



THURBER ENGINEERING LTD.

**FINAL
FOUNDATION INVESTIGATION AND DESIGN REPORT
TEMPORARY DETOUR BRIDGE
SIDEBURNED LAKE BRIDGE HIGHWAY 101
AGREEMENT NO.: 5015-E-0027**

G.W.P. 5144-10-00

Geocres No.: 41O-27

Report to:

McIntosh Perry Consulting Engineers Limited

Latitude: 47.7764°
Longitude: -83.4896°

October 2018
Thurber File No.: 13624

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PART 1. FACTUAL INFORMATION

1 INTRODUCTION

This section of the report presents the factual findings obtained from a foundation investigation completed for the proposed temporary detour bridge to be located approximately 12 m to the south of the existing Sideburned Lake Bridge (Site No. 46-015). The existing Sideburned Lake Bridge is located on Highway 101, approximately 8.5 km west of the south junction of Highway 101 and Highway 129. Thurber Engineering Limited (Thurber) carried out the current investigation as a sub-consultant to McIntosh Perry Consulting Engineers Ltd. (MPCE) under Agreement No. 5015-E-0027.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions influencing design and construction was developed in the course of the current investigation. A base plan survey was provided by MPCE for the preparation of this report.

This report is provided to supplement the Foundation Investigation and Design Report (Geocres 14O-26) completed for the replacement of the existing mainline Sideburned Lake bridge and should be read in conjunction with that report.

2 SITE DESCRIPTION

The existing Sideburned Lake structure is located on Highway 101 within the Township of Chapleau. The location of the bridge is shown on the inset Key Plan on Drawing No. 1 in Appendix A. At the bridge site, Highway 101 is a two-lane highway with a rural cross-section and paved shoulders. Steel guide rails are located on both sides of the highway for a short distance from the bridge. The southeast steel guide rail is extended with a 3-cabled guide rail.

Directly adjacent to the south side of the bridge alignment are remnants of a staging platform used to support a bailey bridge for a temporary detour during the construction of the existing bridge. The topography adjacent to the lake at the site is rolling forested lands with frequent bedrock outcrops. The land in the vicinity of the bridge is uninhabited and undeveloped with the exception of a motel which is present east of the bridge site. Traffic volumes are understood to be 425 AADT (2012)

FINAL

Photographs showing the existing conditions in the area of the temporary detour bridge are included in Appendix D for reference.

3 SITE INVESTIGATION AND FIELD TESTING

The current site investigation and field testing program was carried out on May 13th, June 15th and 16th, 2017. Drilling consisted of advancing one borehole near each of the proposed foundations. Borehole 17-01 was drilled near the proposed east abutment while 17-04 was drilled near the proposed west abutment. The drilling was carried out using track mounted drill rigs. Prior to commencement of drilling, utility clearances were obtained in the vicinity of the borehole locations.

Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). The boreholes were advanced to depths ranging from 6.4 to 13.7 m (elev. 437.4 to 429.9 m) below the existing ground surface. Borehole 17-1 was extended with Dynamic Cone Penetration Testing (DCPT) a further 0.5 m before reaching refusal. Bedrock coring was completed in Borehole 17-4.

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 for further laboratory examination and testing. Following completion of the field investigation the boreholes were backfilled in general accordance with MOEE requirements (O.Reg. 903).

The approximate borehole locations are shown on the Borehole Locations and Soil Strata Drawing included in Appendix A. The coordinates and elevation of the boreholes are provided on this drawing and on the individual Record of Borehole sheets.

4 LABORATORY TESTING

The recovered soil samples were subjected to visual identification and to natural moisture content determination. Selected samples were also subjected to gradation analysis (hydrometer and/or sieve). The results of these tests are summarized on the Record of Borehole sheets included in Appendix B. All laboratory test results from the field investigation are provided in Appendix C.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix B and the Borehole Locations 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 paragraphs. 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 may vary between and beyond borehole locations.

In general terms, the stratigraphy was found to consist of a surficial layer of granular fill overlying rock fill, underlain by native sand above bedrock.

5.1 Fill

5.1.1 Sand

Below a surficial veneer of topsoil was a layer of sand fill varying from silty sand some gravel to sand some silt, some gravel with a thickness of 0.5 to 0.7 m (base elevation 443.0 to 443.2 m). The SPT tests conducted in the fill gave N-values of 7 and 14 blows indicating a relative density of loose to compact. Recorded moisture contents were 6%.

Gradation analysis was completed on one sample of the sand fill. The grain size distribution curve is included in Figure C1 of Appendix C. The results of the test are summarized below and are presented on the corresponding Record of Borehole sheet in Appendix B.

Soil Particle	Percentage (%)
Gravel	11
Sand	78
Silt & Clay	11

5.1.2 Rock Fill

A layer consisting predominantly of rock fill was encountered beneath the granular fill in both boreholes. Rock pieces were cored and indicated particle with diameters up to 1.0 m. The voids between the rock fill pieces contained granular infill material. The rock fill layer was 2.7 to 9.7 m thick with an underside depth of 3.3 to 10.4 m (elevation 440.5 to 433.0 m). The greater thickness of rockfill was noted at the east abutment.

Sampling was attempted, however due to the nature of this material sample recovery was either poor or not feasible. SPT tests conducted between rock fill pieces provided N-values ranging from 1 blow to 63 blows. Moisture contents ranged from 2 to 32%.

Gradation analyses were completed on two samples of the infill material. The grain size distribution curves are included in Figure C1 of Appendix C. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix B.

Soil Particle	Percentage (%)	
Gravel	26 to 46	
Sand	39 to 43	
Silt	30	11
Clay	5	

5.2 Sand with Silt and Gravel

A layer of native silty sand was encountered below the rock fill in Borehole 17-1. Frequent cobbles were noted throughout the layer which made it difficult to advance casing. The casing reached refusal at a base depth of 13.7 m (elevation 429.9 m). The borehole was advanced with a dynamic cone penetration test past the refusal depth of the casing to a

depth of 14.2 m (elevation 429.4 m). An SPT N-value of 47 blows was recorded in the layer indicated a dense relative density. Moisture contents ranged from 6 to 18%.

Gradation analysis was completed on one sample of the sand. The grain size distribution curve is included in Figure C2 of Appendix C. The results of the test are summarized below and are presented on the corresponding Record of Borehole sheet in Appendix B and indicate a SP-SM material.

