



April 11, 2016

FOUNDATION INVESTIGATION REPORT

**SWAMP CROSSINGS - PHASE 2
HIGHWAY 69 FOUR-LANING
FROM 1.0 KM NORTH OF THE NEW HIGHWAY 559
INTERCHANGE NORTHERLY TO 1.5 KM NORTH OF
HIGHWAY 7182 (SHEBESHEKONG ROAD) FOR 17 KM
MINISTRY OF TRANSPORTATION, ONTARIO
G.W.P. 5111-07-00 (PHASE 2 OF G.W.P. 5402-05-00)**

Submitted to:

McCormick Rankin, a member of MMM Group Limited
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8



REPORT

GEOCRES No: 41H-161

Report Number: 07-1111-0029-7

Distribution:

- 3 Copies Ministry of Transportation, Ontario, North Bay, Ontario, (Northeastern Region)
- 1 Copy Ministry of Transportation, Ontario, Downsview, Ontario (Foundation Section)
- 2 Copies McCormick Rankin, a member of MMM Group Limited, Mississauga, Ontario
- 1 Copy Golder Associates Ltd., Mississauga, Ontario



**A world of
capabilities
delivered locally**





Table of Contents

PART A – FOUNDATION INVESTIGATION REPORT

1.0 INTRODUCTION.....	1
2.0 SITE DESCRIPTION.....	1
3.0 INVESTIGATION PROCEDURES.....	2
3.1 Foundation Investigation.....	2
4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS.....	3
4.1 Regional Geology.....	3
4.2 General Overview of Local Subsurface Conditions.....	3
4.3 Highway 69 SBL – STA 15+690 to 15+720 (Swamp 23).....	4
4.4 Highway 69 NBL – STA 15+700 to 15+740 (Swamp 23).....	6
4.5 Highway 69 SBL – STA 16+475 to 16+550 (Swamp 24).....	7
4.6 Highway 69 NBL – STA 16+450 to 16+550 (Swamp 24).....	9
4.7 Highway 69 SBL – STA 17+230 to 17+350 (Swamp 25).....	11
4.8 Highway 69 NBL – STA 17+150 to 17+350 (Swamp 25).....	15
4.9 Site 9 Road – STA 10+225 to 10+300 (Swamp 26).....	18
5.0 CLOSURE.....	21

REFERENCES

LISTS OF SYMBOLS AND ABBREVIATIONS

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

LIST OF TABLES

Table 1	Summary of Swamp Crossings
---------	----------------------------

LIST OF DRAWINGS

Drawing 1	Site Location Plan
Drawing 2	Swamp Crossings – Phase 2 – Index Plan

LIST OF APPENDICES

Appendix A	Highway 69 SBL – STA 15+690 to 15+720 and Highway 69 NBL – STA 15+700 to 15+740 (Swamp 23)
Drawing A1	Borehole Locations and Soil Strata
Drawing A2	Soil Strata
Record of Boreholes	S23-01 to S23-03, S23-03A, S23-04 to S23-11



FOUNDATION REPORT – SWAMP CROSSINGS – PHASE 2 – HIGHWAY 69 G.W.P. 5111-07-00

Record of DCPTs	S23-DC-01 to S23-DC-07
Figure A.S23-1	Grain Size Distribution – Sand
Figure A.S23-2	Grain Size Distribution – Silty Sand to Sand
Figure A.S23-3	Grain Size Distribution – Gravelly Sand

Appendix B

Highway 69 SBL – STA 16+475 to 16+550 and Highway 69 NBL – STA 16+450 to 16+550 (Swamp 24)

Drawing B1	Borehole Locations and Soil Strata
Drawing B2	Soil Strata
Record of Boreholes	S24-01 to S24-15
Record of Drillholes	S24-12 and S24-13
Record of DCPTs	S24-DC-01 to S24-DC04
Figure B.S24-1A	Grain Size Distribution – Silt and Sand to Silty Sand
Figure B.S24-1B	Grain Size Distribution – Silt and Sand to Sand
Figure B.S24-1C	Grain Size Distribution – Silty Sand to Sand
Figure B.S24-1D	Grain Size Distribution – Silty Sand to Sand
Figure B.S24-2	Plasticity Chart – Silty Clay
Figure B.S24-3A	Grain Size Distribution – Sand and Gravel
Figure B.S24-3B	Grain Size Distribution – Sand
Figure B.S24-4A	Grain Size Distribution – Sandy Silt to Sand
Figure B.S24-4B	Grain Size Distribution – Sandy Silt to Sand
Figure B.S24-4C	Grain Size Distribution – Sandy Silt to Sand
Figure B.S24-5	Grain Size Distribution – Silt and Sand

Appendix C

Highway 69 SBL – STA 17+230 to 17+350 and Highway 69 NBL – STA 17+150 to 17+350 (Swamp 25)

Drawing C1	Borehole Locations and Soil Strata
Drawing C2	Soil Strata
Record of Boreholes	S25-01 to S25-17, S25-17A, and S25-18 to S25-26
Record of Drillholes	S25-21
Record of DCPTs	S25-DC-01 to S25-DC-10
Figure C.S25-1	Grain Size Distribution – Silty Sand
Figure C.S25-2	Grain Size Distribution – Silt
Figure C.S25-3	Plasticity Chart – Silt
Figure C.S25-4	Plasticity Chart – Clayey Silt to Clay
Figure C.S25-5	Oedometer Consolidation Summary
Figure C.S25-6	Grain Size Distribution – Silt
Figure C.S25-7	Grain Size Distribution – Silt and Sand to Sand
Figure C.S25-8	Plasticity Chart – Silt
Figure C.S25-9	Grain Size Distribution – Silt and Sand to Sand (Upper Deposit)
Figure C.S25-10A	Plasticity Chart – Clayey Silt to Clay
Figure C.S25-10B	Plasticity Chart – Clayey Silt to Clay
Figure C.S25-11	Grain Size Distribution – Silt
Figure C.S25-12A	Grain Size Distribution – Silt and Sand to Sand (Lower Deposit)
Figure C.S25-12B	Grain Size Distribution – Silt and Sand to Sand (Lower Deposit)
Figure C.S25-13A	Grain Size Distribution – Gravelly Sand
Figure C.S25-13B	Grain Size Distribution – Silt and Sand (Pocket)



FOUNDATION REPORT – SWAMP CROSSINGS – PHASE 2 – HIGHWAY 69 G.W.P. 5111-07-00

Appendix D

Site 9 Road – STA 10+225 to 10+300 (Swamp 26)

Drawing D1	Borehole Locations and Soil Strata
Record of Boreholes	S26-01 to S26-08
Record of DCPTs	S26-DC-01 to S26-DC-03
Figure D.S26-1	Plasticity Chart – Clayey Silt
Figure D.S26-2A	Grain Size Distribution – Sandy Silt to Sand
Figure D.S26-2B	Grain Size Distribution – Silt to Sand
Figure D.S26-3	Grain Size Distribution – Gravelly Sand



PART A

**FOUNDATION INVESTIGATION REPORT
SWAMP CROSSINGS – PHASE 2
HIGHWAY 69 FOUR-LANING
FROM 1.0 KM NORTH OF THE NEW HIGHWAY 559
INTERCHANGE NORTHERLY TO 1.5 KM NORTH OF
HIGHWAY 7182 (SHEBESHEKONG ROAD) FOR 17 KM
MINISTRY OF TRANSPORTATION, ONTARIO
G.W.P. 5111-07-00 (PHASE 2 OF G.W.P. 5402-05-00)**



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by McCormick Rankin (MRC), a member of MMM Group Limited on behalf of Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for four (4) swamp crossings within the Phase 2 limits of the new Highway 69 alignment. The proposed work is part of the detail design for the four-laning of Highway 69 from 1.0 km north of the new Highway 559 Interchange northerly to 1.5 km north of Highway 7182 (Shebeshekong Road), which involves high fill embankments and embankments over swamps, the New Woods Road and Shebeshekong Road interchanges and structures, the Shawanaga River and Site 9 Road structures, the Shebeshekong Road Overpass structures, as well as culvert crossings. The Phase 2 limits of the project extend from 3 km north of the existing Woods Road to 6.1 km north of Highway 7182 (Shebeshekong Road). The general location of this section of the Highway 69 four-laning alignment is shown on Drawing 1.

The Terms of Reference and the scope of work for the foundation investigation are outlined in MTO's Request for Proposal, dated January 2007. Golder's original proposal for foundation engineering services associated with the Phase 2 swamp crossings is contained in Section 6.8 of MRC's Technical Proposal for this assignment. Golder's additional scope of work for the crossings at Swamp 25 and Swamp 26 is contained in Addendum No. 7, dated February 14, 2013. The work has been carried out in accordance with Golder's Supplemental Specialty Quality Control Plan for foundation engineering services for this project, dated July 4, 2007. The General Arrangement (GA) drawing for the proposed new alignment of Highway 69 was provided to Golder by MRC on March 4, 2009 and May 15, 2015.

This report addresses the investigation carried out for the crossings at Swamp 23 to Swamp 26 within the Phase 2 limits. A detailed list of the crossings at Swamp 23 to Swamp 26 Phase 2 is presented in Table 1. Separate reports address the foundation investigations for the Phase 1 swamp crossings and high fill areas, as well as for the culverts and the bridge structures for Phase 1 and 2 components of the project. It should be noted that the crossings at Swamp 18 to Swamp 22 within the Phase 2 limits have been report in the Swamp Crossings and High Fill Areas – Phase 1 report, Geocres No. 41H-73, dated November 2011.

The purpose of this investigation is to establish the subsurface conditions along the roadway alignment at the proposed Phase 2 swamp crossings by borehole drilling, rock coring, in situ testing and laboratory testing on selected samples. The swamp limits were located in the field by Callon Dietz Inc. (Callon Dietz), a professional surveying company retained by MRC. The investigation areas are shown in plan on Drawing 2.

2.0 SITE DESCRIPTION

The section of the new highway alignment being addressed by this report begins approximately 19 km northwest of Nobel, Ontario. Re-aligned and/or newly proposed highways and access / service roads associated with the four-laning of the new Highway 69 in this phase of the project include Shebeshekong Road, the adjoining ramps for the proposed Shebeshekong Road underpass (interchange) and overpass structures and Site No. 9 Road northerly from the interchange. The new four-lane Highway 69 alignment is oriented generally in a southeast-northwest direction with the Phase 2 project limits located within the Shawanaga Township.

In general, the topography in the area of the overall project limits consists of rolling terrain including densely treed areas and numerous bedrock outcrops separated by low-lying swamps containing areas of standing water and various vegetation types and organic soils. The ground surface within the investigated limits of the Phase 2 swamp crossings varies between about Elevation 201.7 m and 213.5 m, referenced to Geodetic datum, and is gently sloping downward from northeast to southwest towards Georgian Bay. A detailed description of each investigated swamp crossing is presented in Section 4.0. The locations of these areas are shown on Drawing 2.



3.0 INVESTIGATION PROCEDURES

3.1 Foundation Investigation

The field work for the Phase 2 swamp crossings investigation was carried out in two periods to cover the additional scope of work, between January 19 and March 22, 2009 and January 22 and February 5, 2015 during which time a total of sixty-two (62) boreholes and twenty-four (24) Dynamic Cone Penetration Tests (DCPTs) were advanced at the locations summarized in Table 1 and shown on Drawings A1 to D1 in Appendices A to D. In general, the boreholes and DCPTs were advanced along the centreline and the toes of the proposed embankment alignment (in accordance with the Terms of Reference).

The field investigation was carried out using a variety of drilling equipment as a result of the varying nature of the terrain within the Phase 2 project limits. The details of the drilling equipment and suppliers are listed below. Hand excavation methods were used as appropriate depending on the terrain.

Drilling Equipment	Supplied and Operated By
Track-mounted CME 55	Landcore Drilling of Sudbury, Ontario
Track-mounted CME 550	Landcore Drilling of Sudbury, Ontario
Track-mounted D-25	Walker Drilling Ltd. of Utopia, Ontario
Portable Equipment	Walker Drilling Ltd. of Utopia, Ontario Landcore Drilling of Sudbury, Ontario

The boreholes were advanced through the overburden using 108 mm inside diameter hollow-stem augers, 101 mm or 115 mm O.D. solid-stem augers, and ‘HW’, ‘BW’ or ‘NW’ casing. Soil samples were obtained continuously at some borehole locations but generally at intervals of depth of about 0.75 m and 1.5 m, using a 50 mm outer diameter (O.D.) split-spoon sampler operated by automatic hammers on the drill rigs, performed in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586 Standard Test Method for Standard Penetration Test). Boreholes advanced by portable equipment employed full weight or half (1/2) weight hammers lifted manually. Where a half weight hammer was used, the hammer was dropped from the SPT height and the ‘N’-values were corrected for the lower energy drive. Select samples of the cohesive soils were obtained using 50 mm or 76 mm O.D. thin-walled ‘Shelby’ tubes (ASTM D15878 Standard Practice for Thin-Walled Tube Sampling) for relatively undisturbed samples. Where BW casing was used to advance the boreholes, 48 mm O.D. Shelby tubes were used to obtain samples. Field vane shear tests were conducted in cohesive soils for determination of undrained shear strengths (ASTM D2573 Standard Test Method for Field Vane Shear Test) using the MTO Standard and ‘N’ size vanes, except where carried out in boreholes advanced by BW casing where a ‘B’ size vane was used. Samples of the bedrock were obtained using an ‘HQ’ size rock core barrel. All boreholes were backfilled with bentonite upon completion in accordance with Ontario Regulation 903-Wells (as amended).

The boreholes and DCPTs were advanced to refusal to further auger, casing and/or split soon advancement, shovel penetration, or cone penetration. The boreholes and DCPT’s were advanced to depths ranging from 0 m (bedrock outcrop) to 20 m below existing ground surface, including coring of bedrock for core lengths of 1.5 m and 1.6 m in three (3) boreholes. Refusal at locations where bedrock was not cored does not confirm bedrock surface elevations, but may be inferred to indicate potential proximity to the bedrock surface. At various borehole locations where refusal was encountered at shallow depth, the bedrock was exposed by hand shovel excavation to confirm the refusal condition.

The groundwater conditions and water levels in the open boreholes were observed during the drilling operations and are described on the Record of Borehole sheets in Appendices A to D. It should be noted that groundwater elevations as encountered in the boreholes may not be representative of static groundwater levels since the



groundwater levels in the boreholes may not have stabilized on completion of drilling. Furthermore, groundwater elevations will vary depending on seasonal fluctuations, precipitation and local soil permeability.

The field work was observed by members of our engineering and technical staff, who located the boreholes, arranged for the clearance of underground services, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined and cared for the soil and rock samples. The samples were identified in the field, placed in appropriate containers, labelled and transported to our Mississauga geotechnical laboratory where the samples underwent further detailed visual examination and laboratory testing. All of the laboratory tests were carried out to MTO and/or ASTM Standards, as appropriate. Classification testing (water content, organic content, Atterberg limits and grain size distribution) was carried out on selected samples. In addition, a one-dimensional consolidation (oedometer) test was carried out on a sample of the cohesive deposit and the summary of the consolidation test results is presented in Table 2. The results of the laboratory classification testing for the swamp crossings are included in Appendices A to D.

The proposed centreline of the highway was staked in the field by Callon Dietz prior to drilling. The borehole locations for the 2009 investigation were surveyed by a member of our technical staff in reference to the centreline stakes and the ground surface elevations at the stakes were provided by MRC (received on November 23, 2009). The boreholes for the 2015 investigation were staked in the field by Callon Dietz and the as-drilled borehole locations, in stations and offsets, and the ground surface elevation at the boreholes were measured in reference to the centreline alignment and were subsequently converted into MTM NAD 83 (Zone 10) coordinates in AutoCAD. The borehole locations shown on Drawings A1 to D1 are positioned relative to MTM NAD 83 northing and easting coordinates and the ground surface elevations are referenced to Geodetic datum.

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

As delineated in *The Physiography of Southern Ontario*¹, this section of Highway 69 lies within the physiographic region known as the Georgian Bay Fringe, which extends along the east side of Georgian Bay through the Parry Sound and Muskoka areas, then eastward from Muskoka in patches into the area north of the Kawartha Lakes.

This part of the Georgian Bay Fringe physiographic region was never submerged during periods of glacial recession. As a result, the surficial soils in this area consist of very shallow deposits of sand, silt and clay underlain by metamorphic bedrock; numerous bare knobs and ridges of bedrock are present throughout the area. Localised low-lying swampy areas, containing peat and/or organic soils underlain by soft/loose native soils, are present in valleys between the bedrock knobs and ridges.

The bedrock in the area consists typically of gneisses of the Britt Domain of the Central Gneiss Belt, a subdivision of the Grenville Structural Province, as described in *Geology of Ontario, OGS Special Volume 4*². Deposition of Paleozoic strata and later erosion during glaciation exposed these Precambrian rocks.

4.2 General Overview of Local Subsurface Conditions

The detailed subsurface soil and groundwater conditions as encountered in the boreholes (including excavations by hand shovel) advanced during this investigation, together with the results of the laboratory tests carried out on selected soil samples, are given on the attached Record of Borehole sheets in Appendices A to D. The detailed results of the laboratory testing are provided in Appendices A to D. The results of the in situ field tests (i.e. SPT

¹ Chapman, L.J. and Putnam, D.F., 1984. *The Physiography of Southern Ontario*, Ontario Geological Survey, Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

² *Geology of Ontario*, 1991. Ontario Geological Society, Special Volume 4, Part 2. Ministry of Northern Development and Mines, Ontario.



'N'-values) as presented on the Record of Borehole sheets and in Section 4.0 are uncorrected. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests (SPTs) and in situ testing. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Further, subsurface conditions will vary between and beyond the borehole locations. The thickness of the overburden in the investigated areas as inferred from the resistance to Dynamic Cone Penetration Test (DCPT) results are shown on the Record of Penetration Test sheets in Appendices A to D.

The inferred soil stratigraphy as encountered in the boreholes and DCPTs advanced for the proposed Phase 2 swamp crossings are shown on Drawings A1 to D1, inclusive. It should be noted that the orientation (i.e. north, south, east, west) stated in the text of the report is typically referenced to project north (along the proposed Highway 69 alignment) and therefore may differ from that shown on the drawings which represents magnetic north.

In general, the stratigraphy encountered at the swamp areas investigated is similar, however, the thickness of the overburden (soil materials) is variable, ranging from no cover (i.e. bedrock outcrops present at ground surface) to about 20 m. The stratigraphy from ground surface to refusal or bedrock generally consists of:

- Surficial layers of peat, organic sand/silt/clayey silt, topsoil, sand and gravel fill and rock fill;
- Deposits of sandy silt to sand with interlayers of clayey silt to silty clay;
- Deposits of mixtures of clayey silt to clay interbedded with sand and silt layers and underlain by deposits of sand and silt, sand, and sand and gravel.

Detailed descriptions of the subsurface conditions at each investigated swamp crossing are provided in the following sections of this report. Where relatively significant thicknesses of overburden were encountered, the various soil types are described in detail for each main deposit or stratum.

4.3 Highway 69 SBL – STA 15+690 to 15+720 (Swamp 23)

The plan and profiles along the centreline and toes of the embankment of the new Highway 69 SBL alignment showing the borehole locations and interpreted stratigraphy between about STA 15+690 and 15+720 are shown on Drawing A1 in Appendix A. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 7 m above existing grade. A total of seven (7) boreholes (Boreholes S23-01 to S23-06, inclusive, and S23-03A), and four (4) Dynamic Cone Penetration Tests (DCPTs S23-DC01 to S23-DC03 and S23-DC07) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed highway is relatively flat with ground cover consisting of shrubs and wet grassy areas, located within the confines of tree covered valley slopes at the north and south limits of the swamp.

In general, the subsurface soils along the SBL alignment in this area consist of a surficial deposit of peat underlain by a deposit of sand which extends to the refusal depth. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at a greater depth at about STA 15+710. Bedrock outcrops are present along the southern limit of the swamp.

Snow / Ice / Water

Snow, ice and water to depths between 0.6 m and 0.9 m was encountered in all boreholes except at Boreholes S23-01 and S23-02.



Peat

A deposit of dark brown, wet, fibrous/amorphous peat containing roots and wood fragments was encountered underlying the ice/water cover in Boreholes S23-03, S23-03A, S23-04 and S23-05. The top of the peat deposit ranges from Elevation 208.8 m to 208.0 m and its thickness ranges from 0.1 m to 1.8 m.

The Standard Penetration Test (SPT) 'N'-values measured within the peat deposit range from 1 blow to 13 blows per 0.3 m of penetration, suggesting a very soft to stiff consistency.

The natural water content measured on two (2) samples of the peat is about 353 per cent and 357 per cent and the organic content measured on one (1) sample of the peat deposit is about 56 per cent.

Sand

A deposit of brown to grey sand, trace to some silt, trace to some gravel and trace clay was encountered underlying the peat deposit and snow cover or at ground surface in all boreholes except at Borehole S23-02. In Borehole S23-06, the deposit contains clay seams near the top between Elevation 207.8 m and 207.0 m. The top of this deposit ranges from Elevation 212.3 m to 206.2 m and its thickness ranges from 0.1 m to 6 m in Boreholes S23-01 to S23-06, including S23-03A and potentially up to about 7.5 m as inferred in DCPT S23-DC02. The bottom of this deposit was defined by refusal to further split-spoon and/or casing advancement, cone penetration or hand (shovel) excavation.

The SPT 'N'-values measured within this deposit range from 1 blow to 22 blows per 0.3 m of penetration, with values between 54 blows and 106 blows per 0.3 m of penetration and up to 68 blows per 0.15 m of penetration measured within the lower portion of the deposit, indicating a very loose to very dense relative density.

The natural water content measured on samples of this deposit ranges from about 14 per cent to 42 per cent but is typically less than 25 per cent. The upper portion of the sand deposit contains organics. Laboratory testing on two (2) samples of the deposit measured organic contents of about 2 per cent and 4 per cent.

The grain size distributions of six (6) samples of this deposit are shown on Figure A.S23-1 in Appendix A.

Bedrock / Refusal

Bedrock outcrops are present along the southern limit of the swamp and along the east toe of the proposed embankment. Bedrock is present below a thin cover of sandy soil on the centreline of the roadway at the south limit of the swamp (Boreholes S23-02 and S23-01, respectively). In Boreholes S23-03 to S23-06 and DCPTs S23-DC01 to S23-DC03 and S23-DC07, refusal to further split-spoon and/or casing advancement or cone penetration was encountered at depths between 1.4 m and 9.6 m below snow/ice or ground surface, corresponding to Elevation 207.5 m and 199.3 m. In general, refusal was encountered at greater depths towards the centre of the swamp between about STA 15+700 and 15+710.

Groundwater Conditions

In general, the samples taken in the boreholes were moist to wet with free water noted in select sand samples. The water levels observed in the boreholes upon completion of drilling range from Elevation 209.4 m to 208.7 m, measured at the ice surface and up to a depth of about 0.6 m below the ice or snow surface.



4.4 Highway 69 NBL – STA 15+700 to 15+740 (Swamp 23)

The plan and profiles along the centreline and toes of the embankment of the new Highway 69 NBL alignment showing the borehole locations and interpreted stratigraphy between about STA 15+700 and 15+740 are shown on Drawings A1 and A2 in Appendix A. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 7 m above existing grade. A total of five (5) boreholes (Boreholes S23-07 to S23-11, inclusive), and three (3) Dynamic Cone Penetration Tests (DCPTs S23-DC04 to S23-DC06) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed highway is relatively flat with ground cover consisting of shrubs and wet grassy areas, located within the confines of tree covered valley slopes at the north and south limits of the swamp.

In general, the subsurface soils along the NBL alignment in this area consist of a surficial deposit of peat underlain by a deposit of silty sand to sand which extends to refusal depth or is underlain by a deposit of gravelly sand in places. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at greater depth at about STA 15+730. Bedrock outcrops are present along the southern limit of the swamp.

Ice / Water

Ice and water to depths between 0.7 m and 0.9 m was encountered in all boreholes except Borehole S23-11.

Peat

A 0.6 m and 0.8 m thick deposit of brown, wet, fibrous peat was encountered underlying the ice/water cover in Boreholes S23-07 and S23-08 at Elevation 208.1 m and 208.2 m, respectively.

The Standard Penetration Test (SPT) 'N'-values measured within the peat deposit are between 1 blow and 2 blows per 0.3 m of penetration, suggesting a very soft consistency.

The natural water content measured on a sample of the peat deposit is about 326 per cent and an organic content measured on this sample is about 64 per cent.

Silty Sand to Sand

A deposit of brown and grey silty sand containing trace to some gravel and clay seams to sand, trace to some silt, was encountered underlying the peat deposit and ice/water cover or at ground surface in all boreholes. The upper portion of the deposit contains a 0.7 m thick pocket of organic sand in Borehole S23-09. The top of this deposit ranges from Elevation 213.5 m to 207.5 m and its thickness ranges from about 4.3 m to 10.2 m as encountered in the boreholes and inferred in the DCPTs, except in Borehole S23-07 where the thickness is 0.7 m. Boreholes S23-08 to S23-10 were terminated within this deposit upon refusal to further split-spoon and/or casing advancement, while Borehole S23-11 was terminated within this deposit on a very dense material.

The SPT 'N'-values measured within this deposit range from 1 blow to 55 blows per 0.3 m of penetration, with values of 87 blows and 89 blows per 0.3 m of penetration measured within the lower portion of the deposit in Borehole S23-08, indicating a very loose to very dense relative density.

The natural water content measured on samples of this deposit ranges from about 9 per cent to 26 per cent. The upper portion of the sand deposit contains trace organics and laboratory testing on one (1) sample of the sand measured an organic content of about 1 per cent.

The grain size distributions of seven (7) samples of this deposit are shown on Figure A.S23-2 in Appendix A.



As noted above, a 0.7 m thick layer of brown and grey organic sand, trace to some silt and trace clay was encountered within the sand deposit in Borehole S23-09. A SPT 'N'-value measured within the layer is 6 blows per 0.3 m of penetration, indicating a loose relative density. The natural water content measured on a specimen of this layer is about 58 per cent.

Gravelly Sand

A deposit of brown gravelly sand some silt was encountered below the sand deposit in Borehole S23-07. The top of this deposit is at Elevation 206.8 and its thickness is 1.2 m. The bottom of this deposit was defined by refusal to further split-spoon and casing advancement.

The SPT 'N'-values measured within this deposit are 48 blows per 0.3 m of penetration and 109 blows per 0.2 m of penetration, indicating a dense to very dense relative density.

The natural water content measured on a sample of this deposit is about 11 per cent.

A grain size distribution of one (1) sample of this deposit is shown on Figure A.S23-3 in Appendix A.

Bedrock / Refusal

Bedrock outcrops are present along the southern limit of the swamp. In Boreholes S23-07 to S23-10 and DCPTs S23-DC04 to S23-DC06, refusal to further split-spoon and/or casing advancement or cone penetration was encountered at depths between 2.8 m and 11 m below ice or ground surface, corresponding to Elevation 209.1 m and 198.4 m. In general, refusal was encountered at greater depths towards the centre of the swamp between about STA 15+710 and 15+730.

Groundwater Conditions

In general, the samples taken in the boreholes were damp to wet with free water noted in select sand samples. Water levels observed in the boreholes upon completion of drilling range from Elevation 211.1 m to 208.4 m, measured at the ice surface or up to a depth of 2.4 m below the ice or ground surface.

4.5 Highway 69 SBL – STA 16+475 to 16+550 (Swamp 24)

The plan and profiles along the centreline and toes of the embankment of the new Highway 69 SBL alignment showing the borehole locations and interpreted stratigraphy between about STA 16+475 and 16+550 are shown on Drawing B1 in Appendix B. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 9 m above existing grade. A total of eight (8) boreholes (Boreholes S24-01 to S24-07 and S24-09), and three (3) Dynamic Cone Penetration Test (DCPTs S24-DC01 to S24-DC03) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed highway is relatively flat to low-lying with ground cover consisting of shrubs and wet grassy areas, located within the confines of tree covered valley slopes at the north and south limits of the swamp.

In general, the subsurface soils along the SBL alignment in this area consist of a surficial deposit of root mat/peat underlain by a deposit of sand and silt to sand which in turn is underlain by a deposit of sand to sand and gravel in places. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at greatest depth at about STA 16+525. Bedrock outcrops are present along the southern limit of the swamp.



Ice / Water

Ice and/or water to depths of 0.1 m and 0.2 m were encountered in Boreholes S24-01 and S24-06.

Root Mat / Peat

A deposit of dark brown, wet, root mat and/or amorphous peat was encountered either at the ground surface or below the ice/water cover in all boreholes advanced for this alignment. The top of the root mat/peat deposit ranges from Elevation 203.1 m to 202.5 m and its thickness ranges from 0.2 m to 0.7 m.

The Standard Penetration Test (SPT) 'N'-values measured within the root mat/peat range from 2 blows to 4 blows per 0.3 m of penetration, suggesting a very soft to soft consistency.

Sand and Silt to Sand

A deposit of non-cohesive soil comprised of brown to grey sand and silt to silty sand to sand some silt, was encountered below the peat deposit in all boreholes. The deposit generally contains trace clay, silt layers, pockets of silty clay and sand and gravel, and organics and rootlets near the surface. The top of this deposit ranges from Elevation 202.6 m to 201.9 m and its thickness ranges from about 2.8 m to 11.7 m and possibly up to 14.2 m. Boreholes S24-01, S24-02, S24-04, S24-06 and S24-09 were terminated within this deposit upon refusal to further split-spoon and/or casing/auger advancement.

The SPT 'N'-values measured within this deposit range from 2 blows to 23 blows per 0.3 m of penetration, but are typically greater than 5 blows per 0.3 m of penetration and a value of 100 blows per 0.25 m of penetration was measured at a location, indicating a generally loose to very dense relative density.

The natural water content measured on samples of this deposit typically ranges from about 19 per cent to 28 per cent and a water content of about 72 per cent was measured on a sample noted to contain organics. In general, the upper portion of this deposit contains trace organics and laboratory testing on specimens of the sand and silt deposit from Boreholes S24-05 and S24-06 measured organic contents of about 1 per cent.

The grain size distributions of eighteen (18) samples of three groupings of similar soil layers comprising this overall non-cohesive deposit are shown on Figures B.S24-1A to B.S24-1D in Appendix B for sand and silt to silty sand, sand and silt to sand, and silty sand to sand. Atterberg limits tests on two (2) specimens of the sand and silt deposit indicate this material to be non-plastic.

In Boreholes S24-03 and S24-04, a 0.1 m and 0.2 m thick layer of brown and grey silt, trace to some sand, trace gravel and trace clay containing slight organic and rootlets was encountered below the peat deposit that locally overlies the sand and silt to sand deposit. The SPT 'N'-values measured within the silt layer are 3 blows and 4 blows per 0.3 m of penetration, indicating very loose relative density.

As noted above, two approximately 0.1 m thick lenses of brown or grey silty clay were encountered in Borehole S24-01 and a 0.2 m thick layer of silty clay lens was encountered in Borehole S24-05 within or underlying the upper non-cohesive layer (zone) of sand and silt to silty sand. The natural water content measured on a specimen of the cohesive layer is about 70 per cent and the Atterberg limits test carried out on this specimen measured a liquid limit of about 46 per cent, a plastic limit of about 19 per cent and a plasticity index of about 27 per cent. The results of the Atterberg limits test are shown on the plasticity chart on Figure B.S24-2 in Appendix B and indicate the material to be silty clay of intermediate plasticity.



Sand to Sand and Gravel

A deposit comprised of grey to brown gravelly sand to sand and gravel, and underlying sand layer was encountered below the sand and silt to sand deposit in Boreholes S24-03, S24-05 and S24-07. The deposit generally contains trace to some silt and trace clay. The top of this deposit ranges from Elevation 196.4 m to 191.6 m and its thickness ranges from 1.6 m to 5.8 m. The bottom of this deposit was defined by refusal to further casing advancement or cone penetration as inferred in Borehole S24-07.

The SPT 'N'-values measured within the sand and gravel to sand deposit range from 15 blows to 33 blows per 0.3 m of penetration, indicating a compact to dense relative density.

The natural water content measured on samples of this deposit ranges from about 9 per cent to 21 per cent, generally greater than 20 per cent.

The grain size distributions of two (2) samples from the sand and gravel layer and one (1) sample from the underlying sand layer are shown on Figure B.S24-3A and B.S24-3B, respectively, in Appendix B.

Bedrock / Refusal

Bedrock outcrops are present along the southern limit of the swamp. In Boreholes S24-01 to S24-07 and S24-09, and DCPTs S24-DC01 to S24-DC03, refusal to further split-spoon, auger and/or casing advancement or cone penetration was encountered at depths between 3.1 m and 15.5 m below ice or ground surface, corresponding to Elevation 199.6 m and 187.3 m. In general, refusal was encountered at greater depths towards the northern limit of the swamp between about STA 16+525 and 16+550.

Groundwater Conditions

In general, the samples taken in the boreholes were wet. Water levels observed in the boreholes upon completion of drilling range from Elevation 202.8 m to 202.5 m, measured at the ice and ground surface or up to a depth of 0.3 m below the ground surface.

4.6 Highway 69 NBL – STA 16+450 to 16+550 (Swamp 24)

The plan and profiles along the centreline and toes of the embankment of the new Highway 69 NBL alignment showing the borehole locations and interpreted stratigraphy between about STA 16+450 and 16+550 are shown on Drawings B1 and B2 in Appendix B. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 9.5 m above existing grade. A total of nine (9) boreholes (Boreholes S24-06 and S24-08 to S24-15, inclusive), and three (3) Dynamic Cone Penetration Tests (DCPTs S24-DC01, S24-DC02 and S24-DC04) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed highway is relatively flat to low-lying with ground cover consisting of shrubs and wet grassy areas, located within the confines of tree covered valley slopes at the north and south limits of the swamp.

In general, the subsurface soils along the NBL alignment in this area consist of a surficial deposit of root mat/peat underlain by a deposit of sandy silt to sand which in turn is underlain by a deposit of sand and gravel interlayered with sand and silt that extends to the refusal depth or by granite gneiss bedrock in places. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at greatest depth at about STA 16+475. Bedrock outcrops are present along the southern limit of the swamp.



Ice / Water

Ice and/or water to depths between 0.1 m and 0.3 m were encountered in Boreholes S24-06, S24-10, S24-11, S24-13 and S24-14.

Root Mat / Peat

A deposit of dark brown and grey, wet, root mat and/or amorphous peat containing sand lenses and rootlets was encountered either at the ground surface or underlying the ice and/or water cover in all boreholes except in Borehole S24-08 where bedrock is exposed. The top of the root mat/peat deposit ranges from Elevation 202.8 m to 201.9 m and its thickness ranges from 0.1 m to 0.4 m across the site except in Borehole S24-11 where the thickness is 1.1 m.

The Standard Penetration Test (SPT) 'N'-values measured within the root mat/peat range from 1 blow to 3 blows per 0.3 m of penetration, with a value of 14 blows per 0.3 m of penetration measured in Boreholes S24-10 and S24-14 at the interface of this deposit with the underlying sand or silt deposit, generally suggesting a very soft to stiff consistency.

Silt

In Boreholes S24-10, S24-12 and S24-15, a 0.2 m and 0.3 m thick layer of brown and grey silt, trace to some sand and trace clay containing slight organic and rootlets was encountered below the peat deposit that is generally underlain by the sand to sandy silt deposit in the other boreholes. The top of the silt layer varies between Elevation 202.7 m and 202.2 m.

The SPT 'N'-values measured within this layer range between 5 blows and 14 blows per 0.3 m of penetration, indicating a loose to compact relative density.

Sandy Silt to Sand

A deposit comprised of brown to grey sandy silt to silt and sand to sand was encountered below the root mat/peat deposit in all boreholes except in Borehole S24-08 and inferred in all DCPTs based on resistance to cone penetration. The deposit generally contains trace gravel, trace clay, silty sand and silt layers, and organics and rootlets near the top surface. The top of this deposit ranges from Elevation 202.5 m to 200.8 m and its thickness ranges from 2.8 m to 11.7 m. Boreholes S24-06, S24-09, S24-11 and S24-14 were terminated within this deposit upon refusal to further split-spoon and/or auger/casing refusal. Borehole S24-15 was extended by a DCPT driven from the bottom of the borehole to refusal to further cone penetration.

The SPT 'N'-values measured within this deposit range from 2 blows to 49 blows per 0.3 m of penetration, and SPT 'N'-values up to 100 blows per 0.05 m of penetration were measured at the bottom of the deposit prior to split-spoon and casing refusal, generally indicating a very loose to very dense relative density.

The natural water content measured on samples of this deposit typically ranges from about 14 per cent to 30 per cent. Water content of about 72 per cent and 82 per cent were also measured within this deposit. The upper portion of this deposit contains organics and laboratory testing on specimens of this deposit measured organic contents up to about 1 per cent.

The grain size distributions of seventeen (17) samples from this deposit are shown on Figures B.S24-4A to B.S24-4C in Appendix B. An Atterberg limits test on one (1) specimen of the sand deposit indicates this material to be non-plastic.



Sand and Gravel

A deposit of grey sand and gravel trace silt containing cobbles and boulders at /near the base of the deposit was encountered below the sand to sand and silt deposit in Borehole S24-10. The sand and gravel deposit is intersected by a 3.2 m thick layer of sand and silt, which is intersected by a 0.6 m thick pocket of silt containing trace sand and trace clay. The top of the sand and gravel deposit is at Elevation 192.5 m and its thickness is 6.2 m. The top of the sand and silt layer within the sand and gravel deposit is at Elevation 191.1 m. The bottom of the lower portion of the sand and gravel deposit containing cobbles and boulders was defined by refusal to further split-spoon and casing advancement.

The SPT 'N'-values measured within the sand and gravel deposit range from 9 blows to 33 blows per 0.3 m of penetration, indicating a loose to dense relative density, with the lower 'N'-value measured at the interface between the sand and silt layer and the silt pocket.

The natural water content measured on a sample of the sand and silt portion of the deposit is about 46 per cent. The grain size distribution of one (1) sample from the sand and silt layer is shown on Figure B.S24-5 in Appendix B.

Bedrock / Refusal

Bedrock outcrops are present along the southern limit of the swamp and on the centreline of the proposed embankment at the location of Borehole S24-08 (at about STA 16+450) at Elevation 206.3 m. In Boreholes S24-06, S24-09 to S24-11, S24-14 and S24-15, and DCPTs S24-DC01, S24-DC02 and S24-DC04, refusal to further split-spoon and/or auger/casing advancement or cone penetration was encountered at depths between 3.1 m and 16.1 m below ice/water or ground surface, corresponding to Elevation 199.6 m and 186.3 m.

Bedrock was encountered and core samples were recovered from Boreholes S24-12 and S24-13. The depth to the surface of the bedrock is 5.1 m and 6.8 m corresponding to Elevation 197.5 m and 195.8 m, and the bedrock was cored for depths of about 1.5 m and 1.6 m. The bedrock generally consists of granite gneiss and the core samples are described as slightly weathered to fresh, fine to medium grained with feldspar banding, foliated, black, pink and grey. The Rock Quality Designation (RQD) measured on the core samples is 98 per cent and 100 per cent, indicating a rock mass of excellent quality. The Total Core Recovery (TCR) is 100 per cent in both boreholes, and the Solid Core Recovery (SCR) is 55 per cent and 98 per cent, in the respective boreholes.

Groundwater Conditions

In general, the samples taken in the boreholes were wet. The water levels observed in the boreholes upon completion of drilling range from Elevation 202.7 m to 202.2 m, measured at the ice or ground surface or at a depth of 0.2 m below the ground surface.

4.7 Highway 69 SBL – STA 17+230 to 17+350 (Swamp 25)

The plan and profiles along the centreline and toes of the embankment of the new Highway 69 SBL alignment showing the borehole locations and interpreted stratigraphy between about STA 17+230 and 17+350 are shown on Drawing C1 in Appendix C. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 8.5 m high above existing grade. A total of eleven (11) boreholes (Boreholes S25-01 to S25-11, inclusive), and five (5) Dynamic Cone Penetration Tests (DCPTs S25-DC01 to S25-DC05, inclusive) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed highway is relatively flat to low-lying consisting of bedrock knobs, grassy and heavily treed ground with areas of shallow open water. The swamp is bounded to the north by a valley slope and to the south by the existing Shebeshekong Road.



In general, the subsurface soils along the SBL alignment in this area consist of a deposit of fill associated with the embankment of the existing Shebeshekong Road and surficial deposit of peat/organic silty sand underlain by a deposit of sandy silt to sand, which in turn is underlain by a clayey silt to clay stratum in places containing pockets of silt or silty sand. The clayey silt to clay strata are underlain by a deposit of sandy silt to sand, underlain by a deposit of sand and gravel in places. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at greatest depth between about STA 17+275 and 17+315. Bedrock outcrops are present along the northern limit of the swamp and to the south of the swamp beyond the adjacent existing Shebeshekong Road traversing the area.

Sand and Gravel Fill

A deposit of fill comprised of grey to brown sand and gravel was encountered at the ground surface in Borehole S25-01 advanced along the south toe of the existing Shebeshekong Road. The top of the granular fill is at Elevation 203.7 m and its thickness is 1.1 m.

A Standard Penetration Test (SPT) 'N'-value measured within this deposit is 8 blows per 0.3 m of penetration, indicating a loose relative density.

Ice / Water

Ice and water to depths between 0.6 m and 0.9 m was encountered in all boreholes and DCPTs except in Borehole S25-01, as noted above.

Peat / Organic Silty Sand to Sand

A deposit of black, wet, amorphous peat or dark brown, wet, organic silty sand to organic sand containing rootlets was encountered underlying the ice/water cover in Boreholes S25-03, S25-08 and S25-09. The top of the peat/organic silty sand to sand ranges from Elevations 202.0 m to 201.7 m and its thickness ranges from 0.2 m to 0.6 m.

The Standard Penetration Test (SPT) 'N'-values measured within the organic silty sand to sand deposit are 4 blows and 13 blows per 0.3 m of penetration, indicating a loose to compact relative density.

The natural water content measured on one (1) sample of the organic silty sand is about 80 per cent, and the organic content measured on this sample is about 11 per cent.

Sandy Silt to Sand

A deposit of non-cohesive soil comprised of dark brown to grey sandy silt, silty sand and sand trace to some silt was encountered underlying the ice/water cover and fill or peat/organic silty sand to organic sand deposit in all boreholes. The deposit generally contains trace to some gravel, trace to some clay, trace organics, wood fibres and rootlets near the top surface. The top of this deposit ranges from Elevations 202.6 m to 201.1 m and its thickness ranges from 1.1 m to 3.8 m. Boreholes S25-01 and S25-11 were terminated within this deposit upon refusal to further split-spoon and auger/casing refusal.

The SPT 'N'-values measured within this deposit range from 0 blows (weight of hammer) to 22 blows per 0.3 m of penetration, but are typically greater than 6 blows per 0.3 m of penetration, indicating a generally loose to compact relative density. SPT 'N'-values of 15 blows per 0.15 m of penetration and 6 blows per 0.1 m of penetration were measured prior to split-spoon and auger/casing refusal in Boreholes S25-01 and S25-11.



The natural water content measured on samples of this deposit ranges from about 15 per cent to 65 per cent, but are typically less than 29 per cent. The upper portion of this deposit was observed to have trace organics and laboratory testing on two (2) specimens of this deposit measured organic contents of about 4 per cent and 5 per cent.

A grain size distribution of one (1) sample of the silty sand deposit is shown on Figure C.S25-1 in Appendix C.

A 0.5 m and 0.9 m thick layer of brown and grey silt some sand, trace organics and containing rootlets was encountered below the peat deposit in Borehole S25-09 at Elevation 201.6 m and within the sand deposit in Borehole S25-11 at Elevation 201.5 m. The natural water content measured on a specimen of the silt layer is about 22 per cent. A grain size distribution of this specimen is shown on Figure C.S25-2 in Appendix C. An Atterberg limits test carried out on this specimen measured a liquid limit of about 18 per cent, a plastic limit of about 17 per cent and a plasticity index of about 1 per cent. The results of the Atterberg limits test are shown on the plasticity chart on Figure C.S25-3 in Appendix C and classified the material as silt of slight plasticity.

Clayey Silt to Clay

A stratum of grey to reddish brown clayey silt to clay, trace sand to clay containing silt seams was encountered below the sandy silt to sand deposit in all boreholes advanced for this alignment except in Boreholes S25-01 and S25-11. The top of this stratum ranges from Elevations 200.0 m to 199.3 m and its thickness ranges from 0.5 m to 2.6 m.

The SPT 'N'-values measured within the cohesive deposit range from 0 blows (weight of hammer) to 3 blows per 0.3 m of penetration. In situ field vane tests carried out within this stratum measured undrained shear strengths ranging from about 13 kPa to 35 kPa and the sensitivity is calculated to range from 1 to 7. The field vane tests results together with the SPT 'N'-values indicate that the clay to clayey silt stratum has a very soft to firm consistency.

