



THURBER ENGINEERING LTD.

**FINAL
FOUNDATION INVESTIGATION 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

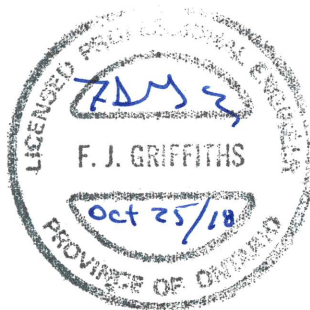
Borehole locations were selected by Thurber relative to existing site features and the proposed foundation locations. The as-drilled locations and ground surface elevations were measured by Thurber following completion of the field program. Elevation benchmarks were provided by MPCE.

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.

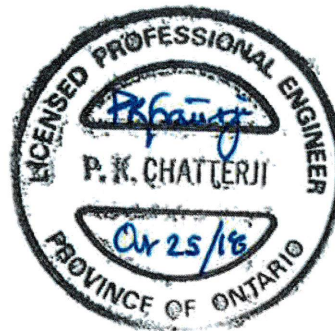
Routine geotechnical laboratory testing was completed by Thurber's laboratory in Ottawa, Ontario. Interpretation of the factual data and preparation of this report were carried out by Dr. Fred Griffiths, P.Eng. and Mr. Stephen Peters P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng. a Designated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