Soil Particle	Percentage (%)
Gravel	42
Sand	47
Silt & Clay	11

5.3 Bedrock

Bedrock was encountered below the overburden soils. Bedrock was proven with coring in Borehole 17-4 and was inferred at DCPT refusal in Borehole 17-1. The proven and inferred bedrock surface ranged from elevation 440.5 to 429.4 m. The Total Core Recovery (TCR) was 100%, the Solid Core Recovery (SCR) ranged from 47 to 100% and the Rock Quality Designation (RQD) ranged from 47 to 100% indicating a poor to excellent rock quality. Photographs of the recovered rock core are provided in Appendix C.

5.4 Groundwater

The groundwater level was not measured in the boreholes due to water being introduced into the borehole during coring operations. It is expected that the groundwater level will largely be controlled by the water level in Sideburned Lake which was noted at elevation 441.3 m during the November 2016 field investigation for the mainline bridge.

It should be noted that the groundwater level at the time of construction may be higher 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.

6 MISCELLANEOUS

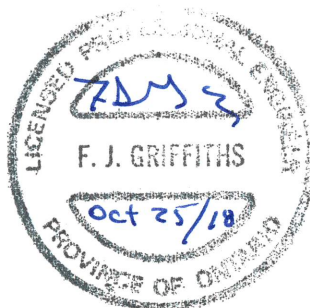
Borehole locations were selected by Thurber relative to existing site features and the proposed foundation locations. The as-drilled locations and ground surface elevations were measured by Thurber following completion of the field program. Elevation benchmarks were provided by MPCE.

George Downing Estate Drilling Ltd of Hawkesbury, Ontario and Forage M3 Drilling also of Hawkesbury, Ontario supplied and operated the drilling equipment to conduct the drilling, soil sampling, in-situ testing and borehole decommissioning. The field investigation was supervised on a full-time basis by Ms. Katya Edney, P.Eng. and Mr. Jeff Morrisison, E.I.T. of Thurber. Overall supervision of the investigation program was conducted by Mr. Stephen Peters, P.Eng.

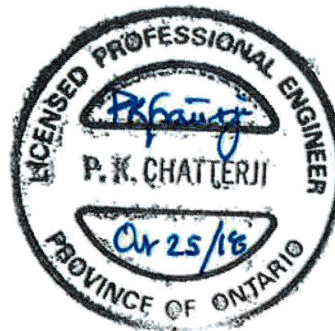
Routine geotechnical laboratory testing was completed by Thurber's laboratory in Ottawa, Ontario. Interpretation of the factual data and preparation of this report were carried out by Dr. Fred Griffiths, P.Eng. and Mr. Stephen Peters P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng. a Designated Principal Contact for MTO Foundation Projects.



Stephen Peters, P.Eng.
Geotechnical Engineer



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PART 2. ENGINEERING DISCUSSION AND RECOMMENDATIONS

7 INTRODUCTION

This section of the report provides an interpretation of the factual data from Part 1 of this report and presents geotechnical recommendations to assist the project team in designing a suitable foundation for the proposed temporary detour bridge to be located approximately 12 m to the south of the existing Sideburned Lake Bridge. The discussion and recommendations presented in this report are based on the information provided by McIntosh Perry Consulting Engineers Ltd. (MPCE) including the 30% Contract Drawings dated October 2017 and on the factual data obtained during the course of the investigation.

This foundation investigation and design report with the interpretation and recommendations are intended for the use of the Ministry of Transportation, and shall not be used or relied upon for any other purposes or by any other parties including the construction or design-build contractor. The construction or design-build 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.

This report is provided to supplement the Foundation Investigation and Design Report (Geocres 41O-26) completed for the replacement of the existing mainline Sideburned Lake Bridge and should be read in conjunction with that report. The following sections address the foundation aspects of the installation of the temporary foundations.

7.1 Proposed Structure

At the time of preparation of the Foundation Investigation and Design Report, a General Arrangement (GA) Drawing of the 30% Contract Package shows that the temporary detour structure is proposed to consist of a one lane temporary modular bridge with a single span 51.816 m long and supported on spread footings with a sleeper slab on a granular pad.

7.2 Applicable Codes and Design Considerations

The geotechnical assessment presented below has been prepared based on the available data regarding the proposed foundations and existing ground conditions and in accordance with the Canadian Highway Bridge Design Code (CHBDC), version CSA S6-14.

FINAL

In accordance with CHBDC CSA S6-14, the analysis and design of structures takes into consideration the importance of the structure and the consequence associated with exceeding limit states. The importance category and consequences classification are defined by the Regulatory Authority, which in this case is the Ministry of Transportation, Ontario (MTO). Although this structure is a temporary structure it is the only river crossing to connect Highway 101 in which case it is understood to still be *Major Route Bridge* with *Typical Consequences*. Accordingly, a consequence factor (Ψ) of 1.0, as per Table 6.1 of the CHBDC, has been used in assessing factored geotechnical resistances. If the consequence classification changes, the geotechnical assessment will need to be reviewed and revised.

8 DESIGN OPTIONS

Based on the proposed structure geometry, the evaluation of foundation alternatives and taking into consideration the required length of service life of the structure, spread footings supported on an engineered granular pad resting on the existing rockfill is the preferred foundation alternative at both abutments. Deep foundations are not considered to be a cost effective option and have not been developed further within this report.

9 FOUNDATIONS DESIGN RECOMMENDATIONS

The geotechnical bearing resistances provided in this report for spread footings include a resistance factor of 0.5 (ϕ_{gu}) and 0.8 (ϕ_{gs}) for the ULS and SLS values, respectively, as per Table 6.2 of the CHBDC (static analysis - typical understanding). The geotechnical resistances presented in the following paragraphs are for vertical concentric loading only and will need to be adjusted for the effects of inclined or eccentric loadings, where applicable, in accordance with CHBDC Clause 6.10.3 and 6.10.4.

At either abutment, a spread footing can be constructed on an engineered pad consisting of minimum of 1.0 m thick Granular 'A' material placed directly over the existing undisturbed rockfill. The engineered pad can bear on the rockfill subgrade provided it is free of any soft or deleterious materials and the surface of the rockfill is chinked. A geotextile (Class II non-woven FOS 50 to 150 μm , OPSS 1860) should be placed as a separator between the Granular 'A' and the rockfill. The top of the Granular 'A' pad must extend to 1.0 m beyond the edge of all sides of the footing and be sloped away from the footing at 1H:1V, or flatter. The elevation of the base of the footing should take into consideration the elevation of the lake water and the resulting potential for ice jacking if the structure is left in place over winter months. The structure should be provided with frost protection if the service life will extend into winter months.