The natural water content measured on samples of this stratum ranges from about 29 per cent to 71 per cent.

Atterberg limits tests were carried out on eight (8) specimens (including two Shelby tube samples) of the cohesive stratum and indicate liquid limits ranging from about 22 per cent to 56 per cent, plastic limits ranging from about 13 per cent to 22 per cent and plasticity indices ranging from about 9 per cent to 34 per cent. The results of the Atterberg limits tests are shown on the plasticity chart on Figure C.S25-4 in Appendix C and indicate the material to be clayey silt of low plasticity to clay of high plasticity.

Borehole Sample No.	Sample Depth / Elevation	σ'_{vo} (kPa)	σ'_p (kPa)	$\sigma'_p - \sigma'_{vo}$ (kPa)	OCR	C_c	C_r	e_o	c_v^* (cm ² /s)
Borehole S25-08 Sample 4	3.3 m / 199.3 m	18	85	67	4.7	0.71	0.07	1.56	2.7×10^{-3}

Note: * For stress range of $20 \text{ kPa} \leq \sigma_v' \leq 160 \text{ kPa}$

where: σ_{vo}' is the effective overburden stress in kPa
 σ_p' is the preconsolidation stress in kPa
OCR is overconsolidation ratio
 e_o is initial void ratio
 C_c is the compression index
 C_r is the recompression index
 c_v is the coefficient of consolidation in cm²/s



Silt

A pocket and a layer of grey silt, trace sand and trace clay was encountered within the clay stratum in Borehole S25-05 and underlying the clayey silt stratum in Borehole S25-07. The top of this stratum is at Elevation 198.9 m and 198.0 m and its thickness is 0.9 m and 2.7 m in the respective boreholes.

The SPT 'N'-values measured within the silt stratum are 3 blows per 0.3 m of penetration, indicating a very loose relative density.

The natural water content measured on two (2) samples of this stratum is about 23 per cent and 27 per cent.

A grain size distribution of one (1) sample of the silt stratum is shown on Figure C.S25-6 in Appendix C.

Sandy Silt to Sand

A deposit comprised of grey to brown sandy silt, silt and sand, silty sand and sand trace to some silt, and a pocket of silt was encountered underlying the clayey silt to clay stratum in all boreholes except in Boreholes S25-01 and S25-11. The deposit generally contains trace to some gravel and trace clay. The top of this deposit ranges from Elevation 199.1 m to 195.3 m and its thickness ranges from 2.3 m to 8.6 m. Boreholes S25-02 to S25-04, S25-06 and S25-08 to S25-10 were terminated within this deposit upon refusal to further split-spoon and/or casing refusal.

The SPT 'N'-values measured within this deposit range from 1 blow to 39 blows per 0.3 m of penetration, but are typically greater than 6 blows per 0.3 m of penetration, indicating a generally loose to dense relative density.

The natural water content measured on samples of this deposit ranges from about 12 per cent to 32 per cent.

The grain size distributions of five (5) samples of the silt and sand to sand deposit are shown on Figure C.S25-7 in Appendix C. An Atterberg limits test on one (1) sample of the sand and silt deposit indicate the material to be non-plastic.

As noted above, a 0.6 m thick pocket of grey silt trace sand was encountered within the silty sand to sand deposit in Boreholes S25-02 Elevation 198.0 m. The natural water content measured on a specimen of the silt pocket is about 29 per cent and an Atterberg limits test carried out on this specimen measured a liquid limit of about 19 per cent, a plastic limit of about 17 per cent and a plasticity index of about 2 per cent. The result of the Atterberg limits test is shown on the plasticity chart on Figure C.S25-8 in Appendix C and classifies the material as silt of slight plasticity.

Sand and Gravel

A deposit of grey sand and gravel was encountered below the sandy silt to sand deposit in Boreholes S25-05 and S25-07. The top of this deposit is at Elevation 190.9 m and 186.7 m and its thickness is 1.7 m and 0.5 m, at the respective boreholes. The bottom of this deposit is defined by refusal to further casing advancement.

A SPT 'N'-value measured within this deposit is 16 blows per 0.3 m of penetration, indicating a compact relative density.

Bedrock / Refusal

Bedrock outcrops are present to the north and to the south of the swamp beyond the adjacent existing Shebeshekong Road. In Boreholes S25-01 to S25-11, and DCPTs S25-DC01 to S25-DC05, refusal to further split-spoon and/or auger/casing advancement or cone penetration was encountered at depths between 4.7 m and 16.5 m below ice/water or ground surface, corresponding to between Elevations 197.9 m and 186.2 m. In general, refusal was encountered at greater depths towards the toe of the embankment in the centre of the swamp between about STA 17+275 and 17+315.



Groundwater Conditions

In general, the samples taken in the boreholes were moist to wet with free water noted in some sand samples. A few boreholes encountered sand flow into the casing due to water pressure confined below cohesive deposits, which required water to be pumped into the borehole casing to maintain a constant head of water in order to allow for sampling by SPT and/or Shelby tube. Water levels observed in the boreholes upon completion of drilling range from Elevations 202.6 m to 202.1 m, measured at the ice surface or up to a depth of 1.6 m below the ice or ground surface.

4.8 Highway 69 NBL – STA 17+150 to 17+350 (Swamp 25)

The plan and profiles along the centreline and toes of the embankment of the new Highway 69 NBL alignment showing the borehole locations and interpreted stratigraphy between about STA 17+150 and 17+350 are shown on Drawings C1 and C2 in Appendix C. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 9 m high above existing grade. A total of sixteen (16) boreholes (Boreholes S25-12 to S25-26, inclusive, and S25-17A), and five (5) Dynamic Cone Penetration Tests (DCPTs S25-DC06 to S25-DC10, inclusive) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed highway is relatively flat to low-lying consisting of bedrock knobs, grassy and heavily treed ground with areas of shallow open water as well as an area of granular/rock fill. The existing Highway 69 is located about 80 m to the east of the proposed NBL alignment.

In general, the subsurface soils along the NBL alignment in this area consist of a deposit of fill associated with the Shawanaga First Nation gas station access road and platform as well as the embankment of the existing Shebeshekong Road and surficial deposit of peat/organic clayey silt/silt. The fill and organic deposits are underlain by a deposit of sandy silt to sand which in turn is underlain by a stratum of clayey silt to clay containing a pocket of silt and sand, or pockets. The clayey silt to clay stratum or silt layer(s) are underlain by a deposit of silt and sand to sand which is in turn underlain by a deposit of gravelly sand at to sand and gravel in places. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at greatest depth between about STA 17+230 and 17+300. Bedrock outcrops are present along the northern limit of the swamp and to the south of the swamp beyond the adjacent existing Shebeshekong Road traversing the area.

Silty Sand to Sand and Gravel Fill and Rock Fill

A deposit of granular fill comprised of brown to grey silt and sand, silty sand, sand and sand and gravel was encountered at the ground surface in Boreholes S25-12 to S25-14, S25-17, S25-23, S25-25 and S25-26, and inferred as observed at ground surface in DCPT S25-DC07. The top of the granular fill ranges from Elevations 203.9 m to 202.7 m and the thickness of the fill ranges from 0.5 m to 2.2 m.

Rock fill was encountered in Boreholes S25-22 to S25-24 and S25-26 and was inferred at ground surface at DCPT S25-DC10. The top of the rock fill ranges from Elevation 202.8 m to 201.9 m and its thickness ranges from 0.6 m to 1.5 m.

The Standard Penetration Test (SPT) 'N'-values measured within the granular deposit range from 7 blows to 50 blows per 0.3 m of penetration, indicating a loose to dense to very dense relative density. The SPT 'N'-values measured within the rock fill range from 54 blows per 0.3 m of penetration to 122 blows per 0.15 m of penetration, indicating a very dense relative density.

The natural water content measured on one (1) sample of the sand and gravel fill is about 6 per cent.



Snow / Ice / Water

Snow, ice and water to depths between 0.2 m and 1.2 m was encountered in Boreholes S25-15, S25-16, S25-18, S25-19 and S25-21.

Peat / Organic Clayey Silt / Organic Silt

An organic deposit was encountered below the snow/ice/water in Boreholes S25-18, S25-19 and S25-21 and over and below the rock fill in Boreholes S25-22. A 0.6 m thick deposit of peat, organic clayey silt and organic silt was encountered in Boreholes S25-19, S25-18 and S25-21, respectively, between Elevations 202.2 m and 201.7 m. Two (2) layers of organic silt, each about 0.3 m thick, were encountered over and below the rock fill in Borehole B25-22 at Elevations 203.1 m and 201.9 m.

The Standard Penetration Test (SPT) 'N'-values measured within the organic deposits are 3 blows and 5 blows per 0.3 m of penetration, suggesting a soft to firm consistency/very loose relative density.

The natural water content measured on samples of the organic deposits is between about 38 per cent and 56 per cent, and the organic content measured on a sample of the organic clayey silt is about 6 per cent.

Sandy Silt to Sand (Upper Deposit)

A non-cohesive deposit comprised of brown to grey sandy silt, silt and sand, silty sand and sand was encountered underlying the ice/water cover and below the fill or peat/organic clayey silt/organic silt deposit in all boreholes, except in Borehole S25-20 which is located on a bedrock outcrop. The deposit generally contains trace gravel, trace clay, clayey silt and sand seams and sandy silt layers, organics and rootlets. The top of this deposit ranges from Elevations 202.4 m to 201.1 m and the thickness of the deposit ranges from 0.8 m to 4.1 m.

The SPT 'N'-values measured within this deposit range from 0 blows (weight of hammer) to 24 blows per 0.3 m of penetration, indicating a very loose to compact relative density.

The natural water content measured on fifteen (15) samples of this deposit ranges from about 17 per cent to 35 per cent. The upper portion of this deposit was observed to contain trace organic and laboratory testing on one (1) specimen of the silty sand deposit measured an organic content of about 3 per cent.

The grain size distributions of six (6) samples of the silt and sand to sand portion of the deposit are shown on Figure C.S25-9 in Appendix C.

Clayey Silt to Clay

A stratum of grey and reddish brown clayey silt, silty clay and clay, containing trace to some sand and silt seams was encountered below the sandy silt to sand deposit in all boreholes, except in Boreholes S25-14, S25-20 and S25-21. The stratum was observed to contain a pocket of silt and sand in Borehole S25-15. The top of this stratum ranges from Elevation 200.8 m to 198.6 m and the thickness of the deposit ranges from 0.3 m to 4 m. Borehole S25-17A was terminated within this stratum, penetrating it for a depth of 0.6 m.

The SPT 'N'-values measured within the cohesive stratum range from 0 blows (weight of hammer) to 5 blows per 0.3 m of penetration with a SPT 'N'-value of 11 blows per 0.3 m of penetration measured at the interface with the underlying silt layer. In situ field vane tests carried out within this stratum measured undrained shear strengths ranging from about 15 kPa to 57 kPa and the sensitivity is calculated to be between 2 and 8. The field vane tests results together with the SPT 'N'-values indicate that the clayey silt to clay stratum has a very soft to stiff consistency.



The natural water content measured on thirteen (13) samples of this stratum ranges from about 22 per cent to 75 per cent.

Atterberg limits tests were carried out on twelve (12) specimens of the clayey silt to clay stratum and indicate liquid limits ranging from about 20 per cent to 61 per cent, plastic limits ranging from about 13 per cent to 24 per cent and plasticity indices ranging from about 7 per cent to 40 per cent. The results of the Atterberg limits tests are shown on the plasticity chart on Figures C.S25-10A and C.S25-10B in Appendix C and indicate the material to be clayey silt of low plasticity to clay of high plasticity.

Within the cohesive stratum in Borehole S25-15, a 0.6 m thick pocket of silt and sand trace clay was encountered at Elevation 198.6 m. A SPT 'N'-value measured in this layer is 6 blows per 0.3 m of penetration, indicating a loose relative density. The natural water content measured on the samples from this pocket is about 19 per cent.

Silt

Underlying the cohesive stratum in Boreholes S25-13, S25-17, S25-22, S25-25 and S25-26 is a stratum of grey silt, some sand and trace to some clay containing an estimated 0.4 m diameter boulder at the top of the deposit in Borehole S25-13. The top of this stratum is between Elevations 200.5 m and 197.3 m and the thickness of the layer ranges from 0.3 m to 2.3 m. Borehole S23-22 was terminated in this deposit due to refusal to further auger advancement.

The SPT 'N'-values measured within the silt stratum range between 4 blows and 8 blows per 0.3 m of penetration, indicating a loose relative density. A SPT 'N'-value of 29 blows per 0.2 m of penetration was measured in Borehole S25-22 at borehole termination on refusal.

The natural water content measured on five (5) samples of this stratum are between about 24 per cent and 31 per cent.

Grain size distributions of four (4) samples of the silt stratum are shown on Figure C.S25-11 in Appendix C.

Silt and Sand to Sand (Lower Deposit)

A deposit comprised of grey to brown silt and sand, silty sand and sand trace to some silt containing trace gravel and trace clay was encountered below the clayey silt to clay stratum or silt stratum in Boreholes S25-12, S25-13, S25-15 to S25-19 and S25-23 to S25-26, and underlying the upper sandy silt to sand deposit in Borehole S25-14. In Borehole S25-14, the deposit contains silty clay seams and a boulder at the bottom of the deposit, and in Borehole S25-17, the auger was noted to be grinding inferred on a boulder. The top of this deposit ranges from Elevations 199.1 m to 195.8 m and the thickness of the deposit ranges from 3 m to 10.3 m and may be up to about 12.2 m thick as inferred from the resistance to cone penetration for the DCPT driven from the bottom of Borehole S25-13. The bottom of this deposit is defined by refusal to further split-spoon, auger and/or casing advancement or cone penetration in all boreholes which the deposit was encountered except for S25-12, S25-24 and S25-25 where it is underlain by a gravelly sand to sand and gravel deposit.

The SPT 'N'-values measured within this deposit typically range from 0 blows (weight of sampler and rod) to 44 blows per 0.3 m of penetration, with occasional SPT 'N'-values between about 73 blows and 101 blows per 0.3 m of penetration, indicating very loose to very dense relative density.

The natural water content measured on twenty-four (24) samples of this deposit range from about 15 per cent to 30 per cent.

The grain size distributions of twelve (12) samples of this deposit are shown on Figures C.S25-12A and C.S25-12B in Appendix C.



Gravelly Sand and Sand and Gravel

A deposit of grey gravelly sand and sand and gravel, trace to some silt and trace clay 1.2 m to 2.2 m thick was encountered below the lower silt and sand to sand deposit in Boreholes S25-12, S25-24 and S25-25 at Elevations 185.7 m and 189.7 m, respectively. The boreholes were terminated in this deposit upon refusal to casing advancement.

A SPT 'N'-values measured within this deposit are 19 blows and 44 blows per 0.3 m of penetration, indicating a compact to dense relative density. A SPT 'N'-value of 23 blows per 0.15 m of penetration was measured in Borehole S25-24 on a silt and sand pocket.

The natural water content measured on three (3) samples of this deposit are about 11 per cent and 17 per cent. The grain size distribution of a sample of the gravelly sand portion of the deposit is shown on Figure C.S25-13A in Appendix C. The grain size distribution of the sample of the silt and sand pocket is shown on Figure C.S25-13B in Appendix C.

Bedrock / Refusal

Bedrock outcrops are present along the northern limit of the swamp at the location of Borehole S25-20 and DCPT S25-DC09 at Elevation 204.7 m and 203.9 m, respectively, and to the south of the swamp near the adjacent existing Shebeshekong Road at about STA 17+200. In Boreholes S25-12 to S25-19 and S25-21 to S25-26 and DCPTs S25-DC06 to S25-DC08 and S25-DC10 refusal to further split-spoon and/or auger/casing advancement or cone penetration was encountered at depths between 3.4 m and 20 m below ice/water or ground surface, corresponding to between Elevations 199.7 m and 183.9 m. In general, refusal was encountered at greater depths near the existing Shebeshekong Road between about STA 17+230 and 17+300.

Bedrock was encountered and core samples were recovered from Borehole S25-21. The depth to the surface of the bedrock is 1.7 m corresponding to Elevation 200.7 m, and the bedrock was cored for a depth of 1.6 m. The bedrock consists of granite gneiss and the core sample is described as slightly weathered, coarse grained with strong banding, foliated, pink, white and grey. The Rock Quality Designation (RQD) measured on the core samples is 100 per cent, indicating a rock mass of excellent quality (Table 3.10 of CFEM, 2006). The Total Core Recovery (TCR) is 100 per cent, and the Solid Core Recovery (SCR) is 90 per cent.

A point load strength index test (ASTM D5731 – Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications) was carried out on one sample of the bedrock core. The diametral point load test carried out on the sample of the bedrock core measured an I_{s50} strength index value of 13.7 MPa, as presented on the Record of Drillhole sheet in Appendix C. The point load strength index value suggests that the sample of gneiss is extremely strong (Table 3.5 of CFEM, 2006).

Groundwater Conditions

In general, the samples taken in the boreholes were moist to wet. A few boreholes encountered sand flow into the casing when the penetrating into non-cohesive deposits below cohesive deposits, requiring the casing to maintain a constant head of water in order to allow for sampling by SPT. The water level observed in the boreholes upon completion of drilling ranges from Elevation 202.6 m to 201.0 m, measured at the ice surface or up to a depth of 1.9 m below ground surface.

4.9 Site 9 Road – STA 10+225 to 10+300 (Swamp 26)

The plan and profiles along the centreline and toes of the embankment of the Site 9 Road alignment showing the borehole locations and interpreted stratigraphy between about STA 10+225 and 10+300 are shown on Drawing D1



in Appendix D. The alignment extends across a swamp area and the proposed roadway embankment will be up to about 9 m above existing grade. A total of eight (8) boreholes (Boreholes S26-01 to S26-08, inclusive), and three (3) Dynamic Cone Penetration Tests (DCPTs S26-DC01 to S26-DC03, inclusive) were completed to investigate the subsurface conditions within this swamp area. The topography of this section of the proposed Site 9 Road is relatively flat, with ground cover consisting of shrubs, sparse trees and wet grassy areas, located within the confines of a relatively higher ground and densely treed area and bounded to the east by the existing Highway 69. Bedrock outcrops are present along the southern limit of the swamp.

In general, the subsurface soils along the Site 9 Road alignment in this area consist of surficial deposits of topsoil, organic silt and clayey silt underlain by a deposit of silt to sandy sand which in turn is underlain by a gravelly sand to sand and gravel stratum in places. Resistance to dynamic cone penetration and borehole advancement, indicative of the potential bedrock surface, was encountered at shallower depths at the southern limit of the swamp, at about STA 10+200. Bedrock outcrops are present along the southern limit of the swamp.

Topsoil / Organic Silt

A 0.2 m to 0.6 m thick deposit of topsoil, organic silt, some sand was encountered at ground surface in Boreholes S26-02 and S26-04 to S26-08. The top of the organic deposits was encountered between Elevations 212.9 m 210.7 m.

A Standard Penetration Test (SPT) 'N'-value measured within the organic silt is 3 blows per 0.3 m of penetration, indicating a very loose relative density.

The natural water content measured on three (3) samples of the organic silt are about 49 per cent and 188 per cent, and the organic content of two (2) sample of the organic silt are about 6 per cent and 25 per cent.

Clayey Silt

A 0.7 m thick deposit of clayey silt was encountered below the topsoil in Borehole S26-06 at a depth of 0.2 m below ground surface, corresponding to Elevation 211.5 m.

The Standard Penetration Test (SPT) 'N'-value measured within the clayey silt is 5 blows per 0.3 m of penetration, suggesting a firm consistency.

The natural water content measured on one (1) sample of the clayey silt is about 23 per cent. An Atterberg limits test carried out on this specimen measured a liquid limit of about 33 per cent, a plastic limit of about 14 per cent and a plasticity index of about 19 per cent. The results of the Atterberg limits test are shown on the plasticity chart on Figure D.S23-1 in Appendix D and indicate the material to be clayey silt of low plasticity.

Silt to Sand

A 2.3 m to 9.8 m thick non-cohesive deposit consisting of silt, sandy silt, silt and sand, silty sand and sand was encountered in all of the boreholes between Elevations 212.7 m and 210.4 m. The deposit was encountered at ground surface in Boreholes S26-01 and S26-03, below the organic silt in Borehole S26-02, S26-04, S26-05 and S26-07, below the clayey silt deposit in S26-06 and below the topsoil in S26-08. A 0.8 m thick pocket of clayey silt was encountered within the silt and sand/silty sand portion of the deposit in Borehole S26-05 at Elevation 209.4 m.

The Standard Penetration Test (SPT) 'N'-values measured within the silt to sand deposit range from 0 blows (weight of hammer) to 26 blows per 0.3 m of penetration, indicating a very loose to compact relative density. SPT



'N'-values of 66 blows per 0.13 m of penetration and 20 blows for 0 m of penetration were measured at the bottom of the deposit prior to split-spoon and casing refusal

The SPT 'N'-value measured within the clayey silt pocket is 3 blows per 0.3 m of penetration. Two (2) in situ field vane tests carried out within this pocket measured undrained shear strengths of about 46 kPa to 67 kPa and the sensitivity is calculated to be 7 and 5, respectively. The field vane test results indicate that the clayey silt pocket has a firm to stiff consistency.

The natural water content measured on thirty-five (35) samples of the silt to sand deposit range between about 14 per cent and 31 per cent and the organic content of one (1) sample of the silty sand portion of the deposit immediately underlying the organic silt deposit is about 1 per cent.

The natural water content measured on a sample of the clayey silt pocket is about 41 per cent, and the Atterberg limits test carried out on this specimen measured a liquid limit of about 30 per cent, a plastic limit of about 16 per cent and a plasticity index of about 14 per cent. The results of the Atterberg limits test are shown on the plasticity chart on Figure D.S23-1 in Appendix D and indicate the material to be clayey silt of low plasticity.

The grain size distributions of twelve (12) samples of the silt to sand deposit classified the selected samples as silt, sandy silt, silty sand and sand. The results are shown on Figures D.S26-2A and D.S26-2B in Appendix D. Atterberg limits tests carried out in two (2) samples of the sandy silt deposit indicates that this material is non-plastic.

Gravelly Sand / Sand and Gravel

A 0.1 m to 1.4 m deposit of gravelly sand to sand and gravel was encountered below the silt and sand deposit in Boreholes 26-01 and 26-05 at depths of 2.3 m and 7.2 m below ground surface, corresponding to Elevations 209.0 m and 203.7 m.

The Standard Penetration Test (SPT) 'N'-value measured within the gravelly sand/sand and gravel is 41 blows per 0.3 m of penetration and 20 blows per 0.15 m of penetration (measured at the bottom of the deposit prior to split-spoon and casing refusal), indicating a dense relative density

The natural water content measured on two (2) samples of the gravelly sand/sand and gravel deposit are about 11 per cent and 15 per cent.

The grain size distribution of one (1) sample of the gravelly sand portion of the deposit is shown on Figure D.S26-3 in Appendix D.

Bedrock / Refusal

Bedrock outcrops are present along the southern limit of the swamp. In Boreholes S26-01 to S26-08 and DCPTs S26-DC01 to S26-DC03, refusal to further split-spoon and/or auger advancement or cone penetration was encountered at depths ranging between 2.4 m and 10.1 m below ground surface, corresponding to between Elevations 208.9 m and 200.6 m. In general, refusal was encountered at shallower depths at the southern limit of the swamp, at about STA 10+200.

Groundwater Conditions

In general, the samples taken in the boreholes were wet. The water levels observed in the boreholes upon completion of drilling range from Elevation 212.0 m to 209.1 m, measured at the ground surface or at depths ranging from 0.2 m to 2.2 m below the ground surface.



5.0 CLOSURE

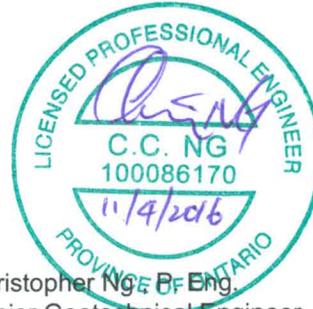
The field technicians directing the drilling program were Messrs. Indulis Dumpis, Mathew Riopelle and Matt Rhody. This report was prepared by Mmes Veronica T. Ayetan, P. Eng., and Madison C. Kennedy and was reviewed by Mr. Christopher Ng, P. Eng., a Geotechnical Engineer and Associate of Golder. Mr. Jorge M. A. Costa, P. Eng., Golder's Designated MTO Contact for this project and Principal of Golder, conducted a technical and an independent quality control review of the report.



**FOUNDATION REPORT – SWAMP CROSSINGS –
PHASE 2 – HIGHWAY 69 G.W.P. 5111-07-00**

Report Signature Page

Madison C. Kennedy, B.A.Sc.
Geotechnical Engineering Group



Christopher Ng, P. Eng.
Senior Geotechnical Engineer, Associate



Jorge M. A. Costa, P. Eng.,
Designated MTO Foundations Contact, Principal

MCK/AJS/CN/JMAC/mck

n:\active\2007\1111\07-1111-0029 - mrc - hwy 69 four-laning -\report\final\7 - swamp crossings - phase 2\07-1111-0029-7 rpt 16apr11 highway 69 swamp crossings - phase 2.docx



REFERENCES

Canadian Geotechnical Society. 2006. Canadian Foundation Engineering Manual, 4th Edition. The Canadian Geotechnical Society c/o BiTech Publisher Ltd, British Columbia.

Chapman, L.J., and Putnam, D.F. 1984. The Physiography of Southern, 3rd Edition. Ontario Geological Survey, Special Volume 2. Ontario Ministry of Natural Resources.

Geology of Ontario. 1991. Ontario Geological Society, Special Volume 4, Part 2. Eds. P.C. Thurston, H.R. Williams, R.H. Sutcliffe and G.M. Stott. Ministry of Northern Development and Mines, Ontario.

Golder Associates Ltd. 2011. Foundation Investigation and Design Report, Swamp Crossings and High Fill Areas – Phase 1, Highway 69 Four Laning, from 1.0 km North of the New Highway 559 Interchange Northerly to 1.5 km North of Highway 7182 (Shebeshekong Road) for 17 km, Ministry of Transportation, Ontario, G.W.P. 5402-05-00, Geocres No. 41H-73.

STANDARDS:

ASTM International:

ASTM D1586	Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils
ASTM D1587	Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
ASTM D2573	Standard Test Method for Field Vane Shear Test in Cohesive Soil
ASTM D5731	Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications

Ontario Provincial Standard Drawing:

OPSD 202.010	Slope Flattening Using Surplus Excavated Material on Earth or Rock Embankments.
OPSD 203.010	Embankments Over Swamp – New Construction

Ontario Provincial Standard Specification:

OPSS.PROV 206	Construction Specification for Grading
OPSS.PROV 209	Construction Specification for Embankments Over Swamps and Compressible Soils
OPSS.PROV 539	Construction Specification for Temporary Protection Systems

Ontario Water Resources Act:

Ontario Regulation 372/97	Amendment to Ontario Regulation 903
Ontario Regulation 903/90	Wells



LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$,	natural logarithm of x
\log_{10}	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_c	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_{α}	secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$



LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split-spoon
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

Dynamic Cone Penetration Resistance; N_d :

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

V. MINOR SOIL CONSTITUENTS

Per cent by Weight	Modifier	Example
0 to 5	Trace	Trace sand
5 to 12	Trace to Some (or Little)	Trace to some sand
12 to 20	Some	Some sand
20 to 30	(ey) or (y)	Sandy
over 30	And (non-cohesive) or With (cohesive)	Sand and Gravel Silty Clay with sand / Clayey Silt with sand

III. SOIL DESCRIPTION

(a) Non-Cohesive Soils

Density Index	N
Relative Density	Blows/300 mm or Blows/ft
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils Consistency

	C_u, S_u	kPa	psf
Very soft	0 to 12	0 to 12	0 to 250
Soft	12 to 25	12 to 25	250 to 500
Firm	25 to 50	25 to 50	500 to 1,000
Stiff	50 to 100	50 to 100	1,000 to 2,000
Very stiff	100 to 200	100 to 200	2,000 to 4,000
Hard	over 200	over 200	over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.



LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of weathering

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

BEDDING THICKNESS

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

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery (TCR)

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varied from 0% for completely broken core to 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

Description and Notes

An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

JN Joint	PL Planar
FLT Fault	CU Curved
SH Shear	UN Undulating
VN Vein	IR Irregular
FR Fracture	K Slickensided
SY Stylolite	PO Polished
BD Bedding	SM Smooth
FO Foliation	SR Slightly Rough
CO Contact	RO Rough
AXJ Axial Joint	VR Very Rough
KV Karstic Void	
MB Mechanical Break	



TABLES



**FOUNDATION REPORT – SWAMP CROSSINGS –
PHASE 2 – HIGHWAY 69 G.W.P. 5111-07-00**

**TABLE 1 – SUMMARY OF SWAMP CROSSINGS
HIGHWAY 69 FOUR-LANING – PHASE 2**

<i>Highway</i>	<i>Approx. Station</i>	<i>Designation</i>	<i>Proposed Embankment Height¹</i>	<i>Boreholes/DCPT</i>
Highway 69 SBL	15+690 to 15+720	Swamp 23	2.5 m to 7 m	7 Boreholes (S23-01 to S23-06 and S23-03A) 4 DCPTs (S23-DC01 to S23-DC03 and S23-DC07)
Highway 69 NBL	15+700 to 15+740	Swamp 23	1.5 m to 7 m	5 Boreholes (S23-07 to S23-11) 3 DCPTs (S23-DC04 to S23-DC06)
Highway 69 SBL	16+475 to 16+550	Swamp 24	8 m to 9 m	8 Boreholes (S24-01 to S24-07 and S24-09) 3 DCPTs (S24-DC01 to S24-DC03)
Highway 69 NBL	16+450 to 16+550	Swamp 24	5.5 m to 9.5 m	9 Boreholes (S24-06 and S24-08 to S24-15) 3 DCPTs (S24-DC01, S24-DC02 and S24-DC04)
Highway 69 SBL	17+230 to 17+350	Swamp 25	7 m to 8.5 m	11 Boreholes (S25-01 to S25-11) 5 DCPTs (S25-DC01 to S25-DC05)
Highway 69 NBL	17+150 to 17+350	Swamp 25	7 m to 9 m	16 Boreholes (S25-12 to S25-26 and S25-17A) 5 DCPTs (S25-DC06 to S25-DC10)
Site 9 Road	10+225 to 10+300	Swamp 26	9 m	8 Boreholes (S26-01 to S26-08) 3 DCPTs (S26-DC01 to S26-DC03)

Note: 1. Based on centreline of highway alignments and existing ground surface profiles provided by MRC on January 10, 2007.

Prepared By: VA/MCK

Reviewed By: CN/JMAC



DRAWINGS

METRIC
 DIMENSIONS ARE IN METRES AND/OR
 MILLIMETRES UNLESS OTHERWISE SHOWN.
 STATIONS IN KILOMETRES + METRES.

CONT No.
 GWP No. 5111-07-00

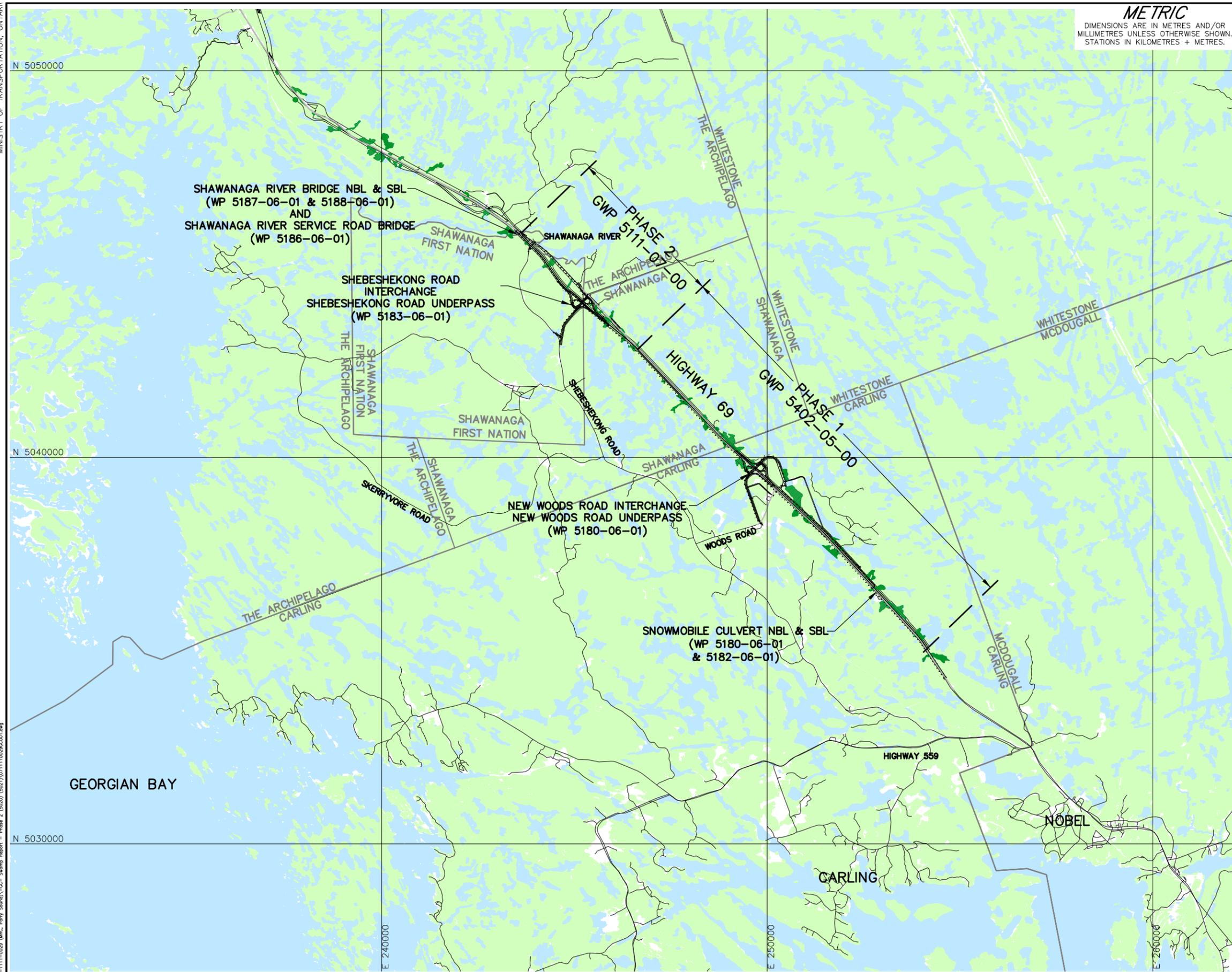


HIGHWAY 69
 SITE LOCATION PLAN

SHEET



KEY PLAN
 NOT TO SCALE



PLAN



FILE NAME: April 7, 2015
 PLANNING: I:\Projects\2007-07-1111-0029 (MFC, Perry Sound)_GC- Swamp Report - Phase 2 (5020) (5020)\07111100295020.dwg

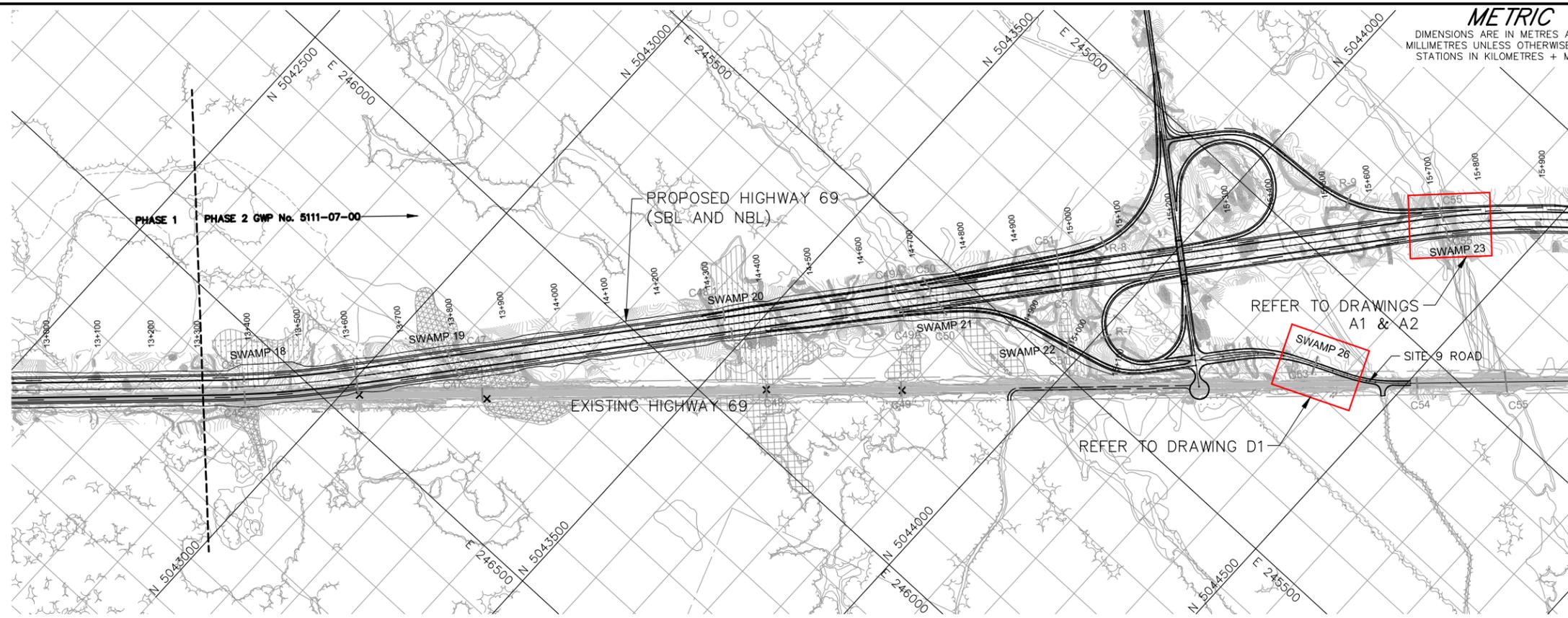
REFERENCE
 Base Data - MNR NRVIS, obtained 2004, CANMAP v2006.4
 Produced by Golder Associates Ltd under licence from
 Ontario Ministry of Natural Resources, ©Queens Printer 2008
 Datum : NAD 83 Projection : MTM Zone 10

NO.	DATE	BY	REVISION
Geocres No. 41H-161			
HWY. 69			PROJECT NO. 07-1111-0029 DIST.
SUBM'D. VA	CHKD. VA/OK	DATE: May 2012	SITE:
DRAWN: JFC/CD	CHKD. CN	APPD. JPD/JMAC	DWG. 1

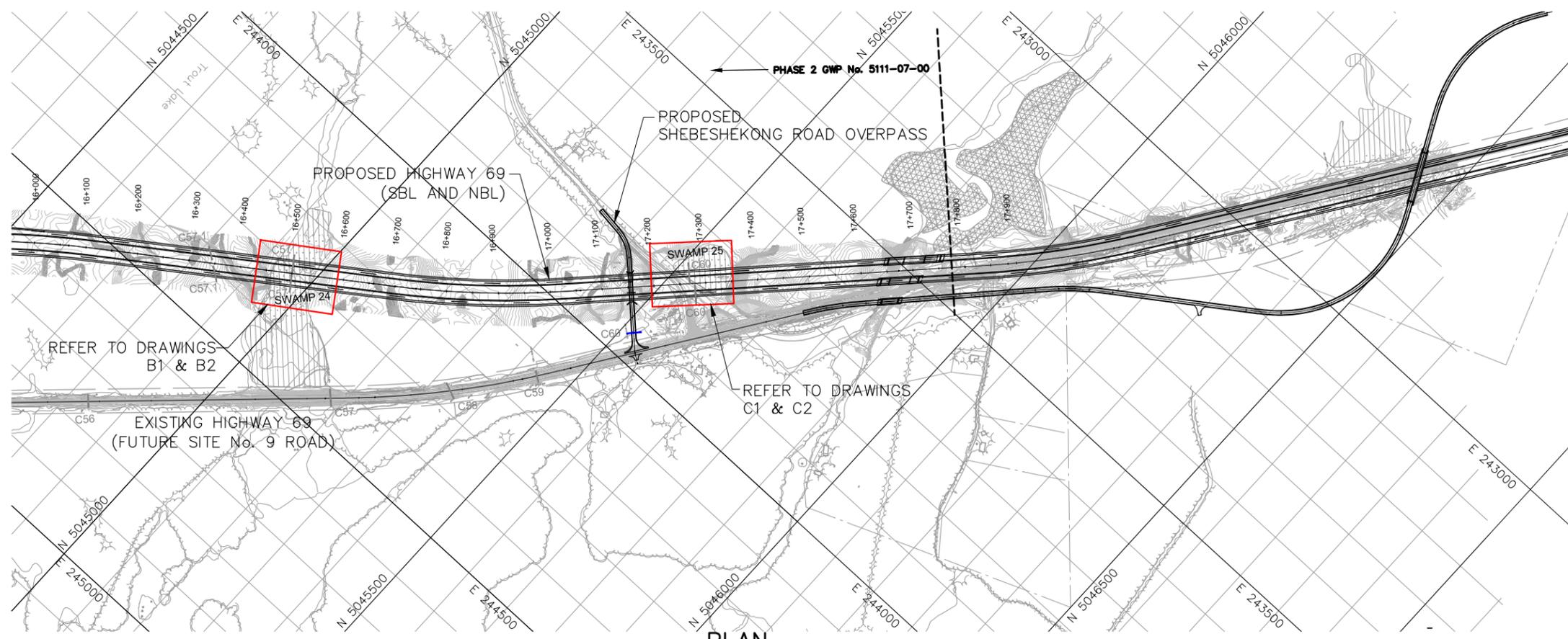
METRIC
 DIMENSIONS ARE IN METRES AND/OR
 MILLIMETRES UNLESS OTHERWISE SHOWN.
 STATIONS IN KILOMETRES + METRES.

CONT No.
 GWP No. 5111-07-00

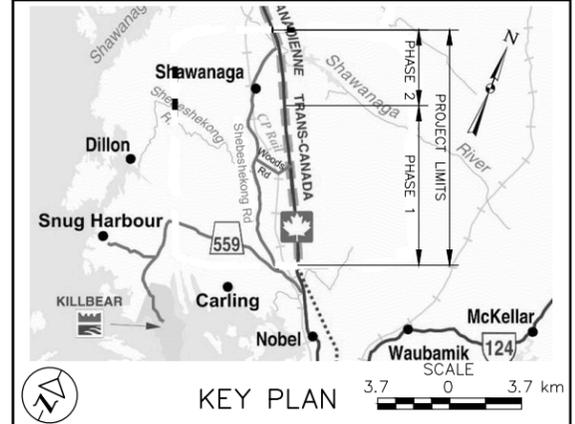
HIGHWAY 69
 SWAMP CROSSINGS – PHASE 2
 INDEX PLAN



PLAN



PLAN



KEY PLAN

NOTE
 Crossing at Swamp 18 to Swamp 22 within the Phase 2 limits are reported in "Swamp Crossing and High Fill Areas – Phase 1" report Geocres No. 41H-73 dated November 2011, (Golder 2011).