Stephen Peters, P.Eng.
Geotechnical Engineer



Dr. Fred Griffiths, P.Eng.
Senior Associate
Senior Geotechnical Engineer

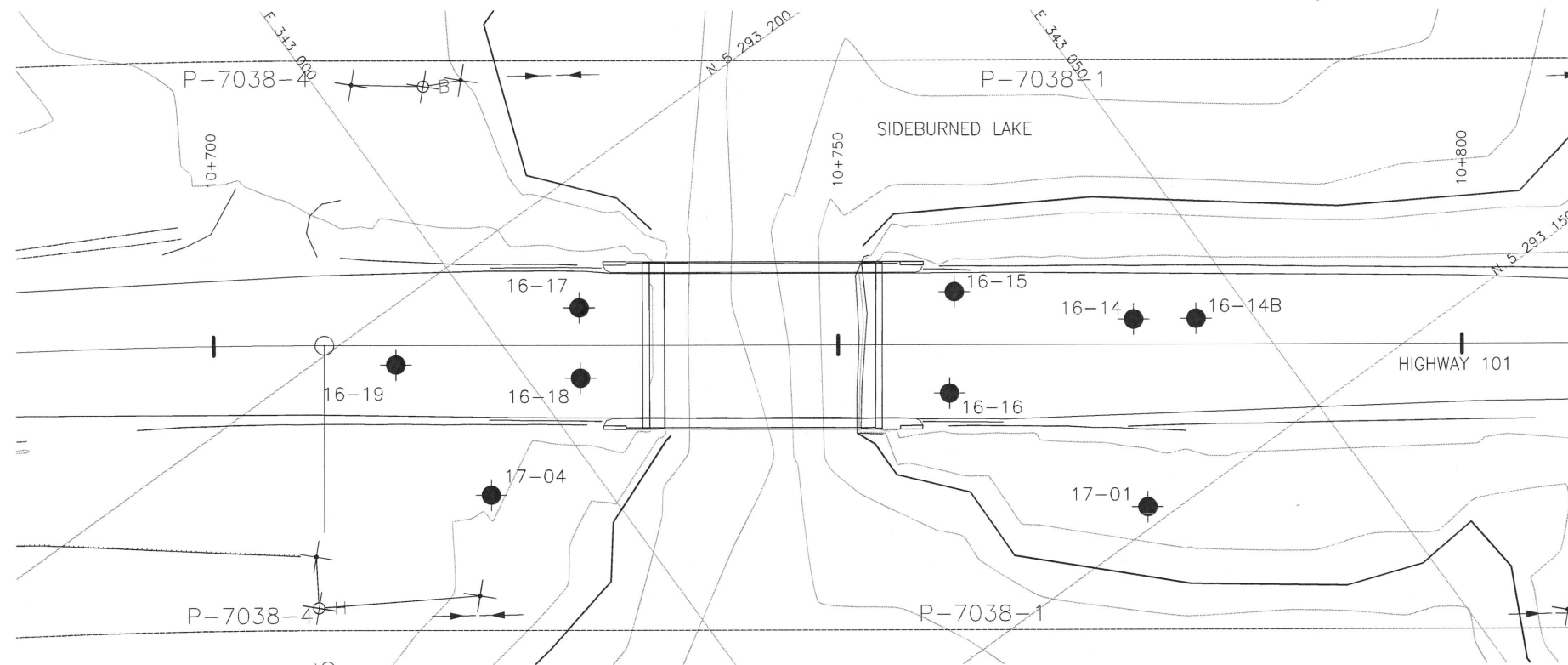


Dr. P.K. Chatterji, P.Eng.
Review Principal
Senior Geotechnical Engineer

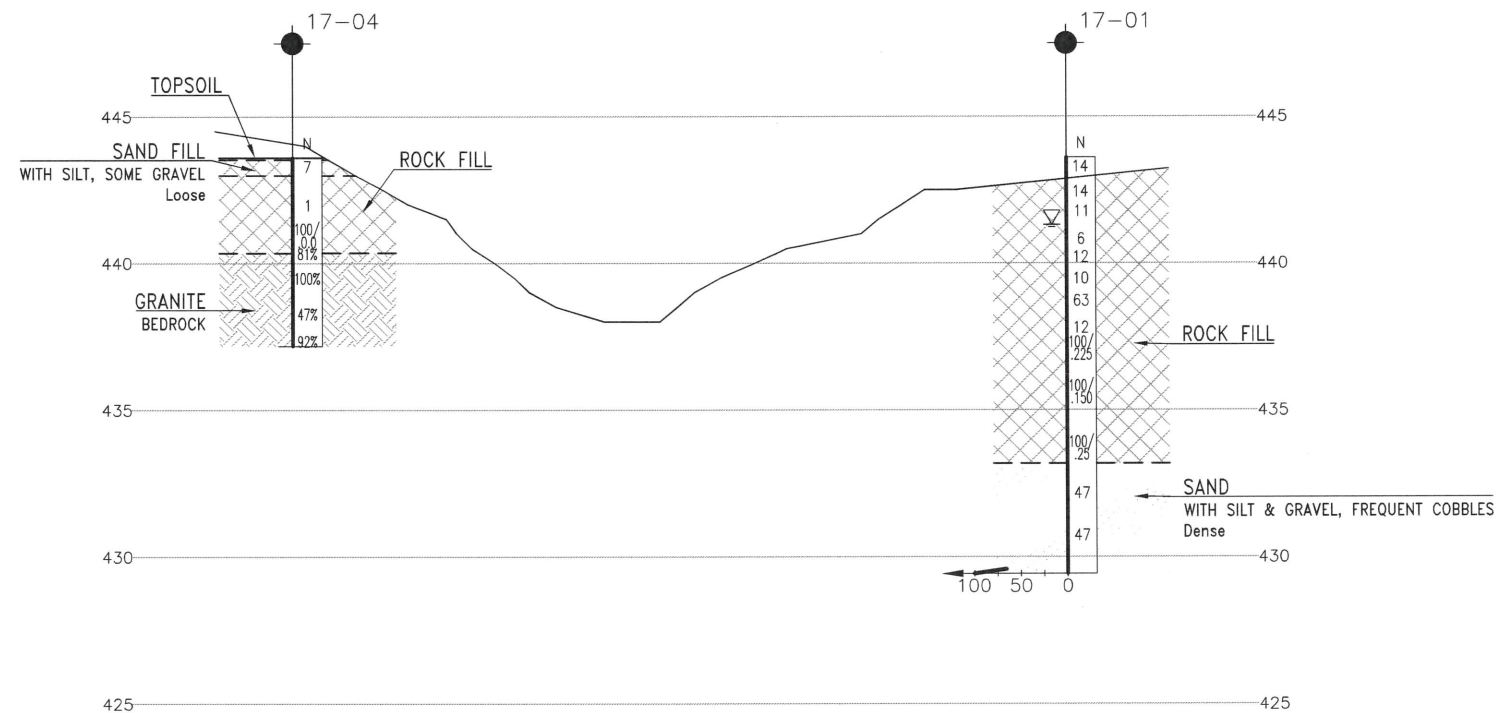
TEMPORARY DETOUR BRIDGE
SIDEBURNED LAKE BRIDGE HIGHWAY 101

Appendix A.

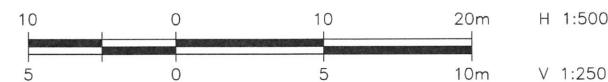
Borehole Location Plan and Stratigraphic Drawings



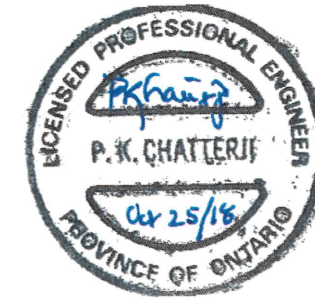
PLAN



PROFILE



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

McINTOSH PERRY



THURBER ENGINEERING LTD.



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-

- 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) 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 | — |
| DATE | OCT 2018 | 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).

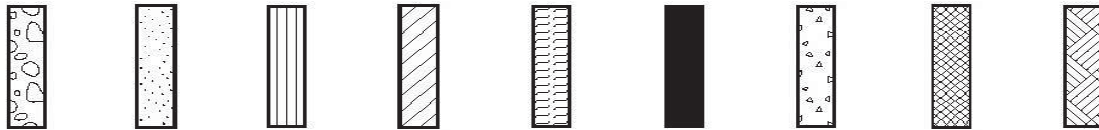
DYNAMIC CONE PENETRATION TEST (DCPT):

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 × LAB VANE | | | | | | | |
| | | | | WATER CONTENT (%) | | | | | | | | | | | |
| | | | | 20 40 60 80 100 | | | | 20 40 60 | | | | | | | |
| 443.6 | | | | | | | | | | | | | | | |