The following factored geotechnical resistance values are recommended at this site for a 2.0 m wide cast-in-place footing positioned a minimum of 5 m from the crest of the forward slope, 2 m offset from the crest of sideslopes and founded on a minimum of 1.0 m thick engineered fill pad:

- Factored Geotechnical Resistance at ULS of 225 kPa
- Factored Geotechnical Resistance at SLS of 150 kPa

The horizontal resistance against sliding between a cast-in-place concrete footing founded on engineered fill can be computed using a friction factor of 0.55. Appropriate resistance factors should be applied for the design.

Concrete slab foundations for a modular bridge should be founded on an engineered fill pad with a minimum embedment of 0.5 m

Further discussions on frost depth, subgrade preparation, bedding, backfilling, earth pressures and embankment construction should follow Sections 9.4 through 9.8 of the mainline Sideburned Lake Foundation Investigation and Design Report (Geocres No.: 41O-26).

Approach fills for the temporary detour could be placed early to allow for settlement to occur prior to construction of the temporary and permanent abutment foundations. Alternatively, if preloading is not completed for the temporary alignment, there may be a requirement for additional ongoing maintenance such as shimming/re-leveling the temporary detour bridge and regrading of the temporary detour approach embankments. It is expected that some settlement may also be noted at the existing Sideburned Lake Bridge as a result of fill placement for the temporary approach embankments.

10 CONSTRUCTION CONSIDERATIONS

10.1 Excavation

All excavation must take into consideration the proximity to the existing bridge foundation and must not encroach within 1.5H:1V from the base of the temporary excavation to the existing or newly constructed bridge foundation to avoid undermining those foundations.

All excavation must be carried out in accordance with the Occupational Health and Safety Act (OHSA). For the purposes of OHSA the fills and native soils above the water table and the rockfill below the water table at this site should be classified as Type 3 soil.

Excavation for the temporary structure must be carried out in accordance with OPSS 902. Selection of the equipment and methodology to excavate and prepare the founding surface is the responsibility of the Contractor. Stockpiling or surface surcharge should not be allowed on the temporary embankment or side slopes.

The sides of temporary excavations must be sloped in accordance with the requirement of the OHSA. At locations where there are space restrictions or where a slope has to be retained, the excavations will need to be carried out within a protection system. Design of the temporary protection system is the responsibility of the Contractor.

10.2 Surface and Groundwater Control

Subgrade preparation and placement of granular pads and abutments must be carried out in the dry. Based on the GA drawing provided, the footings are shown to be above the water table.

The Contractor must be prepared to control the groundwater and surface water flow at the site to permit construction in a dry and stable excavation

Water from either surface flow and/or groundwater must be diverted away from the excavation at all times. Groundwater perched within the embankment fill and, surface runoff will tend to seep into, and accumulate in proposed excavations.

Dewatering and surface water diversion must remain operational and effective until the temporary excavation is backfilled. Design of an effective dewatering system must be carried out by the Contractor. Dewatering systems should be designed, operated and removed in accordance with OPSS.PROV 517 and Special Provision No. 517F01 with the following inputs for Table A: Note 1 = Yes and ***** = N/A.

The assessment for the need for a Permit to take Water (PTTW) should be carried out by a specialist experienced in this field.

10.3 Scour Protection and Erosion Control

Slope protection and drainage measures will be required to ensure the surficial stability of the temporary embankment slopes. The contractor should provide silt fences and erosion control blankets, as required, throughout the duration of the construction to prevent silt/sediment from running off the site as per OPSS 805.

Scour and erosion protection should be provided in the area of the temporary detour bridge abutments. Typically, rock protection should be provided over all earth surfaces subjected to flowing water in accordance with OPSS 511.

11 CONSTRUCTION CONCERNS

Potential construction concerns include, but are not necessarily limited to:

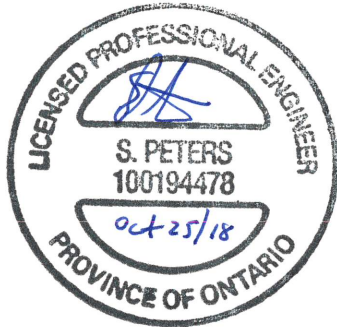
- Buried obstructions may be encountered in the existing rock fill and could interfere with excavation and/or roadway protection installation (if required).
- Shallow depth of refusal may interfere with installation of roadway protection installation (if required)
- Seasonal fluctuations of the groundwater and river level are to be expected which may impact the construction. Dewatering in rockfill will be difficult.
- The Contractor's selection of construction equipment and methodology must include assessment of the capability of the existing ground conditions to support the proposed construction equipment and any temporary structure fill (i.e., as a pad for crane support).

The successful performance of the structure will depend largely upon good workmanship and quality control during construction. Subgrade examination and field density testing should be carried out by qualified geotechnical personnel during construction in accordance with SP109S12 to confirm that foundation recommendations are correctly implemented and material specifications are met.

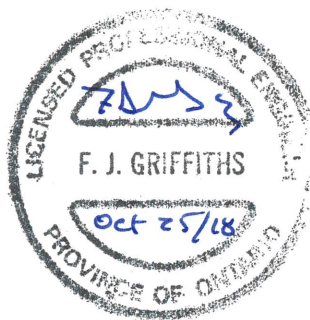
12 CLOSURE

Engineering analysis and preparation of this report were carried out by Dr Fred Griffiths, P.Eng and Mr. Stephen Peters, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng a Designated Principal Contact for MTO Foundation Projects.

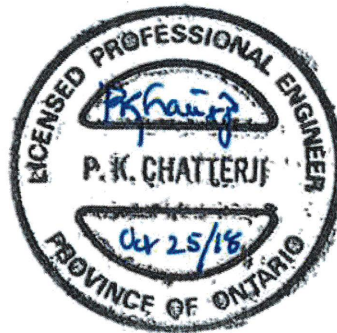
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Senior Geotechnical Engineer