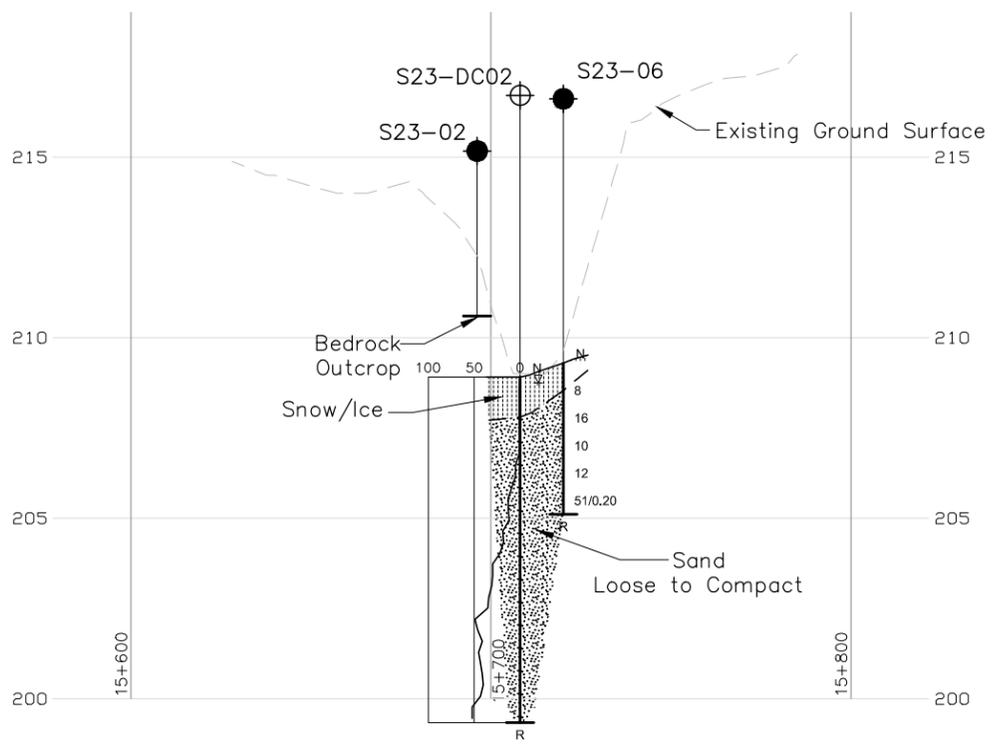
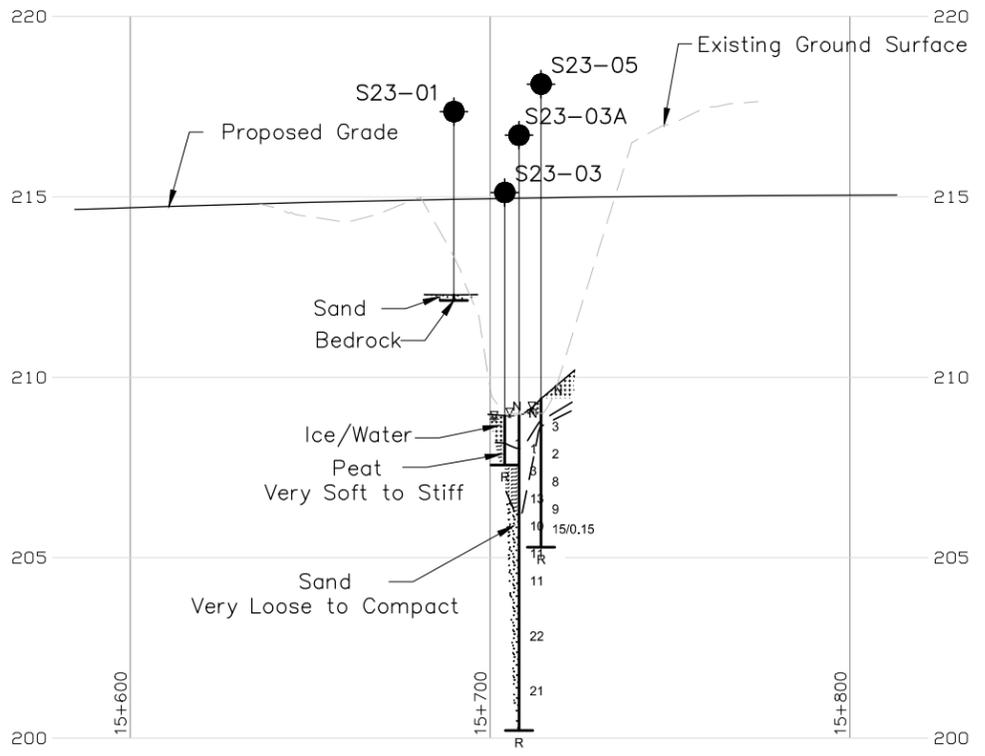
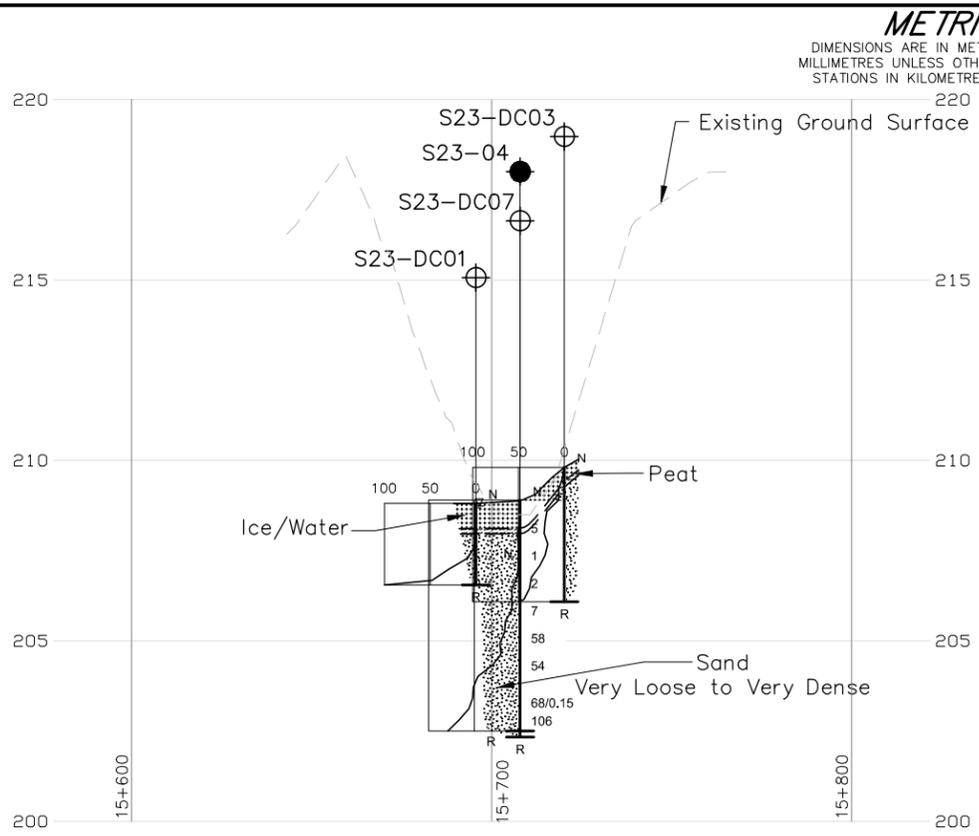
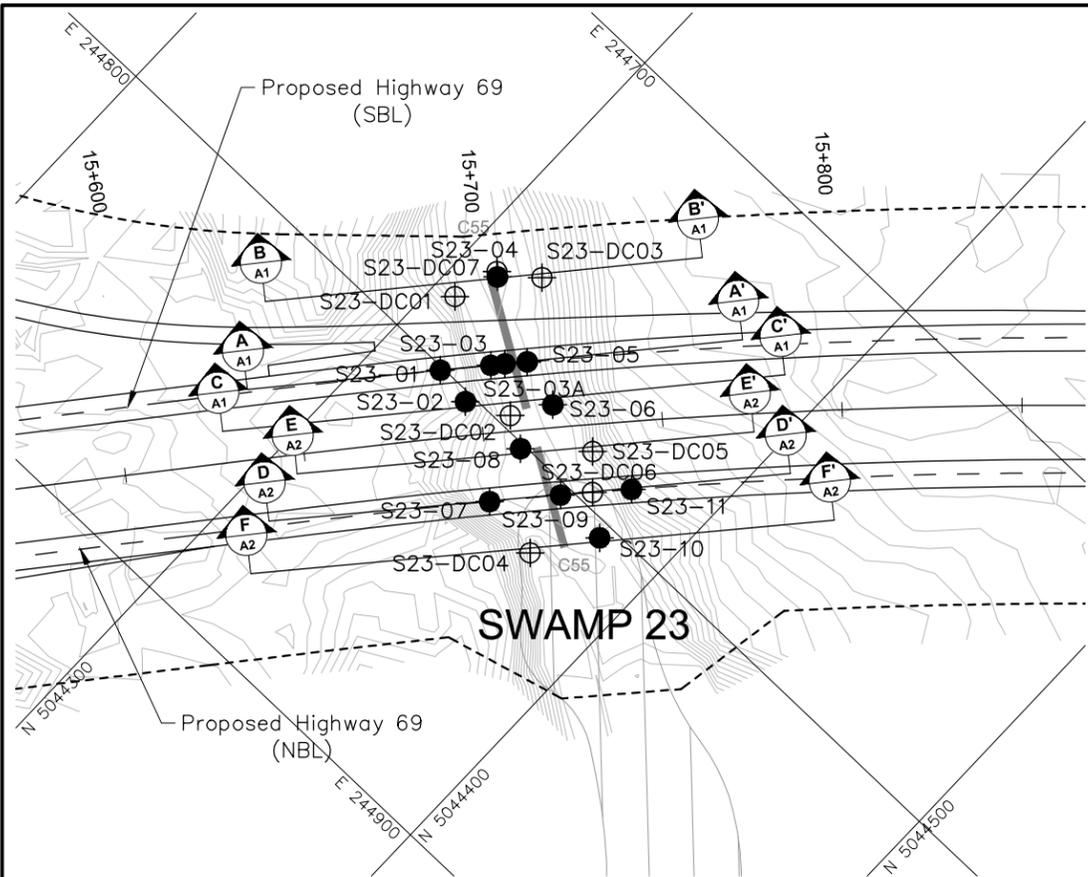
REFERENCE
 Base plans provided in digital format by MRC, drawing file 5271XB01.DWG, 5271-XPB-ARCHIPELAGO.dwg, 5271-XPB-Carling.dwg, 5271-XPB-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007, and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009, h6878_PHASE2_XA1, h6878_PHASE2_XN1.dwg, received January 21, 2009.

NO.	DATE	BY	REVISION
Geocres No. 41H-161			
HWY. 69		PROJECT NO. 07-1111-0029	DIST.
SUBM'D. VA	CHKD. VA/OK	DATE: Nov. 2009	SITE:
DRAWN: DD/RJ	CHKD. CN	APPD. JPD/JMAC	DWG. 2



APPENDIX A

**Highway 69 SBL – STA 15+690 to 15+720 and
Highway 69 NBL – STA 15+700 to 15+740 (Swamp 23)**

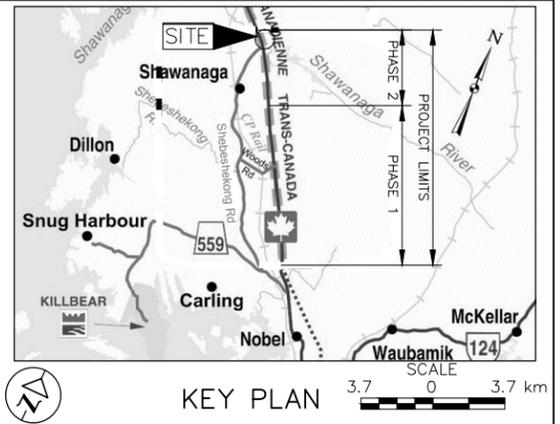


REFERENCE

Base plans provided in digital format by MRC, drawing file 5271XB01.DWG, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007, and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009, h6878_PHASE2_XA1, h6878_PHASE2_XN1.dwg, received January 21, 2009.

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No. GWP No. 5111-07-00
HIGHWAY 69 (SBL) STA 15+690 TO STA 15+720
HIGHWAY 69 (NBL) STA 15+700 TO STA 15+740
BOREHOLE LOCATIONS AND SOIL STRATA



LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling
- R Refusal

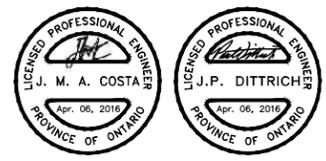
No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
S23-01	212.3	5044317.4	244800.9
S23-02	210.6	5044328.5	244802.4
S23-03	208.9	5044326.7	244790.2
S23-03A	208.9	5044329.2	244787.2
S23-04	208.9	5044311.1	244771.2
S23-05	209.4	5044333.3	244782.6
S23-06	209.3	5044346.7	244786.3
S23-07	209.0	5044352.4	244817.8
S23-08	208.9	5044348.5	244801.3
S23-09	208.9	5044365.5	244803.0
S23-10	209.4	5044381.5	244804.1
S23-11	213.5	5044378.7	244788.3
S23-DC01	208.8	5044306.3	244783.3
S23-DC02	208.9	5044340.2	244796.6
S23-DC03	209.8	5044320.2	244762.8
S23-DC04	208.8	5044370.3	244820.4
S23-DC05	211.9	5044363.7	244788.1
S23-DC06	209.5	5044371.4	244796.3
S23-DC07	208.9	5044310.0	244770.2

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

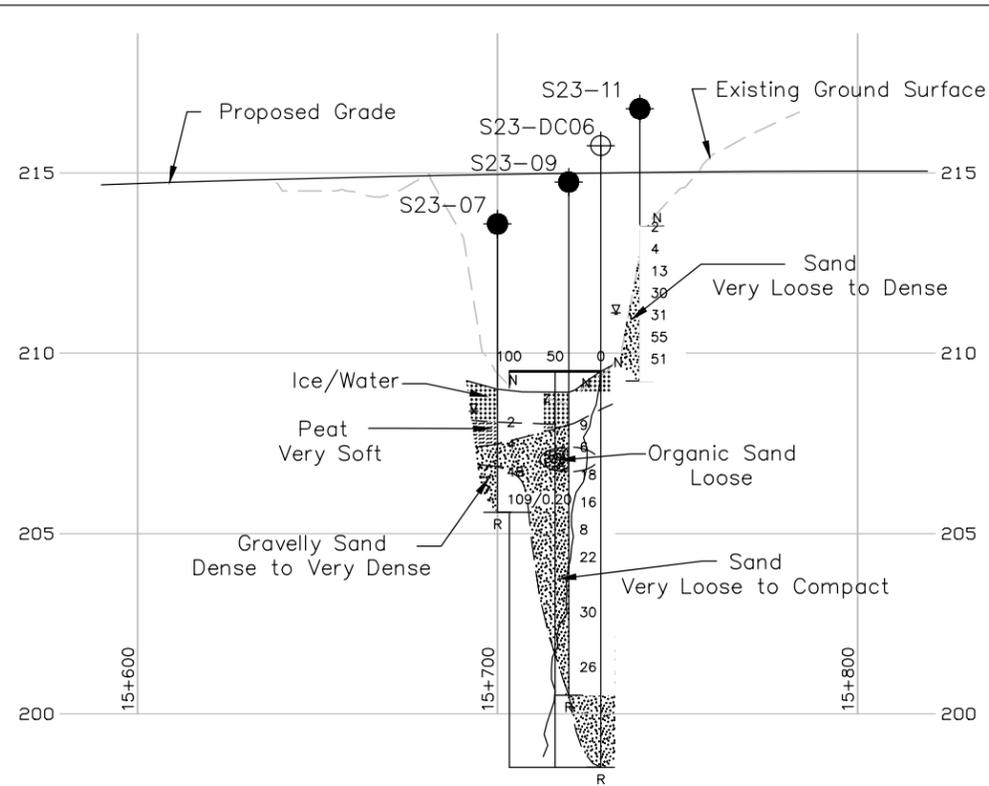
The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.



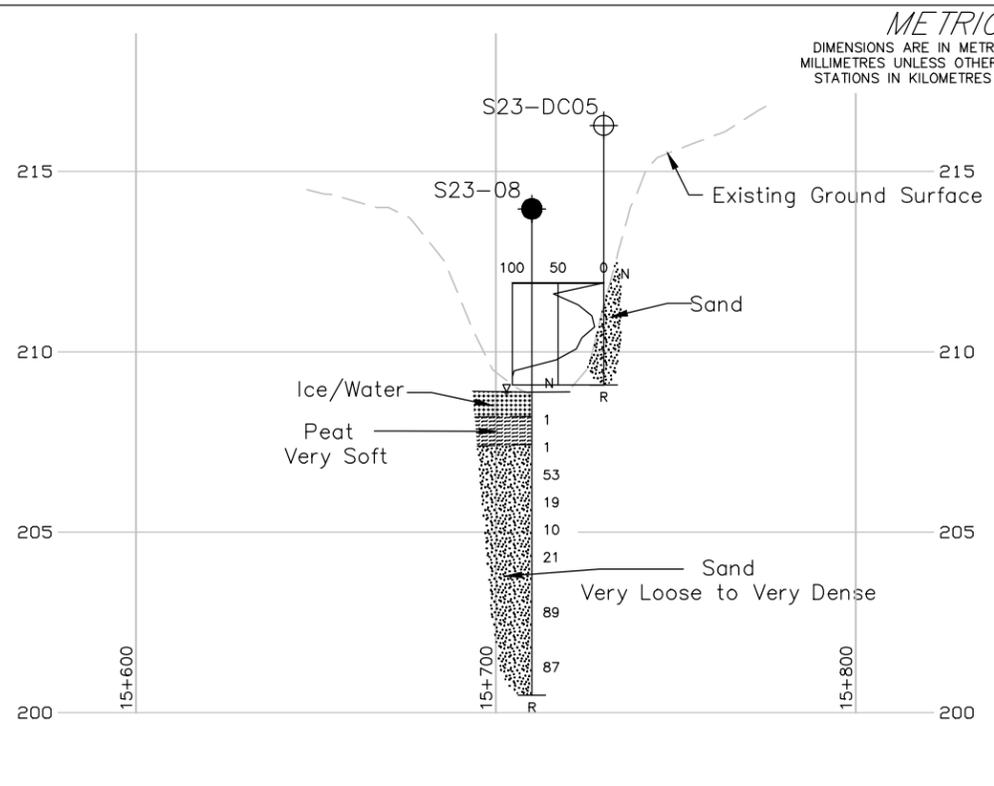
NO.	DATE	BY	REVISION
1			

Geocres No. 41H-161

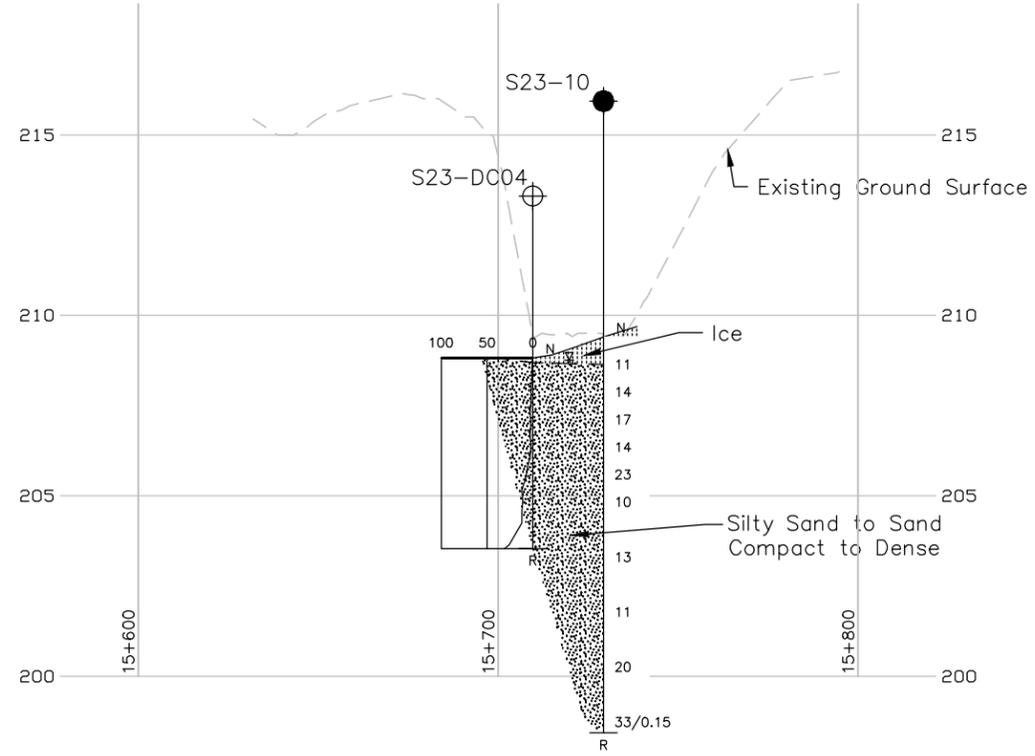
HWY. 69	PROJECT NO. 07-1111-0029	DIST.
SUBM'D. VA	CHKD. VA/OK	DATE: Nov. 2009
SUBM'D. CN	CHKD. CN	SITE:
DRAWN: DD/RJ	APPD. JPD/JMAC	DWG. A1



D-D
A1 CENTRELINE PROFILE
 HIGHWAY 69 (NBL)
 HORIZONTAL SCALE: 1:200
 VERTICAL SCALE: 1:4



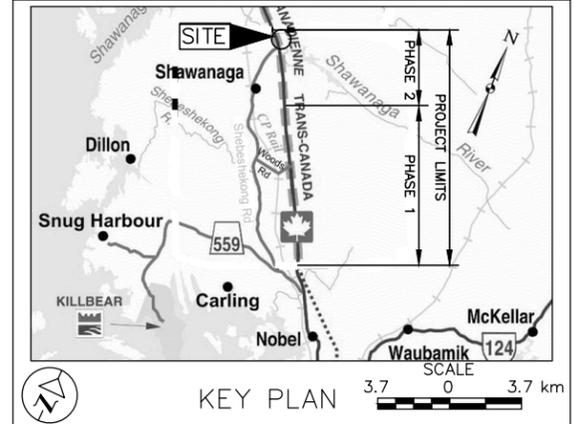
E-E
A1 EMBANKMENT TOE PROFILE
 HIGHWAY 69 (NBL)
 HORIZONTAL SCALE: 1:200
 VERTICAL SCALE: 1:4



F-F
A1 EMBANKMENT TOE PROFILE
 HIGHWAY 69 (NBL)
 HORIZONTAL SCALE: 1:200
 VERTICAL SCALE: 1:4

METRIC
 DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No. GWP No. 5111-07-00
 HIGHWAY 69 (NBL) STA 15+700 TO STA 15+740
 SOIL STRATA



LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling
- R Refusal

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
S23-07	209.0	5044352.4	244817.8
S23-08	208.9	5044348.5	244801.3
S23-09	208.9	5044365.5	244803.0
S23-10	209.4	5044381.5	244804.1
S23-11	213.5	5044378.7	244788.3
S23-DC04	208.8	5044370.3	244820.4
S23-DC05	211.9	5044363.7	244788.1
S23-DC06	209.5	5044371.4	244796.3

NOTES

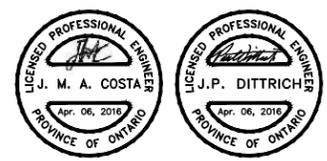
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans provided in digital format by MRC, drawing file 5271XB01.dwg, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007, and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009, h6878_PHASE2_XA1, h6878_PHASE2_XN1.dwg, received January 21, 2009.



NO.	DATE	BY	REVISION

Geocres No. 41H-161

HWY. 69	PROJECT NO. 07-1111-0029	DIST.
SUBM'D. VA	CHKD. MCK	DATE: Nov. 2009
DRAWN: DD/RJ	CHKD. CN	APPD. JPD/JMAC
		DWG. A2

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-01	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044317.4 ; E 244800.9</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Hand Excavation</u>	COMPILED BY <u>PKS</u>	
DATUM <u>Geodetic</u>	DATE <u>February 20, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W		
212.3	GROUND SURFACE															
0.0	SAND, trace silt, trace organics															
0.2	Brown Moist END OF EXCAVATION BEDROCK															
	NOTES: 1. Hand digging carried out at proposed borehole location to expose bedrock. 2. Water level in excavation not noted.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-02	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044328.5 ; E 244802.4</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Hand Excavation</u>	COMPILED BY <u>PKS</u>	
DATUM <u>Geodetic</u>	DATE <u>February 20, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					W _p	W	W _L		
						20	40	60	80	100						
210.6 0.0	GROUND SURFACE BEDROCK OUTCROP															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-03	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044326.7 ; E 244790.2</u>	ORIGINATED BY <u>ID</u>	
DIST <u> </u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>PKS</u>	
DATUM <u>Geodetic</u>	DATE <u>February 18, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W		
						20 40 60 80 100	20 40 60 80 100	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	GR SA SI CL
208.9	ICE SURFACE															
0.0	Ice															
208.3																
0.8	Water															
207.6	PEAT (Fibrous) Very soft Dark brown Wet		1	SS	1		208									
1.4	SAND, trace to some silt, trace organics Brown Wet END OF BOREHOLE CASING REFUSAL NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 208.8 m) upon completion of drilling. 2. An additional borehole was drilled adjacent to Borehole S23-03; see Record of Borehole S23-03A for details.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DDJ/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S23-03A** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044329.2 ; E 244787.2 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** PKS
DATUM Geodetic **DATE** February 18, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
208.9	ICE SURFACE																		
0.0	Ice																		
208.5																			
0.4	Water																		
208.0																			
0.9	PEAT, trace roots and wood fragments (Amorphous) Very soft to stiff Dark brown Wet		1	SS	1														OC=55.5%
			2	SS	3														
206.2			3	SS	13														
2.7	SAND, trace to some silt, trace to some gravel Compact Brown Wet																		
			4	SS	10														7 85 7 1
			5	SS	11														
			6	SS	11														
			7	SS	22														17 76 7 0
			8	SS	21														
200.2																			
8.7	END OF BOREHOLE CASING AND SPOON REFUSAL (HAMMER BOUNCING)																		
	NOTES: 1. Water level in open borehole at ice surface (Elev. 208.9 m) upon completion of drilling 2. Borehole caved to a depth of 3.1 m below ice surface (Elev. 205.8 m) upon removal of casing.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S23-04** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044311.1; E 244771.2 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Portable Equipment, BW Casing, Wash Boring COMPILED BY PKS
 DATUM Geodetic DATE February 17 and 18, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60	γ	GR SA SI CL	
208.9	ICE SURFACE															
0.0	Ice															
208.4	Water															
208.1	Water															
0.9	PEAT, trace roots and wood fragments (Amorphous) Dark brown Wet		1A	SS	5									357.3		OC = 2.2%
	SAND, trace to some silt, trace clay, trace organics Very loose to loose Brown Wet		1B	SS	1											OC = 3.8%
			2	SS	1											
			3	SS	2											0 89 10 1
			4	SS	7											
205.2	SAND, some gravel, trace to some silt, trace clay Very dense Brown to grey Wet		5	SS	58											
3.7			6	SS	54											
			7	SS	68/0.15											15 76 8 1
	Grey below a depth of 6.1 m		8	SS	106											
202.4	END OF BOREHOLE SPOON AND CASING REFUSAL															
6.6	NOTES: 1. Borehole advanced using portable drilling equipment with half-weight hammer to a depth of 5.9 m. SPT 'N' values shown have been adjusted to reflect values that would be obtained using a standard weight hammer. 2. Water level in open borehole at a depth of 0.2 m below ice surface (Elev. 208.7 m) upon completion of drilling.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-05	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044333.3; E 244782.6</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>PKS</u>	
DATUM <u>Geodetic</u>	DATE <u>February 19, 2009</u>	CHECKED BY <u>VA/OK</u>	

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										
						20	40	60	80	100								
209.4	ICE SURFACE																	
0.0	Ice																	
209.1	Water																	
208.8																		
0.8	PEAT, containing wood fragments (Fibrous) Dark brown Wet		1	SS	3													
	SAND, some gravel, trace to some silt Very loose to compact Brown Wet		2	SS	2						o							
			3	SS	8													
			4	SS	9						o							
205.3			5	SS	15/0.15						o				18	80	2	0
4.1	END OF BOREHOLE SPOON AND CASING REFUSAL																	
	NOTES: 1. Water level in open borehole at ice surface (Elev. 209.4 m) upon completion of drilling. 2. Borehole caved to a depth of 2.2 m below ice surface (Elev. 207.2 m) upon removal of casing.																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-06	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044346.7 ; E 244786.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>PKS</u>	
DATUM <u>Geodetic</u>	DATE <u>February 19, 2009</u>	CHECKED BY <u>VA/OK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)			
						20	40	60	80	100	20	40	60		GR	SA	SI	CL		
209.3 0.0	ICE SURFACE Ice																			
208.5 0.8	SAND, trace to some silt, trace gravel, trace clay, trace organics to a depth of 1.5 m, clay seams between depths of 1.5 m and 2.3 m Loose to compact Brown Wet		1	SS	8															
			2	SS	16															
				3	SS	10														
				4	SS	12														
				5	SS	51/0.20														
205.1 4.2	END OF BOREHOLE SPOON AND CASING REFUSAL NOTES: 1. Water level in open borehole at a depth of 0.6 m below ice surface (Elev. 208.7 m) upon completion of drilling. 2. Borehole caved to a depth of 1.6 m below snow surface (Elev. 207.7 m) upon removal of casing.																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DDJ/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-07	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044352.4 ; E 244817.8</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 18, 2009</u>	CHECKED BY <u>VA/OK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
209.0 0.0	ICE SURFACE Ice					▽											
208.1 0.9	PEAT (Fibrous) Very soft Brown Wet		1	SS	2		208										
207.5 1.5	SAND, trace gravel, trace organic Very loose Brown/grey Wet		2	SS	4		207										OC = 0.5%
206.8 2.2	Gravelly SAND, some silt Dense to very dense Brown Wet		3	SS	48		206										26 59 14 1
205.6 3.4	END OF BOREHOLE SPOON AND CASING REFUSAL		4	SS	109/0.20												
	NOTES: 1. Water level in open borehole at a depth of 0.6 m below ice surface (Elev. 208.4 m) upon completion of drilling. 2. Borehole caved to a depth of 1.2 m below ice surface (Elev. 207.8 m) upon removal of casing.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-08	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044348.5; E 244801.3</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 17, 2009</u>	CHECKED BY <u>VA/OK</u>	

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								
						20 40 60 80 100	20 40 60 80 100	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60
208.9	ICE SURFACE															
0.0	Ice															
208.6	Water															
208.2																
0.7	PEAT, trace wood fragments (Fibrous) Very soft Brown Wet		1	SS	1											OC = 64.3%
207.5																
1.5	SAND, trace gravel, trace silt Very loose to very dense Grey Wet		2	SS	1											
			3	SS	53											
			4	SS	19											
			5	SS	10											0 95 5 0
			6	SS	21											
			7	SS	89											
			8	SS	87											1 95 4 0
200.5																
8.4	END OF BOREHOLE CASING REFUSAL															
	NOTES: 1. Water level in open borehole at ice surface (Elev. 208.9 m) upon completion of drilling. 2. Borehole caved to a depth of 1.5 m below ice surface (Elev. 207.4 m) upon removal of casing.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S23-09** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044365.5 ; E 244803.0 ORIGINATED BY MJR
 DIST HWY 69 BOREHOLE TYPE Portable Equipment, BW Casing, Wash Boring COMPILED BY VA
 DATUM Geodetic DATE February 19, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
208.9	ICE SURFACE															
0.0	Ice															
208.3																
208.0	Water															
0.9	SAND, trace gravel, trace silt, trace organics		1	SS	9											
207.4	Loose Brown and grey															
1.5	Wet		2	SS	6											
206.7	Organic SAND, trace to some silt, trace clay															
2.2	Loose Dark brown/grey															
	Wet SAND, trace to some silt, trace gravel, trace clay		3	SS	18											
	Loose to compact															
	Brown		4	SS	16										0 89 10 1	
	Wet															
			5	SS	8											
			6	SS	22											
			7	SS	30											
			8	SS	26											
200.5																
8.4	END OF BOREHOLE CASING REFUSAL															
	NOTES:															
	1. Water level in open borehole at a depth of 0.3 m below ice surface (Elev. 208.6 m) upon completion of drilling.															
	2. Borehole caved to a depth of 1.4 m below ice surface (Elev. 207.5 m) upon removal of casing.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-10	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044381.5; E 244804.1</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>PKS</u>	
DATUM <u>Geodetic</u>	DATE <u>February 19 and 20, 2009</u>	CHECKED BY <u>VA/OK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
209.4 0.0	ICE SURFACE Ice	[Strat Plot]																	
208.6 0.8	SAND, trace silt, trace organics Compact Brown Wet		1	SS	11														
207.9 1.5	Silty SAND, trace gravel, containing clay seams Compact Brown Wet		2	SS	14														
			3	SS	17														
			4	SS	14														0 75 24 1
			5	SS	23														
			6	SS	10														1 78 20 1
			7	SS	13														
			8	SS	11														
			9	SS	20														
199.2 10.2	SAND, some gravel, trace silt Dense Brown Wet		10	SS	33/0.15														
198.4 11.0	END OF BOREHOLE SPOON AND CASING REFUSAL NOTES: 1. Water level in open borehole at a depth of 0.6 m below ice surface (Elev. 208.8 m) upon completion of drilling. 2. Borehole caved to a depth of 2.1 m below ice surface (Elev. 207.3 m) upon removal of casing.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S23-11	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044378.7 ; E 244788.3</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 20, 2009</u>	CHECKED BY <u>VA/OK</u>	

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								
						20 40 60 80 100	20 40 60 80 100	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60			
213.5 0.0	GROUND SURFACE															
	SAND, trace to some silt, trace gravel, trace organics to a depth of 1.8 m Very loose to very dense Brown Damp to wet		1	SS	2		213						○			
			2	SS	4											
			3	SS	13		212						○		4	89 7 0
			4	SS	30											
			5	SS	31	▽	211						○			
			6	SS	55		210									
			7	SS	51								○		1	85 14 0
209.2 4.3	END OF BOREHOLE															
	NOTE: 1. Borehole advanced using portable drilling equipment with half-weight hammer. SPT N values shown have been adjusted to reflect values that would be obtained using a standard weight hammer. 2. Water level in open borehole at a depth of 2.4 m below ground surface (Elev. 211.1 m) upon completion of drilling.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC01	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044306.3 ; E 244783.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 18, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
208.8 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					20	40	60	80	100						
206.5 2.3	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)					20	40	60	80	100						

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC02	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044340.2 ; E 244796.6</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 17, 2009</u>	CHECKED BY <u>VA/OK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL
208.9 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)														
						208									
						207									
						206									
						205									
						204									
						203									
						202									
						201									
						200									
199.3 9.6	END OF DCPT Refusal to Further Penetration (150 Blows / 0.1 m)									150					

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC03	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044320.2 ; E 244762.8</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 19, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					W _p	W	W _L		
209.8 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					20	40	60	80	100						
						209										
						208										
						207										
206.1 3.7	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC04	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044370.3 ; E 244820.4</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 23, 2009</u>	CHECKED BY <u>VA/OK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
208.8	GROUND SURFACE					20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL	
0.0	Dynamic Cone Penetration Test (DCPT)					208										
203.5	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)					204										

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC05	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044363.7 ; E 244788.1</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 17, 2009</u>	CHECKED BY <u>VA/OK</u>	

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									
211.9 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					20	40	60	80	100						
						20	40	60	80	100						
209.1 2.8	END OF DCPT Refusal to Further Penetration (125 Blows / 0.1 m) NOTE: 1. DCPT advanced using portable drilling equipment with half weight hammer. Blows shown have been adjusted to reflect values that would be obtained using a standard weight hammer.									125						

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC06	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044371.4 ; E 244796.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 23, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION	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								
209.5 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					20	40	60	80	100	20	40	60		
198.5 11.0	END OF DCPT					20	40	60	80	100	20	40	60		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S23-DC07	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044310.0; E 244770.2</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 18, 2009</u>	CHECKED BY <u>VA/OK</u>	

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									
208.9 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					20	40	60	80	100	20	40	60			
208																
207																
206																
205																
204																
203																
202.5 6.4	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)															

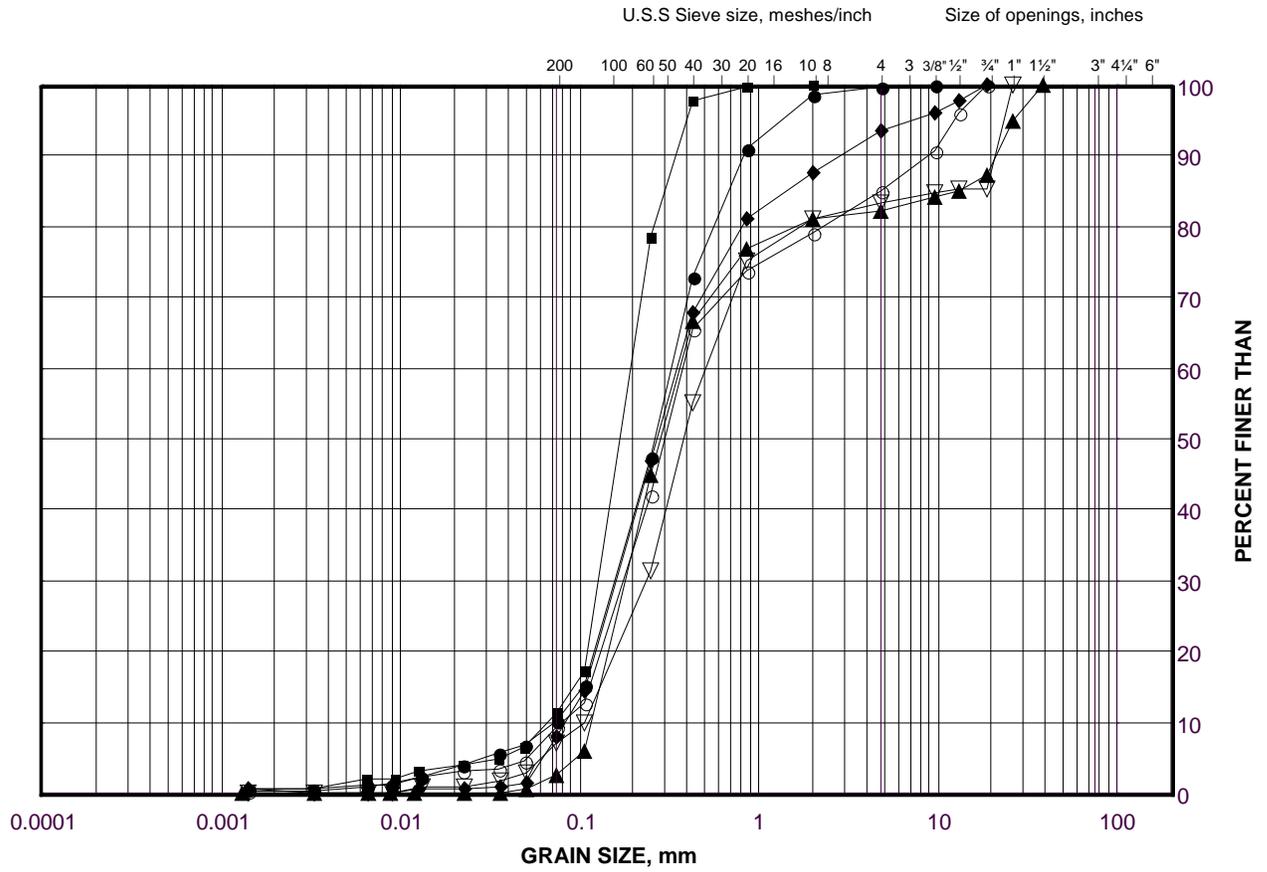
GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GRAIN SIZE DISTRIBUTION

Sand
Highway 69 (SBL) STA 15+690 to 15+720

FIGURE A.S23-1



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S23-06	2	207.5
■	S23-04	3	206.3
◆	S23-03A	4	205.6
▲	S23-05	5	205.5
▽	S23-03A	7	202.5
○	S23-04	7	203.1

Project Number: 07-1111-0029

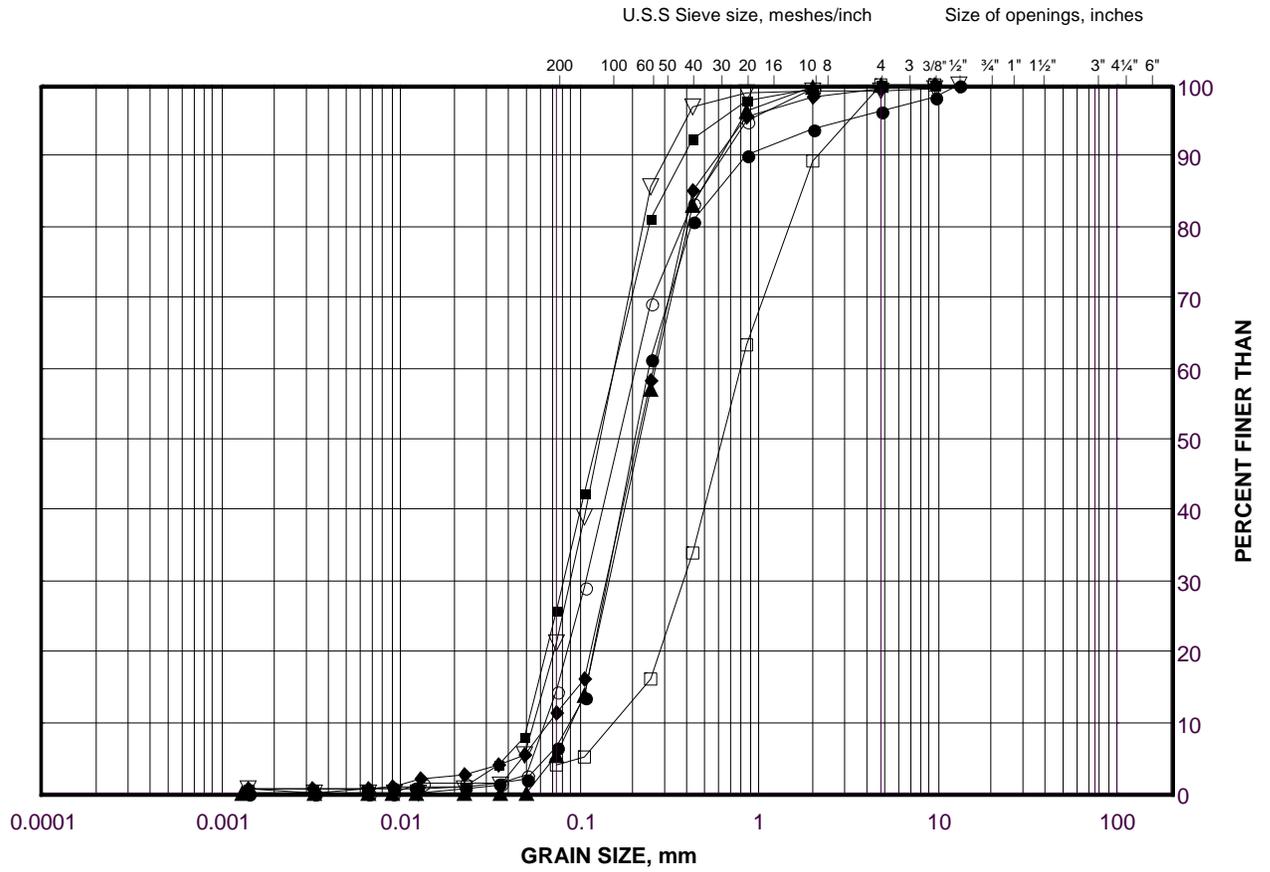
Checked By: CN

Golder Associates

Date: 27-Nov-09

GRAIN SIZE DISTRIBUTION
 Silty Sand to Sand
 Highway 69 (NBL) STA 15+700 to 15+740

FIGURE A.S23-2



SILT AND CLAY SIZES			FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED			SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S23-11	3	212.0
■	S23-10	4	206.1
◆	S23-09	4	205.5
▲	S23-08	5	204.8
▽	S23-10	6	204.5
○	S23-11	7	209.5
□	S23-08	8	201.0