| 0.0 | Silty SAND some gravel Brown Compact | | 1 | SS | 14 | | | | | | | | | | |
| 443.0 | | | | | | | 443 | | | | | | | | |
| 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 | | | | | | | | | 26 39 30 5 | |
| | - 180 mm Cobble at 1.5 m | | 3 | SS | 11 | | 442 | | | | | | | | |
| | - 225 mm Boulder at 2.1 m | | | | | | | | | | | | | | |
| | - Cobbles from 2.4 m to 2.5 m | | 4 | SS | 6 | | 441 | | | | | | | | |
| | | | 5 | SS | 12 | | 440 | | | | | | | | |
| | | | 6 | SS | 10 | | | | | | | | | | |
| | - 125 mm Cobble at 4.4 m | | | | | | 439 | | | | | | | | |
| | - Cobbles from 5.2 m to 6.1 m | | 7 | SS | 63 | | | | | | | | | 46 43 11 (SI+CL) | |
| | | | 8 | SS | 12 | | 438 | | | | | | | | |
| | | | 9 | SS | 100/ 225mm | | 437 | | | | | | | | |
| | - Cobbles from 6.6 m to 6.8 m - 280 mm Boulder at 6.8 m | | | | | | | | | | | | | | |
| | - 355 mm Boulder at 7.2 m | | | | | | 436 | | | | | | | | |
| | | | 10 | SS | 100/ 150mm | | 435 | | | | | | | | |
| | - 815 mm Boulder at 8.1 m | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | - 75 mm Cobble at 9.0 m | | | | | | 434 | | | | | | | | |
| | | | 11 | SS | 100/ 25mm | | | | | | | | | | |
| | - 305 mm Boulder at 9.8 m | | | | | | | | | | | | | | |