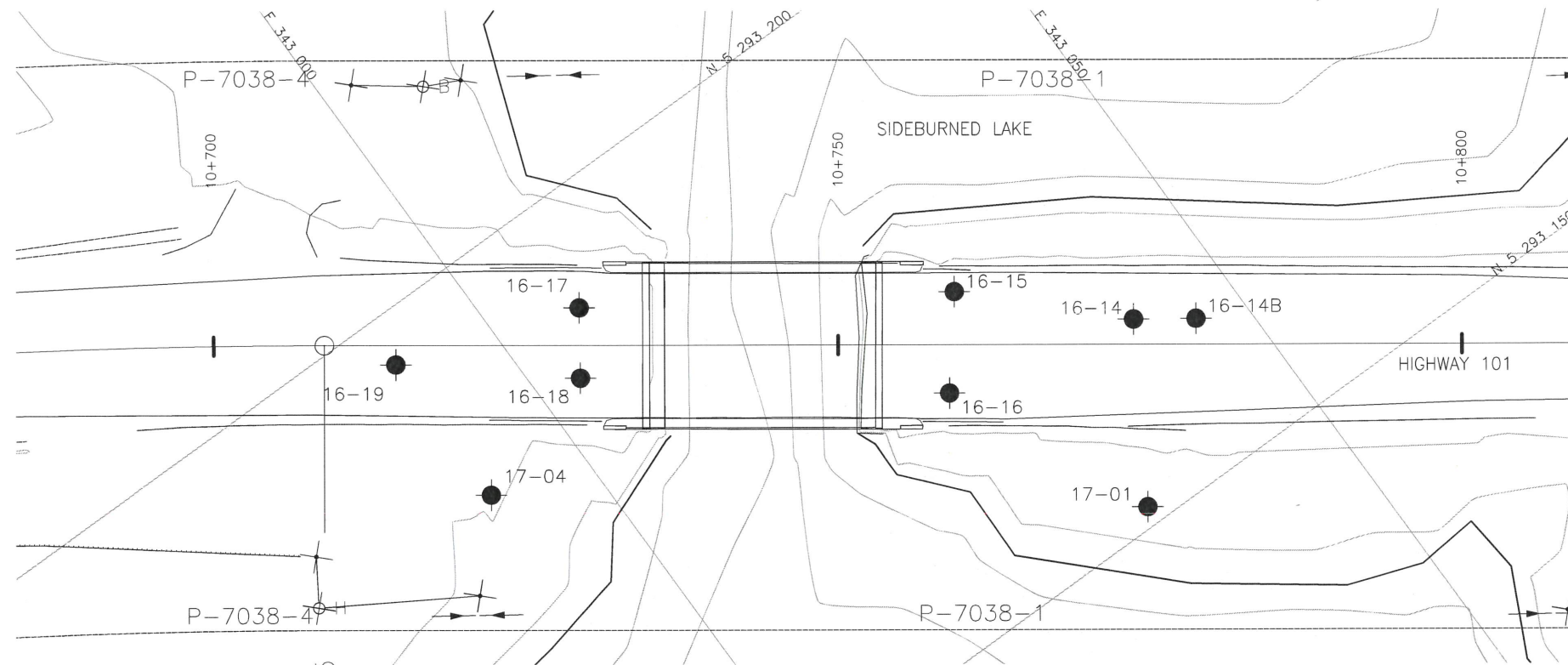


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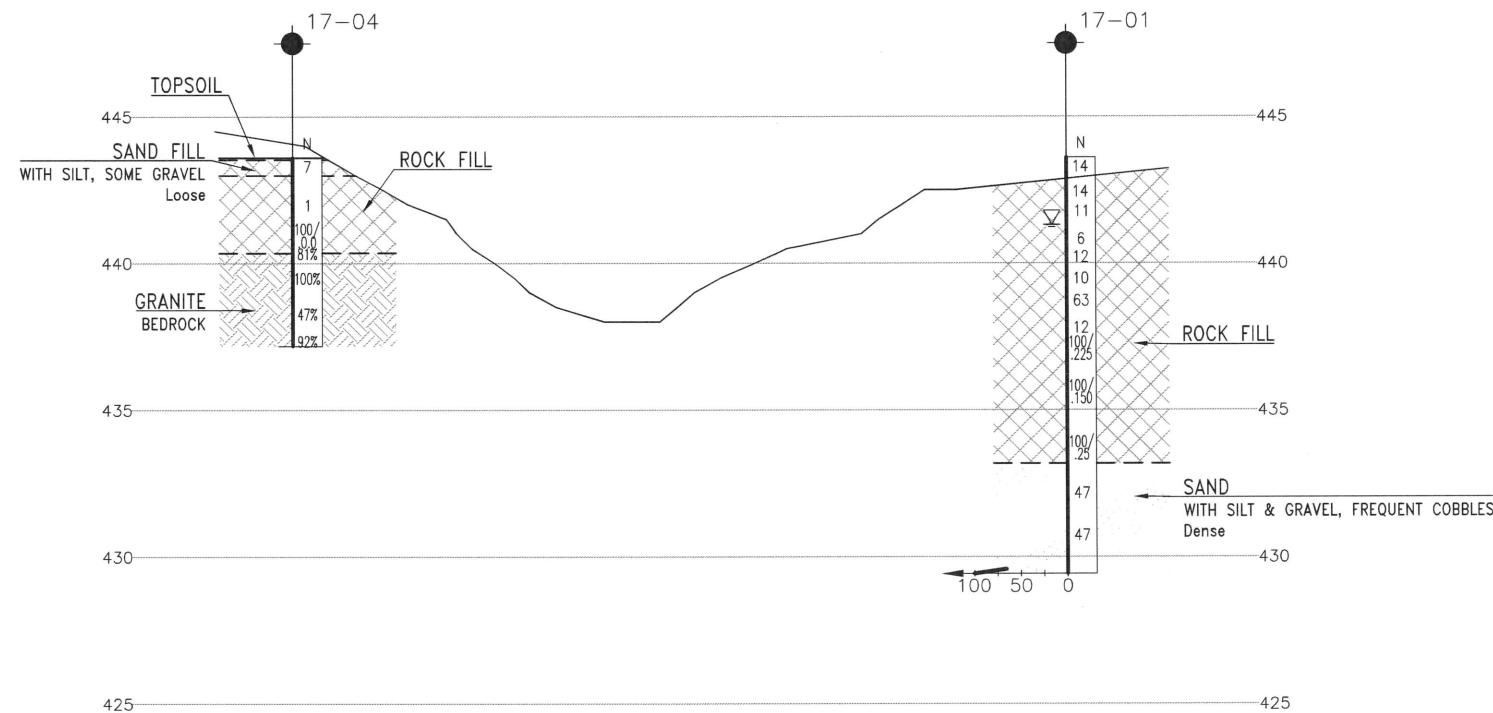
TEMPORARY DETOUR BRIDGE
SIDEburnED LAKE BRIDGE HIGHWAY 101

Appendix A.