Project Number: 07-1111-0029

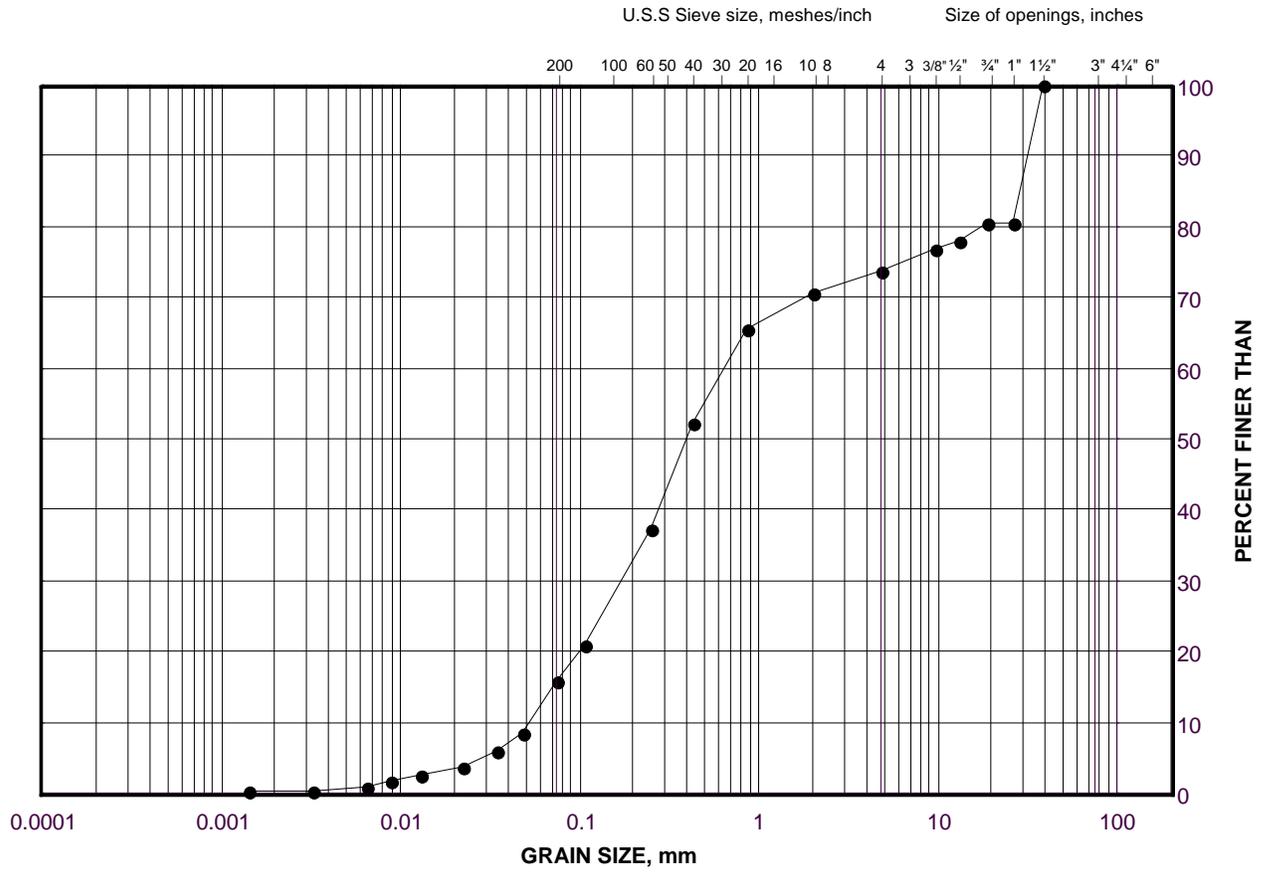
Checked By: CN

Golder Associates

Date: 27-Nov-09

GRAIN SIZE DISTRIBUTION
 Gravelly Sand
 Highway 69 (NBL) STA 15+700 to 15+740

FIGURE A.S23-3



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S23-07	3	206.4

Project Number: 07-1111-0029

Checked By: CN

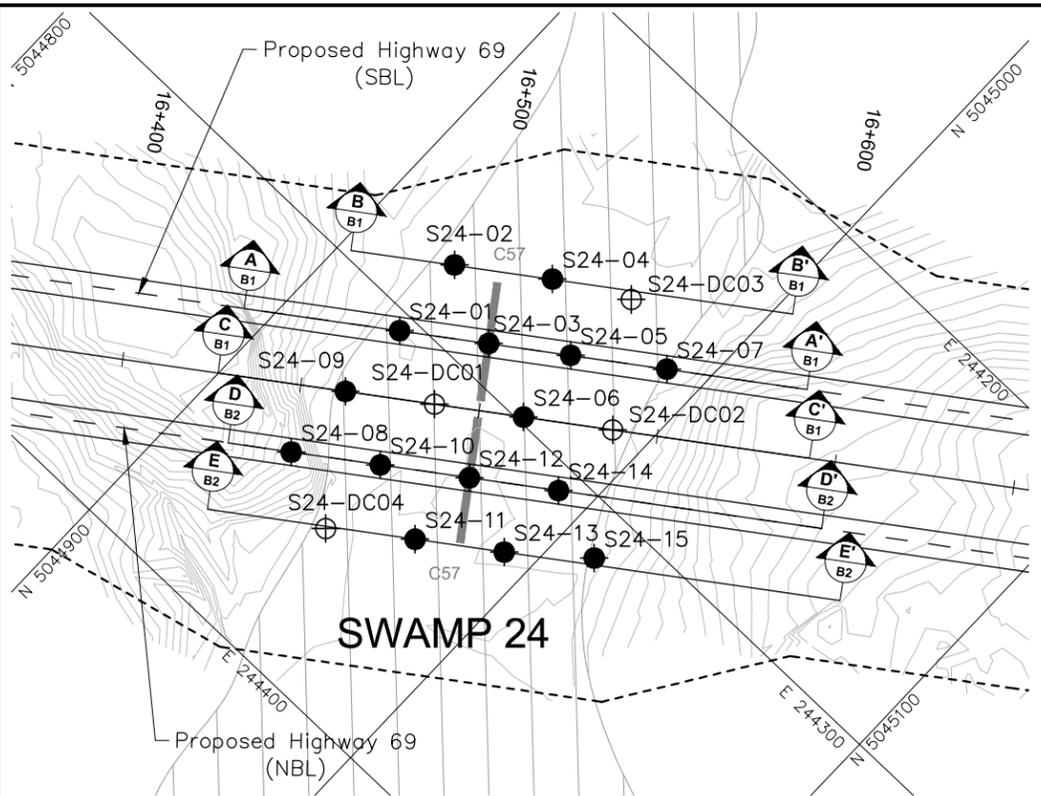
Golder Associates

Date: 27-Nov-09

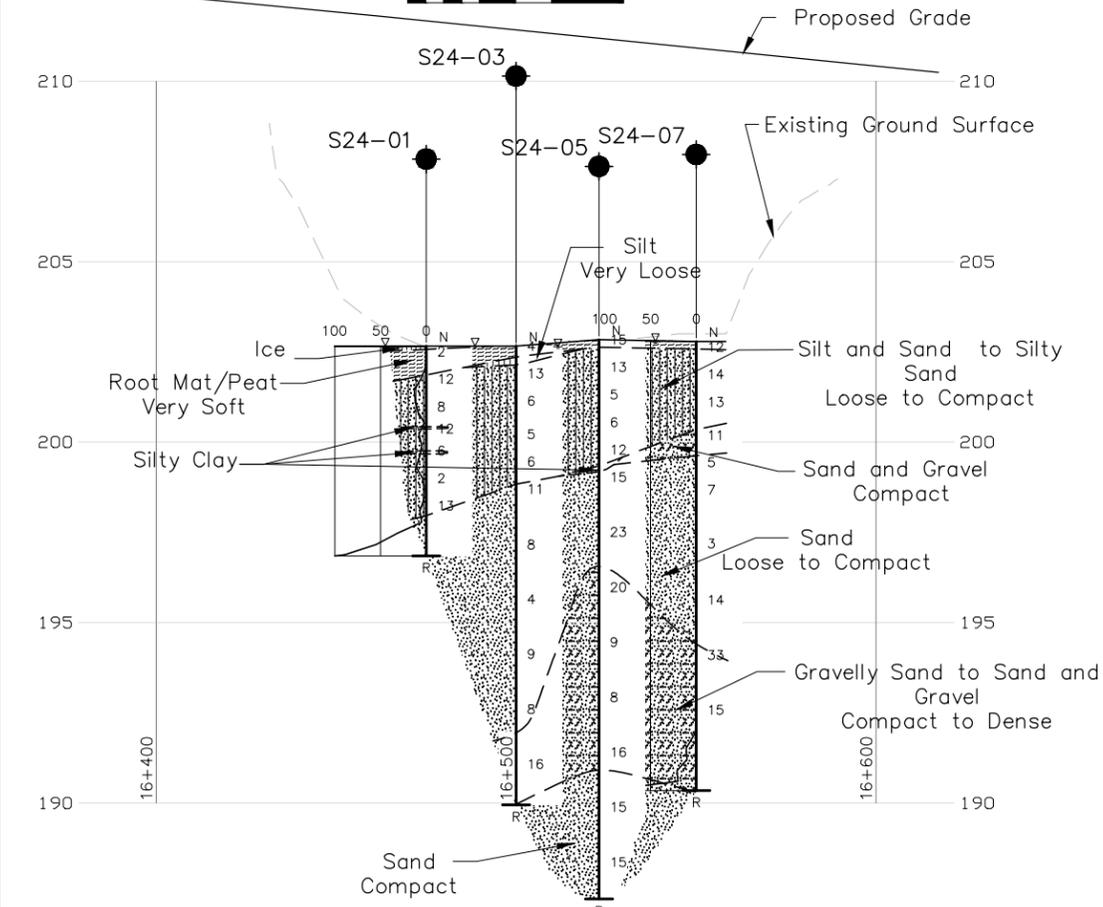


APPENDIX B

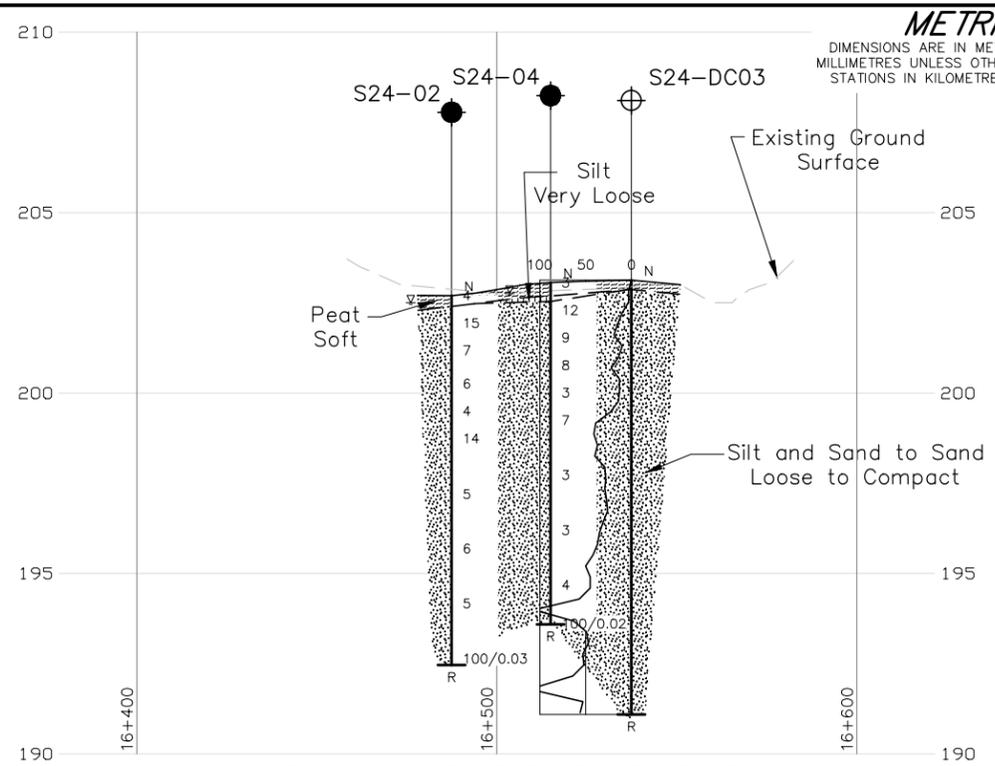
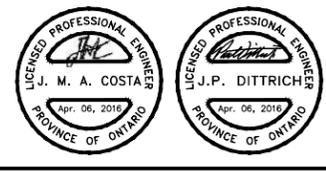
**Highway 69 SBL – STA 16+475 to 16+550 and
Highway 69 NBL – STA 16+450 to 16+550 (Swamp 24)**



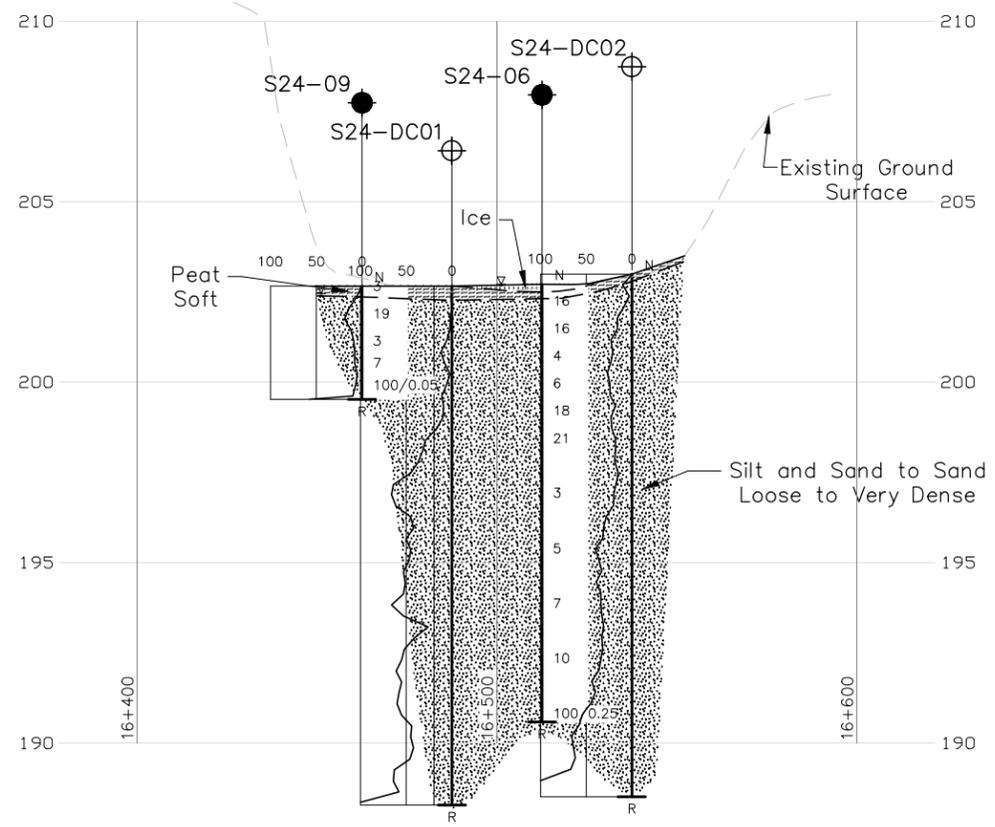
PLAN
SCALE
20 0 20 40 m



A-A' B1
CENTRELINE PROFILE HIGHWAY 69 (SBL)
HORIZONTAL SCALE
20 0 20 40 m
VERTICAL SCALE
2 0 2 4 m



B-B' B1
EMBANKMENT TOE PROFILE HIGHWAY 69 (SBL)
HORIZONTAL SCALE
20 0 20 40 m
VERTICAL SCALE
2 0 2 4 m

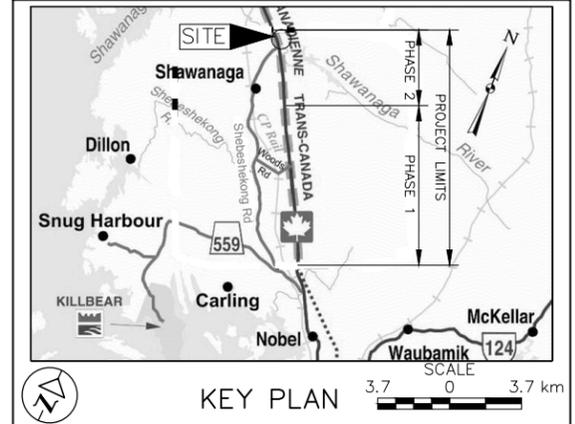


C-C' B1
EMBANKMENT TOE PROFILE HIGHWAY 69 (MEDIAN)
HORIZONTAL SCALE
20 0 20 40 m
VERTICAL SCALE
2 0 2 4 m

REFERENCE
Base plans provided in digital format by MRC, drawing file 5271XB01.DWG, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007, and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009, h6878_PHASE2_XA1, h6878_PHASE2_XN1.dwg, received January 21, 2009.

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No. GWP No. 5111-07-00
HIGHWAY 69 (SBL) STA 16+475 TO STA 16+550
HIGHWAY 69 (NBL) STA 16+450 TO STA 16+550
BOREHOLE LOCATIONS AND SOIL STRATA



- LEGEND**
- Borehole - Current Investigation
 - ⊕ Dynamic Cone Penetration Test
 - N Standard Penetration Test Value
 - 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
 - ≡ WL upon completion of drilling
 - R Refusal

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
S24-01	202.7	5044928.4	244304.7
S24-02	202.7	5044927.0	244281.0
S24-03	202.7	5044948.8	244290.3
S24-04	203.1	5044949.4	244265.1
S24-05	202.8	5044967.6	244277.0
S24-06	202.7	5044969.9	244298.4
S24-07	202.8	5044989.7	244261.4
S24-08	206.3	5044929.8	244349.9
S24-09	202.7	5044929.1	244327.3
S24-10	202.4	5044950.2	244335.4
S24-11	202.2	5044971.3	244343.7
S24-12	202.6	5044970.6	244321.0
S24-13	202.6	5044991.8	244329.3
S24-14	202.7	5044991.0	244306.5
S24-15	202.8	5045011.1	244313.3
S24-DC01	202.7	5044949.5	244312.9
S24-DC02	203.0	5044990.3	244284.0
S24-DC03	203.1	5044969.2	244254.2
S24-DC04	202.1	5044951.3	244358.6

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

NO.	DATE	BY	REVISION
Geocres No. 41H-161			
HWY. 69	PROJECT NO. 07-1111-0029		DIST.
SUBM'D. VA	CHKD. VA/OK	DATE: Nov. 2009	SITE:
DRAWN: DD/RJ	CHKD. CN	APPD. JPD/JMAC	DWG. B1

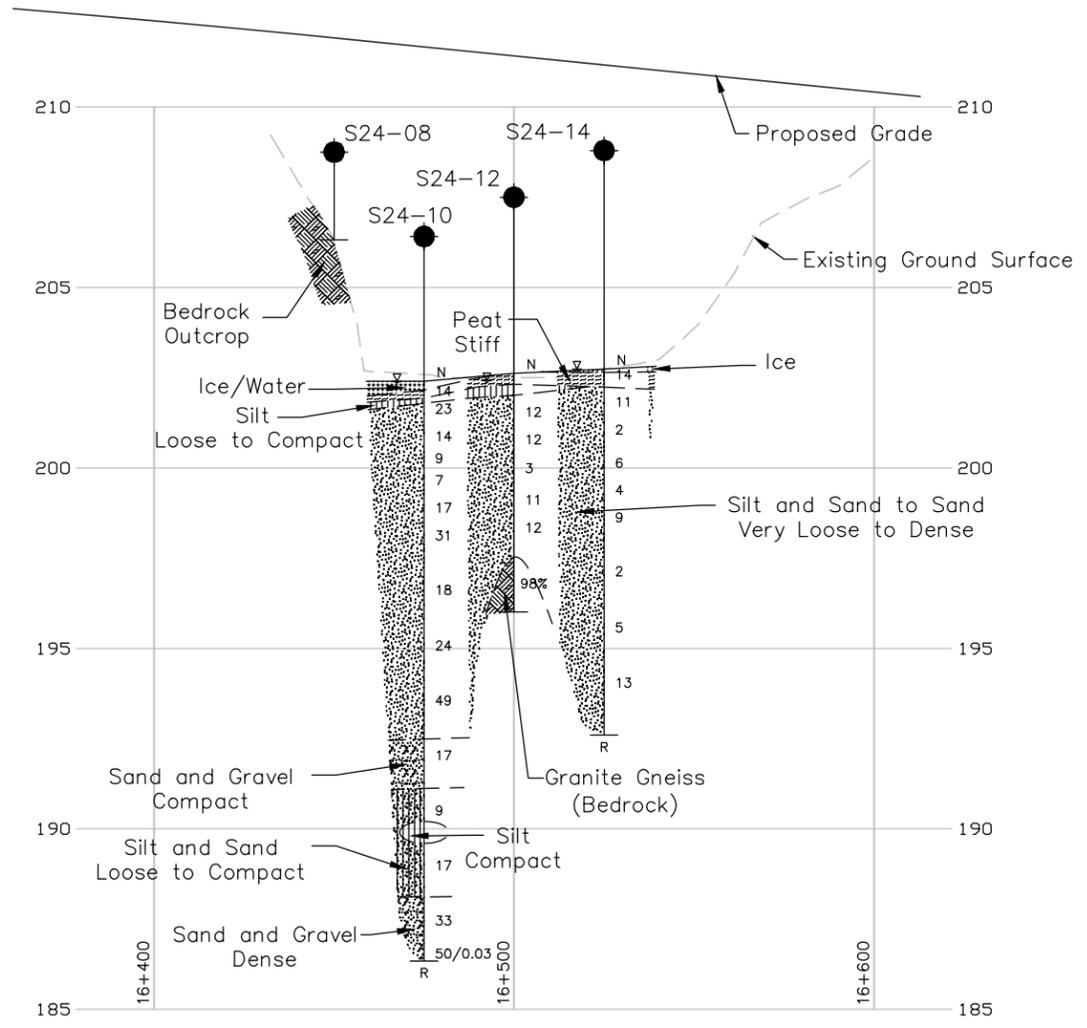
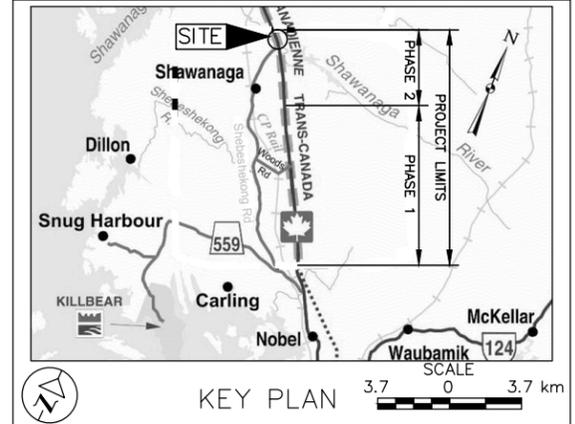
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 5111-07-00

HIGHWAY 69 (NBL) STA 16+450 TO STA 16+550

SOIL STRATA

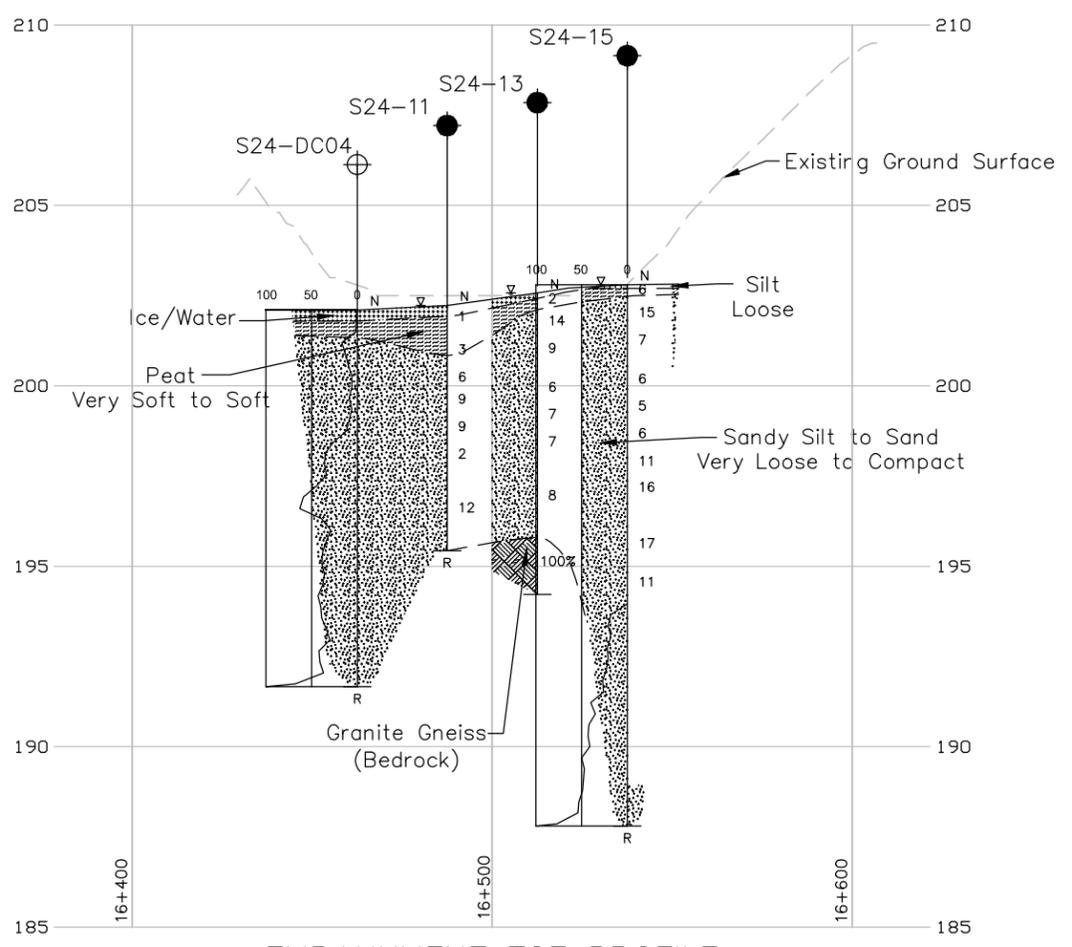
SHEET



D-D'
B1 CENTRELINE PROFILE
HIGHWAY 69 (NBL)

HORIZONTAL SCALE
0 20 40 m

VERTICAL SCALE
0 2 4 m



E-E'
B1 EMBANKMENT TOE PROFILE
HIGHWAY 69 (NBL)

HORIZONTAL SCALE
0 20 40 m

VERTICAL SCALE
0 2 4 m

LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ▽ WL upon completion of drilling
- R Refusal
- 100% Rock Quality Designation (RQD)

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
S24-08	206.3	5044929.8	244349.9
S24-10	202.4	5044950.2	244335.4
S24-11	202.2	5044971.3	244343.7
S24-12	202.6	5044970.6	244321.0
S24-13	202.6	5044991.8	244329.3
S24-14	202.7	5044991.0	244306.5
S24-15	202.8	5045011.1	244313.3
S24-DC04	202.1	5044951.3	244358.6

NOTES

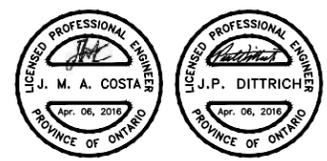
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans provided in digital format by MRC, drawing file 5271XB01.DWG, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007, and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009, h6878_PHASE2_XA1, h6878_PHASE2_XN1.dwg, received January 21, 2009.



NO.	DATE	BY	REVISION

Geocres No. 41H-161

HWY. 69	PROJECT NO. 07-1111-0029	DIST.
SUBM'D. VA	CHKD. VA/OK	DATE: Nov. 2009
DRAWN: DD/RJ	CHKD. CN	APPD. JPD/JMAC

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-01** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044928.4 ; E 244304.7 ORIGINATED BY MR
 DIST HWY 69 BOREHOLE TYPE 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring COMPILED BY MWK
 DATUM Geodetic DATE January 26, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20
202.7	ICE SURFACE																	
0.0	Ice																	
0.3	Root mat																	
201.9	PEAT, trace rootlets (Amorphous)		1	AS	2													
0.8	Very soft Dark brown Wet																	
	Silty SAND, trace clay		2	SS	12									0	77	21	2	
	Loose to compact Brown Wet																	
			3B	SS	8													
200.5																		
2.3	SILTY CLAY, trace sand Grey Wet		4	SS	12									0	61	36	3	
199.8	SILT and SAND, trace clay Compact Grey Wet		5A	SS	6									0	47	50	3	
3.0	SILTY CLAY, trace sand Brown Wet		5B	SS	6													
	SILT and SAND, trace clay, containing silt layers Very loose to compact Grey Wet		6	SS	2													
198.0			7A	SS	13													
4.7	SAND, trace silt Compact Grey Wet		7B	SS	13													
197.5																		
5.2																		
196.9	END OF BOREHOLE CASING REFUSAL																	
5.8	END OF DCPT Refusal to Further Penetration (100 Blows / 0.03 m)																	
NOTES: 1. Water level in open borehole at ice surface (Elev. 202.7 m) upon completion of drilling. 2. A Dynamic Cone Penetration Test was advanced 1.5 m west of Borehole S24-01, refusal encountered at a depth of 5.8 m below ice surface (Elev. 196.9 m).																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-02** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044927.0 ; E 244281.0 ORIGINATED BY MR
 DIST HWY 69 BOREHOLE TYPE 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring COMPILED BY MWK
 DATUM Geodetic DATE January 28, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
202.7	GROUND SURFACE																		
0.0 202.4	PEAT (Amorphous) Soft Dark brown Wet		1	SS	4														
202.0																			
0.7	SAND, some silt Loose Brown Wet		2	SS	15						○				0	58	40	2	
	SILT and SAND, trace clay Loose to compact Grey Wet		3	SS	7														
200.4																			
2.3	SAND, some silt, trace gravel, trace clay Loose to compact Grey Wet		4	SS	6						○								
			5	SS	4														
			6	SS	14						○				1	83	12	4	
197.5																			
5.2	Silty SAND, trace to some gravel below a depth of 9.5 m, trace clay Loose to dense Grey Wet		7	SS	5														
			8	SS	6						○								
			9	SS	5						○				0	78	21	1	
192.5			10	SS	100/0.03														
10.2	END OF BOREHOLE SPOON AND CASING REFUSAL																		
	NOTE: 1. Water level in open borehole at a depth of 0.2 m below ground surface (Elev. 202.5 m) upon completion of drilling.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-04** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044949.4 ; E 244265.1 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring **COMPILED BY** MWK
DATUM Geodetic **DATE** January 28, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
						20	40	60	80	100	20	40	60	GR	SA	SI	CL
203.1	GROUND SURFACE																
0.0	PEAT (Amorphous)																
202.7	Soft Dark brown Wet		1	SS	3												
0.5	SILT, trace sand, trace clay, trace organics Brown and grey Wet		2	SS	12									0	82	17	1
201.3	SAND, some silt, trace clay Loose to compact Grey to brownish grey Wet		3A	SS	9												
1.8	SAND, trace silt, trace clay Very loose to loose Grey Wet		3B														
			4	SS	8												
			5	SS	3									0	94	4	2
			6	SS	7												
			7	SS	3												
	Trace gravel below a depth of 6.4 m																
			8	SS	3									1	96	2	1
			9	SS	4												
193.6	END OF BOREHOLE SPOON AND CASING REFUSAL		10	SS	100/0.02												
9.5	NOTE: 1. Water level in open borehole at a depth of 0.3 m below ground surface (Elev. 202.8 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-05** **SHEET 1 OF 2** **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044967.6; E 244277.0 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring **COMPILED BY** MWK
DATUM Geodetic **DATE** January 27, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								WATER CONTENT (%)		
						20	40	60	80	100	20	40	60	GR	SA	SI	CL	
202.8	GROUND SURFACE																	
0.0	Root mat																	
0.2	SILT and SAND, trace clay, trace organics to a depth of 1.4 m Loose to compact Brown to grey Wet		1	SS	15													OC=1.0%
			2	SS	13													
			3	SS	5													
	Silt layer between depths of 2.2 m and 3.5 m		4	SS	6													
			5A															
199.3	SILTY CLAY, trace sand Very soft Brown Wet		5B	SS	12													Non-Plastic
3.7	SAND, trace to some silt, trace clay Compact Grey Wet		6	SS	15													
			7	SS	23													0 83 15 2
196.4	Gravelly SAND, trace to some silt, trace clay Loose to compact Grey Wet		8	SS	20													20 73 7 2
			9	SS	9													
			10	SS	8													
191.8	SAND and GRAVEL, trace silt Compact Grey Wet		11	SS	16													
190.6	SAND, trace to some silt Compact Grey Wet		12	SS	15													0 90 10 0
			13	SS	15													

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S24-05	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044967.6; E 244277.0</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 27, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W		
187.3 15.5	END OF BOREHOLE CASING REFUSAL NOTE: 1. Water level in open borehole at a depth of 0.2 m below ground surface (Elev. 202.6 m) upon completion of drilling.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-07** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044989.7 ; E 244261.4 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring **COMPILED BY** MWK
DATUM Geodetic **DATE** January 27, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
202.8	GROUND SURFACE															
0.0	PEAT (Amorphous)															
0.2	SILT and SAND, trace clay, trace organics to a depth of 0.8 m and rootlets Compact Brown to grey Wet	[Strat Plot]	1	SS	12											
			2	SS	14											
			3	SS	13											
200.4	SAND and GRAVEL, trace silt Compact Grey Wet	[Strat Plot]														
2.4			4	SS	11											
199.5	SAND, trace to some silt, trace gravel Very loose to compact Brown to brownish grey Wet	[Strat Plot]														
3.3			5	SS	5											
			6	SS	7											
			7	SS	3											3 86 11 0
			8	SS	14											
194.6	SAND and GRAVEL, trace to some silt Compact to dense Brown to brownish grey Wet	[Strat Plot]														
8.2			9	SS	33										44 50 6 0	
			10	SS	15											
192.0	END OF BOREHOLE															
10.8																
190.4	END OF DCPT Refusal to Further Penetration (100 Blows / 0.23 m)															
12.4	NOTES: 1. Water level in open borehole at ground surface (Elev. 202.8 m) upon completion of drilling. 2. A Dynamic Cone Penetration Test was carried out below a depth of 10.8 m; refusal encountered at a depth of 12.4 m below ground surface (Elev. 190.4 m)															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S24-08	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044929.8 ; E 244349.9</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Hand Excavation</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 25, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					W _p	W	W _L		
						20	40	60	80	100						
206.3 0.0	GROUND SURFACE BEDROCK OUTCROP															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-09** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044929.1 ; E 244327.3 ORIGINATED BY MR
 DIST HWY 69 BOREHOLE TYPE 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring COMPILED BY MWK
 DATUM Geodetic DATE January 25, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
202.7	GROUND SURFACE															
0.0 202.4	PEAT, trace rootlets (Amorphous) Soft Dark Brown Wet		1	SS	3											
0.7 202.0	SAND, trace to some silt, trace organics Very loose Brown Wet		2	SS	19											
	SILT and SAND, trace clay, containing silty sand and silt layers Very loose to compact Brown to grey Wet		3	SS	3										0 63 33 4	
			4	SS	7											
199.7	END OF BOREHOLE SPOON AND CASING REFUSAL		5	SS	100/0.05											
3.1	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)															
NOTES: 1. Water level in open borehole at a depth of 0.2 m below ground surface (Elev. 202.5 m) upon completion of drilling. 2. A Dynamic Cone Penetration Test was advanced 1.5 m west of Borehole S24-09, refusal encountered at a depth of 3.1 m below ground surface (Elev. 199.6 m).																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-10** SHEET 1 OF 2 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044950.2 ; E 244335.4 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring **COMPILED BY** MWK
DATUM Geodetic **DATE** January 23, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			T _N VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)	
						20	40	60	80	100	20	40	60	GR	SA	SI	CL	
202.4	ICE SURFACE																	
0.0	Ice																	
	Water																	
0.6	PEAT (Amorphous) Stiff Dark brown Wet		1A 1B 1C	SS	14													
	SILT, trace sand, trace clay, trace rootlets Compact Grey Wet		2	SS	23													
	SILT and SAND, trace clay, trace rootlets to a depth of 0.8 m Loose to compact Grey Wet		3	SS	14													0 39 60 1
			4	SS	9													
			5	SS	7													
199.0																		
3.4	Silty SAND, trace clay Compact to dense Grey Wet		6	SS	17													
			7	SS	31													0 76 21 3
			8	SS	18													
			9	SS	24													
194.0																		
8.4	SAND, some silt, trace gravel, trace clay Dense Grey Wet		10	SS	49													3 80 15 2
			11	SS	17													
192.5																		
9.9	SAND and GRAVEL, trace silt Compact Grey Wet		12	SS	9													
191.1																		
11.3	SILT and SAND, trace clay Loose Grey Wet		13	SS	17													0 69 30 1
190.2																		
12.2	SILT, trace sand, trace clay Loose Grey Wet		14	SS	9													
189.6																		
12.8	SILT and SAND, trace clay, some cobbles and boulder Compact Grey Wet		15	SS	17													
187.9																		
14.5																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S24-10	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044950.2 ; E 244335.4</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 23, 2009</u>	CHECKED BY <u>VA/OK</u>	

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 (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W			W _L	20
186.3	--- CONTINUED FROM PREVIOUS PAGE --- SAND and GRAVEL, trace silt, containing cobbles and boulders between depths of 14.5 m and 14.8 m Dense Grey Wet	*	14	SS	33													
16.1		END OF BOREHOLE SPOON AND CASING REFUSAL NOTE: 1. Water level in open borehole at ice surface (Elev. 202.4 m) upon completion of drilling.	*	15	SS	50/0.03												

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-11** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044971.3; E 244343.7 ORIGINATED BY MR
 DIST HWY 69 BOREHOLE TYPE 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring COMPILED BY MWK
 DATUM Geodetic DATE January 23, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			T _N VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
						20	40	60	80	100	20	40	60	GR	SA	SI	CL
202.2	ICE SURFACE																
0.0	Ice																
0.3	Water																
200.8	PEAT, trace sand layers (Amorphous) Very soft Dark brown Wet		1	SS	1												
200.8			2A	SS													
200.8			2B	SS	3												OC=0.4%
200.3	SILT and SAND, trace gravel, trace organics Very loose Grey Wet		3	SS	6												0 23 75 2
200.3	Sandy SILT, trace clay Loose Grey Wet		4	SS	9												
198.9			5	SS	9												
198.9	Silty SAND, trace clay Very loose to compact Grey Wet		6	SS	2												0 77 22 1
198.9			7	SS	12												
195.4	END OF BOREHOLE CASING REFUSAL																
195.4	NOTES: 1. Water level in open borehole at ice surface (Elev. 202.2 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II\CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-12** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044970.6; E 244321.0 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring **COMPILED BY** VA
DATUM Geodetic **DATE** January 24, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			T _N VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
						20	40	60	80	100	20	40	60	GR	SA	SI	CL
202.6	GROUND SURFACE																
0.0	PEAT (Amorphous)		1	AS	-												
202.3	Dark brown Wet																
202.0	SILT, some sand, trace clay, trace organics and rootlets		2A	SS	5												OC=0.6%
201.6	Loose Grey Wet		2B														
1.0	SAND, some silt, trace clay, trace organics and rootlets		3	SS	12												
	Loose Grey Wet																
	SAND, trace to some silt		4	SS	12												0 84 15 1
	Very loose to compact Grey Wet																
			5	SS	3												
			6	SS	11												
			7	SS	12												0 84 15 1
197.5	Granite Gneiss (BEDROCK)																
5.1	Bedrock cored from depths of 5.1 m to 6.6 m		1	RC	REC 100%												RQD = 98%
196.0	END OF BOREHOLE																
6.6	NOTE: 1. Water level in open borehole at a depth of 0.2 m below ground surface (Elev. 202.4 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-13** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044991.8 ; E 244329.3 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring **COMPILED BY** VA
DATUM Geodetic **DATE** January 22, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			T _N VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)			
						20	40	60	80	100	20	40	60		GR	SA	SI	CL		
202.6 0.0	ICE SURFACE Ice																			
202.1 0.5	PEAT (amorphous), containing rootlets Soft Grey Wet		1	SS	2															
	Silty SAND to SAND, trace gravel, trace organics and rootlets near surface of deposit Very loose to compact Grey Wet		2	SS	14															
			3	SS	9															
			4	SS	6															0 87 13 1
			5	SS	7															
			6	SS	7															
			7	SS	8															0 69 30 1
195.8 6.8	Granite Gneiss (BEDROCK) Bedrock cored from depths of 6.8 m to 8.4 m For bedrock coring details, refer to Record of Drillhole S24-13		1	RC	REC 100%														RQD = 100%	
194.3 8.4	END OF BOREHOLE NOTE: 1. Water level in open borehole at ice surface (Elev. 202.6 m) upon completion of drilling.																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II\CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: S24-13

SHEET 1 OF 1

LOCATION: N 5044991.8 ;E 244329.3

DRILLING DATE:

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D25

DRILLING CONTRACTOR: Walker Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	B Angle	DIP W/EL CORE AXIS	DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY		Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES		
								TOTAL CORE %	SOLID CORE %					Jr	Ja	Ja	K, cm/sec	10 ⁰				10 ¹	10 ²
								80	80					80	80	80	80	80				80	80
		Continued from Record of Borehole S24-13		195.83																			
7	HQRC January 22, 2009	GRANITE GNEISS Slightly weathered to fresh, fine to medium grained with feldspar banding, foliated, black, pink and grey		6.77	1																		
8																							
		END OF DRILLHOLE		194.25																			
8.35																							
9																							
10																							
11																							
12																							
13																							
14																							
15																							
16																							

GTA-RCK 018 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-MISS.GDT 03/25/16 DD/SAC



PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-14** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044991.0; E 244306.5 ORIGINATED BY MR
 DIST HWY 69 BOREHOLE TYPE 115 mm O.D. Continuous Flight Solid Stem Augers and HW Casing, Wash Boring COMPILED BY MWK
 DATUM Geodetic DATE January 25, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
202.7	ICE SURFACE																
0.0	Ice																
0.1	PEAT, containing rootlets (Amorphous)	1	SS	14													
0.2	Stiff																
0.5	Dark brown Wet																
	SAND, trace to some silt, trace gravel, trace clay, trace organics to a depth of 0.8 m	2	SS	11													1 87 11 1
	Very loose to compact																
	Grey Wet	3	SS	2													
		4	SS	6													
		5	SS	4													
		6	SS	9													0 94 6 0
		7	SS	2													
		8	SS	5													
194.5	SAND, trace silt, containing cobbles and boulders																
8.2	Compact																
	Grey Wet	9	SS	13													
	Containing cobbles and boulder below a depth of 9.8 m																
192.6	END OF BOREHOLE CASING REFUSAL																
10.1	NOTE: 1. Water level in open borehole at ice surface (Elev. 202.7 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S24-15** SHEET 1 OF 2 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045011.1 ; E 244313.3 **ORIGINATED BY** MR
DIST HWY 69 **BOREHOLE TYPE** 108 mm I.D. Continuous Flight Hollow Stem Augers and HW Casing, Wash Boring **COMPILED BY** MWK
DATUM Geodetic **DATE** January 21, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20
202.8	GROUND SURFACE																
0.0	PEAT (Amorphous) Dark brown Wet	1	SS	6													
0.3	SILT, trace sand, trace clay, trace rootlets Loose Brown Wet	2	SS	15													
	SAND, trace to some silt, trace gravel, trace clay Loose to compact Grey to brownish grey Wet	3	SS	7													Non-Plastic
		4	SS	6													
		5	SS	5													
		6	SS	6													
		7	SS	11								81.7					0 97 3 0
		8	SS	16													8 85 7 0
		9	SS	17													
194.0	END OF BOREHOLE	10	SS	11													
187.8																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S24-15	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045011.1 ; E 244313.3</u>	ORIGINATED BY <u>MR</u>	
DIST <u> </u> HWY <u>69</u>	BOREHOLE TYPE <u>108 mm I.D. Continuous Flight Hollow Stem Augers and HW Casing, Wash Boring</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 21, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L			GR
15.0	END OF DCPT Refusal to Further Penetration (100 Blows / 0.1 m) NOTES: 1. Water level in open borehole at ground surface (Elev. 202.8 m) upon completion of drilling. 2. A Dynamic Cone Penetration Test was carried out below a depth of 8.8 m; refusal encountered at a depth of 15.0 m (Elev. 187.8 m) upon completion drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S24-DC-01	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044949.5 ; E 244312.9</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>D-25 Track Mount, Dynamic Cone Penetration Test</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 24, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100			
202.7 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)										GR SA SI CL
188.3 14.4	END OF DCPT Refusal to Further Penetration (100 Blows / 0.03 m)										

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S24-DC-02	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044990.3 ; E 244284.0</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>PENETRATION TEST</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 21, 2009</u>	CHECKED BY <u>VA/OK</u>	

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			20 40 60 80 100	20 40 60 80 100					
203.0	GROUND SURFACE												
0.0	Dynamic Cone Penetration Test (DCPT)												
188.5	END OF DCPT												
14.5	Refusal to Further Penetration (100 Blows / 0.15 m)												

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S24-DC-03	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044969.2 ; E 244254.2</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>PENETRATION TEST</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 22, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION	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									
						20	40	60	80	100						
203.1 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					203										
						202										
						201										
						200										
						199										
						198										
						197										
						196										
						195										
						194										
						193										
						192										
191.1 12.0	END OF DCPT Refusal to Further Penetration (100 Blows / 0.15 m)															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S24-DC-04	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044951.3 ; E 244358.6</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>PENETRATION TEST</u>	COMPILED BY <u>MWK</u>	
DATUM <u>Geodetic</u>	DATE <u>January 23, 2009</u>	CHECKED BY <u>VA/OK</u>	