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 NATURAL MOISTURE CONTENT LIQUID LIMIT | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|---|--|--|--|--|-------------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | WATER CONTENT (%) | | | | | |
| | | | | | | | | | | | | W P W W L | | | | | |
| | | | | | | | | | | | | | | | | | |
| | 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 | | | | | | | | | | |
| | | | 12 | SS | 47 | | | | | | | | | | | | 42 47 11 (SI+CL) |
| | | | | | | | 432 | | | | | | | | | | |
| | - Unable to advance casing past 12.2 m due to frequent Cobbles | | 1 | GS | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | 13 | SS | 47 | | 431 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 429.4 | - Unable to advance core barrel past 13.7 m due to risk of jamming - switch to dCPT at 13.7 m | | | | | | 430 | | | | | | | | | | |
| 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 | | | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | | |
|---------------|---|------------|---------|------|-------------|----------------------------|-----------------|--|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|--|---|-------------------|--|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | WATER CONTENT (%) | | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | | | | | | | | | | | | |
| 443.8 | | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | | | | | |
| 0.0 | 75mm Topsoil | | 1 | SS | 7 | | | | | | | | | | | 11 78 11 (SI+CL) | | | | |
| 0.1 | SAND with Silt, some Gravel FILL Loose Brown | | | | | | | | | | | | | | | | | | | |
| 443.2 | | | 2 | SS | 1 | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | | | |
| | - 275 mm Boulder at 2.6 m | | 3 | SS | 100/ 0mm | | | | | | | | | | | | | | | |
| | - 355 mm Boulder at 2.9 m | | | | | | | | | | | | | | | | | | | |
| 440.5 | | | 1 | RUN | | | | | | | | | | | | RUN #1 TCR=100% SCR=81% RQD=81% | | | | |
| 3.3 | BEDROCK Granite Slightly weathered Medium grained Grey | | 2 | RUN | | | | | | | | | | | | RUN #2 TCR=100% SCR=100% RQD=100% | | | | |
| | | | 3 | RUN | | | | | | | | | | | | RUN #3 TCR=100% SCR=47% RQD=47% | | | | |
| | - Broken rock with silt seams from 5.4 m to 5.7 m | | | | | | | | | | | | | | | | | | | |
| | - Broken rock with silt seams from 6.0 m to 6.1 m | | 4 | RUN | | | | | | | | | | | | RUN #4 TCR=100% SCR=92% RQD=92% | | | | |
| 437.4 | | | | | | | | | | | | | | | | | | | | |
| 6.4 | End of Borehole | | | | | | | | | | | | | | | | | | | |