Borehole Location Plan and Stratigraphic Drawings

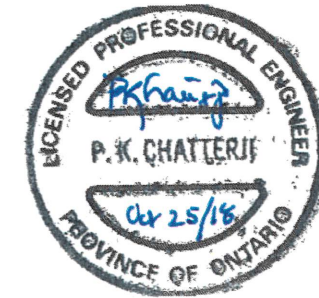


PLAN
SCALE 1:500



PROFILE
H 1:500
V 1:250

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



CONT No
GWP No 5144-10-00

HIGHWAY 101
SIDEburned LAKE
TEMPORARY BRIDGE
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
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
16-14	444.5	5 293 164.3	343 042.0
16-14B	444.5	5 293 161.4	343 046.1
16-15	444.4	5 293 174.6	343 031.7
16-16	444.5	5 293 168.2	343 026.6
16-17	444.7	5 293 191.1	343 006.7
16-18	444.7	5 293 186.5	343 003.5
16-19	444.7	5 293 196.0	342 992.2
17-01	443.6	5 293 151.5	343 034.1
17-04	443.8	5 293 183.1	342 992.2

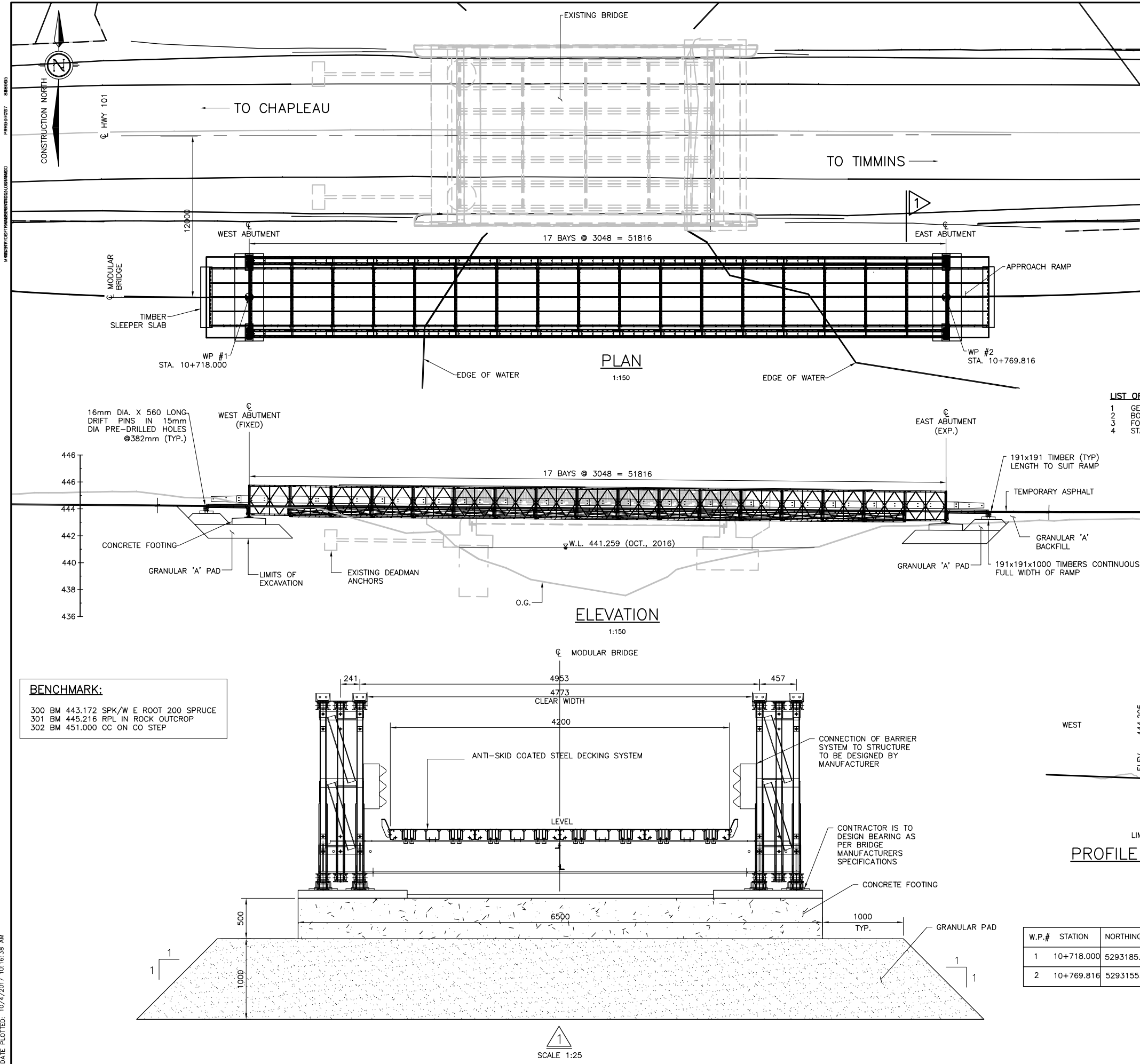
-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Borehole locations are shown in MTM Zone 13 coordinates.

GEOCRES No. 410-27

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	JG	CHK	—
DRAWN	MFA	CHK	JG
CODE	—	LOAD	—
SITE	46-015	STRUCT	—
DWG	1	—	—
DATE	OCT 2018	—	—

CAD FILE LOCATION AND NAME: M:\02-Documents\2016\KIM-16-7040 - MTO NER - 3 Str Replace + 1 Str Rehab Hwy 101 & 129\12 CAD\8 Contract Drawings\Structural\BR-05 TMB Sideburned\S16-7040_BR-05_001CA.dwg
MODIFIED: 10/4/2017 8:36:08 AM BY: A.STUART
DATE PLOTTED: 10/4/2017 10:16:38 AM



METRIC

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AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

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UNIVERSITY OF TRANSITION / CORRADO