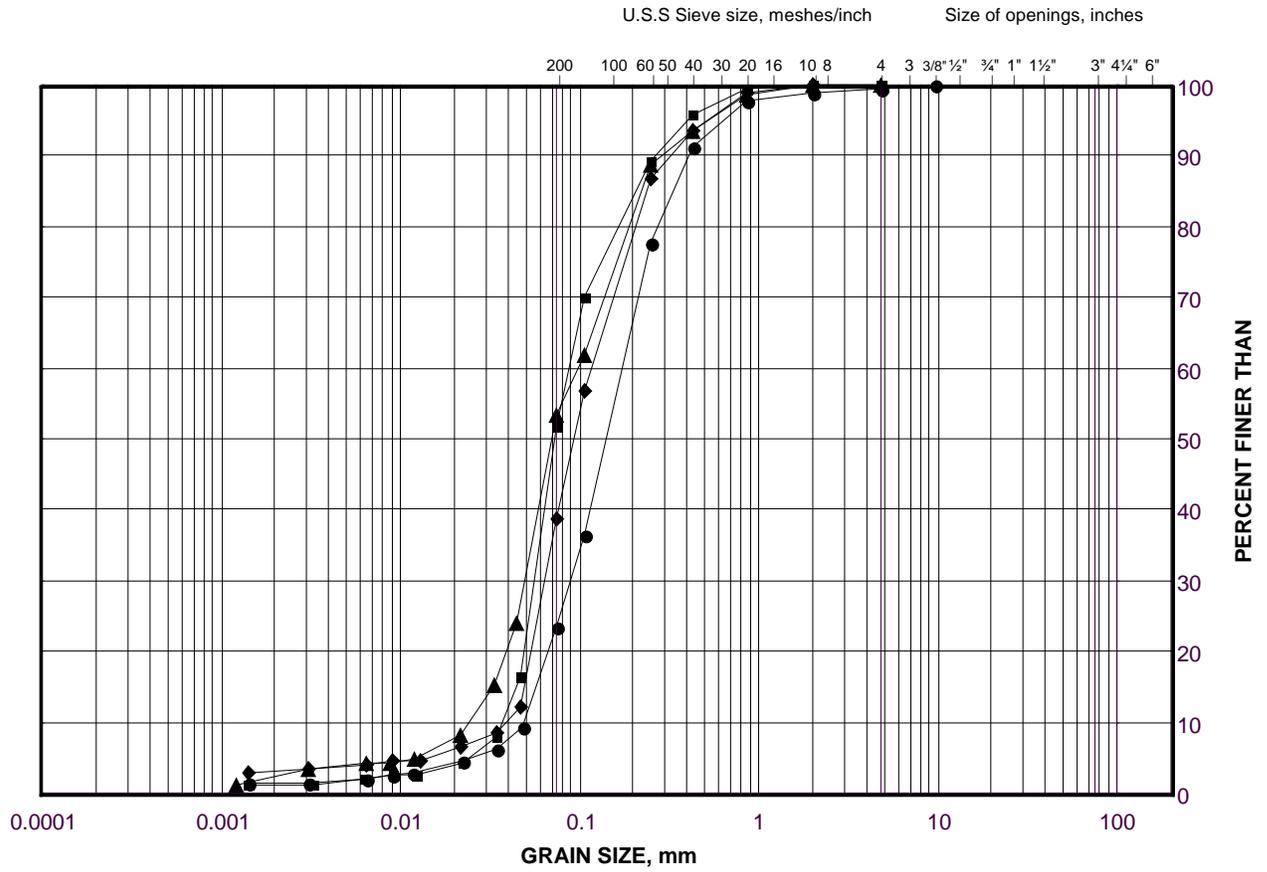
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL	
202.1	GROUND SURFACE															
0.0	Dynamic Cone Penetration Test (DCPT)					202										
						201										
						200										
						199										
						198										
						197										
						196										
						195										
						194										
						193										
						192										
191.7	END OF DCPT Refusal to Further Penetration (100 Blows / 0.08 m)															
10.4																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GRAIN SIZE DISTRIBUTION
 Silt and Sand to Silty Sand
 Highway 69 (SBL) STA 16+475 to 16+550

FIGURE B.S24-1A



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-01	2	201.4
■	S24-03	3	200.9
◆	S24-01	4	200.1
▲	S24-01	5B	199.5

Project Number: 07-1111-0029

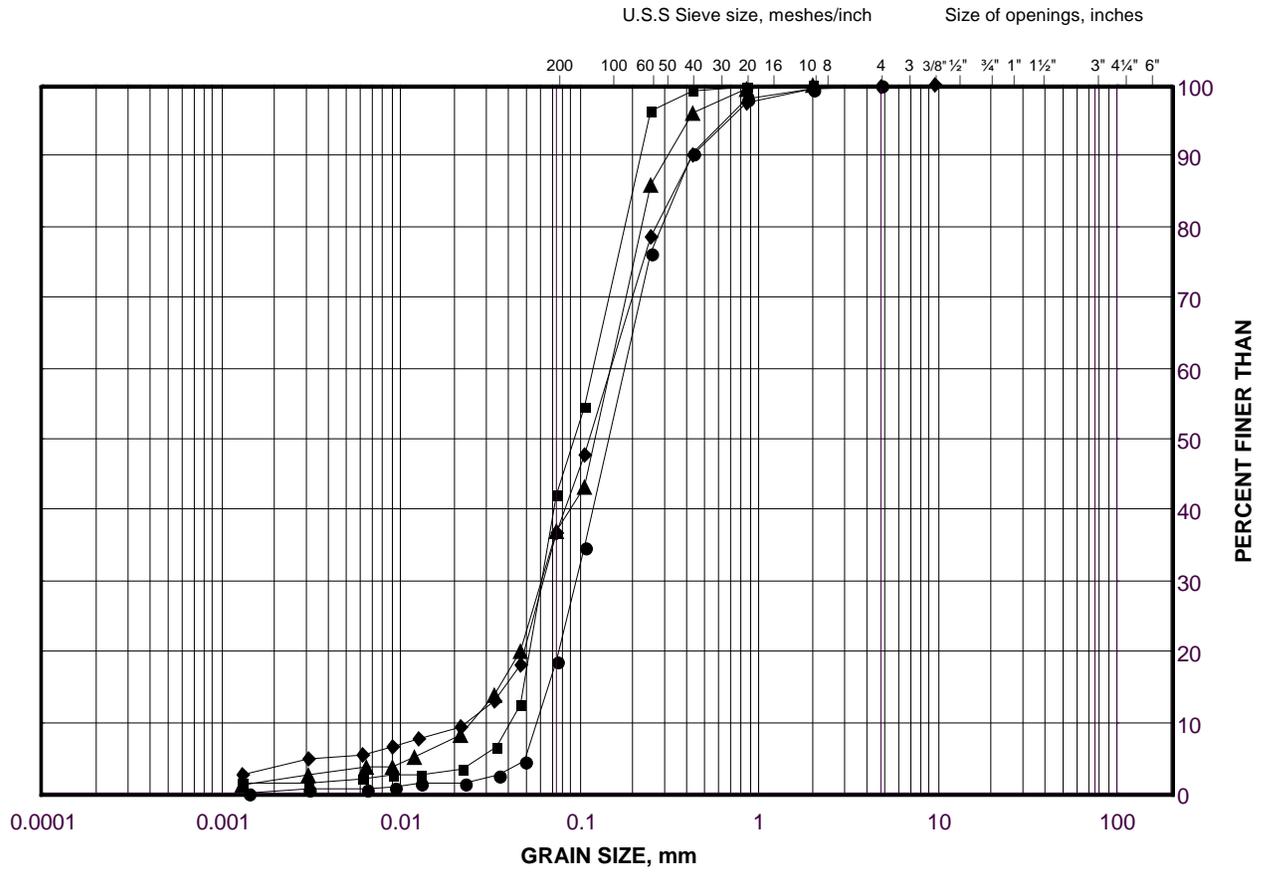
Checked By: CN

Golder Associates

Date: 15-Dec-09

GRAIN SIZE DISTRIBUTION
 Silt and Sand to Sand
 Highway 69 (SBL) STA 16+475 to 16+550

FIGURE B.S24-1B



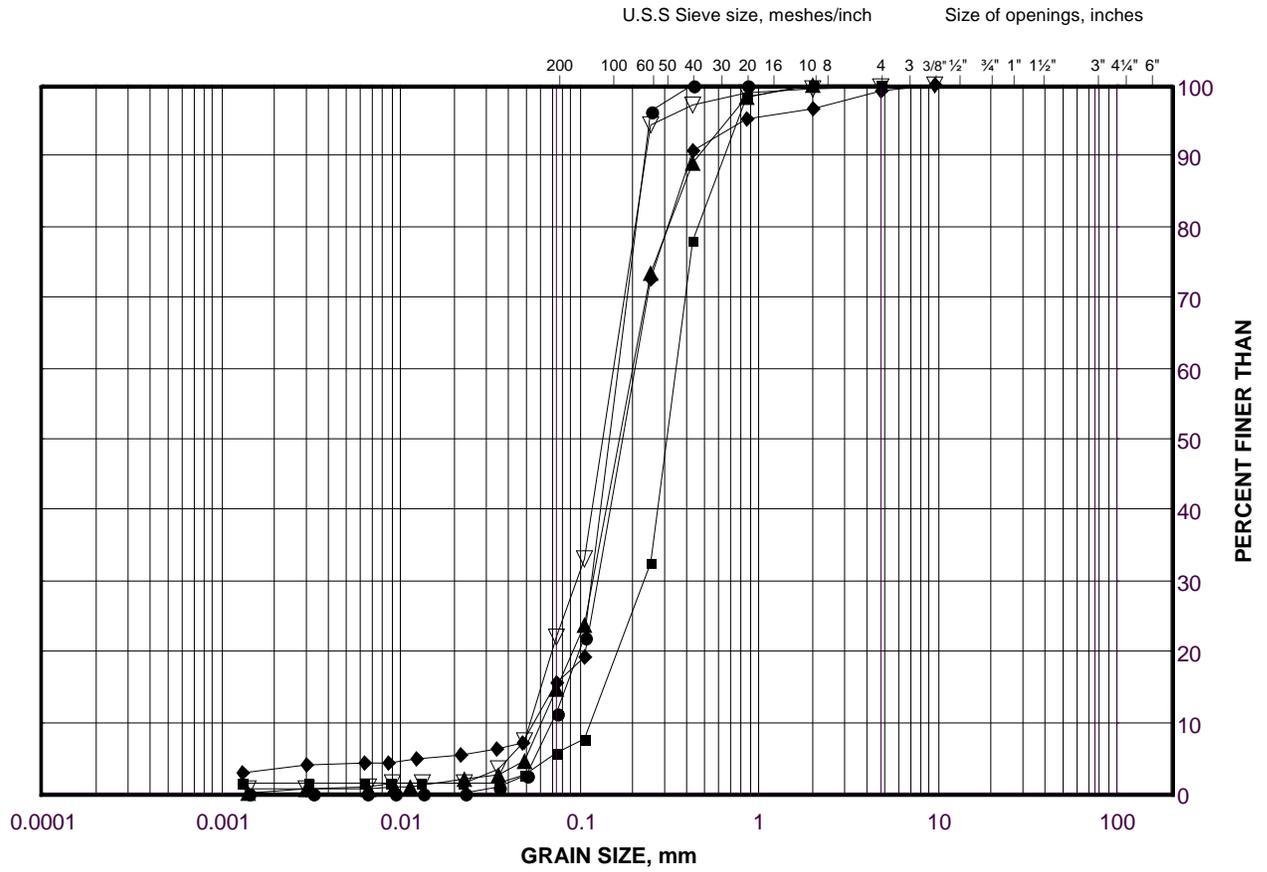
SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-04	2	202.0
■	S24-02	2	201.6
◆	S24-09	3	200.9
▲	S24-06	3	200.4

GRAIN SIZE DISTRIBUTION
 Silty Sand to Sand
 Highway 69 (SBL) STA 16+475 to 16+550

FIGURE B.S24-1C



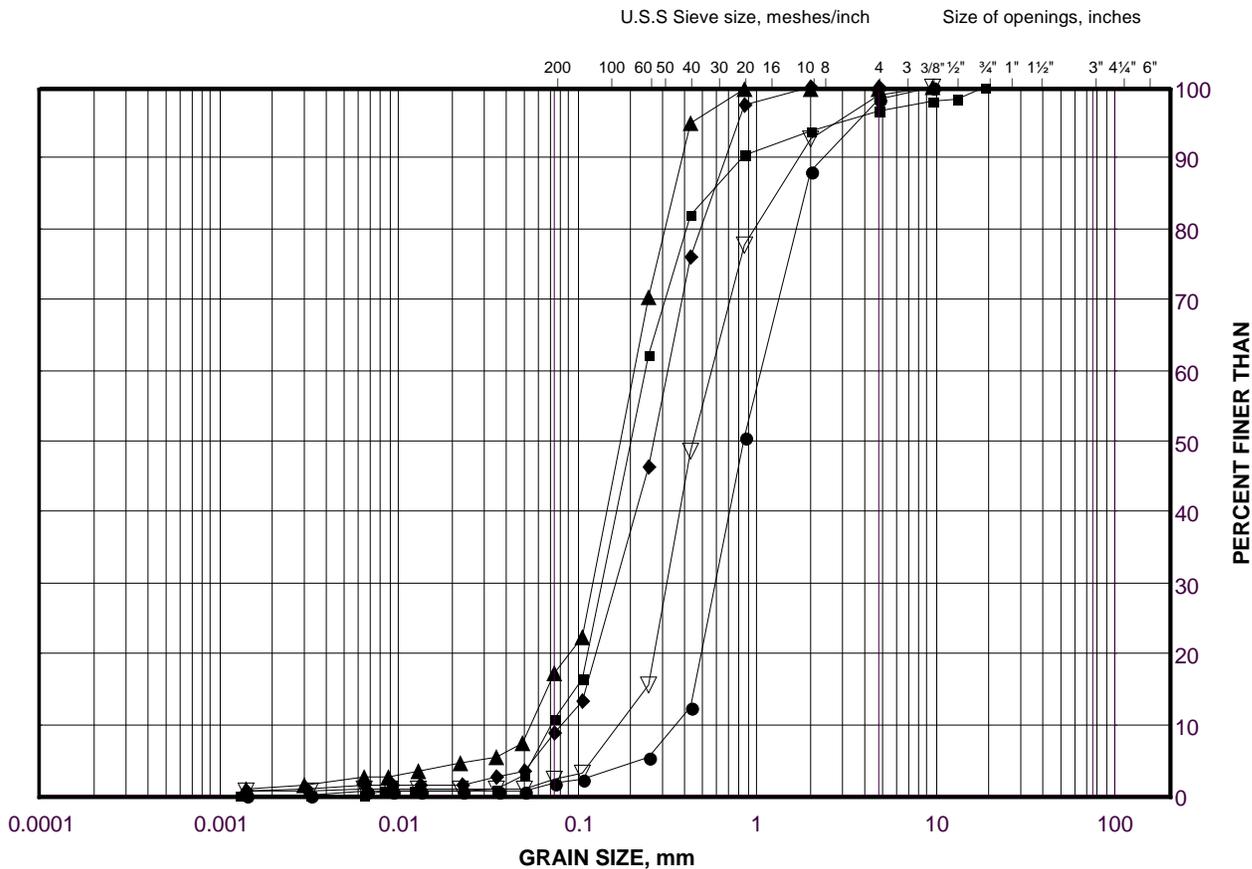
SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

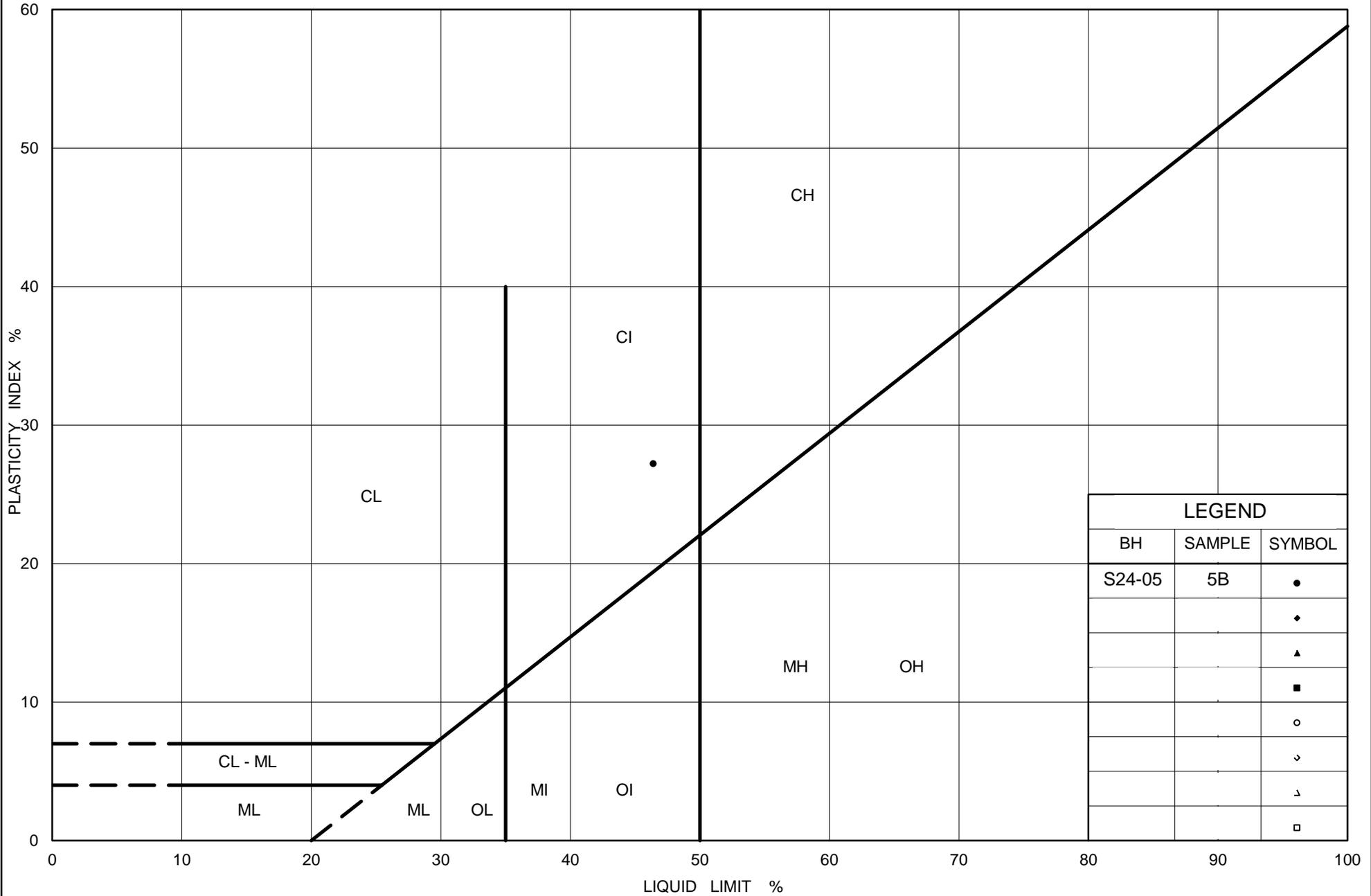
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-03	10	192.3
■	S24-04	5	199.7
◆	S24-02	6	198.4
▲	S24-03	7	196.9
▽	S24-02	9	193.9

GRAIN SIZE DISTRIBUTION
 Silty Sand to Sand
 Highway 69 (SBL) STA 16+475 to 16+550

FIGURE B.S24-1D





LEGEND		
BH	SAMPLE	SYMBOL
S24-05	5B	•
		◊
		▲
		■
		○
		▽
		△
		□



Ministry of Transportation

Ontario

PLASTICITY CHART
 Silty Clay
 Highway 69 (SBL) STA 16+475 to 16+550

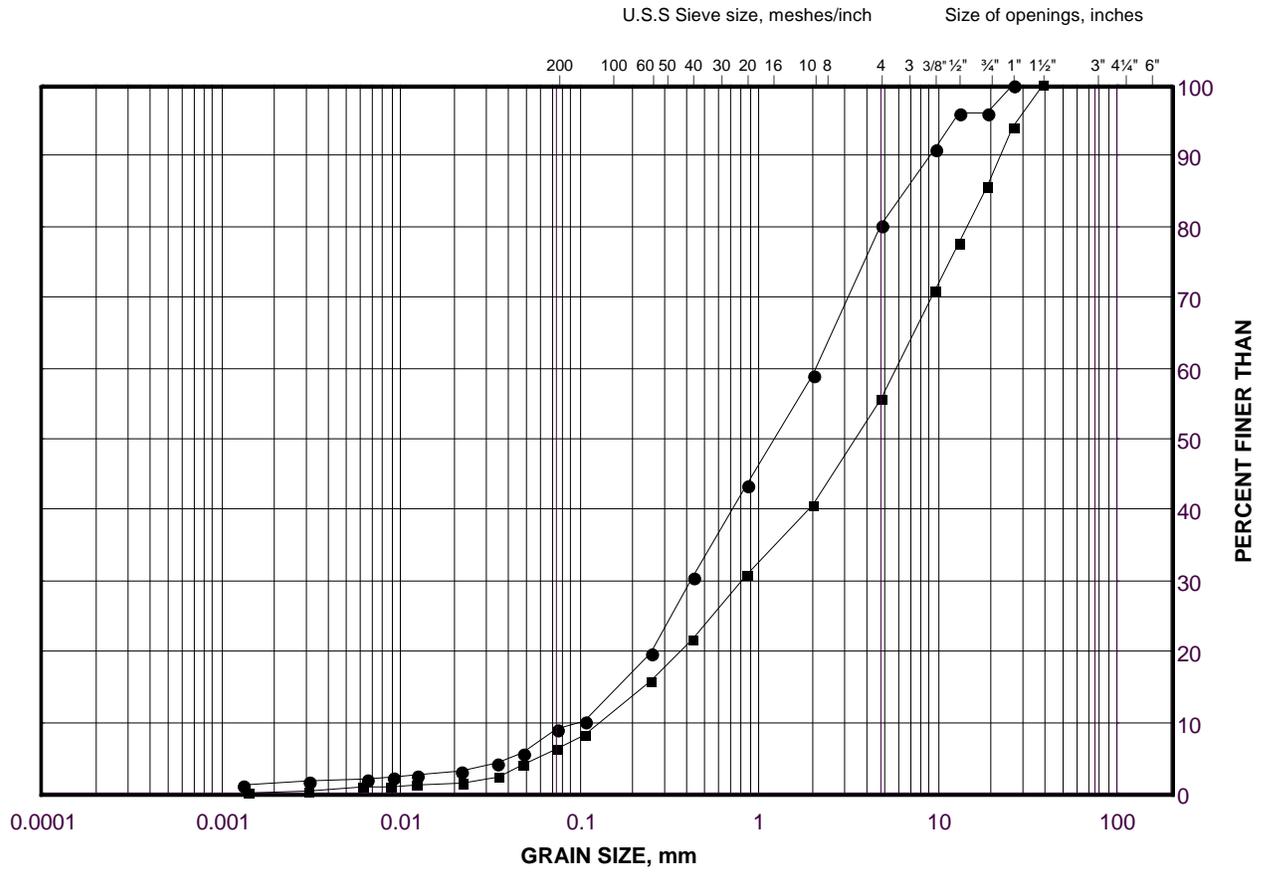
Figure No. B.S24-2

Project No. 07-1111-0029

Checked By: CN

GRAIN SIZE DISTRIBUTION
 Sand and Gravel
 Highway 69 (SBL) STA 16+475 to 16+550

FIGURE B.S24-3A



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-05	8	195.6
■	S24-07	9	193.8

Project Number: 07-1111-0029

Checked By: CN

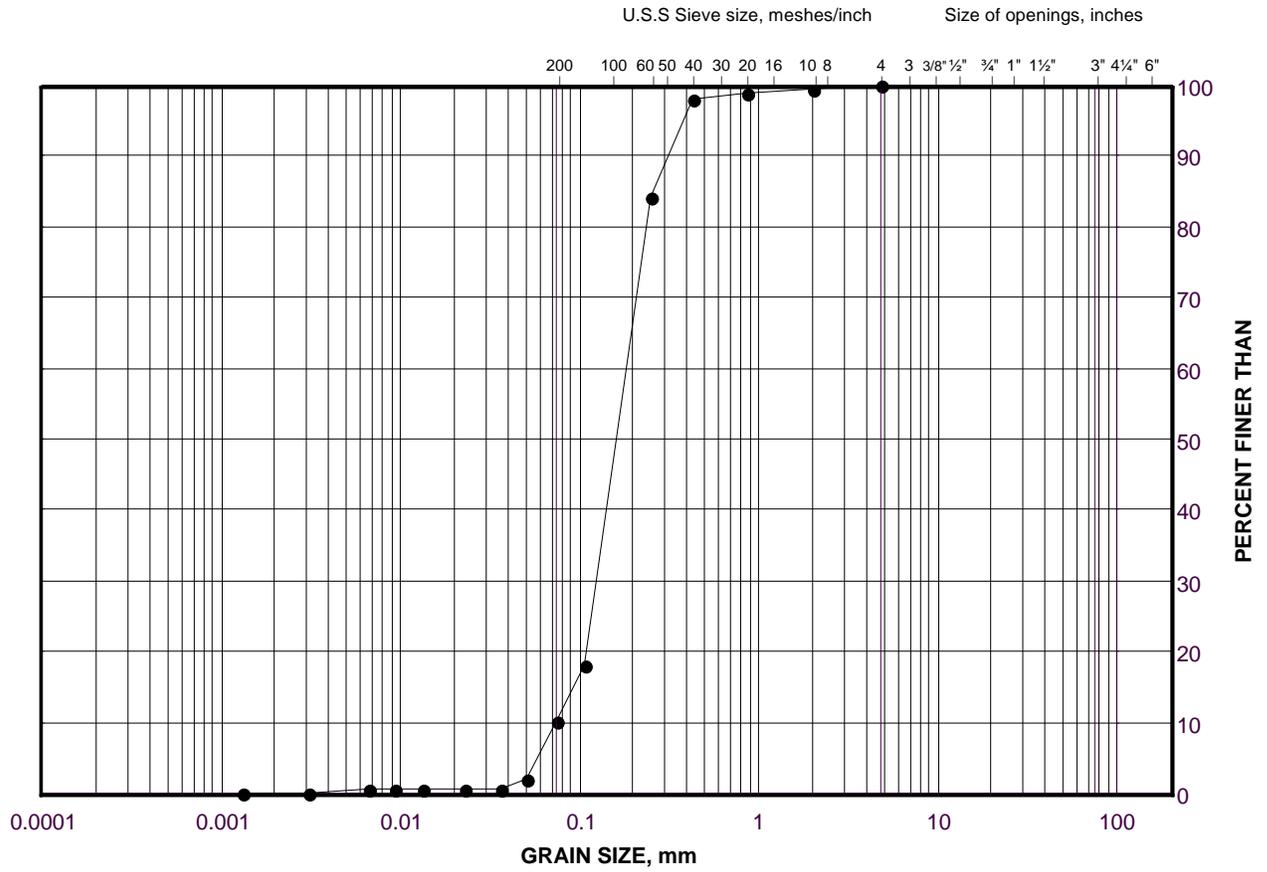
Golder Associates

Date: 15-Dec-09

GRAIN SIZE DISTRIBUTION

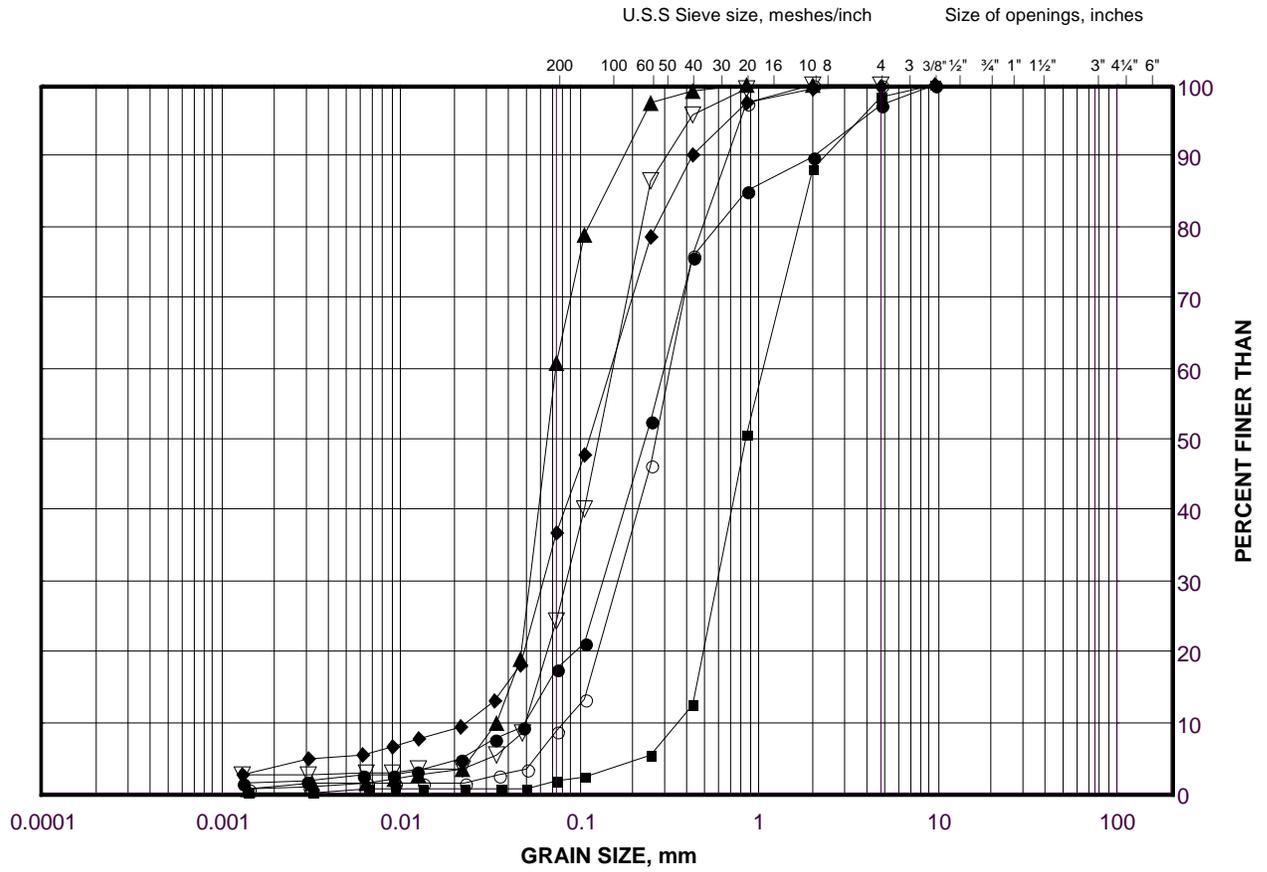
Sand
Highway 69 (SBL) STA 16+475 to 16+550

FIGURE B.S24-3B



GRAIN SIZE DISTRIBUTION
 Sandy Silt to Sand
 Highway 69 (NBL) STA 16+450 to 16+550

FIGURE B.S24-4A



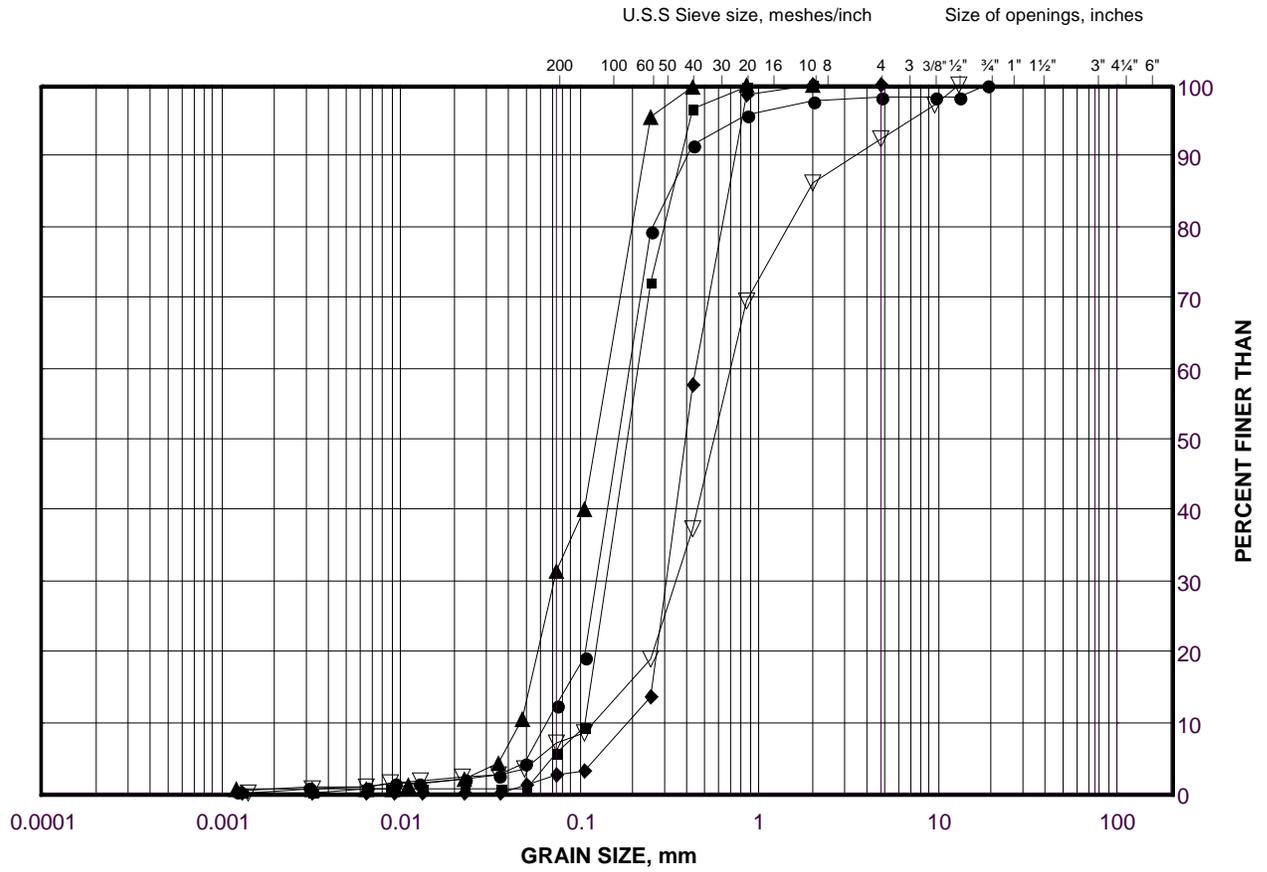
SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-10	10	193.3
■	S24-06	10A	192.1
◆	S24-09	3	200.8
▲	S24-10	3	200.6
▽	S24-10	7	197.8
○	S24-06	7	196.6

GRAIN SIZE DISTRIBUTION
 Sandy Silt to Sand
 Highway 69 (NBL) STA 16+450 to 16+550

FIGURE B.S24-4B



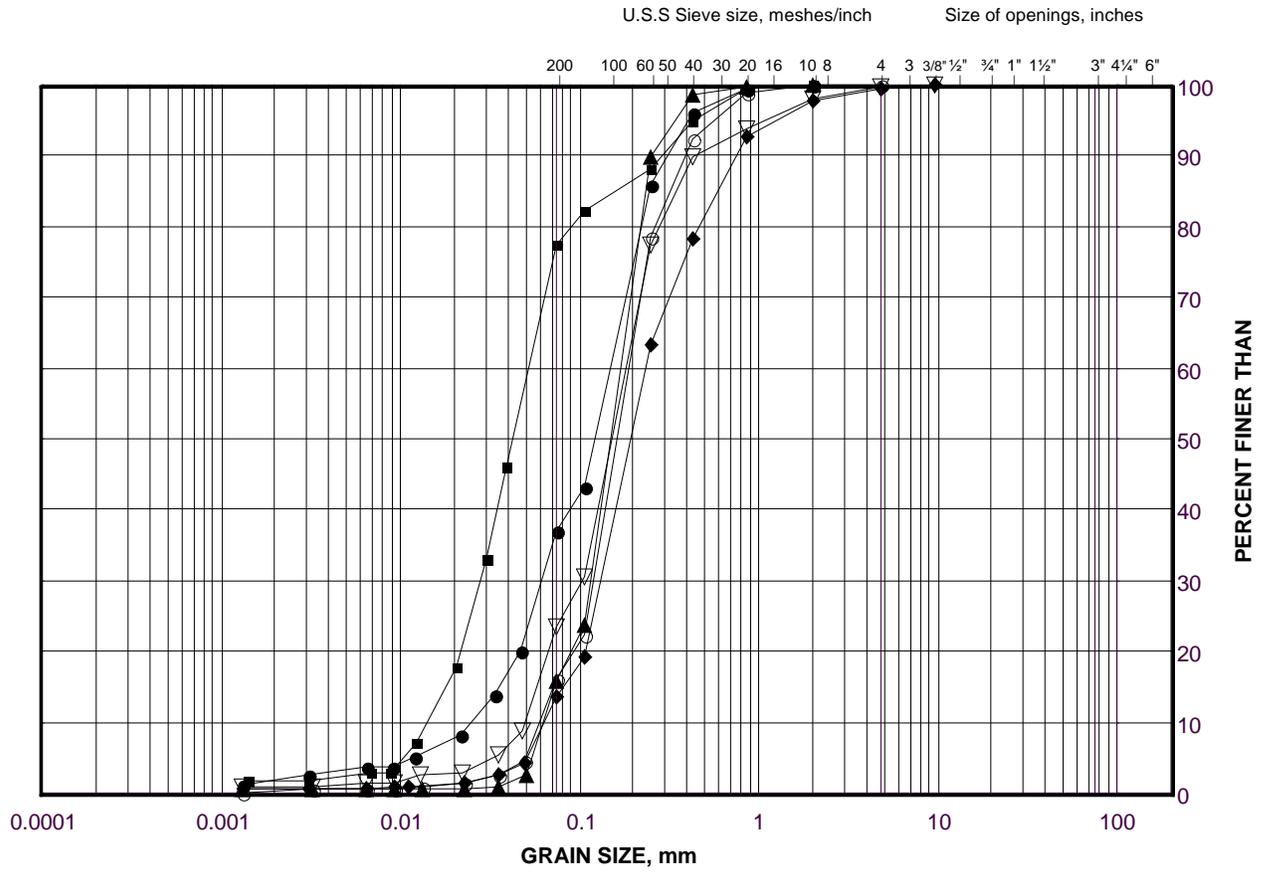
SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-14	2	201.5
■	S24-14	6	198.3
◆	S24-15	7	197.6
▲	S24-13	7	196.7
▼	S24-15	8	196.9

GRAIN SIZE DISTRIBUTION
 Sandy Silt to Sand
 Highway 69 (NBL) STA 16+450 to 16+550

FIGURE B.S24-4C



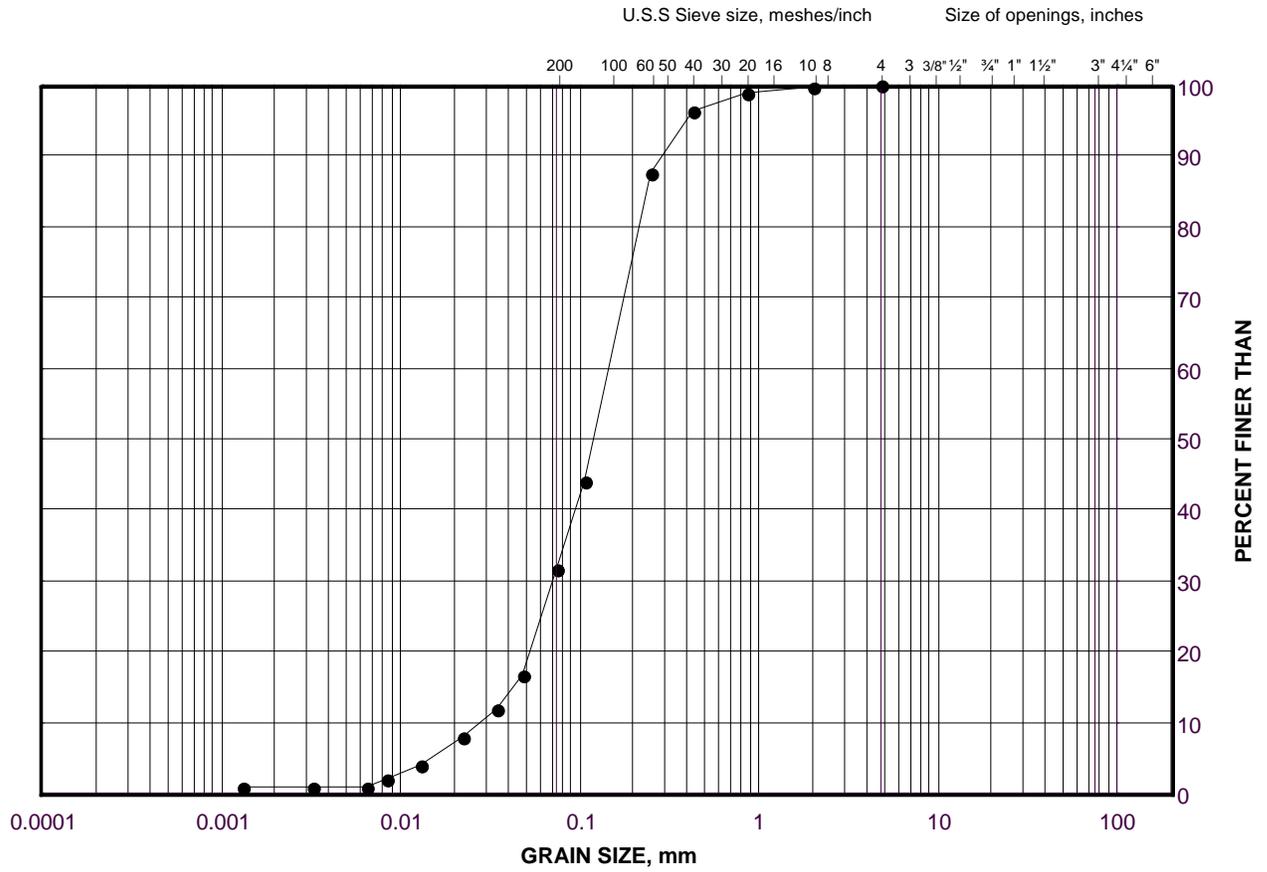
SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-06	3	200.4
■	S24-11	3	199.9
◆	S24-13	4	199.7
▲	S24-12	4	200.5
▽	S24-11	6	197.8
○	S24-12	7	198.0

GRAIN SIZE DISTRIBUTION
Silt and Sand
Highway 69 (NBL) STA 16+450 to 16+550

FIGURE B.S24-5



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S24-10	13	188.7

Project Number: 07-1111-0029

Checked By: CN

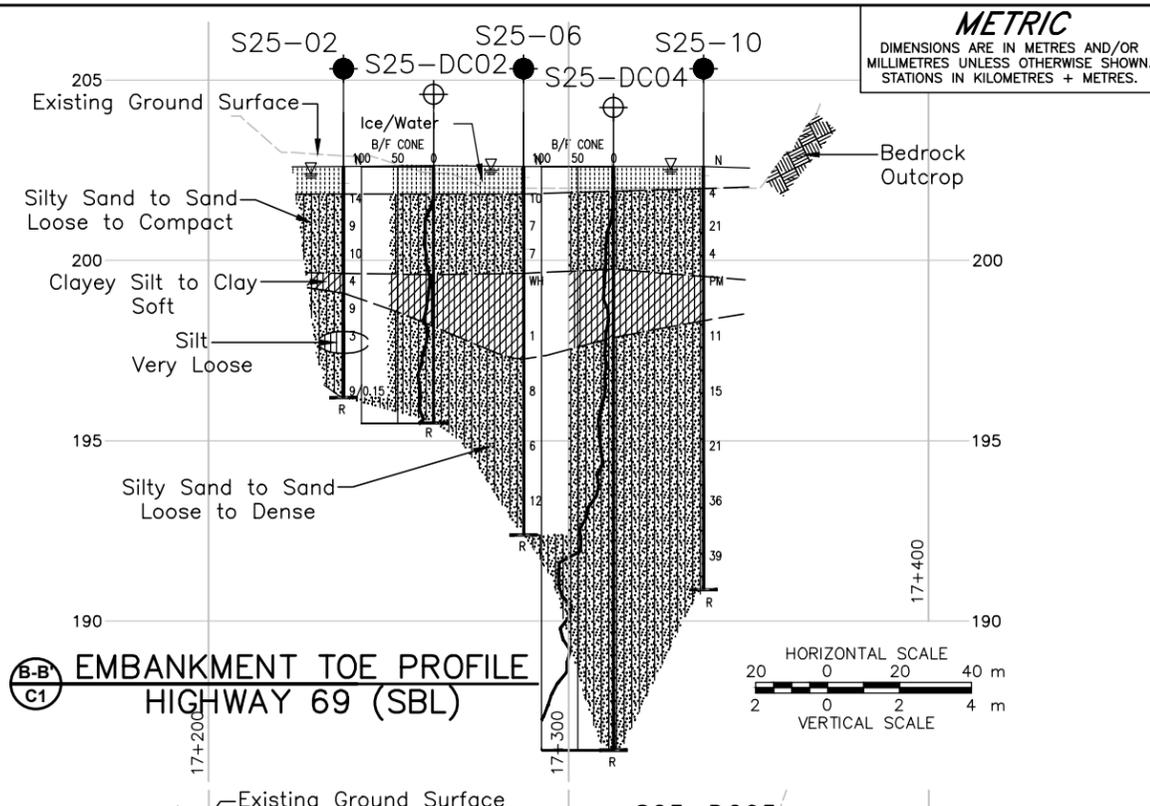
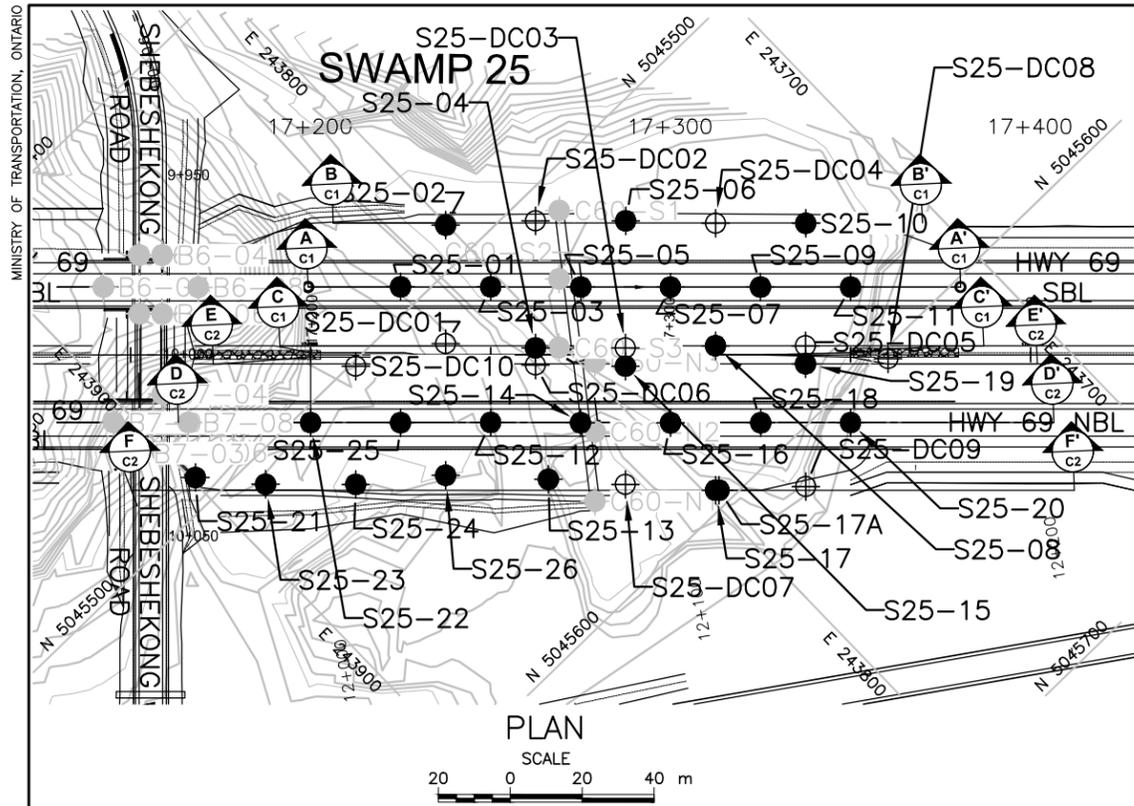
Golder Associates