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

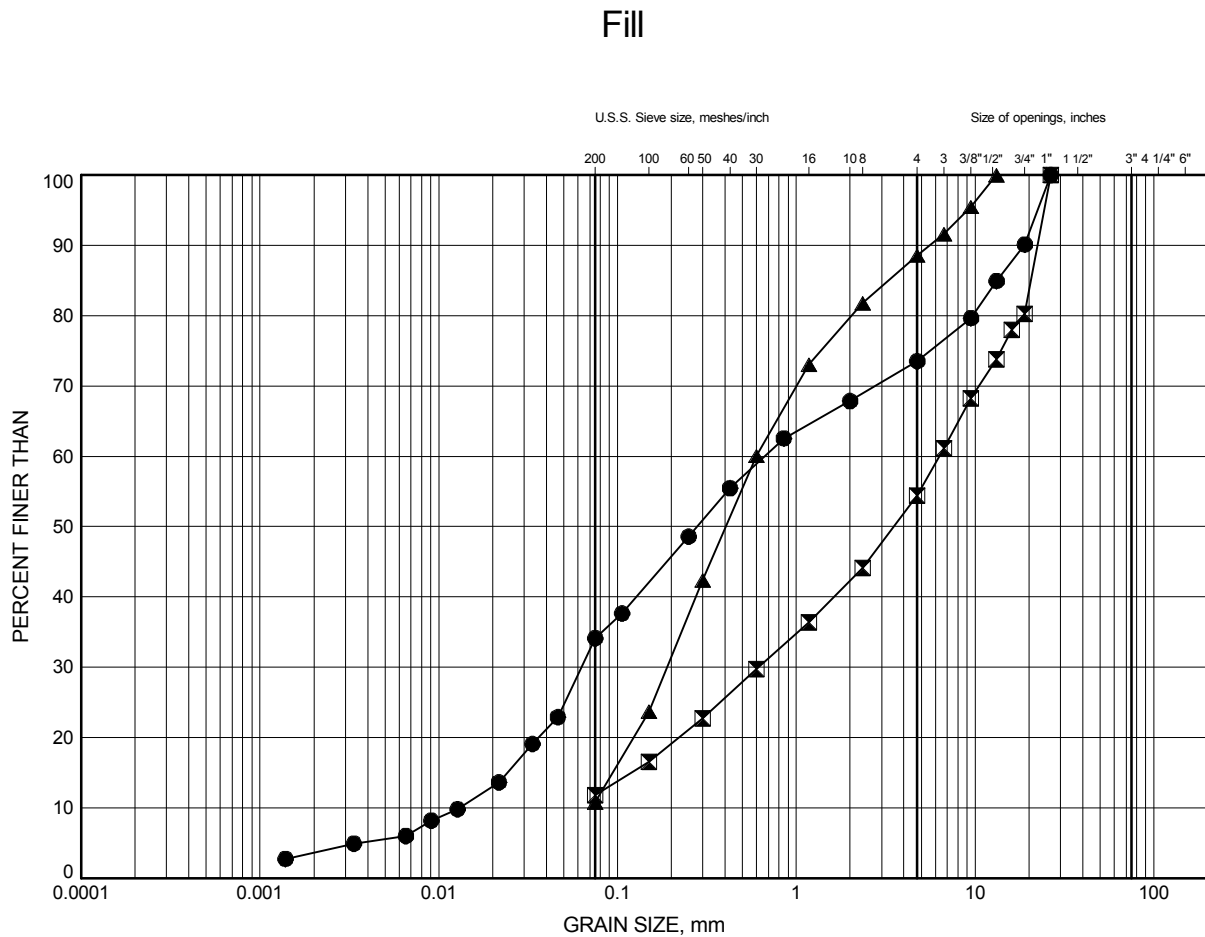
Appendix C.