DISTRICT

CONT. No. 2017-XXXX

WP No. 5845-05-01

HIGHWAY 101
SIDEBURNED RIVER BRIDGE
BRIDGE REPLACEMENT

GENERAL ARRANGEMENT
TEMPORARY MODULAR BRIDGE

SHEET

76

McINTOSH PERRY

- APPLICABLE STANDARD DRAWINGS:**
- OPSD 925.020 THREE BEAM MEDIAN GUIDE
RAIL- POST, OFFSET BLOCK
AND BACK-UP PLATE
- OPSD 3941.200 FIGURES IN CONCRETE
- LIST OF ABBREVIATIONS:**
- T/D DENOTES TOP OF DECK
T/F TOP OF FOOTING
T/B TOP OF BEARING SEAT
EL. DENOTES ELEVATION
BRGS. DENOTES BEARINGS
ABUT. DENOTES ABUTMENT
TYP. DENOTES TYPICAL
W.P. DENOTES WORKING POINT
STA. DENOTES STATION
NTS DENOTES NOT TO SCALE
EXP DENOTES EXPANSION
DWG DENOTES DRAWING
EXT. DENOTES EXISTING
O.G. ORIGINAL GROUND
- LIST OF DRAWINGS:**
- 1 GENERAL ARRANGEMENT
2 BOREHOLE LOCATION AND SOIL STRATA
3 FOOTING DETAILS, SLEEPER SLAB AND APPROACH DETAIL
4 STANDARD DETAILS
- CLASS OF CONCRETE :**
- PRECAST 40 MPa
 - REMAINDER 30 MPa
- CLEAR COVER TO REINFORCING STEEL**
- PRECAST 55 ± 10mm
 - REMAINDER 70 ± 20mm
- REINFORCING STEEL:**
- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.
 - STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa. UNLESS OTHERWISE SPECIFIED.
 - UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES FOR REINFORCING STEEL BARS SHALL BE CLASS 'B'
 - BAR MARKS WITH PREFIX 'S' DENOTES STAINLESS STEEL BARS
- STRUCTURAL STEEL:**
- ALL STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH MANUFACTURE'S SPECIFICATIONS.
- STEEL MODULAR BRIDGE:**
- THE NEW STEEL MODULAR BRIDGE SHALL BE HOT DIPPED GALVANIZED.
 - THE NEW MODULAR BRIDGE SHALL BE "MABEY" COMPACT 200 MODULAR EW DSHR2+ SD C/W ANTI-SKID COATED STEEL DECK OR APPROVED EQUIVALENT. CONTRACTOR IS RESPONSIBLE FOR THE SUPPLY, DELIVERY, AND ERECTION OF THE NEW MODULAR BRIDGE.
 - THE CONTRACTOR SHALL VERIFY AND ADJUST DIMENSIONS AS NECESSARY FOR A STRUCTURE PROVIDED BY AN APPROVED EQUIVALENT
 - THE NEW MODULAR BRIDGE SHALL BE DESIGNED TO ACCOMMODATE A DIFFERENTIAL SETTLEMENT OF 50mm.
- CONSTRUCTION NOTES:**
- ASSEMBLY AND ERECTION OF THE MODULAR BRIDGE TO BE IN ACCORDANCE WITH THE MANUFACTURE'S INSTRUCTIONS.
 - ALL PINS, BOLTS AND THREADED PARTS MUST BE FREE OF DIRT AND BE LUBRICATED AT THE TIME OF INSTALLATION.
 - THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO THE COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENTS OF THE WORK REQUIRED TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.
 - CONTRACTOR IS RESPONSIBLE FOR STABILITY OF STRUCTURE THROUGHOUT CONSTRUCTION.
 - CONTRACTOR TO PLACE SLEEPER SLABS AFTER ERECTION OF BRIDGE TO ENSURE THE PROPER DIMENSIONS OF EXPANSION JOINT GAPS.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ERECTION OF THE STRUCTURE AND SHALL SUBMIT TO THE CONTRACT ADMINISTRATOR WORKING DRAWINGS AS PER THE SPECIAL PROVISION AND SPECIFICATIONS WITH ALL NECESSARY DETAILS AND REQUIREMENTS TO CARRY OUT THE OPERATIONS. CONTRACTOR SHALL SUBMIT A DETAILED WORK PLAN WITH PROJECT SCHEDULE TO THE CONTRACT ADMINISTRATOR FOR REVIEW BEFORE ERECTION.
 - THE CONTRACTOR SHALL CARRYOUT SITE SURVEY AND FIELD VERIFY UTILITY LOCATIONS BEFORE COMMENCING WITH CONSTRUCTION.
- SPECIFICATIONS:**
- CANADIAN HIGHWAY BRIDGE DESIGN CODE, S6-14
 - LIVE LOAD: CL-625-ONT.

W.P.#	STATION	NORTHING	EASTING	T/D ELEVATION	LOCATION
1	10+718.000	5293185.510	342988.890	444.205	CL. WEST ABUT. BRGS.
2	10+769.816	5293155.121	343030.859	443.819	CL. EAST ABUT. BRGS.

REVISIONS	DATE	BY	REV	DESCRIPTION
DESIGN	AS	CHK	TT	CODE CHBDC-14 LOAD CL-625-ONT DATE OCT/17
DRAWN	KGP	CHK	AS	SITE 46-015 STRUCT SCHEME DWG 1

TEMPORARY DETOUR BRIDGE
SIDEburnED LAKE BRIDGE HIGHWAY 101

Appendix B.

Record of Borehole Sheets



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.



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

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



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

RECORD OF BOREHOLE No 17-01

1 OF 2

METRIC

GWP# 5144-10-00 LOCATION Hwy 101 - Sideburned Lake Temporary Bridge N 5 293 151.5 E 343 034.1 ORIGINATED BY JM
 HWY 101 BOREHOLE TYPE HW Casing / NW Casing / NWT Coring COMPILED BY JM
 DATUM Geodetic DATE 2017.06.15 - 2017.06.16 CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								UNCONFINED + FIELD VANE					
								QUICK TRIAXIAL x LAB VANE					
WATER CONTENT (%)				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT									
W P W W L													
443.6													
0.0	Silty SAND some gravel Brown Compact		1	SS	14								
443.0													
0.7	ROCK FILL Frequent Gravel with Sand infills, Brown, Loose to Compact - Cobbles from 0.7 m to 0.9 m		2	SS	14								
	- 180 mm Cobble at 1.5 m		3	SS	11								
	- 225 mm Boulder at 2.1 m		4	SS	6								
	- Cobbles from 2.4 m to 2.5 m		5	SS	12								
			6	SS	10								
	- 125 mm Cobble at 4.4 m		7	SS	63								
	- Cobbles from 5.2 m to 6.1 m		8	SS	12								
			9	SS	100/ 225mm								
	- Cobbles from 6.6 m to 6.8 m - 280 mm Boulder at 6.8 m												
	- 355 mm Boulder at 7.2 m												
			10	SS	100/ 150mm								
	- 815 mm Boulder at 8.1 m												
	- 75 mm Cobble at 9.0 m												
	- 305 mm Boulder at 9.8 m		11	SS	100/ 25mm								