Date: 15-Dec-09



APPENDIX C

**Highway 69 SBL – STA 17+230 to 17+350 and
Highway 69 NBL – STA 17+150 to 17+350 (Swamp 25)**

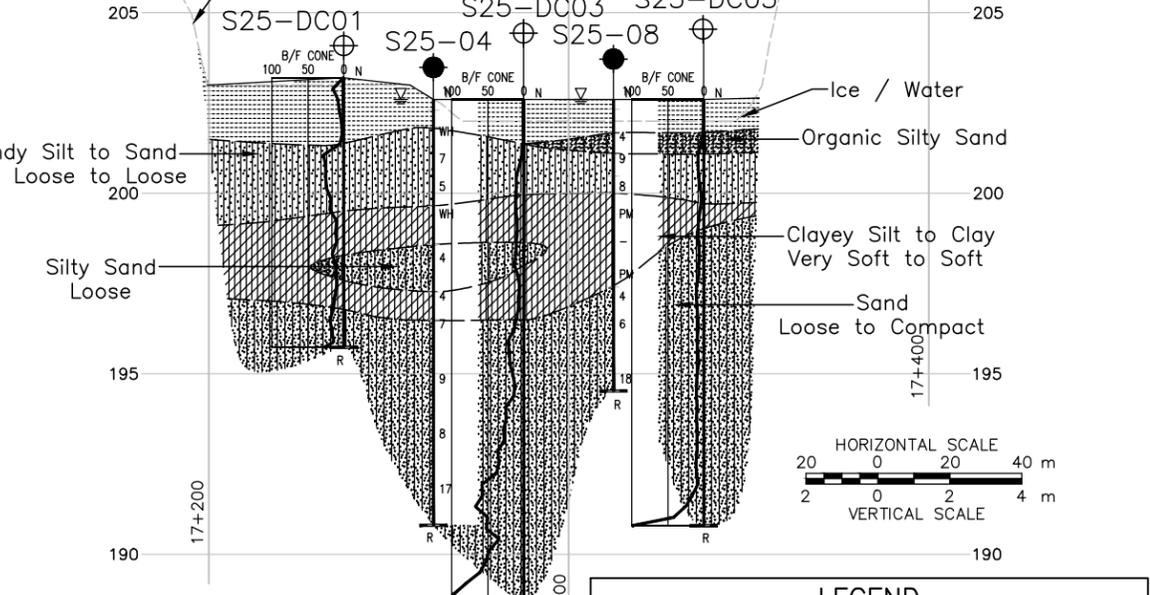
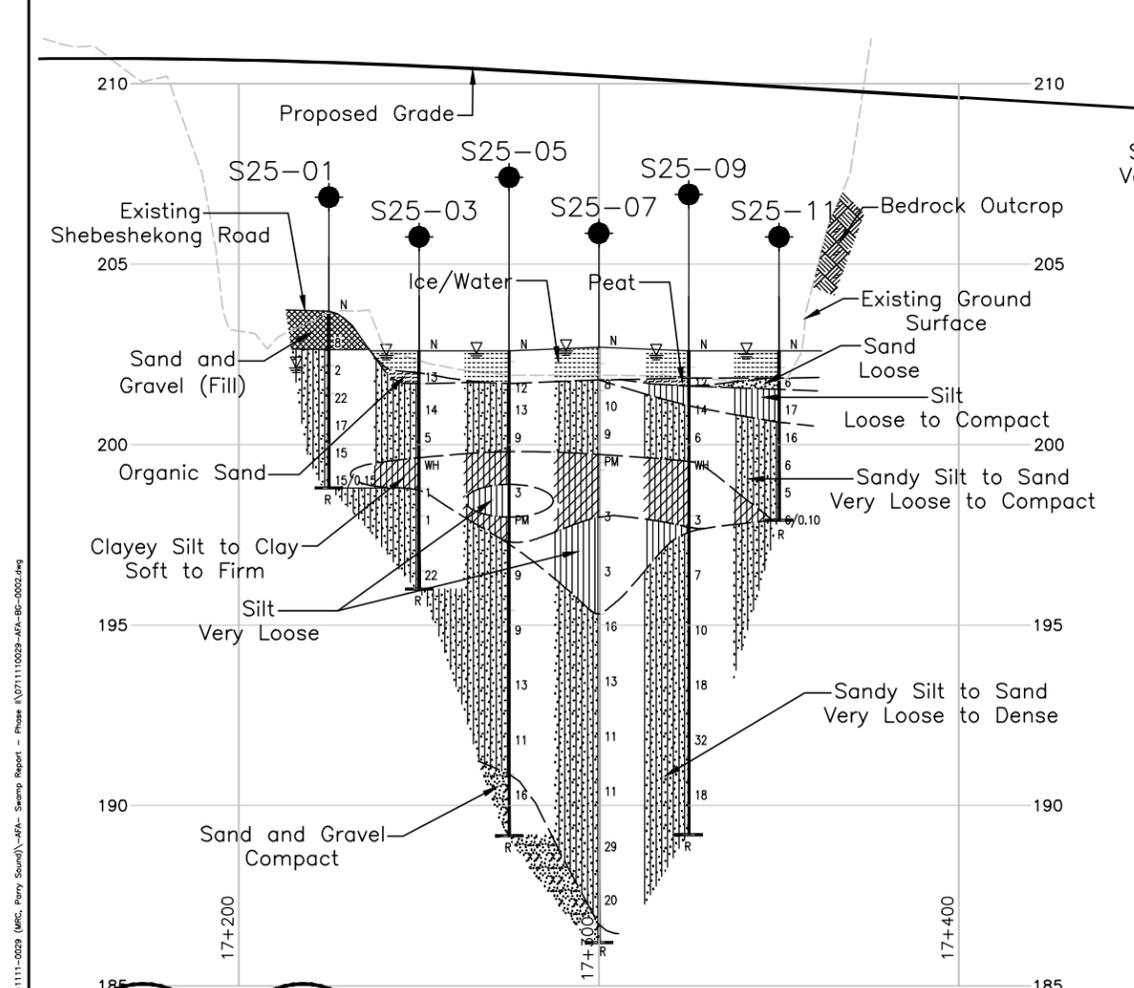
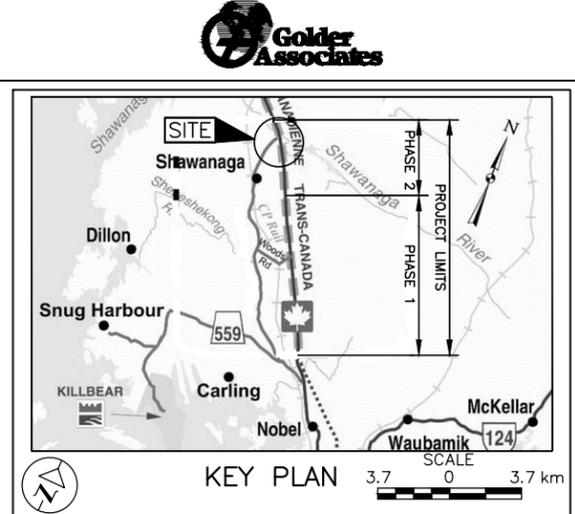


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 5111-07-00

HIGHWAY 69 (SBL) STA 17+230 TO 17+350
HIGHWAY 69 (NBL) STA 17+150 TO 17+350

BOREHOLE LOCATIONS AND SOIL STRATA



BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
S25-01	203.7	5045494.1	243821.2
S25-02	202.6	5045490.5	243800.3
S25-03	202.6	5045511.5	243803.2
S25-04	202.6	5045532.3	243806.0
S25-05	202.6	5045528.9	243785.2
S25-06	202.6	5045524.4	243763.5
S25-07	202.7	5045546.2	243767.3
S25-08	202.6	5045566.6	243769.6
S25-09	202.6	5045563.6	243749.3
S25-10	202.6	5045559.6	243728.0
S25-11	202.6	5045581.0	243731.3
S25-12	203.5	5045538.5	243829.3
S25-13	203.9	5045561.0	243828.7
S25-14	203.2	5045555.9	243811.4
S25-15	202.6	5045553.3	243791.5
S25-16	202.5	5045573.3	243793.4
S25-17	203.3	5045595.4	243797.4
S25-17A	203.3	5045596.1	243796.7
S25-18	202.6	5045590.7	243775.4
S25-19	202.6	5045587.6	243755.1
S25-20	204.7	5045608.0	243757.4
S25-21	202.4	5045492.5	243898.9
S25-22	203.1	5045503.8	243865.3
S25-23	202.9	5045507.4	243886.2
S25-24	203.0	5045524.8	243868.2
S25-25	203.0	5045521.2	243847.3
S25-26	202.7	5045540.4	243848.5

LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ▽ WL upon completion of drilling
- R Refusal

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
S25-DC01	203.2	5045514.1	243823.1
S25-DC02	202.6	5045507.0	243781.5
S25-DC03	202.6	5045549.7	243788.0
S25-DC04	202.6	5045542.2	243746.0
S25-DC05	202.6	5045584.0	243751.6
S25-DC06	203.0	5045535.7	243809.3
S25-DC07	202.2	5045576.9	243814.3
S25-DC08	202.6	5045602.5	243737.6
S25-DC09	203.9	5045612.1	243778.7
S25-DC10	202.9	5045501.2	243845.4

185
17+200
17+400
185

LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ▽ WL upon completion of drilling
- R Refusal

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans contours and centreline profile provided in digital format by MMM, drawing file nos. S6878-330-001SGA.dwg, dated November 2013, s6878xb02 contours.dwg, h6878_PHASE2_XD1 grading.dwg and h6878_PHASE2_XN1.dwg, received November 10, 2014, 6878 jh Hwy 69 Profile Raise-July 23, 2013.dwg received May 14, 2015.

NO.	DATE	BY	REVISION

Geocres No. 41H-161

HWY. 69 PROJECT NO. 07-1111-0029 DIST.

SUBM'D. CN/AJS CHKD. CN DATE: 5/20/2015 SITE:

DRAWN: MR CHKD. CN APPD. JPD/JMAC DWG. C1

PROFESSIONAL ENGINEER
J. M. A. COSTA
APR 6, 2016
PROVINCE OF ONTARIO

PROFESSIONAL ENGINEER
J.P. DITTRICH
APR 6, 2016
PROVINCE OF ONTARIO

SCALE
HORIZONTAL SCALE 20 0 20 40 m
VERTICAL SCALE 2 0 2 4 m

MINISTRY OF TRANSPORTATION, ONTARIO

DATE: April 11, 2015
FILENAME: TO:\proj\07-1111-0029 (MMC, Perry, Sord)_FA- Swamp Report - Phase 1\0711110029-FA-8C-0002.dwg

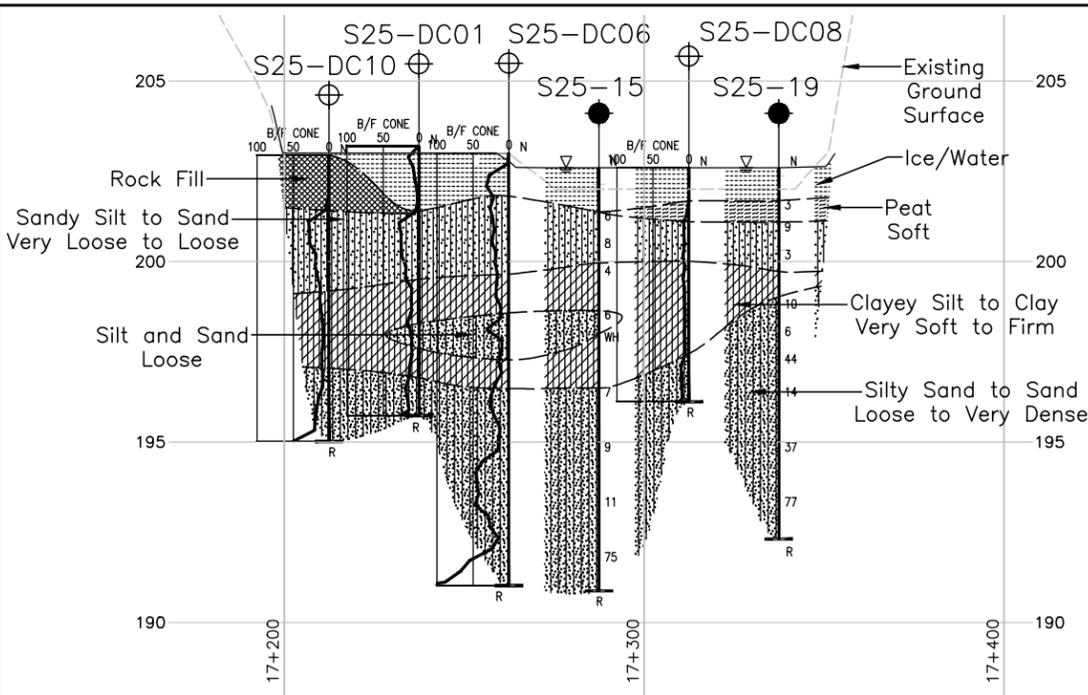
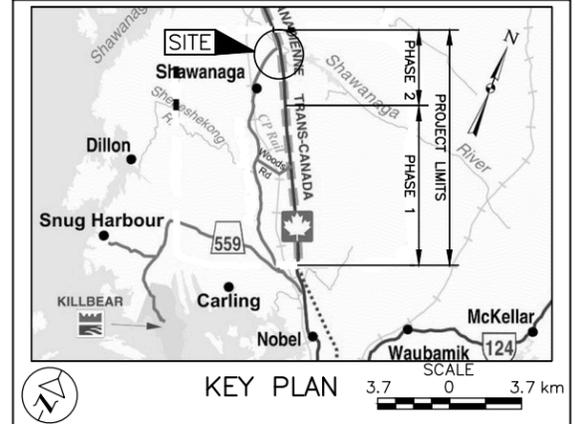
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 5111-07-00

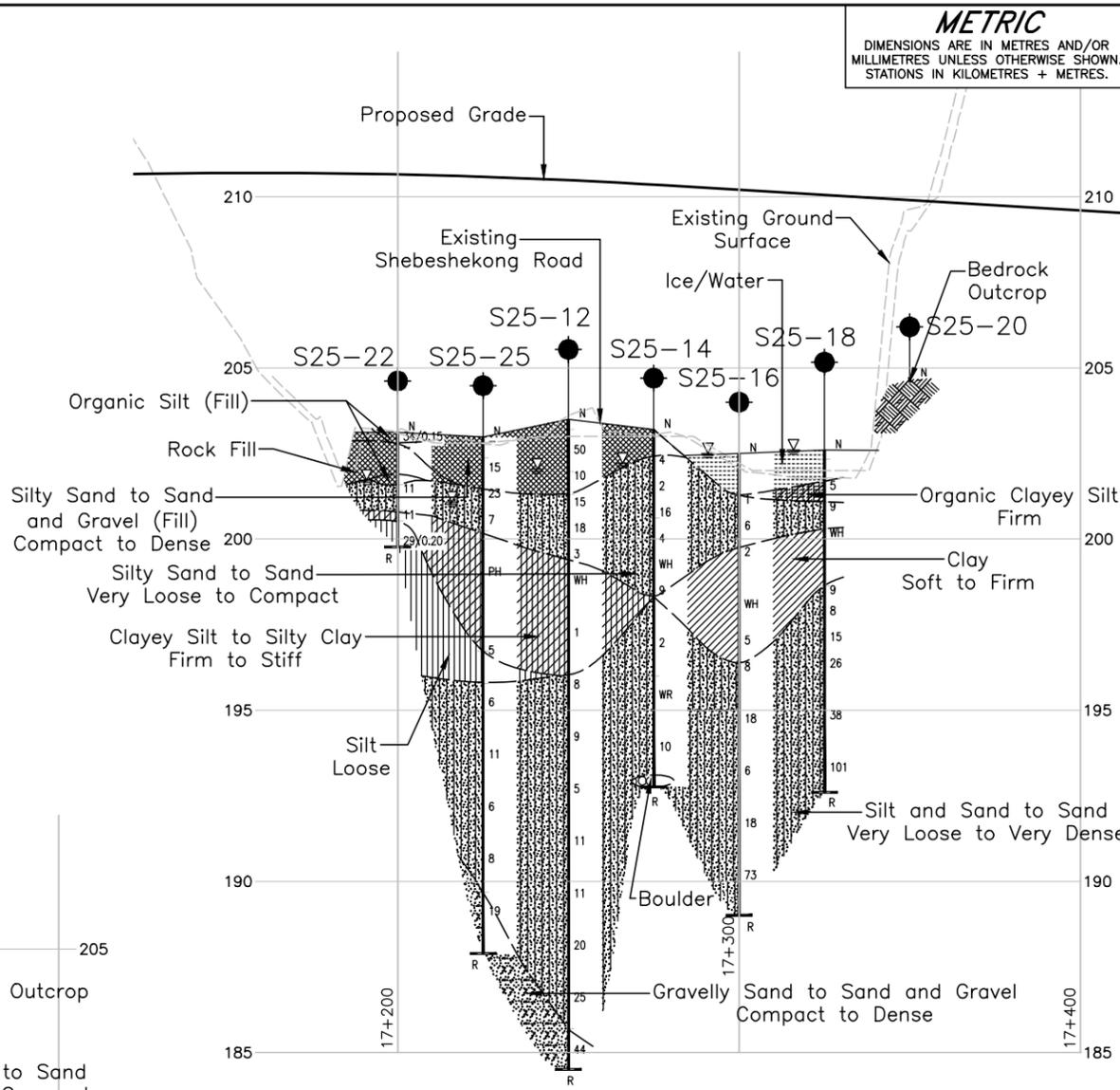
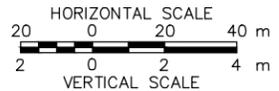
HIGHWAY 69 (NBL) STA 17+150 TO 17+350

SOIL STRATA

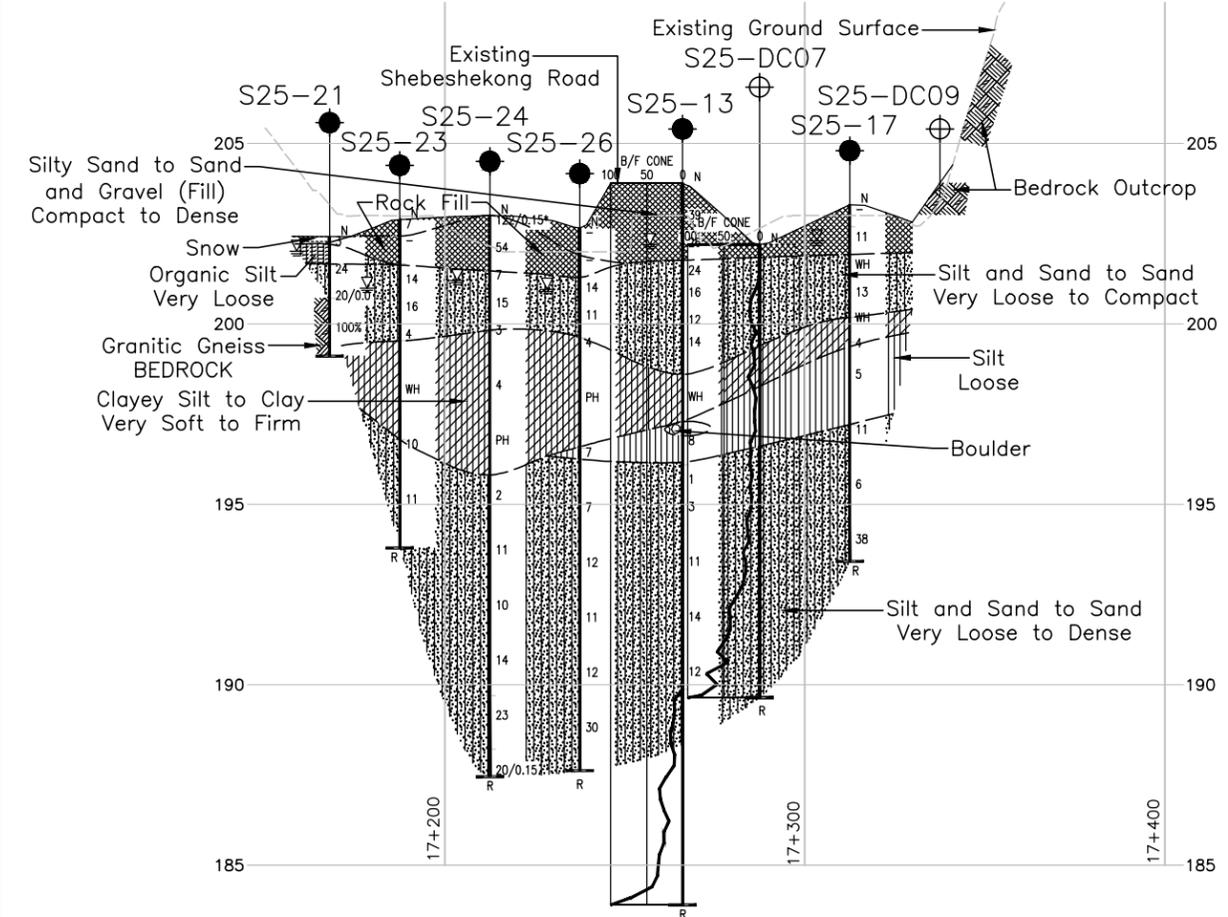
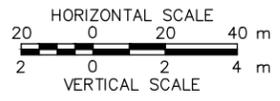
Golder Associates



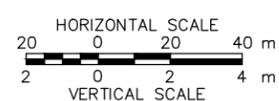
E-E'
C2 EMBANKMENT TOE PROFILE
HIGHWAY 69 (NBL)



D-D'
C2 CENTRELINE PROFILE
HIGHWAY 69 (NBL)



F-F'
C2 EMBANKMENT TOE PROFILE
HIGHWAY 69 (NBL)



LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- ▽ WL upon completion of drilling
- R Refusal

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
S25-12	203.5	5045538.5	243829.3
S25-13	203.9	5045561.0	243828.7
S25-14	203.2	5045555.9	243811.4
S25-15	202.6	5045553.3	243791.5
S25-16	202.5	5045573.3	243793.4
S25-17	203.3	5045595.4	243797.4
S25-18	202.6	5045590.7	243775.4
S25-19	202.6	5045587.6	243755.1
S25-20	204.7	5045608.0	243757.4
S25-21	202.4	5045492.5	243898.9
S25-22	203.1	5045503.8	243865.3
S25-23	202.9	5045507.4	243886.2
S25-24	203.0	5045524.8	243868.2
S25-25	203.0	5045521.2	243847.3
S25-26	202.7	5045540.4	243848.5
S25-DC01	203.2	5045514.1	243823.1
S25-DC06	203.0	5045535.7	243809.3
S25-DC07	202.2	5045576.9	243814.3
S25-DC08	202.6	5045570.2	243773.1
S25-DC09	203.9	5045612.1	243778.7
S25-DC10	202.9	5045501.2	243845.4

REFERENCE

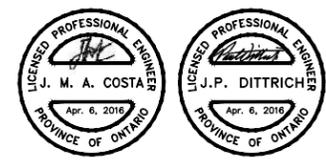
Base plans contours and centreline profile provided in digital format by MMM, drawing file nos. S6878-330-001SGA.dwg, dated November 2013, s6878xb02 contours.dwg, h6878_PHASE2_XD1 grading.dwg and h6878_PHASE2_XN1.dwg, received November 10, 2014, 6878 jh Hwy 69 Profile Raise-July 23, 2013.dwg received May 14, 2015.

NO.	DATE	BY	REVISION

Geocres No. 41H-161

HWY. 69	PROJECT NO. 07-1111-0029	DIST. .
SUBM'D. CN/AJS	CHKD. CN	DATE: 5/20/2015
DRAWN: MR	CHKD. CN	APPD. JPD/JMAC

DWG. C2



PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-01** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5045494.1 ; E 243821.2 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers COMPILED BY TZ
 DATUM Geodetic DATE March 21, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
203.7 0.0	GROUND SURFACE Sand and gravel (FILL) Grey to brown Moist to wet Loose															
202.6 1.1	SAND, some gravel Loose Brown Moist		1	SS	8											
202.2 1.5	Silty SAND, trace organics, trace wood fibres Very loose Grey Wet		2	SS	2										0 70 30 0 OC=4.8%	
201.4 2.3	SAND, trace silt Compact Brown to grey Wet		3	SS	22											
			4	SS	17											
			5	SS	15											
198.8 4.9	Some gravel below a depth of 4.7 m END OF BOREHOLE SPOON AND AUGER REFUSAL		6	SS	15/0.15											
NOTES: 1. Water level in open borehole at a depth of 1.6 m below ground surface (Elev. 202.1 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-02** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045490.5 ; E 243800.3 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** February 25, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
202.6	ICE SURFACE															
0.0	Ice															
202.1	Water															
201.8																
0.8	SAND, trace organics to a depth of 1.4 m Loose to compact Brown to grey Wet		1	SS	14											
			2	SS	9											
			3	SS	10											
199.6																
3.0	CLAY, trace sand Soft Grey Wet		4	SS	4		4									
199.1							+									
3.5	Silty SAND, trace clay Loose Grey Wet		5	SS	9											
198.0																
4.6	SILT, trace sand Very loose Grey Wet		6	SS	3											
197.4																
5.2	SAND, trace silt Compact Grey Wet															
196.2			7	SS	9/0.15											
6.4	END OF BOREHOLE SPOON AND CASING REFUSAL															
	NOTES: 1. Water level in open borehole at a depth of 0.2 m below ice surface (Elev. 202.4 m) upon completion of drilling. 2. An additional borehole was drilled 1.5 m east of Borehole S25-02 to carry out in situ vane testing at depths of 3.4 m and 3.7 m below ice surface (Elev. 199.2 m and 198.9 m).															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-03** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045511.5;E 243803.2 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** February 26, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60	KN/m ³	GR SA SI CL	
202.6	ICE SURFACE															
0.0	Ice															
202.3	Water															
202.0	Water															
201.7	Organic SAND Dark brown Wet		1	SS	13											
0.9	SAND, trace silt Loose to compact Brown Wet		2	SS	14											
199.9	Sandy SILT Loose Grey Wet		3	SS	5											
3.0	SILT CLAY Soft Grey Wet		4	SS	WH	5										
198.8	Sandy SILT Very loose Grey Wet		5	SS	1											
3.8	SILT and SAND, trace clay Very loose Grey Wet		6	SS	1											
198.0																
4.6																
196.5	SAND, trace gravel Compact Grey Wet		7	SS	22											
6.1																
196.0	END OF BOREHOLE SPOON AND CASING REFUSAL															
6.6																
	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.5 m) upon completion of drilling. 2. Two additional boreholes were drilled 1.5 m north and 1.5 m north-east of Borehole S25-03 to obtain a Shelby tube sample between depths of 2.9 m and 3.3 m below ice surface (Elev. 199.7 m and 199.2 m), and to carry out in situ vane testing at depths of 3.0 m and 3.4 m below ice surface (Elev. 199.6 m and 199.2 m).														0 61 36 3 Non-Plastic	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-04** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045532.3 ; E 243806.0 **ORIGINATED BY** MJR
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** March 4, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
202.6	ICE SURFACE															
0.0	Ice															
202.3																
0.3	Water															
201.8																
0.8	Silty SAND, trace gravel, trace organics to a depth of 2.1 m Very loose to loose Dark brown Wet		1	SS	WH											
			2	SS	7											
			3	SS	5											
199.6																
3.0	CLAYEY SILT Very soft Grey Wet		4	SS	WH											
198.6																
4.0	Silty SAND, trace clay Loose Grey Wet		5	SS	4											
197.3																
5.3	SILTY CLAY Soft Reddish brown Wet		6	SS	4											
196.5																
6.1	SAND, trace to some silt Loose to compact Grey Wet		7	SS	7											
			8	SS	9											
			9	SS	8											
			10	SS	17											
190.8																
11.8	END OF BOREHOLE CASING REFUSAL															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-05** **SHEET 1 OF 2** **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045528.9 ; E 243785.2 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** February 26, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40	60	80	100	20
202.6	ICE SURFACE																	
0.0	Ice																	
202.3	Water																	
0.3																		
201.7																		
1.1	SAND, trace organics Loose Dark brown Wet		1	SS	12													
	SAND, trace silt Loose to compact Brown Wet		2	SS	13													
199.9			3	SS	9													
2.7	CLAY Soft Grey and brown Wet																	
198.9																		
3.7	SILT, trace sand, trace clay Very loose Grey Wet		4	SS	3													
198.0																		
4.6	CLAY Grey and brown Wet		5	TO	PM													
197.3																		
5.3	Silty SAND Loose Grey Wet		6	SS	9													
195.4																		
7.2	SAND, trace gravel, trace silt Loose to compact Grey Wet		7	SS	9													
195.4																		
			8	SS	13													
194																		
			9	SS	11													
192																		
190.9																		
11.7	SAND and GRAVEL Compact Grey Wet		10	SS	16													
189.2																		
13.4	END OF BOREHOLE CASING REFUSAL																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-05	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045528.9 ; E 243785.2</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>February 26, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					W _p	W	W _L		
	--- CONTINUED FROM PREVIOUS PAGE ---															
	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.5 m) upon completion of drilling. 2. Borehole caved to a depth of 2.5 m below ice surface (Elev. 200.1 m) upon removal of casing.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-06** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5045524.4 ; E 243763.5 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Portable Equipment, BW Casing, Wash Boring COMPILED BY TZ
 DATUM Geodetic DATE February 25, 2009 CHECKED BY VA/OK

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
202.6	ICE SURFACE															
0.0	Ice															
202.3	Water															
0.3																
201.8																
0.8	SAND, trace organics to a depth of 0.9 m Loose Brown and grey Wet		1	SS	10											
			2	SS	7											
200.3																
2.3	Silty SAND Loose Grey Wet		3	SS	7											
199.6																
3.0	CLAYEY SILT, some silt seams Soft Grey Wet		4	SS	WH											
			5	SS	1											
197.3																
5.3	SAND, trace gravel, trace silt Loose to compact Grey Wet		6	SS	8											
			7	SS	6											
			8	SS	12											
192.4																
10.2	END OF BOREHOLE SPOON AND CASING REFUSAL															
	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.5 m) upon completion of drilling. 2. Borehole caved to a depth of 2.2 m below ice surface (Elev. 200.4 m) upon removal of casing.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-07** SHEET 1 OF 2 **METRIC**
 W.P. 5111-07-00 LOCATION N 5045546.2 ; E 243767.3 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Portable Equipment, BW Casing, Wash Boring COMPILED BY TZ
 DATUM Geodetic DATE March 2, 2009 CHECKED BY VA/OK

SOIL PROFILE		STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20
202.7	ICE SURFACE																	
0.0	Ice																	
202.2	Water																	
0.5																		
201.8							202											
201.5	SAND, trace organics Loose Dark brown Wet		1	SS	8													
1.2	SAND, trace to some silt Loose to compact Brown to grey Wet		2	SS	10													
			3	SS	9													
199.5							200											
3.4	Sandy SILT, trace to some clay Grey Wet		4	TO	PM													
	CLAYEY SILT, trace sand Firm Grey Wet						199											
198.0							198											
4.7	SILT, trace sand, trace clay Very loose Grey Wet		5	SS	3													
							197											
							196											
			6	SS	3													
195.3							195											
7.4	SAND, trace to some silt, trace gravel Compact Grey Moist		7	SS	16													
							194											
			8	SS	13													
							193											
							192											
			9	SS	11													
							191											
							190											
			10	SS	11													
							189											
			11	SS	29													
							188											

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.LCPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-07	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045546.2 ; E 243767.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>March 2, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					W _p	W			W _L	
	--- CONTINUED FROM PREVIOUS PAGE ---					20 40 60 80 100	○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× REMOULDED								
186.7	SAND, trace to some silt, trace gravel Compact Grey Moist	*	12	SS	20													
16.0 186.2	SAND and GRAVEL Grey Wet	* *																
16.5	END OF BOREHOLE CASING REFUSAL NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.6 m) upon completion of drilling. 2. Borehole caved to a depth of 2.5 m below ice surface (Elev. 200.2 m) upon removal of casing.																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-08	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045566.6 ; E 243769.6</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>February 25, 2009</u>	CHECKED BY <u>VA/OK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
202.6	ICE SURFACE																
202.9	Ice																
202.9	Water																
201.7	0.9 Organic Silty SAND, trace rootlets Loose Dark brown Wet		1	SS	4										80.4		OC=11.4 %
201.1	1.5 SAND, trace to some silt, trace gravel Loose Grey Wet		2	SS	9												
200.5	2.1																
200.0	2.6 Sandy SILT, trace to some clay Loose Grey Wet		3A	SS	8												
200.0			3B														
199.4	4 SILTY CLAY, trace sand Soft Grey and reddish brown Wet		4	TO	PM												
199.4			5	WS	-												
197.4	5.2 SAND, some silt, trace clay Loose to compact Grey to brown Wet		6	TO	PM												
197.4			7	SS	4												
197.4			8	SS	6												0 82 18 0
194.5	8.1 END OF BOREHOLE SPOON AND CASING REFUSAL		9	SS	18												

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.LCPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-09** **SHEET 1 OF 2** **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045563.6 ; E 243749.3 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** March 3, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40	60	80	100	20
202.6	ICE SURFACE																	
0.0	Ice																	
202.1	Water																	
201.8	Water																	
1.0	PEAT (Amorphous) Black Wet		1	SS	12													
201.1	SILT Compact Grey Wet		2	SS	14													
1.5	SAND, trace to some silt Loose to compact Brown and grey Wet		3	SS	6													
199.6	CLAY, trace sand Soft to firm Grey Wet		4	SS	WH													
3.1	CLAYEY SILT Firm Grey and brown Wet		5	SS	3													
198.0	SAND, trace gravel, trace silt Loose to dense Grey to brown Wet		6	SS	7													
197.7	SAND, trace gravel, trace silt Loose to dense Grey to brown Wet		7	SS	10													
4.9	SAND, trace gravel, trace silt Loose to dense Grey to brown Wet		8	SS	18													
			9	SS	32													
			10	SS	18													
189.2	END OF BOREHOLE CASING REFUSAL																	
13.4																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-09	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045563.6 ; E 243749.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>March 3, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L			GR	SA
	--- CONTINUED FROM PREVIOUS PAGE ---																	
	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.5 m) upon completion of drilling. 2. An additional borehole was drilled 1.5 m north of Borehole S25-09 to carry out in situ vane testing at depths of 3.2 m and 3.5 m below ice surface (Elev. 199.4 m and 199.1 m) and at depth of 4.6 m below ice surface (Elev. 198.0 m).																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-10** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5045559.6 ; E 243728.0 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Portable Equipment, BW Casing, Wash Boring COMPILED BY TZ
 DATUM Geodetic DATE February 24, 2009 CHECKED BY VA/OK

SOIL PROFILE		STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
202.6	ICE SURFACE																
0.0	Ice																
	Water																
202.0							202										
0.6	SAND, trace to some silt, trace gravel, trace organics and rootlets to a depth of 0.9 m Loose to compact Brown Wet		1A 1B	SS	4												OC = 3.9%
			2	SS	21												
			3	SS	4												
199.5																	
3.1	CLAY Soft Grey Wet		4	TO	PM		199										
198.3																	
4.3	SAND, trace to some gravel, trace to some silt Compact to dense Brown Wet		5	SS	11		198										
			6	SS	15		196										8 81 11 0
			7	SS	21		195										
			8	SS	36		193										
			9	SS	39		192										
190.9							191										
11.7	END OF BOREHOLE CASING REFUSAL																
	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.5 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-11** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5045581.0; E 243731.3 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Portable Equipment, BW Casing, Wash Boring COMPILED BY TZ
 DATUM Geodetic DATE March 3, 2009 CHECKED BY VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
202.6	ICE SURFACE															
0.0	Ice															
202.1	Water															
201.8	Water															
201.5	SAND, trace organics, trace rootlets Loose Dark brown Wet		1	SS	6											
1.1																
200.6	SILT, some sand, containing organics to a depth of 1.4 m Loose to compact Grey to brown Wet		2	SS	17										0 17 72 11	
2.0																
	SAND, trace gravel Loose to compact Brown Wet		3	SS	16											
			4	SS	6											
			5	SS	5											
197.9	END OF BOREHOLE SPOON AND CASING REFUSAL		6	SS	6/0.10											
4.7	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ice surface (Elev. 202.5 m) upon completion of drilling. 2. Borehole caved to a depth of 2.7 m below ice surface (Elev. 199.9 m) upon removal of casing.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-12	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045538.5 ; E 243829.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>115 mm O.D. Continuous Flight Solid Stem Augers and NW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>March 21, 2009</u>	CHECKED BY <u>VA/OK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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 (%)		
			NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20	40
185.7	--- CONTINUED FROM PREVIOUS PAGE ---		13	SS	20		188												
187																			
186																			
17.8	Gravelly SAND, trace to some silt, trace clay Dense Grey Wet		15	SS	44		185												26 67 6 1
184.5	END OF BOREHOLE CASING REFUSAL																		
19.0	NOTE: 1. Water level in open borehole at a depth of 1.5 m below ground surface (Elev. 202.0 m) upon completion of drilling.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-13	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045561.0; E 243828.7</u>	ORIGINATED BY <u>MR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>115 mm O.D. Continuous Flight Solid Stem Augers and NW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>March 22, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W		
183.9 20.0	--- CONTINUED FROM PREVIOUS PAGE --- END OF DCPT Refusal to Further Penetration (100 Blows / 0.18 m) NOTES: 1. Water level in open borehole at a depth of 1.7 m below ground surface (Elev. 202.2 m) upon completion of drilling. 2. An additional borehole was drilled 1.0 m west of Borehole S25-13 to carry out in situ vane testing at depths of 5.9 m and 6.2 m below ground surface (Elev. 198.0 m and 197.7 m).														

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-14** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045555.9 ; E 243811.4 **ORIGINATED BY** EHS
DIST HWY 69 **BOREHOLE TYPE** 101 mm O.D. Continuous Flight Solid Stem Augers and NW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** March 5, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
203.2	GROUND SURFACE																		
0.0	Sand, trace gravel, trace silt, trace rootlets (FILL) Light brown Moist																		
202.4																			
0.8	Frozen to a depth of 0.3 m Silty SAND, trace clay, trace organics Very loose to loose Brown to grey Moist to wet		1	SS	4														
			2	SS	2														
200.6																			
2.6	SAND, trace to some silt, clayey silt seams and sandy silt layers throughout Very loose to compact Light grey Wet		3	SS	16														
			4	SS	4														
			5	SS	WH														
198.3			6A																
4.9	SILT and SAND, trace clay, silty clay seams Very loose to loose Grey and reddish brown Wet		6B	SS	9														
			7	SS	2														
196.0																			
7.2	SAND, trace to some silt Very loose to compact Grey Wet		8	SS	WR														
			9	SS	10														
192.8	Boulder encountered at depth of 10.1 m																		
10.4	END OF BOREHOLE CASING REFUSAL																		
	NOTE: 1. Water level in open borehole at a depth of 1.0 m below ground surface (Elev. 202.2 m) upon completion of drilling.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-15** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045553.3 ; E 243791.5 **ORIGINATED BY** MJR
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, BW Casing, Wash Boring **COMPILED BY** TZ
DATUM Geodetic **DATE** March 3, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			T _N VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
202.6	ICE SURFACE																		
0.0	Ice																		
202.1	Water																		
0.5																			
201.4																			
1.2	SAND, trace to some silt, trace organics Loose Brown to grey Wet		1	SS	6														
			2	SS	8														
200.0																			
2.6	CLAYEY SILT, trace to some sand Firm Grey Wet		3	SS	4														
198.6																			
4.0	SILT and SAND, trace clay Loose Grey Wet		4	SS	6														
198.0																			
4.6	CLAY, trace silt, trace sand Soft Grey and reddish brown Wet		5	SS	WH														
196.5																			
6.1	Silty SAND, trace gravel Loose to very dense Grey to brown Wet		6	SS	7														
			7	SS	9														
			8	SS	11														
			9	SS	75														
190.9	END OF BOREHOLE CASING REFUSAL																		
11.7																			
	NOTES: 1. Water level in open borehole at ice surface (Elev. 202.6 m) upon completion of drilling. 2. Borehole caved to a depth of 6.4 m below ice surface (Elev. 196.2 m) upon removal of casing.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-16	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045573.3 ; E 243793.4</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>March 2, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L			20	40	60	GR
	--- CONTINUED FROM PREVIOUS PAGE ---																			
	NOTES: 1. Water level in open borehole at ice surface (Elev. 202.5 m) upon completion of drilling. 2. Borehole caved to a depth of 3.2 m below ice surface (Elev. 199.3 m) upon removal of casing.																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-17A	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045596.1 ; E 243796.7</u>	ORIGINATED BY <u>EHS</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>101 mm O.D. Continuous Flight Solid Stem Augers</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>March 4 & 5, 2009</u>	CHECKED BY <u>VA/OK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
203.3	GROUND SURFACE																	
0.0	See Record of Borehole S25-17 for subsurface conditions within these elevations.																	
201.8	Silty SAND, trace gravel, trace clay, trace organics, some sand seams Very loose to compact Brownish grey Wet		1	SS	WH													
1.5			2	SS	15													
200.2																		
3.1	CLAY, trace sand Soft Reddish brown Wet		3A	SS	1													
199.6			3B															
3.7	END OF BOREHOLE																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-18	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045590.7 ; E 243775.4</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>February 26, 2009</u>	CHECKED BY <u>VA/OK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	T _N VALUES			20	40					
202.6	ICE SURFACE													
202.9	Ice													
202.3	Water													
201.7							202							
0.9	Organic CLAYEY SILT, trace rootlets		1	SS	5									OC = 5.5%
201.1	Firm Dark brown and grey						201							
1.5	Wet		2	SS	9									
200.3	SAND, trace to some silt, trace clay													
2.3	Loose Brown to grey		3	SS	WH		200							
	Wet													
198.6	CLAY, trace silt						199							
4.0	Soft to firm Grey to reddish brown													
	Wet													
			4	SS	9		198							
			5	SS	8									
			6	SS	15		197							
			7	SS	26		196							
			8	SS	38		195							0 99 1 0
			9	SS	101		194							
192.6							193							
10.0	END OF BOREHOLE CASING REFUSAL													
	NOTES: 1. Water level in open borehole at ice surface (Elev. 202.6 m) upon completion of drilling. 2. Borehole caved to a depth of 2.0 m below ice surface (Elev. 200.6 m) upon removal of casing.													