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

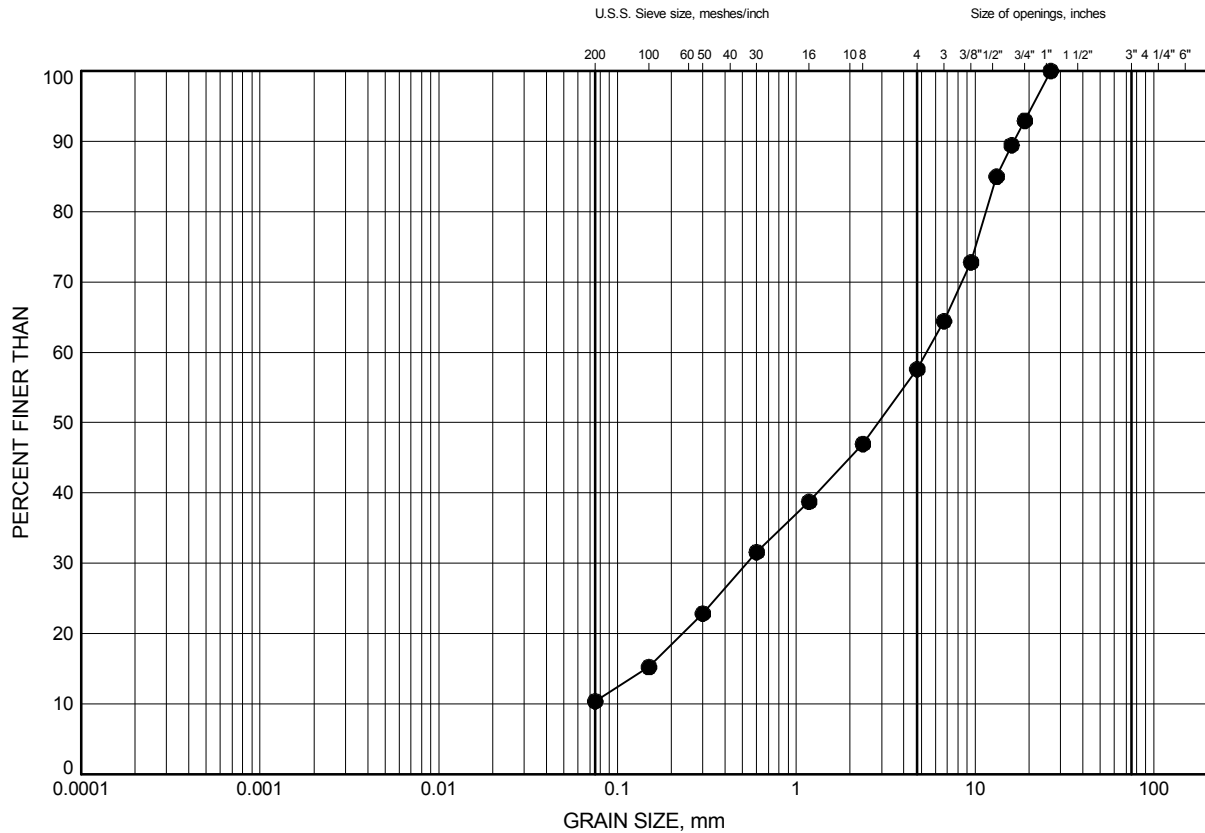


Prep'd CM
Chkd. SP

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

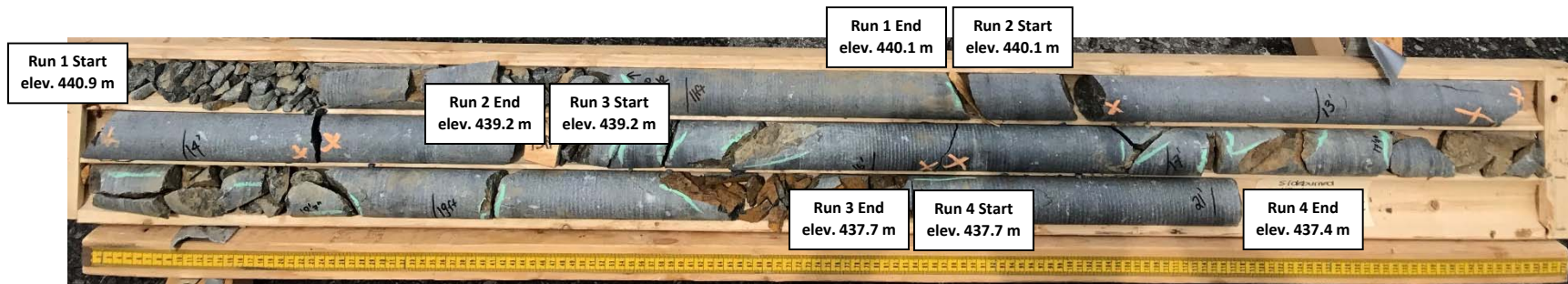


Prep'd CM
Chkd. SP

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.

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].