Engineering Ltd.

Address 103-2010 Winston Park
Oakville, ON
L6H 5R7, Canada

Contact Michael Eastman

Telephone 647-954-1613

Facsimile 905-829-1166

Email meastman@thurber.ca; sloranger@thurber.ca

Project 46407, Two Non-Structural Culverts, Upsala, ON

Order Number

Samples Soil (2)

LABORATORY DETAILS

Project Specialist Brad Moore Hon. B.Sc

Laboratory SGS Canada Inc.

Address 185 Concession St., Lakefield ON, K0L 2H0

Telephone 705-652-2143

Facsimile 705-652-6365

Email brad.moore@sgs.com

SGS Reference CA40021-JAN24

Received 01/08/2024

Approved 01/17/2024

Report Number CA40021-JAN24 R1

Date Reported 01/17/2024

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C

Cooling Agent Present: Yes

Custody Seal Present: Yes

Chain of Custody Number: n/a

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Brad Moore Hon. B.Sc

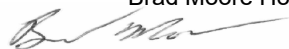




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Legend..... 6

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FINAL REPORT

CA40021-JAN24 R1

Client: Thurber Engineering Ltd.
Project: 46407, Two Non-Structural Culverts, Upsala, ON
Project Manager: Michael Eastman
Samplers: Liam Scalena

MATRIX: SOIL

Sample Number	5	6
Sample Name	24-01 Corrosivity	24-02 Corrosivity
Sample Matrix	Soil	Soil
Sample Date	02/01/2024	03/01/2024

Parameter	Units	RL		Result	Result
Corrosivity Index					
Corrosivity Index	none	1		1	11
Soil Redox Potential	mV	no		159	121
Sulphide (Na2CO3)	%	0.01		< 0.01	< 0.01
pH	pH Units	0.05		6.62	6.60
Resistivity (calculated)	ohms.cm	-9999		6210	1180
General Chemistry					
Conductivity	uS/cm	2		161	845
Metals and Inorganics					
Moisture Content	%	0.1		9.8	26.3
Sulphate	µg/g	0.4		12	8.4
Other (ORP)					
Chloride	µg/g	0.4		46	430



FINAL REPORT

CA40021-JAN24 R1

QC SUMMARY

Anions by IC
Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0374-JAN24	µg/g	0.4	<0.4	11	35	90	80	120	101	75	125
Sulphate	DIO0374-JAN24	µg/g	0.4	<0.4	3	35	100	80	120	94	75	125

Carbon/Sulphur
Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide (Na2CO3)	ECS0053-JAN24	%	0.01	< 0.01								

Conductivity
Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0187-JAN24	uS/cm	2	< 2	1	20	102	90	110	NA		



QC SUMMARY

pH
Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0187-JAN24	pH Units	0.05	NA	1		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.

RL Reporting Limit.

↑ Reporting limit raised.

↓ Reporting limit lowered.

NA The sample was not analysed for this analyte

ND Non Detect

Results relate only to the sample tested.

Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.

"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

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This report supersedes all previous versions.

-- End of Analytical Report --



Request for Laboratory Services and CHAIN OF CUSTODY

No: 1

Page 1 of 1

Environment, Health & Safety - Lakefield - 665 Concession St., Lakefield, ON K0L 2H0 Phone: 705-852-2000 Fax: 705-852-9395 Web: www.sgs.com/environment

London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-872-4500 Toll Free: 877-848-8060 Fax: 519-872-0361

Laboratory Information Section - Lab use only

Received By: Tijunvi Lad
Received Date: 01/08/24 (mm/dd/yy)
Received Time: 12:15 (hr:min)

Received By (signature): T.L.
Custody Seal Present: Yes ☒ No ☐
Custody Seal Intact: Yes ☒ No ☐

Cooling Agent Present: Yes ☒ No ☐
Temperature Upon Receipt (°C): 9.9 Type: 1.1

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Michael Eastman
Address: 103 - 2010 Winston Park Dr.
Oakville, ON L6H 5R7
Phone: 416-700-8079
Fax: _____
Email: meastman@thurber.ca

INVOICE INFORMATION

☒ (same as Report Information)

Company: _____
Contact: _____
Address: _____
Phone: _____
Email: accountingON@thurber.ca

LAB LIMS #: 40021

P.O. #: 21750-10

Site Location/ID: Two Non-Structural Culverts, Upsala, ON

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7 days)

TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 0pm or on weekends, TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____
NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04:

Table 1 ☐ Res/Park Soil Texture: _____
Table 2 ☐ Ind/Com ☐ Coarse ☐ Medium/Fine
Table 3 ☐ Agri/Other _____
Table ☐ _____

Other Regulations:

☐ Reg 347/556 (3 Day min TAT)
☐ PWOO ☐ MMER
☐ CCME ☐ Other: _____
☐ MISA

Sewer By-Law:

☐ Sanitary
☐ Storm
☐ Municipality

ANALYSIS REQUESTED

Regulation 133/04:										Sewer By-Law:														
Other Regulations:										Soil Texture:														
<input type="checkbox"/> Reg 347/558 (3 Day min TA/T)										<input type="checkbox"/> Res/Park														
<input type="checkbox"/> PWQO										<input type="checkbox"/> Coarse														
<input type="checkbox"/> CCME										<input type="checkbox"/> Ind/Com														
<input type="checkbox"/> MISA										<input type="checkbox"/> Agri/Other														
										<input type="checkbox"/> Medium/														
										<input type="checkbox"/> Fine														
RECORD OF SITE CONDITION (RSC)																								
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO																								
SAMPLE IDENTIFICATION					DATE SAMPLED					TIME SAMPLED					# OF BOTTLES					MATRIX				
24-01 Corrosivity					2024-01-02					-					1					soil				
24-02 Corrosivity					2024-01-03					-					1					soil				

Observations/Comments/Special Instructions

Sampled By (NAME): Liam Scalena

Relinquished by (NAME): Liam Scalena

Revision # 1.3
Date of Issue 13 Oct. 2019

Signature: [Signature]
Signature: [Signature]

Date: 01/08/24 (mm/dd/yy)

Date: 01/08/24 (mm/dd/yy)

Pink Copy - Client

Yellow & White Copy - SGS

Note: Submission of samples to SGS is acknowledgment that you have been provided direction on sample collection, handling and transportation of samples. (2) Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). (3) Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

APPENDIX D

Site Photographs



Photo 1: Culvert inlet *(taken on January 2, 2024)*



Photo 2: Culvert outlet *(taken on January 2, 2024)*



Photo 3: Highway 17 east of the culvert alignment *(taken on January 2, 2024)*



Photo 4: Highway 17 west of the culvert alignment *(taken on January 2, 2024)*



Photo 5: Looking east at the eastbound embankment *(taken on January 2, 2024)*



Photo 6: Looking east at the westbound embankment *(taken on January 2, 2024)*