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-19	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045587.6 ; E 243755.1</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, BW Casing, Wash Boring</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>February 24, 2009</u>	CHECKED BY <u>VA/OK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)				
								20	40	60	80	100						GR	SA	SI	CL	
202.6	ICE SURFACE																					
0.0	Ice																					
0.2	Water																					
201.7							202															
0.9	PEAT (Amorphous), some wood fragments		1	SS	3																	
201.1	Soft Dark brown						201															
1.5	Wet		2	SS	9																	
200.3	SAND, trace to some silt																					
2.3	Loose Grey Wet		3	SS	3		200															
199.7	Sandy SILT																					
2.9	Very loose Grey Wet																					
199.1	SILTY CLAY						199															
3.5	Soft Grey Wet		4	SS	10																	
	SAND, trace gravel, trace silt																					
	Loose to very dense Grey Wet		5	SS	6		198															
			6	SS	44		197															
			7	SS	14		196															
			8	SS	37		195															
			9	SS	77		193															
192.3	END OF BOREHOLE CASING REFUSAL																					
10.3																						

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-20	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045608.0 ; E 243757.4</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Hand Excavation</u>	COMPILED BY <u>TZ</u>	
DATUM <u>Geodetic</u>	DATE <u>February 24, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					W _p	W	W _L		
						20	40	60	80	100						
204.7 0.0	GROUND SURFACE BEDROCK OUTCROP															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-21	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045492.5 ; E 243898.9</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing, Wash Boring</u>	COMPILED BY <u>KD</u>	
DATUM <u>Geodetic</u>	DATE <u>January 22, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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
			NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
202.4	GROUND SURFACE																
0.0	SNOW																
0.2	ORGANIC SILT Very loose		1A	SS	3	▽	202										
201.6			1B														
0.8	SILT and SAND, trace to some clay, trace gravel Compact Brown Wet		2	SS	24		201										
200.7			3	SS	20/0.0												1 35 59 5
1.7	Granite Gneiss (BEDROCK)																
	Bedrock cored from depths of 1.7 m to 3.3 m. For bedrock coring details refer to Record of Drillhole S25-21.		1	RC	REC 100%		200										RQD = 100%
199.1																	
3.3	END OF BOREHOLE NOTE: 1. Water level in open borehole measured at a depth of 0.4 m below ground surface (Elev. 202.0 m) upon completion of drilling.																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: S25-21

SHEET 1 OF 1

LOCATION: N 5045492.5 ; E 243898.9

DRILLING DATE: January 22, 2015

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: C.M.E 550

DRILLING CONTRACTOR: Landcore Drilling Inc.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH	COLOUR % RETURN	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	B Angle	DIP W/EL. CORE AXIS	DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY			Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES		
								TOTAL CORE %	SOLID CORE %					TYPE AND SURFACE DESCRIPTION	Ur	Ja	Un	K, cm/sec	10				10	10
								80	80															
		Continued from Record of Borehole S25-21		200.73																				
2	NW Casings NQRC January 22, 2015	Slightly weathered, foliated, pink, white and grey coarse grained, non-porous, strong banded GRANITE GNEISS		1.68	1																		13.7 MPa	
3				199.11																				
		END OF DRILLHOLE		3.30																				
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								

GTA-RCK 018 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-MISS.GDT 03/25/16 DD/SAC

DEPTH SCALE

1 : 50



LOGGED: ID

CHECKED: AJS/MCK

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-22** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045503.8 ; E 243865.3 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing, Wash Boring **COMPILED BY** KD
DATUM Geodetic **DATE** January 23, 2015 **CHECKED BY** AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
203.1	GROUND SURFACE																	
0.0	Organic silt, some sand (FILL)	[Hatched Pattern]	1A	SS	34/0.15													
202.8	Dark grey to grey Moist																	
0.3	Rock fill (FILL)																	
201.9			1B	RC	-													
201.6	ORGANIC SILT																	
201.5	Sandy SILT, trace organics	[Vertical Lines]																
200.8	Compact Grey to brown Wet		2	SS	11													
200.5	SILTY CLAY		3A	SS	11													
2.6	Stiff Brown to grey Moist		3B	SS	11													
199.7	SILT, some sand, some clay																	
3.4	Compact Brown to grey Wet		4	SS	29/0.20													
	SPOON AND AUGER REFUSAL END OF BOREHOLE																	
	NOTE: 1. Water level in open borehole measured at a depth of 1.4 m below ground surface (Elev. 201.7 m) upon completion of drilling.																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-23** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045507.4 ; E 243886.2 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing, Wash Boring **COMPILED BY** KD
DATUM Geodetic **DATE** January 22, 2015 **CHECKED BY** AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)			
						20	40	60	80	100	20	40	60		GR	SA	SI	CL		
202.9	GROUND SURFACE																			
0.0	Silt and sand, some gravel, trace organics (FILL)	[Hatched Pattern]	1A	SS	7															
202.4	Loose Dark grey Moist Rock fill (FILL)		1B	RC	-															
201.7	SILT and SAND, trace gravel, trace organics (FILL)	[Dotted Pattern]	2	SS	14	▽														
1.2	Compact Brown Wet		3	SS	16															
199.5	SILT and SAND, trace gravel, trace organics (FILL)		4A	SS	4															
3.4	Compact Brown Wet		4B	SS	4															
199.5	SILTY CLAY to CLAY Firm to stiff Grey Moist to wet	[Diagonal Hatched]	5	SS	WH															
198.8			6	SS	10															
196.8			7	SS	11															
196.8	SAND, trace silt Loose to compact Grey Wet	[Dotted Pattern]	6	SS	10															
6.1			7	SS	11															
193.8	CASING REFUSAL END OF BOREHOLE																			
9.1	NOTE: 1. Water level in open borehole measured at a depth of 1.9 m below ground surface (Elev. 201.0 m) upon completion of drilling.																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-24** SHEET 1 OF 2 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045524.8 ; E 243868.2 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** NW Casing, Wash Boring **COMPILED BY** KD
DATUM Geodetic **DATE** January 23, 2015 **CHECKED BY** AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60	GR	SA	SI	CL		
203.0	GROUND SURFACE																		
0.0	Rock fill (FILL) Very dense Grey		1	SS	22/0.15														
			2	SS	54														
201.5	Silty SAND, trace organics Loose to compact Dark brown to brown Wet		3	SS	7											0	72	24	4
			4	SS	15														
199.8	CLAY Soft to firm Brown to grey Wet		5A	SS	3														
			5B																
			6	SS	4														
	Sand seams at a depth of 6.1 m		7	TO	PH														
195.8	SAND, trace to some silt Very loose to compact Brown to grey Wet		8	SS	2														
			9	SS	11														
			10	SS	10											0	92	8	0
			11	SS	14														
189.7	SILT and SAND, some gravel, some silt, containing silt pockets Compact Grey Wet		12	SS	23														
13.3	Auger grinding below a depth of 14.6 m																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-24	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045524.8 ; E 243868.2</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>NW Casing, Wash Boring</u>	COMPILED BY <u>KD</u>	
DATUM <u>Geodetic</u>	DATE <u>January 23, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W			W _L	20	40	60	GR
187.5 15.5	--- CONTINUED FROM PREVIOUS PAGE --- SILT and SAND, some gravel, containing silt pockets Compact Grey Wet SPOON AND CASING REFUSAL END OF BOREHOLE NOTES: 1. Water level in open borehole measured at a depth of 1.8 m below ground surface (Elev. 201.2 m) upon completion of drilling.		13	SS	20/0.15						o										

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity o 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-25	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045521.2 ; E 243847.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing, Wash Boring</u>	COMPILED BY <u>KD</u>	
DATUM <u>Geodetic</u>	DATE <u>January 27, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L			20	40	60	GR
187.9	CASING REFUSAL END OF BOREHOLE NOTE: 1. Water level in open borehole measured at a depth of 1.9 m below ground surface (Elev. 201.1 m) upon completion of drilling.																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S25-26** SHEET 1 OF 2 **METRIC**
 W.P. 5111-07-00 LOCATION N 5045540.4 ; E 243848.5 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE 108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing, Wash Boring COMPILED BY KD
 DATUM Geodetic DATE January 28, 2015 CHECKED BY AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
202.7	GROUND SURFACE												
0.0	Silty sand, some gravel (FILL) Dark grey Wet		1A	AS	-								
201.9	Rock fill (FILL)		1B	RC	-								
201.3	Silty SAND, some gravel, trace clay, trace organics Compact Dark brown Wet		2	SS	14								
199.7	CLAYEY SILT, some sand Firm Brown to grey Wet		4	SS	4								
196.6	SILT, some sand, trace to some clay Loose Grey Wet		6A	SS	7								0 14 81 5
196.3	SAND, trace to some silt Loose to compact Brown to grey Wet		6B	SS	7								0 92 8 0
196.4			7	SS	7								
			8	SS	12								
			9	SS	11								
			10	SS	12								0 87 12 1
			11	SS	30								
187.7													

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S25-26	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045540.4 ; E 243848.5</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>108 mm I.D. Continuous Flight Hollow Stem Augers, NW Casing, Wash Boring</u>	COMPILED BY <u>KD</u>	
DATUM <u>Geodetic</u>	DATE <u>January 28, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
15.0	CASING REFUSAL END OF BOREHOLE NOTE: 1. Water level in open borehole measured at a depth of 1.7 m below ground surface (Elev. 201.0 m) upon completion of drilling.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC01	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045514.1 ; E 243823.1</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>March 21, 2009</u>	CHECKED BY <u>VA/OK</u>	

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									
						20	40	60	80	100						
203.2 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					203										
						202										
						201										
						200										
						199										
						198										
						197										
						196										
195.7 7.5	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC02	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045507.0 ; E 243781.5</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 26, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L				
						20	40	60	80	100					GR	SA	SI	CL
202.6 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					202												
195.5 7.1	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)					196												

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

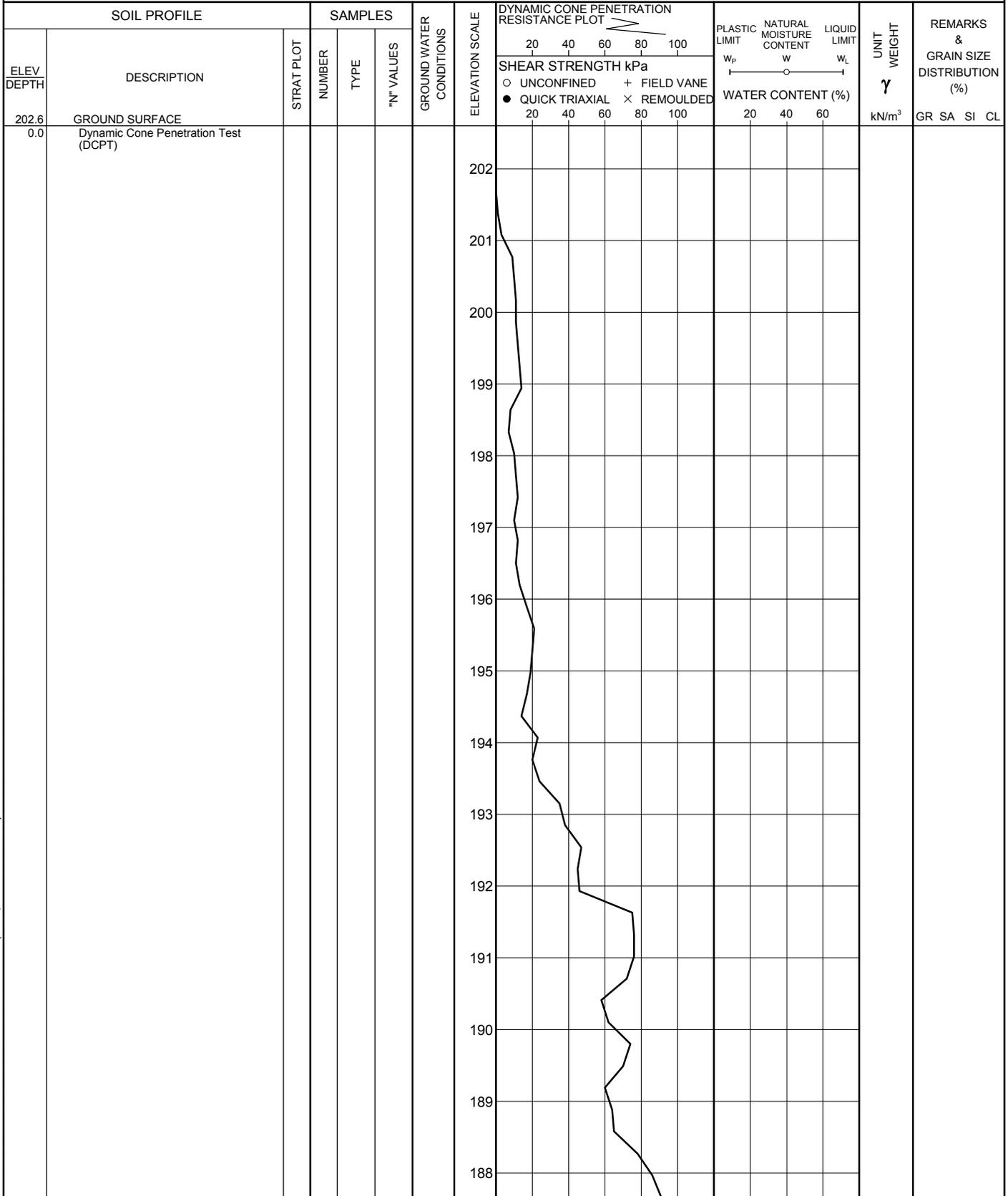
PROJECT 07-1111-0029 **RECORD OF DCPT No S25-DC03** **SHEET 1 OF 1** **METRIC**
W.P. 5111-07-00 **LOCATION** N 5045549.7 ; E 243788.0 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Portable Equipment, Dynamic Cone Penetration Test **COMPILED BY** VA
DATUM Geodetic **DATE** March 3, 2009 **CHECKED BY** VA/OK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40					
202.6	GROUND SURFACE												
0.0	Dynamic Cone Penetration Test (DCPT)												
188.8	END OF DCPT Refusal to Further Penetration												

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC04	SHEET 1 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045542.2 ; E 243746.0</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 25, 2009</u>	CHECKED BY <u>VA/OK</u>	



GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC04	SHEET 2 OF 2	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045542.2 ; E 243746.0</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 25, 2009</u>	CHECKED BY <u>VA/OK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
186.4	--- CONTINUED FROM PREVIOUS PAGE ---					187										
16.2	END OF DCPT Refusal to Further Penetration															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC05	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045584.0 ; E 243751.6</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 23, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE 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									
						20	40	60	80	100						
202.6 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)															
190.8 11.8	END OF DCPT Refusal to Further Penetration															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC07	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045576.9 ; E 243814.3</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>March 5, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION	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									
						20	40	60	80	100						
202.2 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					202										
						201										
						200										
						199										
						198										
						197										
						196										
						195										
						194										
						193										
						192										
						191										
						190										
189.6 12.6	END OF DCPT Refusal to Further Penetration															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC08	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045570.2 ; E 243773.1</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 25, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
						20	40	60	80	100					GR SA SI CL	
202.6 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)					202										
196.1 6.5	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)					197										

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC09	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045612.1 ; E 243778.7</u>	ORIGINATED BY <u>MJR</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Portable Equipment, Dynamic Cone Penetration Test</u>	COMPILED BY <u>VA</u>	
DATUM <u>Geodetic</u>	DATE <u>February 25, 2009</u>	CHECKED BY <u>VA/OK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L			20	40	60	GR
203.9 0.0	GROUND SURFACE BEDROCK OUTCROP																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S25-DC10	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5045501.2 ; E 243845.4</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration Test</u>	COMPILED BY <u>MR</u>	
DATUM <u>Geodetic</u>	DATE <u>January 27, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

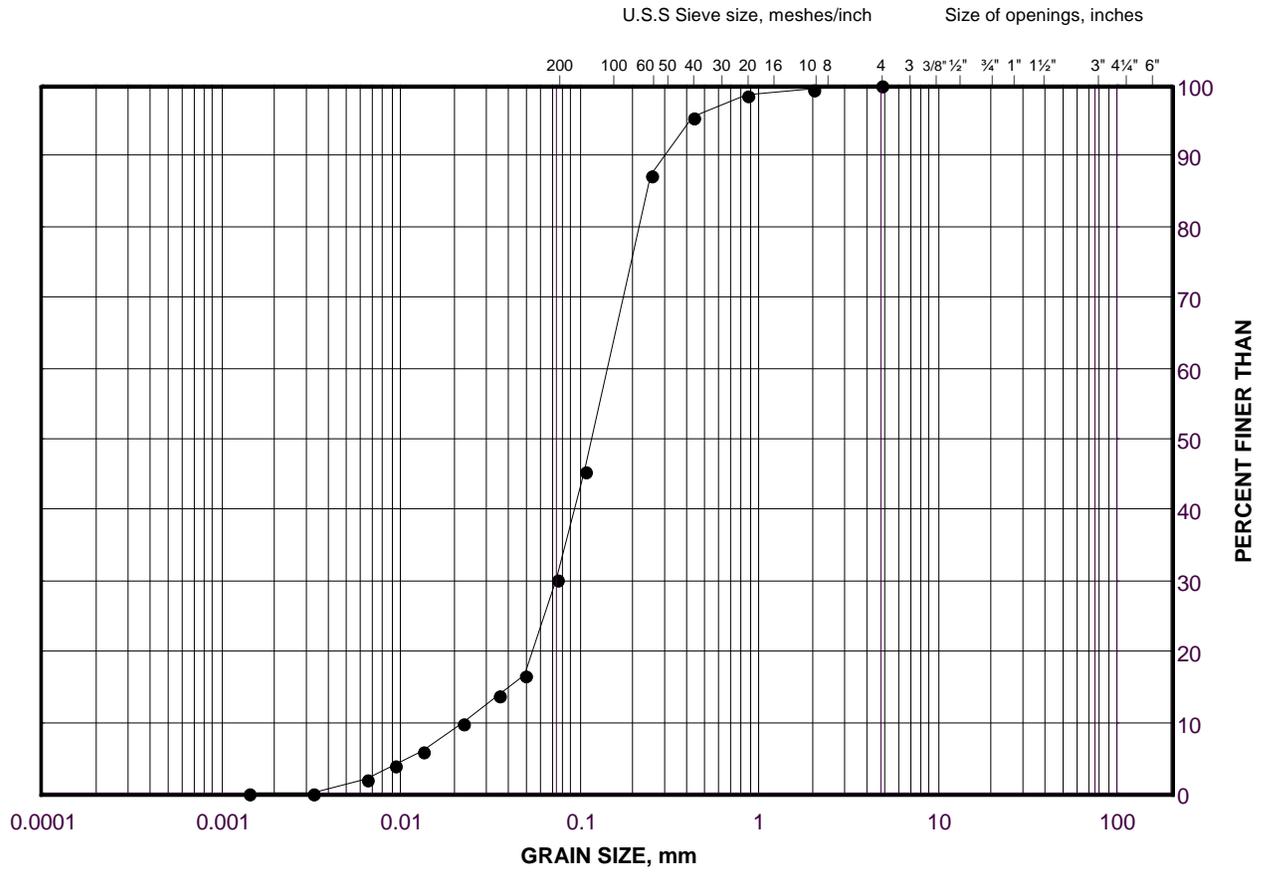
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
202.9 0.0	GROUND SURFACE AUGERED THROUGH ROCK FILL															
201.7 1.2	Dynamic Cone Penetration Test (DCPT)															
195.0 7.9	END OF DCPT Refusal to Further Penetration (Hammer Bouncing)															

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

GRAIN SIZE DISTRIBUTION
 Silty Sand
 Highway 69 (SBL) STA 17+230 to 17+350

FIGURE C.S25-1



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-01	2	201.9

Project Number: 07-1111-0029

Checked By: CN

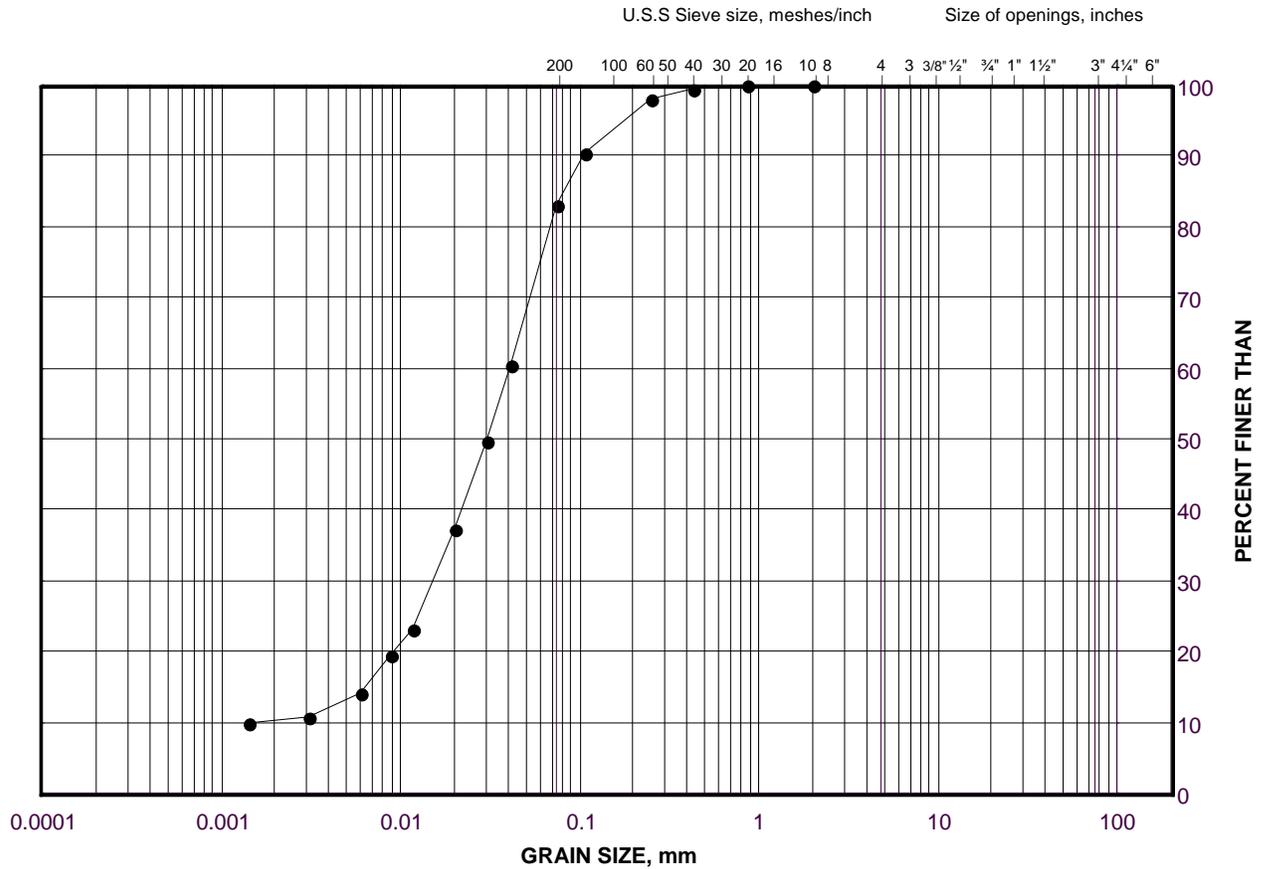
Golder Associates

Date: 27-Nov-09

GRAIN SIZE DISTRIBUTION

Silt
Highway 69 (SBL) STA 17+230 to 17+350

FIGURE C.S25-2



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

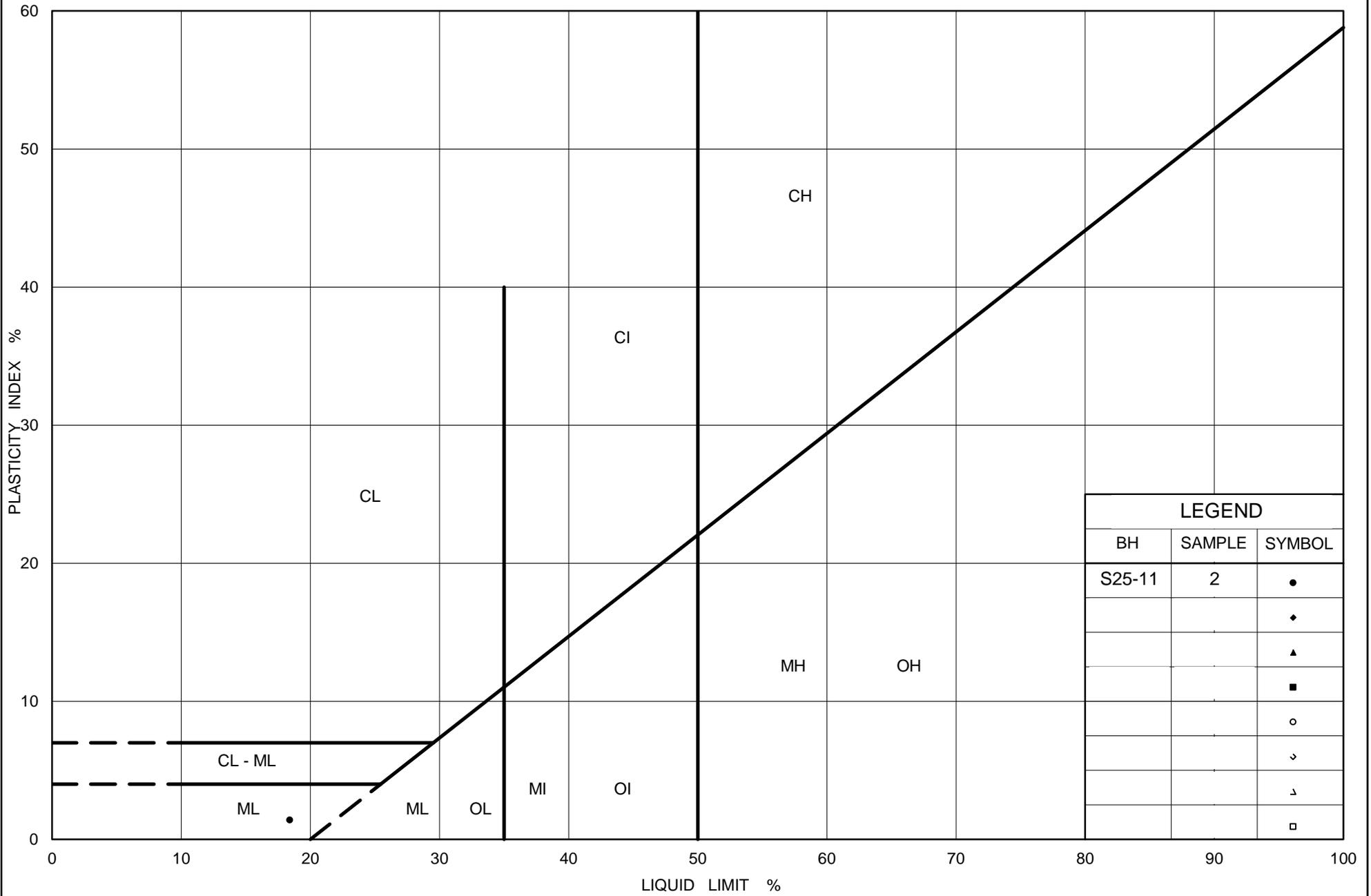
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-11	2	200.8

Project Number: 07-1111-0029

Checked By: CN

Golder Associates

Date: 27-Nov-09



Ministry of Transportation

Ontario

PLASTICITY CHART

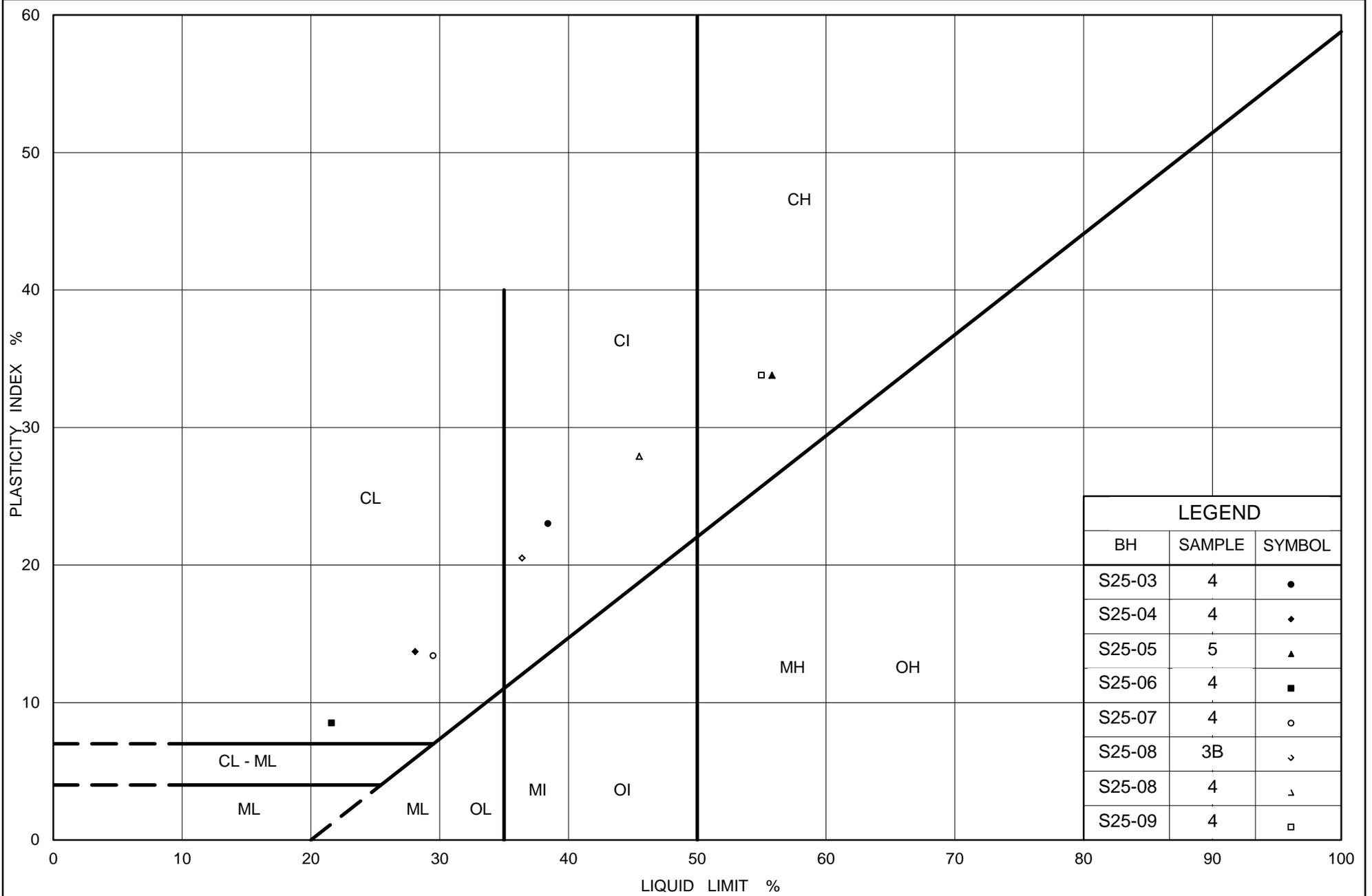
Silt

Highway 69 (SBL) STA 17+230 to 350

Figure No. C.S25-3

Project No. 07-1111-0029

Checked By: CN



LEGEND		
BH	SAMPLE	SYMBOL
S25-03	4	●
S25-04	4	◆
S25-05	5	▲
S25-06	4	■
S25-07	4	○
S25-08	3B	∨
S25-08	4	△
S25-09	4	□



Ministry of Transportation

Ontario

PLASTICITY CHART
 Clayey Silt to Clay
 Highway 69 (SBL) STA 17+230 to 17+350

Figure No. C.S25-4

Project No. 07-1111-0029

Checked By: CN

OEDOMETER CONSOLIDATION SUMMARY

FIGURE C.S25-5
Sheet 1 of 4

SAMPLE IDENTIFICATION

Project Number	07-1111-0029	Sample Number	4
Borehole Number	S25-08	Sample Depth, m	3.0-3.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	8		
Date Started	10/2/2009		
Date Completed	10/24/2009		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.25	Unit Weight, kN/m ³	16.52
Sample Diameter, cm	4.97	Dry Unit Weight, kN/m ³	10.58
Area, cm ²	19.40	Specific Gravity, measured	2.76
Volume, cm ³	24.31	Solids Height, cm	0.490
Water Content, %	56.12	Volume of Solids, cm ³	9.50
Wet Mass, g	40.95	Volume of Voids, cm ³	14.80
Dry Mass, g	26.23	Degree of Saturation, %	99.4

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t ₉₀ sec	cv. cm ² /s	mv m ² /kN	k cm/s
0.00	1.253	1.558	1.253				
5.00	1.243	1.537	1.248	12	2.75E-02	1.61E-03	4.35E-06
10.00	1.231	1.513	1.237	43	7.54E-03	1.88E-03	1.39E-06
20.00	1.212	1.474	1.222	94	3.37E-03	1.52E-03	5.00E-07
40.00	1.184	1.418	1.198	86	3.54E-03	1.11E-03	3.85E-07
80.00	1.140	1.327	1.162	140	2.05E-03	8.84E-04	1.77E-07
160.00	1.074	1.192	1.107	158	1.64E-03	6.59E-04	1.06E-07
320.00	0.984	1.008	1.029	206	1.09E-03	4.49E-04	4.79E-08
640.00	0.895	0.826	0.939	171	1.09E-03	2.23E-04	2.39E-08
1280.00	0.819	0.671	0.857	135	1.15E-03	9.45E-05	1.07E-08
2560.00	0.753	0.537	0.786	124	1.06E-03	4.12E-05	4.26E-09
1280.00	0.767	0.566	0.760				
320.00	0.775	0.582	0.771				
80.00	0.804	0.642	0.790				
20.00	0.837	0.709	0.821				
5.00	0.852	0.738	0.844				

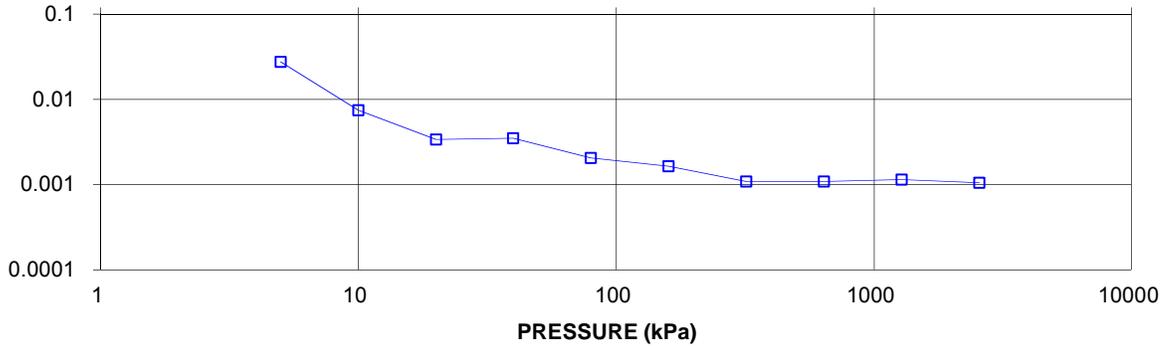
Note:
k calculated using cv based on ϕ_0 values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	0.85	Unit Weight, kN/m ³	20.23
Sample Diameter, cm	4.97	Dry Unit Weight, kN/m ³	15.57
Area, cm ²	19.40	Specific Gravity, measured	2.76
Volume, cm ³	16.52	Solids Height, cm	0.490
Water Content, %	29.89	Volume of Solids, cm ³	9.50
Wet Mass, g	34.07	Volume of Voids, cm ³	7.02
Dry Mass, g	26.23		

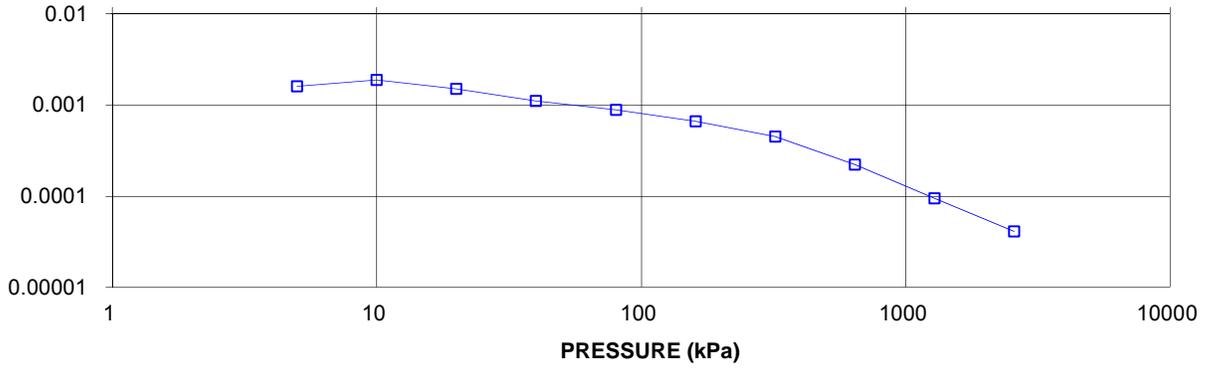
CONSOLIDATION TEST
CV cm²/s VS PRESSURE (kPa)
BH S25-08 SA 4

COEFFICIENT OF CONSOLIDATION,
cm²/s



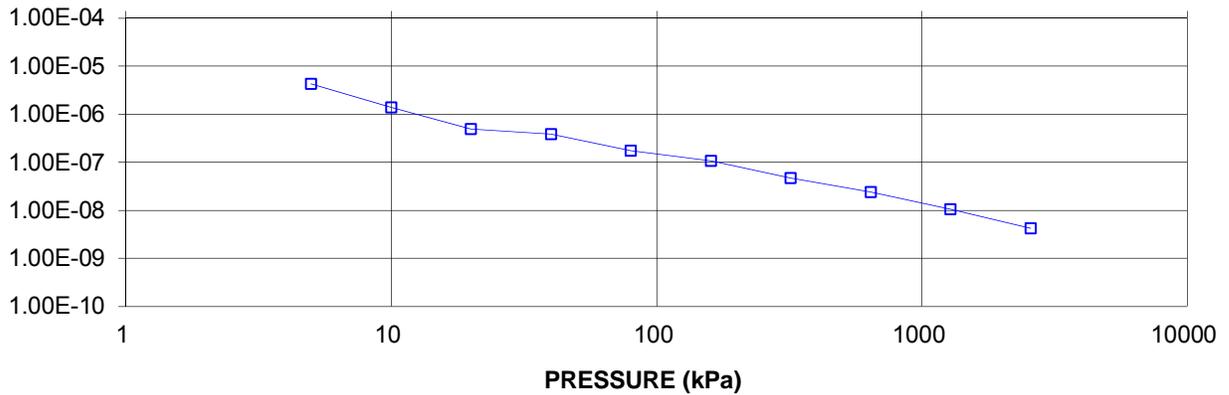
CONSOLIDATION TEST
MV m²/kN vs PRESSURE (kPa)
BH S25-08 SA 4