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

ONTMT4S 13624 - 101 AND 129 - SIDEBURNED LAKE.GPJ 2012TEMPLATE(MTO).GDT 24/10/18

RECORD OF BOREHOLE No 17-01

2 OF 2

METRIC

GWP# 5144-10-00 LOCATION Hwy 101 - Sideburned Lake Temporary Bridge N 5 293 151.5 E 343 034.1 ORIGINATED BY JM
 HWY 101 BOREHOLE TYPE HW Casing / NW Casing / NWT Coring COMPILED BY JM
 DATUM Geodetic DATE 2017.06.15 - 2017.06.16 CHECKED BY SP

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								
	Continued From Previous Page							20	40	60	80	100				
433.2	- 100 mm Cobble at 10.3 m															
10.4	SAND (SP-SM) with Silt and Gravel, frequent Cobbles Brown Dense						433									42 47 11 (SI+CL)
			12	SS	47		432									
			1	GS			431									
			13	SS	47		430									
429.4	- Unable to advance casing past 12.2 m due to frequent Cobbles															
	- Unable to advance core barrel past 13.7 m due to risk of jamming - switch to dCPT at 13.7 m															
14.2	End of borehole at 14.2 m on probable Bedrock (dCPT refusal) Groundwater level measured in open borehole at 2.3 m BGS upon completion															

ONTMT4S 13624 - 101 AND 129 - SIDEBURNED LAKE.GPJ 2012TEMPLATE(MTO).GDT 24/10/18

RECORD OF BOREHOLE No 17-04

1 OF 1

METRIC

GWP# 5144-10-00 LOCATION Hwy 101 - Sideburned Lake Temporary Bridge N 5 293 183.1 E 342 992.2 ORIGINATED BY KE
HWY 101 BOREHOLE TYPE NW Casing / NQ Coring COMPILED BY CM
DATUM Geodetic DATE 2017.05.13 - 2017.05.13 CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
443.8														
0.0														
0.1	75mm Topsoil		1	SS	7									11 78 11 (SI+CL)
443.2	SAND with Silt, some Gravel FILL Loose Brown													
0.6	ROCK FILL - Bent split spoon at 0.8 m, inferred boulder Silty SAND infill 0.9 m to 1.9 m, brown, very loose		2	SS	1									
	- 275 mm Boulder at 2.6 m		3	SS	100/ 0mm									
	- 355 mm Boulder at 2.9 m		1	RUN										RUN #1 TCR=100% SCR=81% RQD=81%
440.5	BEDROCK Granite Slightly weathered Medium grained Grey		2	RUN										RUN #2 TCR=100% SCR=100% RQD=100%
3.3			3	RUN										RUN #3 TCR=100% SCR=47% RQD=47%
	- Broken rock with silt seams from 5.4 m to 5.7 m		4	RUN										RUN #4 TCR=100% SCR=92% RQD=92%
	- Broken rock with silt seams from 6.0 m to 6.1 m													
437.4	End of Borehole													
6.4														

ONTMT4S 13624 - 101 AND 129 - SIDEBURNED LAKE.GPJ 2012TEMPLATE(MTO).GDT 24/10/18

Appendix C.

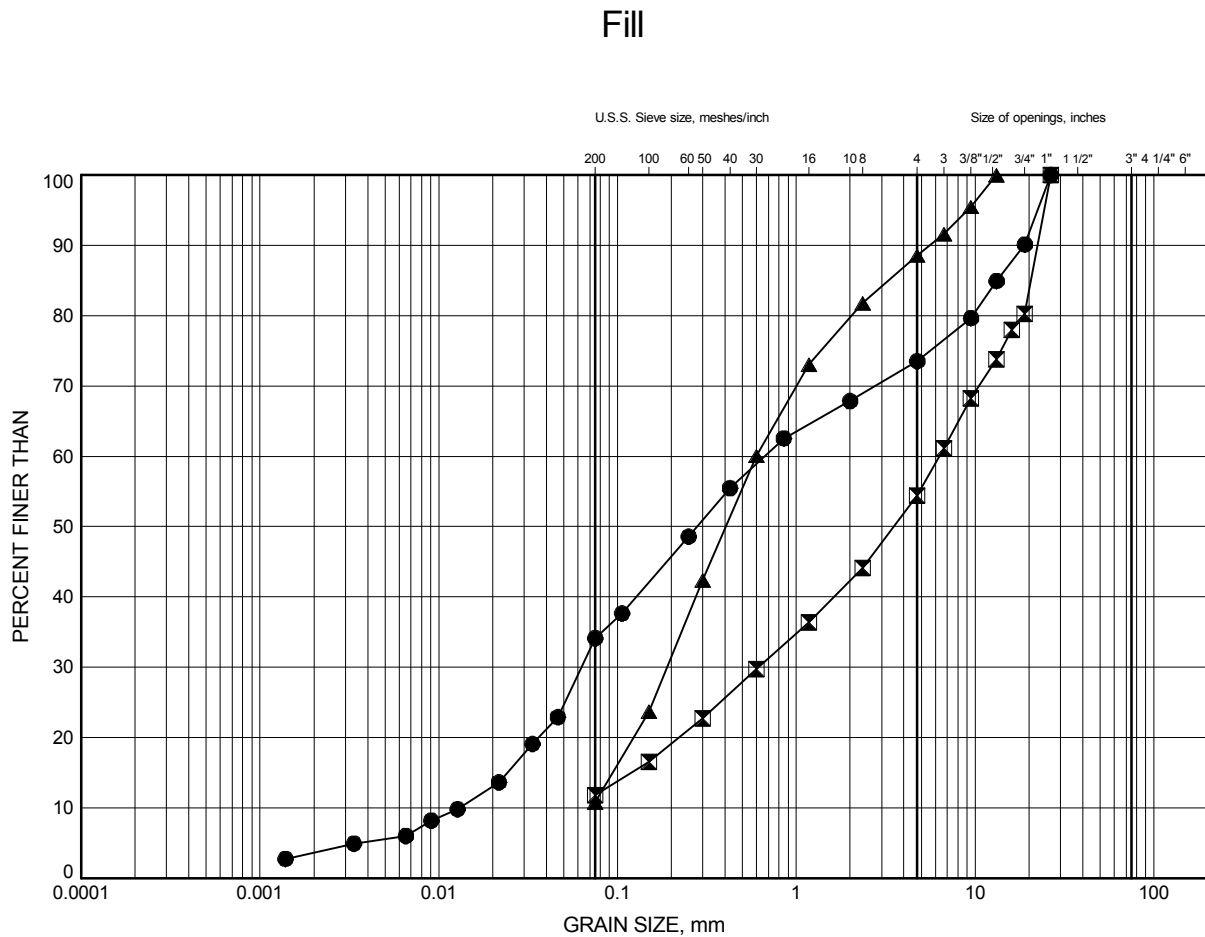
Laboratory Testing

Appendix C.1
Particle Size Analysis Figures

Sideburned Lake Bridge

GRAIN SIZE DISTRIBUTION

FIGURE C1



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	17-01	1.19	442.43
⊠	17-01	4.88	438.74
▲	17-04	0.30	443.48

Date July 2017
GWP# 5144-10-00

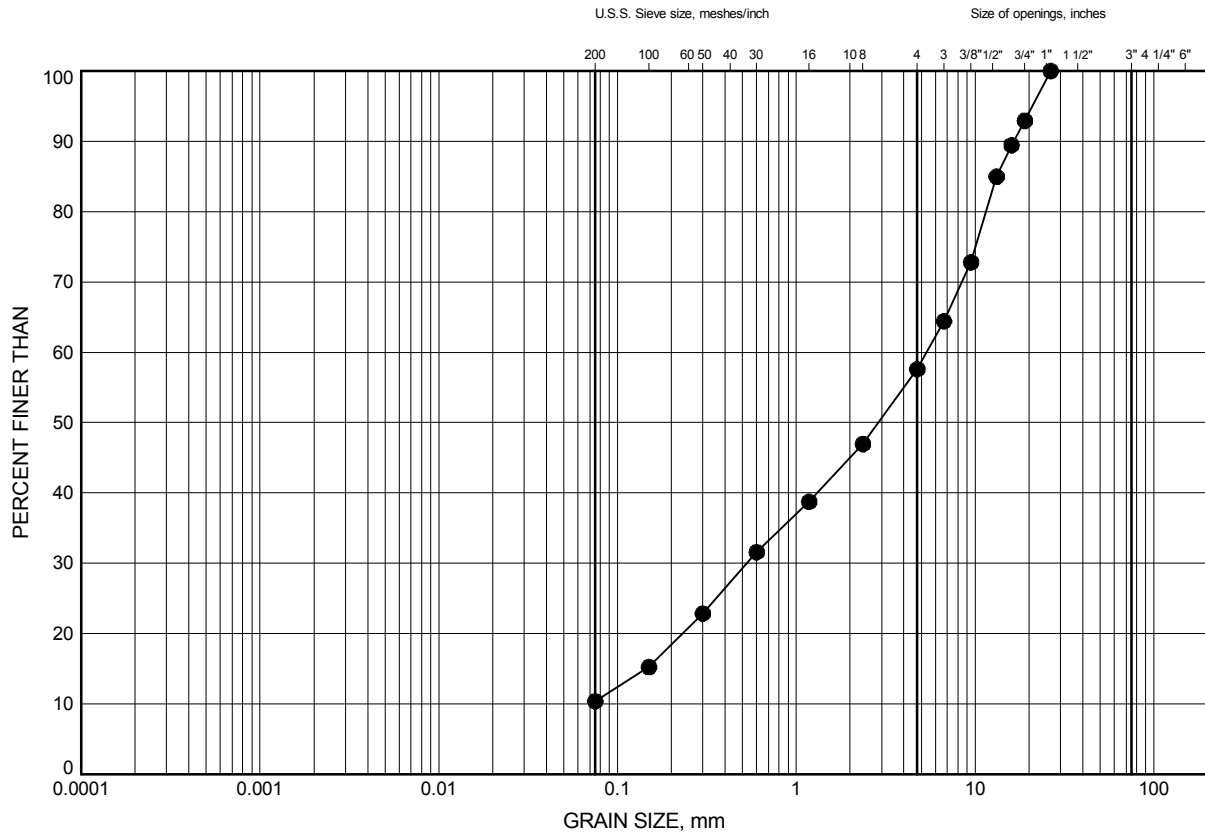


Prep'd CM
Chkd. SP

Sideburned Lake Bridge GRAIN SIZE DISTRIBUTION

FIGURE C2

Sand with Silt and Gravel



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	17-01	11.16	432.47

Date July 2017
GWP# 5144-10-00

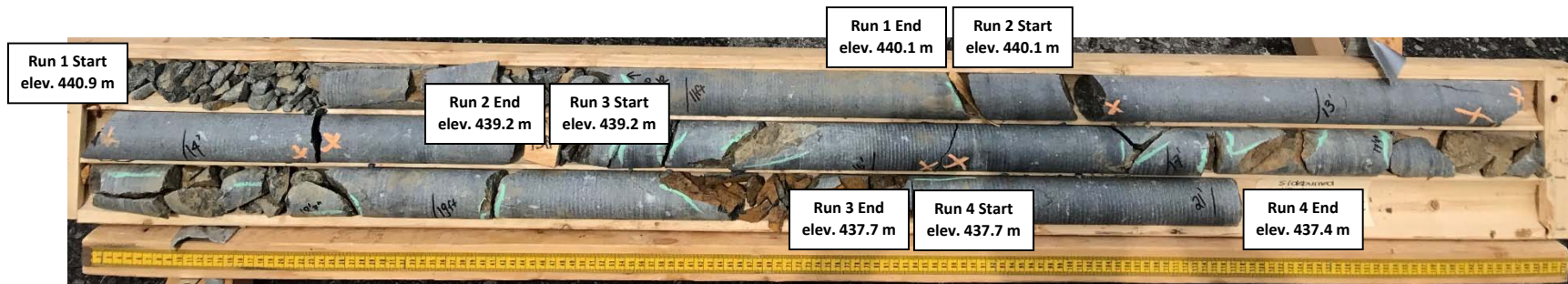


Prep'd CM
Chkd. SP

TEMPORARY DETOUR BRIDGE
SIDEburnED LAKE BRIDGE HIGHWAY 101

Appendix C.2
Rock Core Photographs

Borehole 17-4
Run 1 to 4 (of 4)
Elevation 440.9 m to 437.4 m



TEMPORARY DETOUR BRIDGE
SIDEBURNED LAKE BRIDGE HIGHWAY 101

Appendix D.

Selected Site Photographs

TEMPORARY DETOUR BRIDGE
SIDEBURNED LAKE BRIDGE HIGHWAY 101



Photo 1. South side of highway looking west [taken June 2017].



Photo 2. South side of highway looking east [taken June 2017].