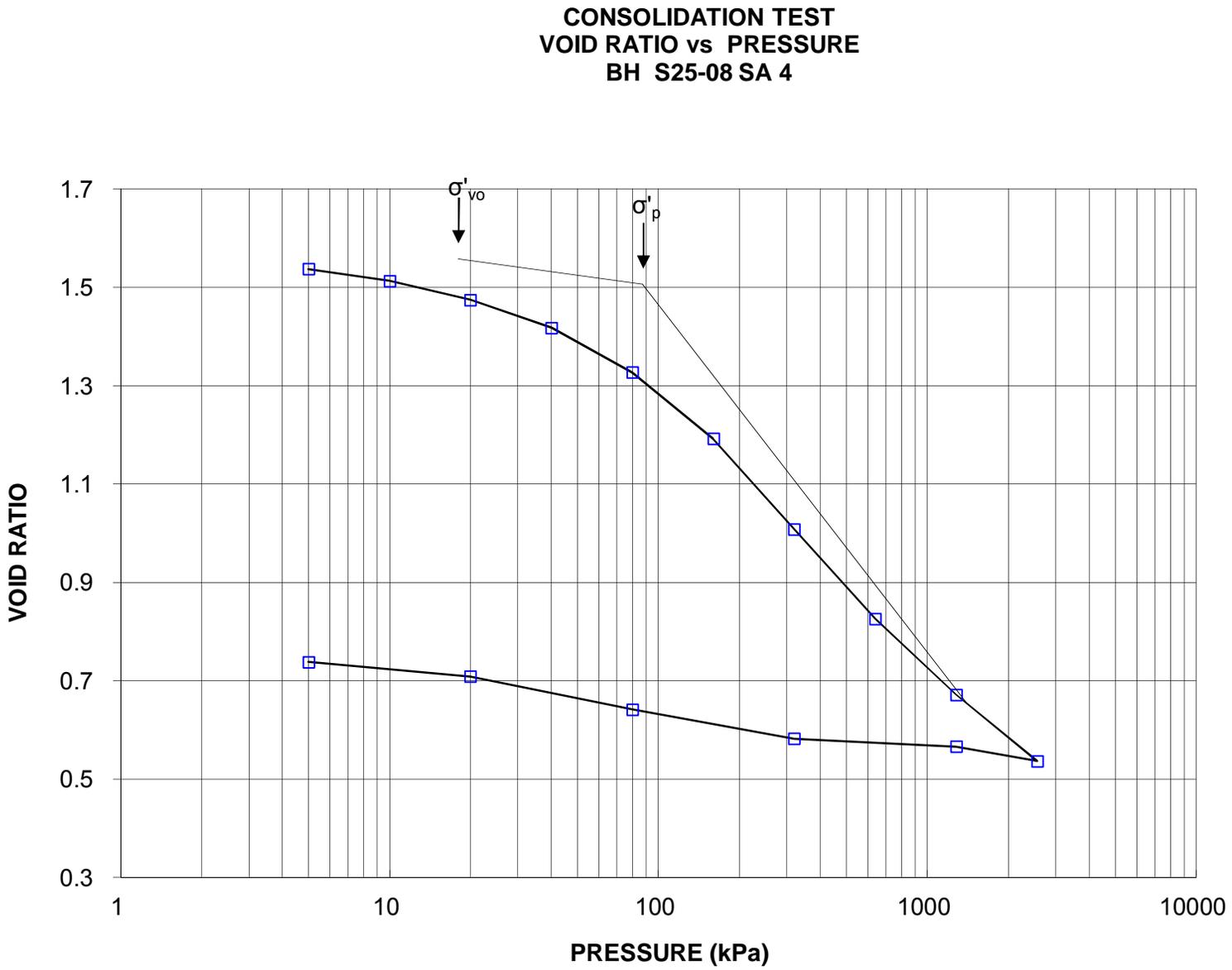
VOLUME COMPRESSIBILITY, m²/kN

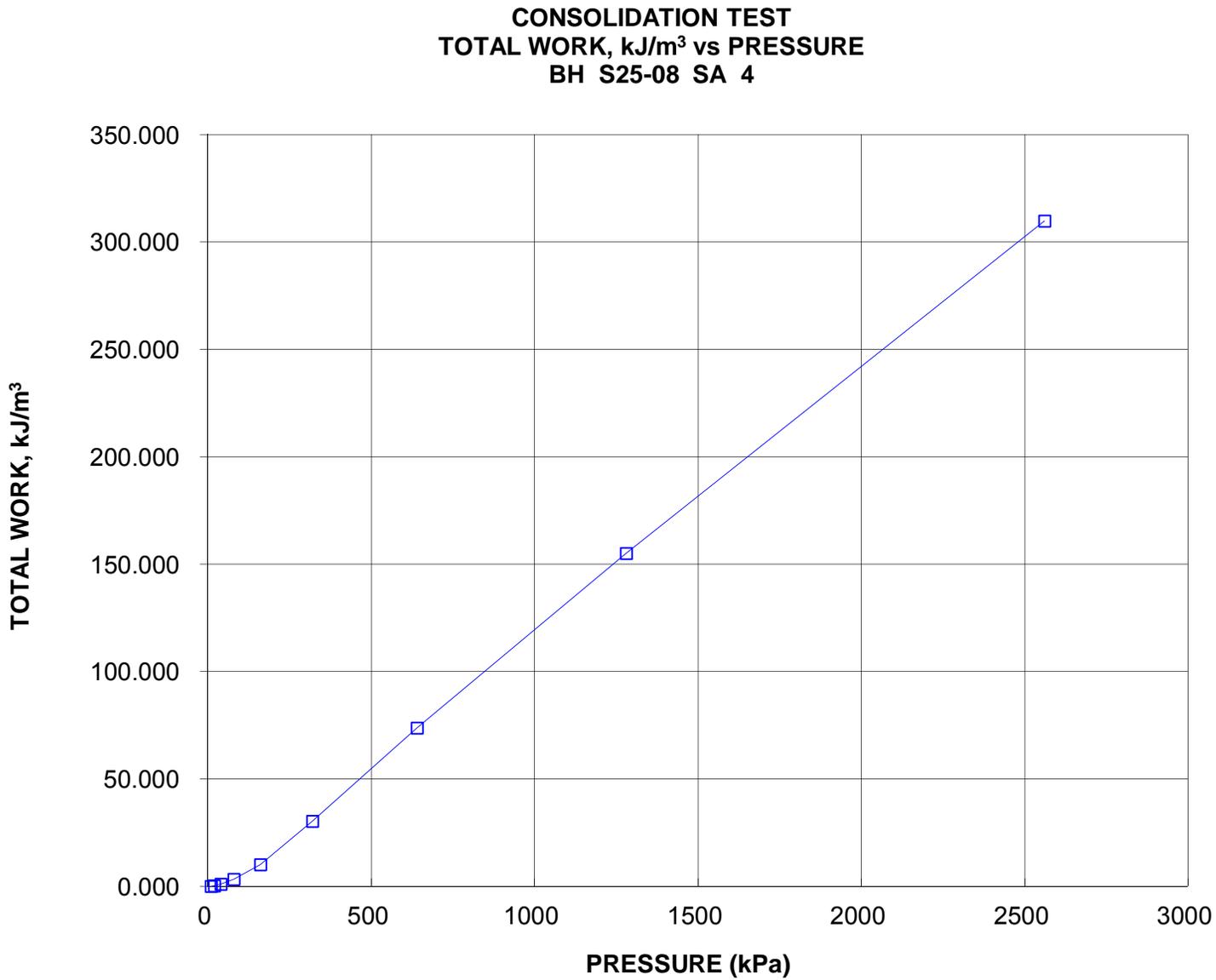


CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH S25-08 SA 4

HYDRAULIC CONDUCTIVITY,
cm/s





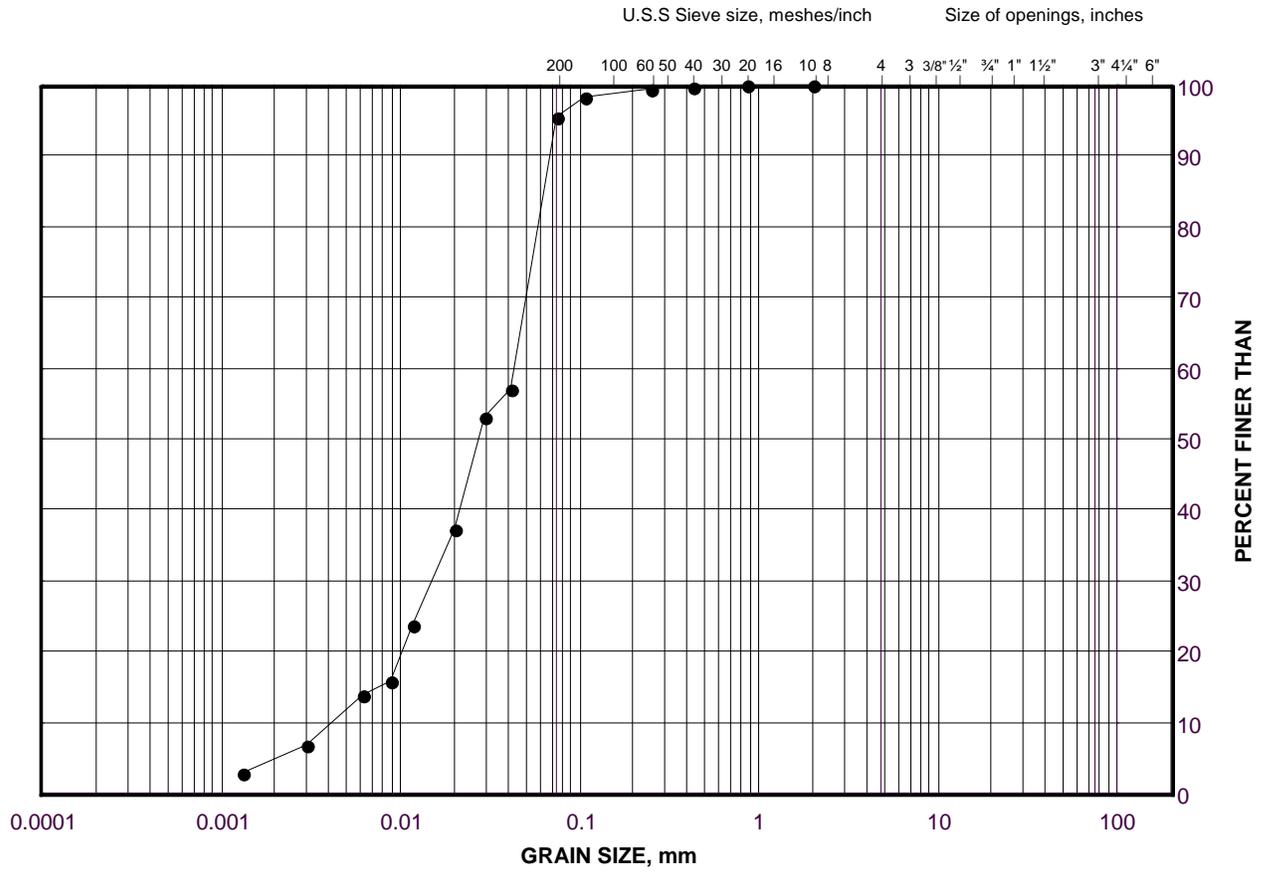


GRAIN SIZE DISTRIBUTION

Silt

Highway 69 (SBL) STA 17+230 to 17+350

FIGURE C.S25-6



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	S25-07	6	196.3

Project Number: 07-1111-0029

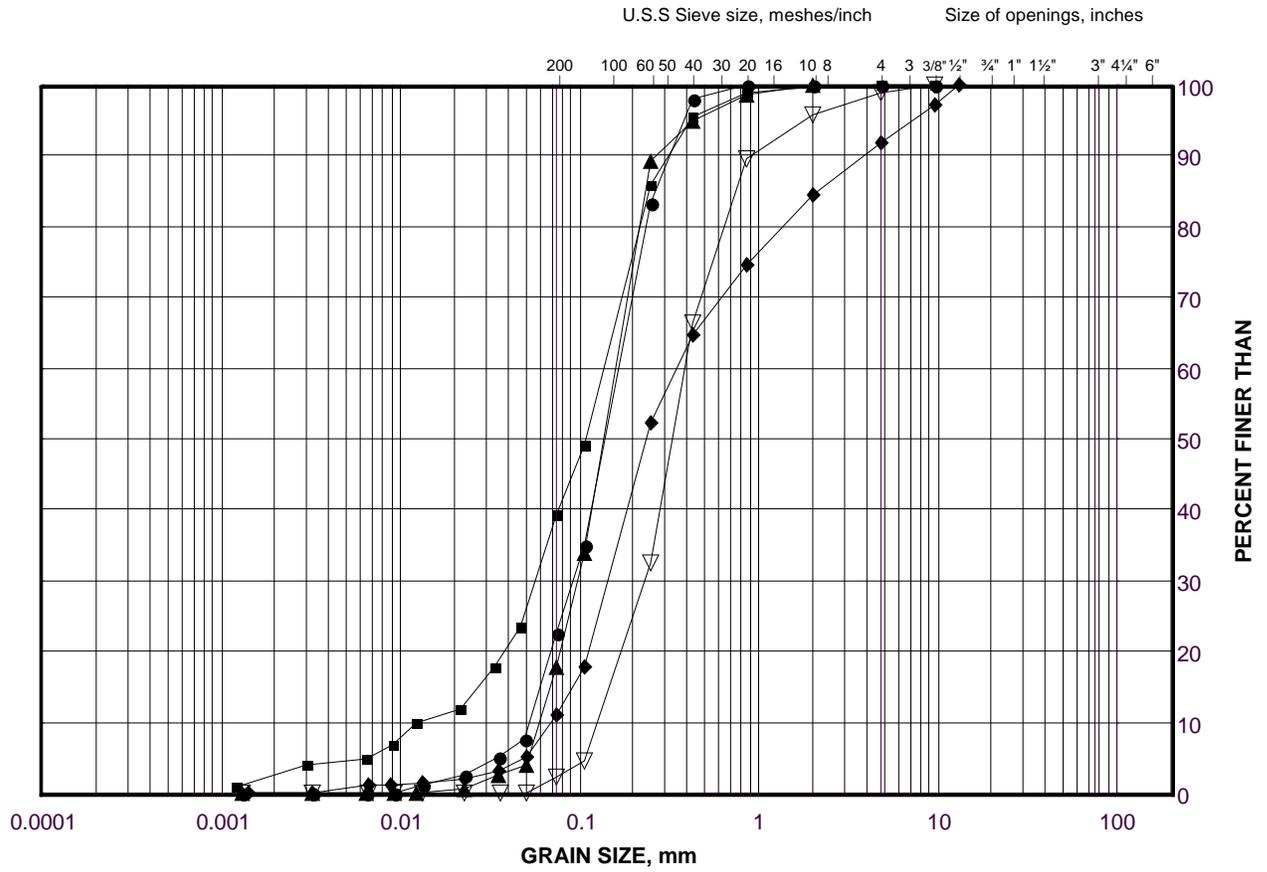
Checked By: CN

Golder Associates

Date: 27-Nov-09

GRAIN SIZE DISTRIBUTION
 Silt and Sand to Sand
 Highway 69 (SBL) STA 17+230 to 17+350

FIGURE C.S25-7



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

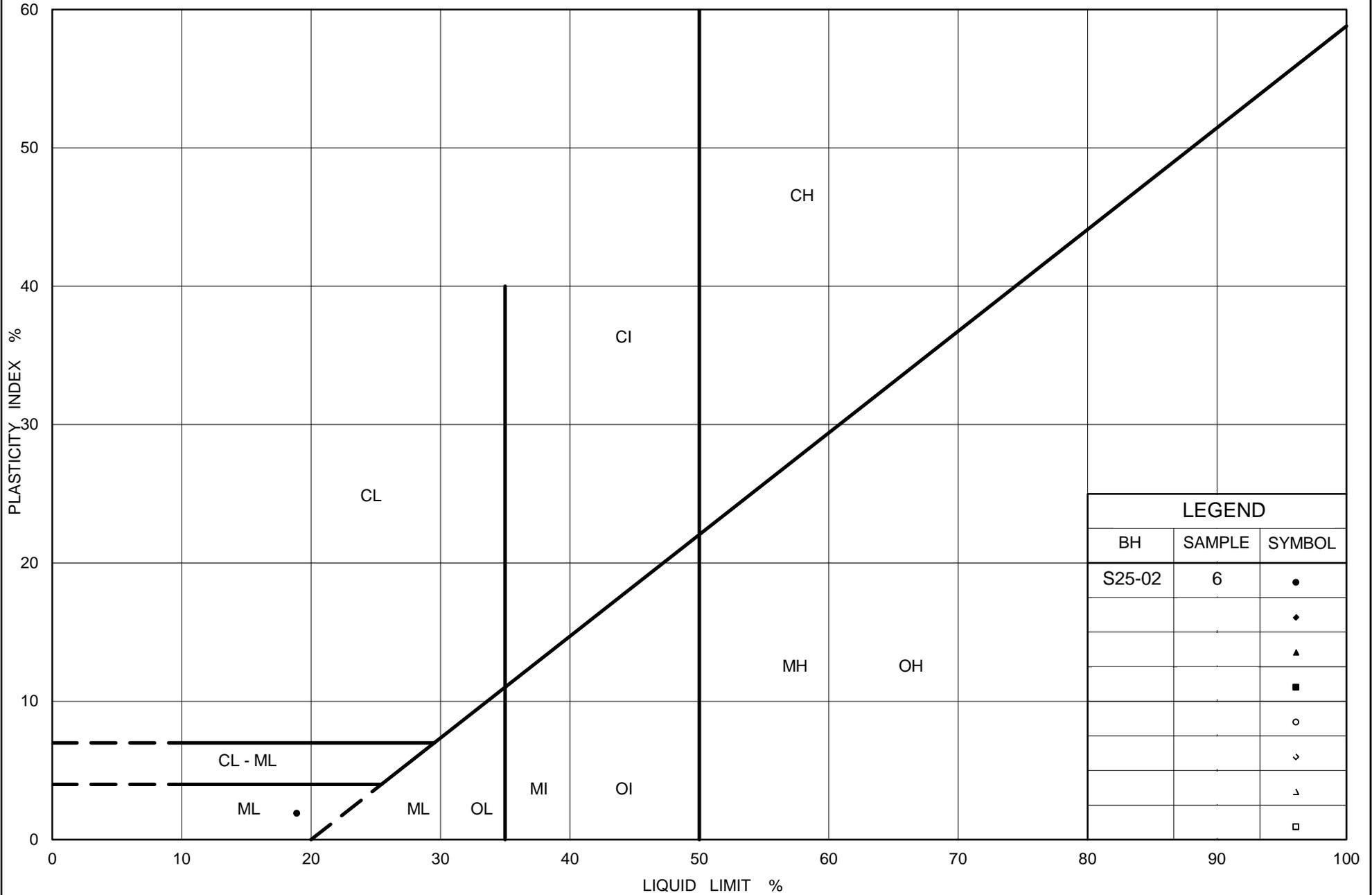
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-05	6	196.2
■	S25-03	6	197.7
◆	S25-10	6	196.2
▲	S25-08	8	196.2
▽	S25-09	9	191.6

Project Number: 07-1111-0029

Checked By: CN

Golder Associates

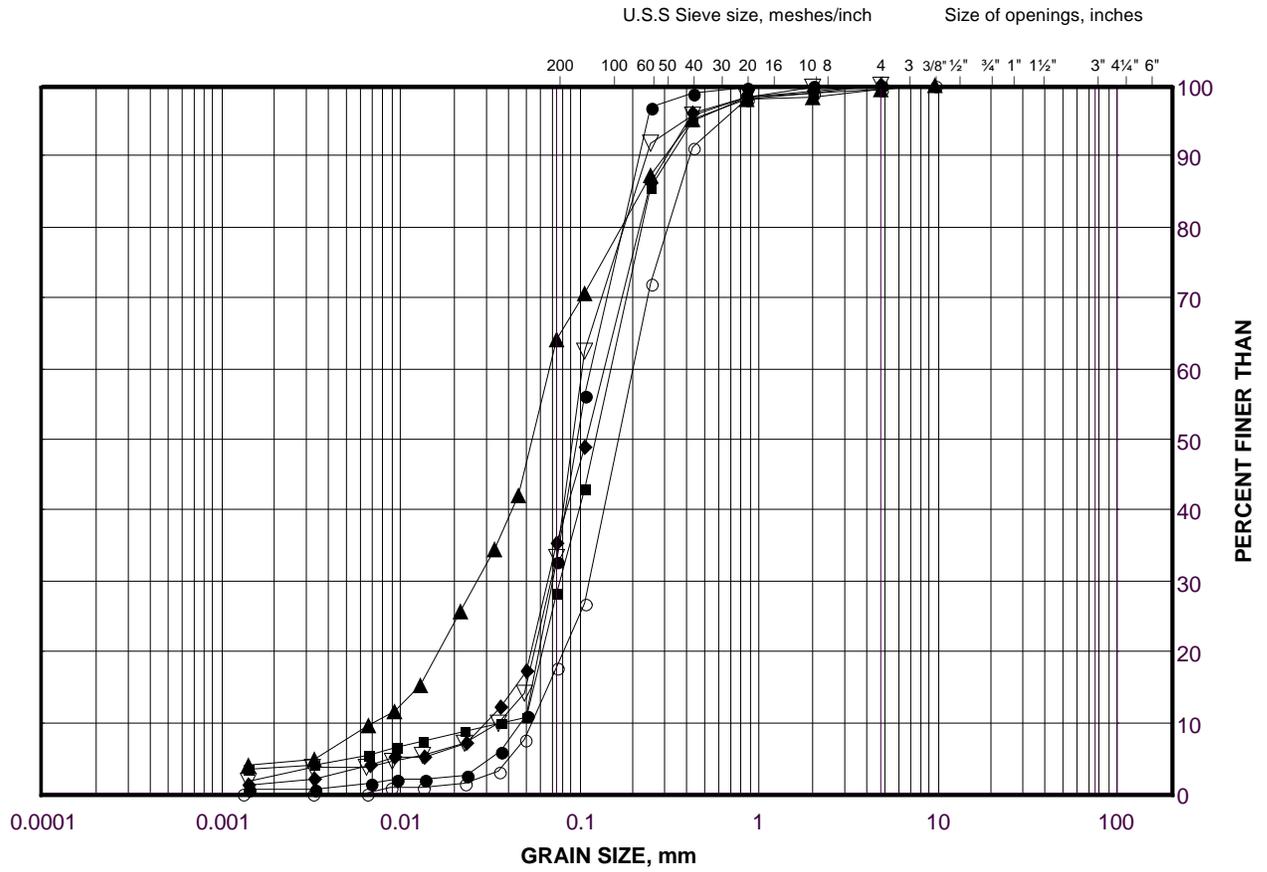
Date: 15-Dec-09



LEGEND		
BH	SAMPLE	SYMBOL
S25-02	6	●
		◆
		▲
		■
		○
		◇
		▽
		□

GRAIN SIZE DISTRIBUTION
 Silt and Sand to Sand (Upper Deposit)
 Highway 69 (NBL) STA 17+150 to 17+350

FIGURE C.S25-9



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

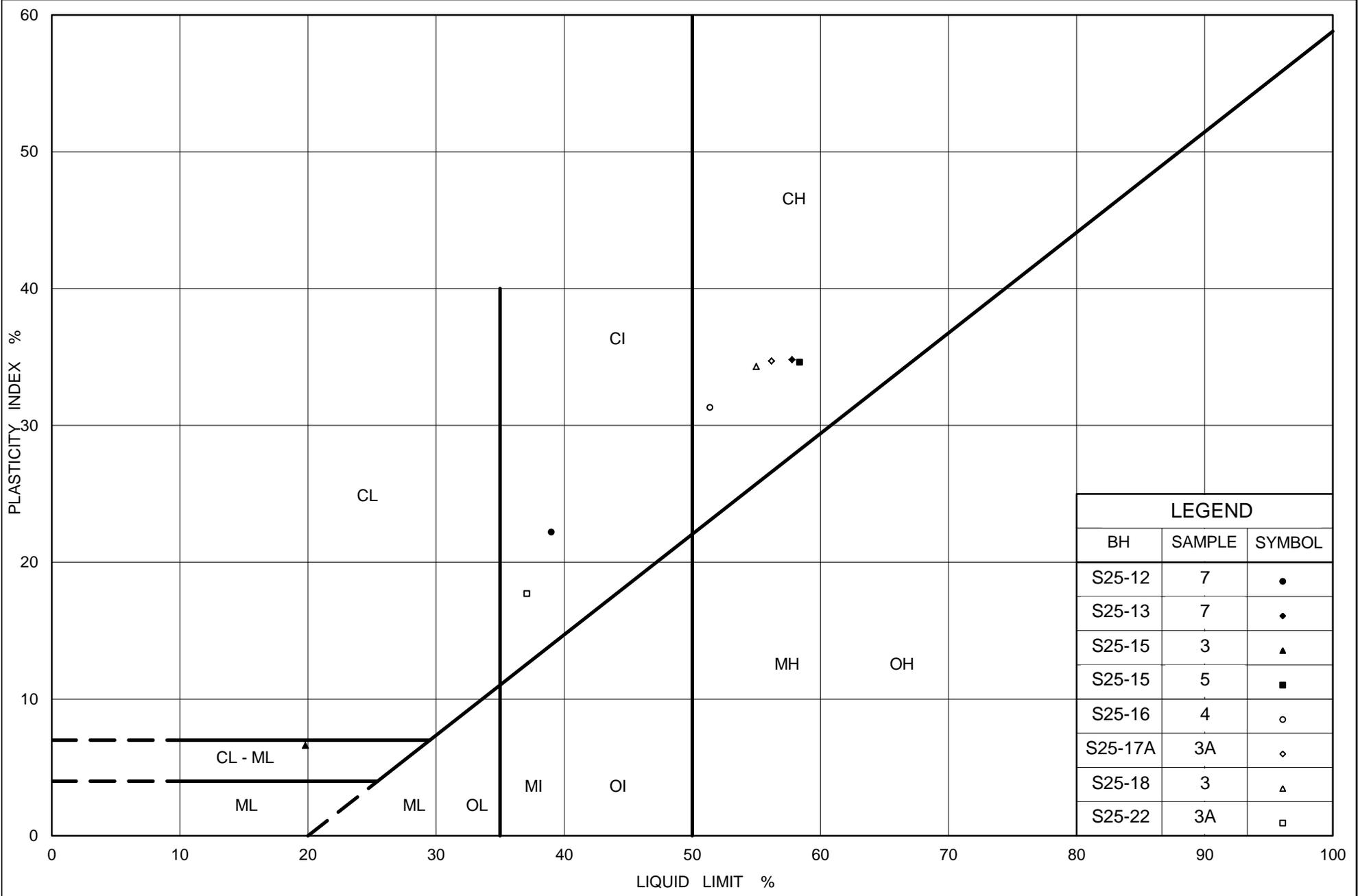
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-25	3	201.2
■	S25-24	3	201.2
◆	S25-23	3	200.3
▲	S25-21	3	200.6
▽	S25-17	4	200.9
○	S25-13	5	199.9

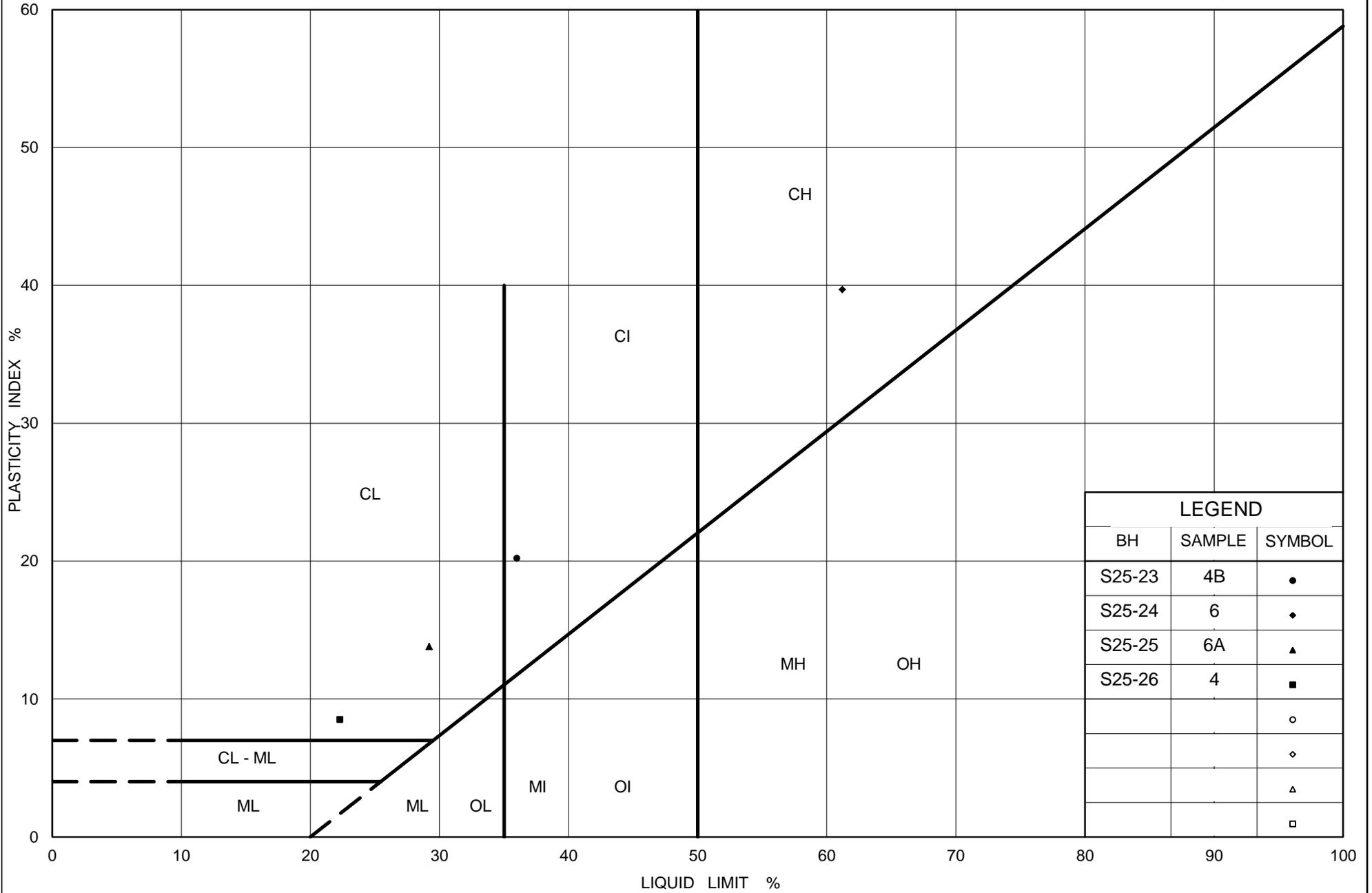
Project Number: 07-1111-0029

Checked By: CN

Golder Associates

Date: 22-May-15





Ministry of Transportation

Ontario

PLASTICITY CHART
 Clayey Silt to Clay
 Highway 69 (NBL) STA 17+150 to 17+350

Figure No. C.S25-10B

Project No. 07-1111-0029

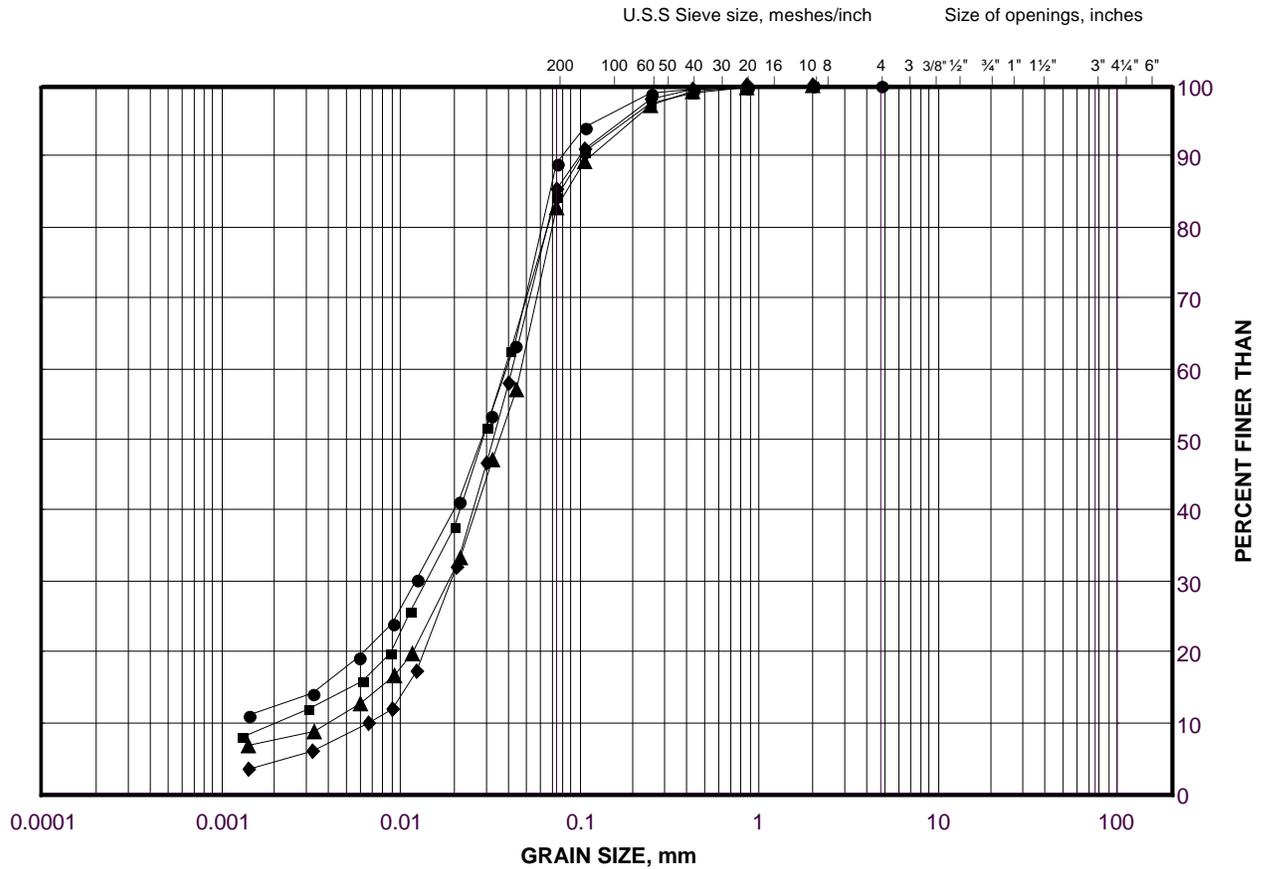
Checked By: CN

GRAIN SIZE DISTRIBUTION

Silt

Highway 69 (NBL) STA 17+150 to 17+350

FIGURE C.S25-11



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-22	4	199.8
■	S25-17	6	199.2
◆	S25-26	6A	196.5
▲	S25-25	6B	196.5

Project Number: 07-1111-0029

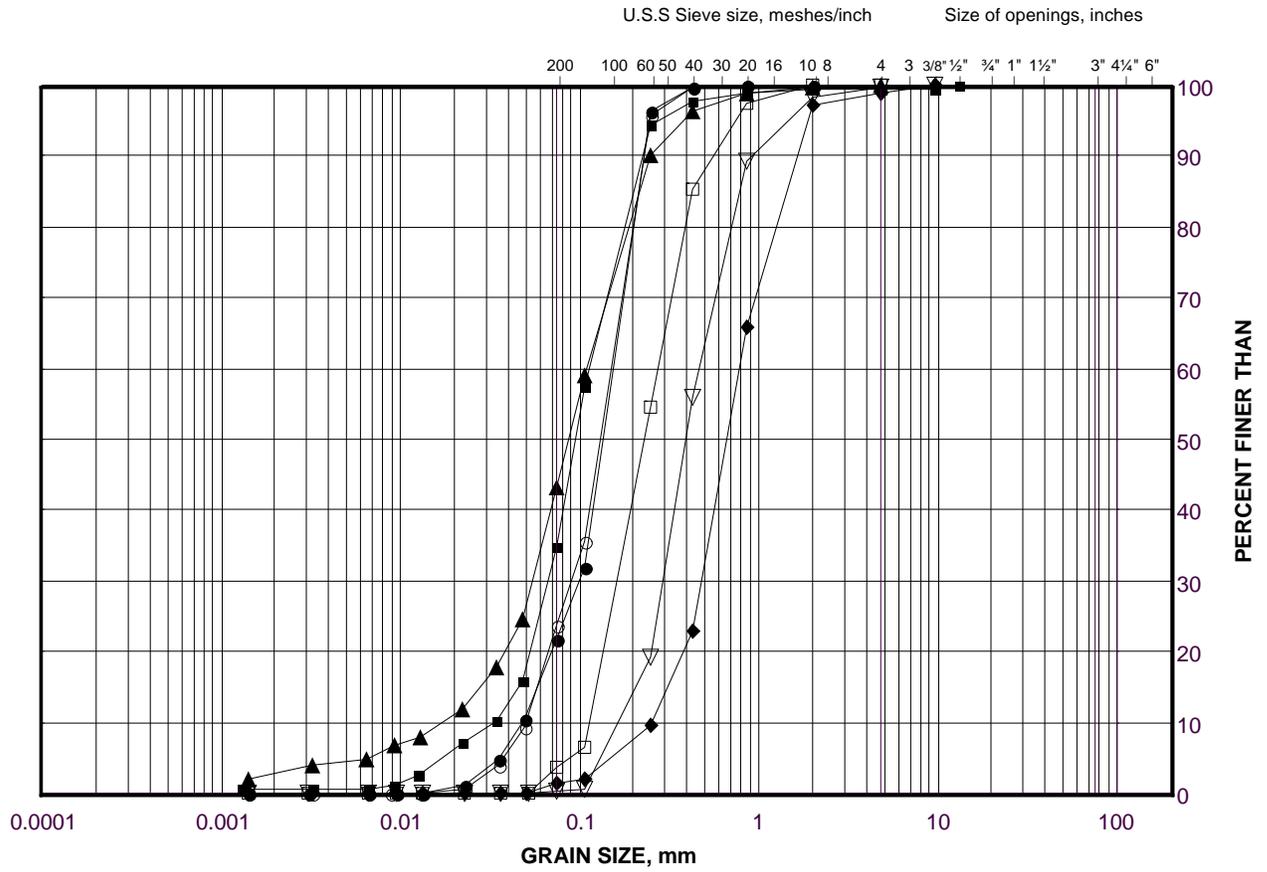
Checked By: CN

Golder Associates

Date: 31-Jul-15

GRAIN SIZE DISTRIBUTION
 Silt and Sand to Sand (Lower Deposit)
 Highway 69 (NBL) STA 17+150 to 17+350

FIGURE C.S25-12A



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-12	11	191.0
■	S25-13	12	191.7
◆	S25-19	5	197.9
▲	S25-14	6B	198.3
▽	S25-18	8	194.7
○	S25-15	8	193.2
□	S25-16	9	191.5

Project Number: 07-1111-0029

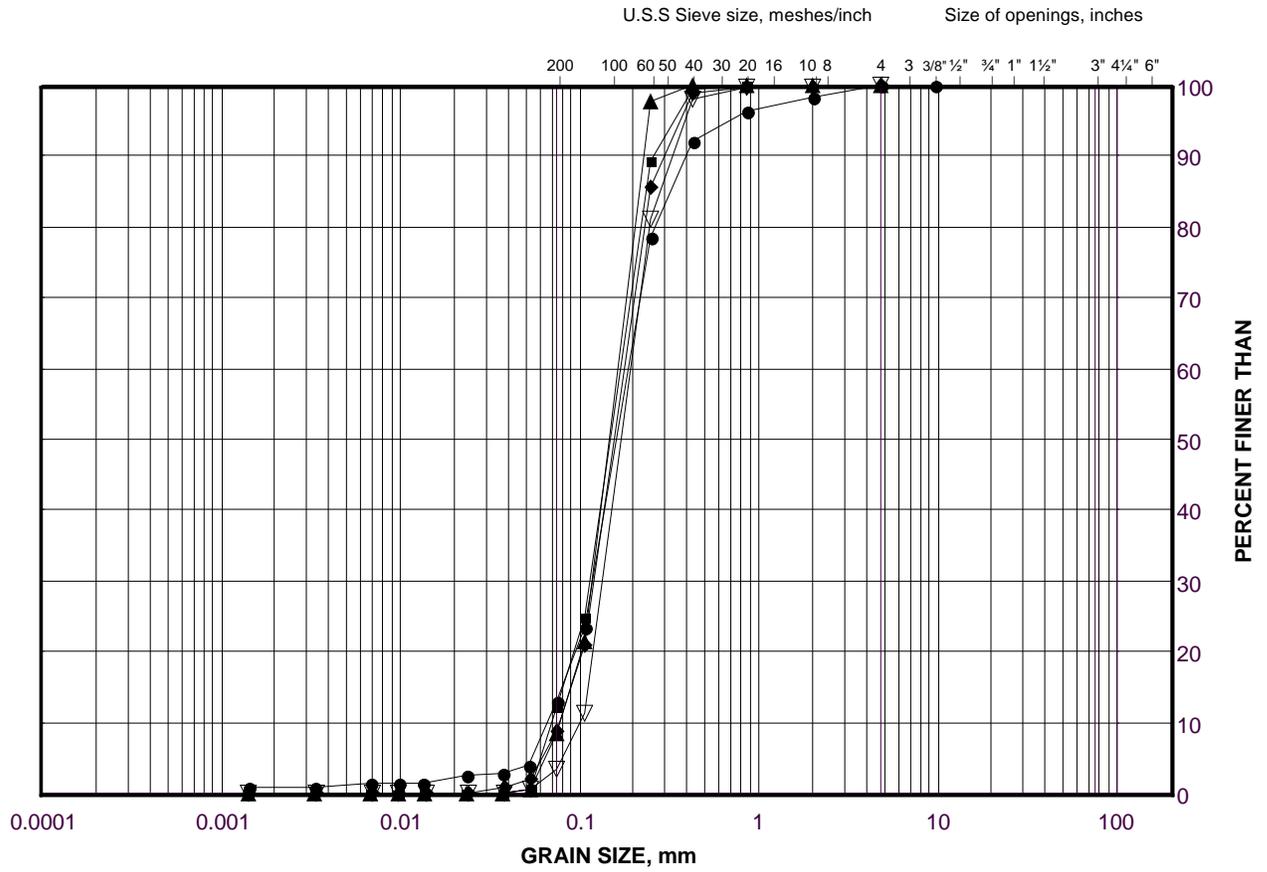
Checked By: CN

Golder Associates

Date: 22-May-15

GRAIN SIZE DISTRIBUTION
 Silt and Sand to Sand (Lower Deposit)
 Highway 69 (NBL) STA 17+150 to 17+350

FIGURE C.S25-12B



SILT AND CLAY SIZES			FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED			SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-26	10	190.2
■	S25-25	10	190.5
◆	S25-24	10	192.0
▲	S25-26	7	194.8
▽	S25-23	7	195.0

Project Number: 07-1111-0029

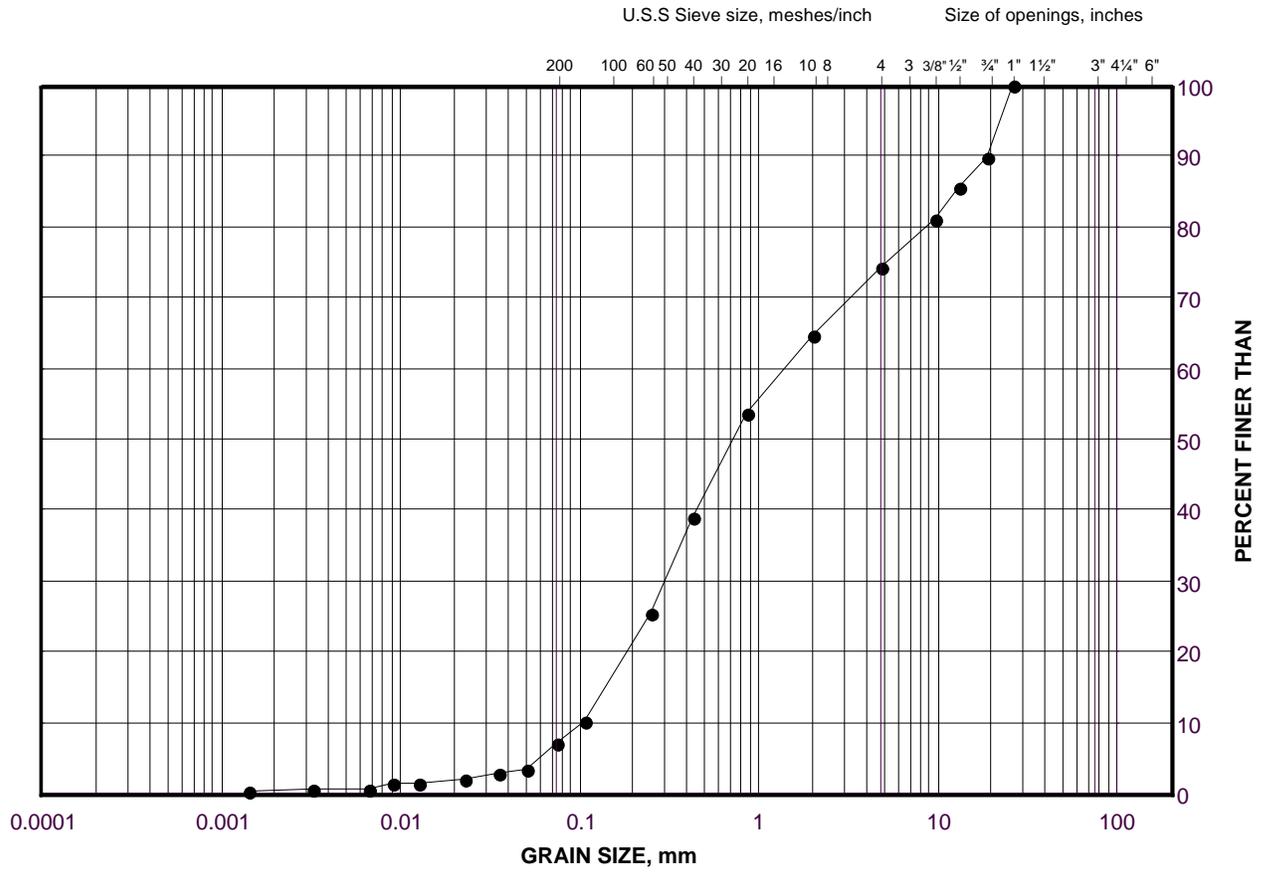
Checked By: CN

Golder Associates

Date: 31-Jul-15

GRAIN SIZE DISTRIBUTION
 Gravelly Sand
 Highway 69 (NBL) STA 17+150 to 17+350

FIGURE C.S25-13A



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-12	15	184.9

Project Number: 07-1111-0029

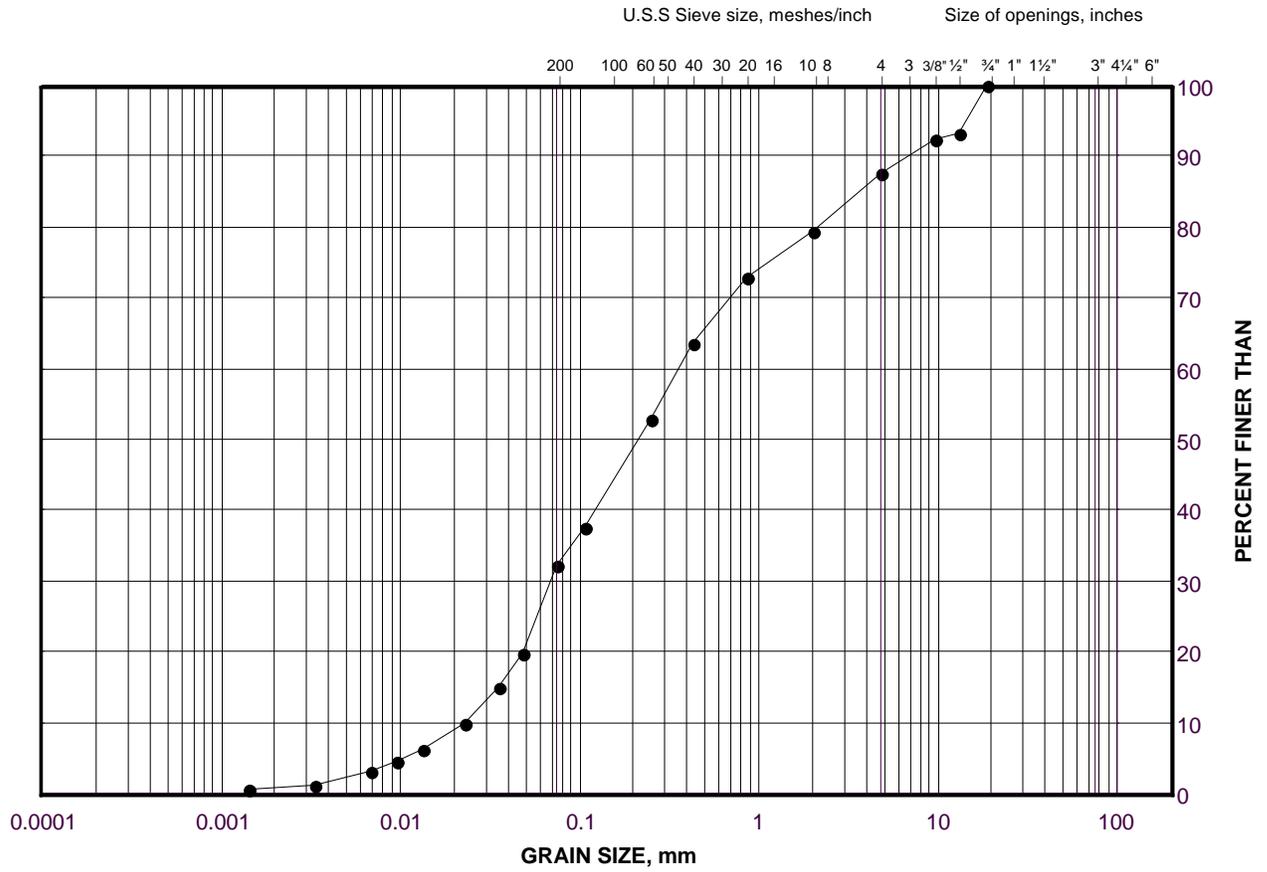
Checked By: CN

Golder Associates

Date: 27-Nov-09

GRAIN SIZE DISTRIBUTION
 Silt and Sand (Pocket)
 Highway 69 (NBL) STA 17+150 to 17+350

FIGURE C.S25-13B



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S25-24	12	189.0

Project Number: 07-1111-0029

Checked By: CN

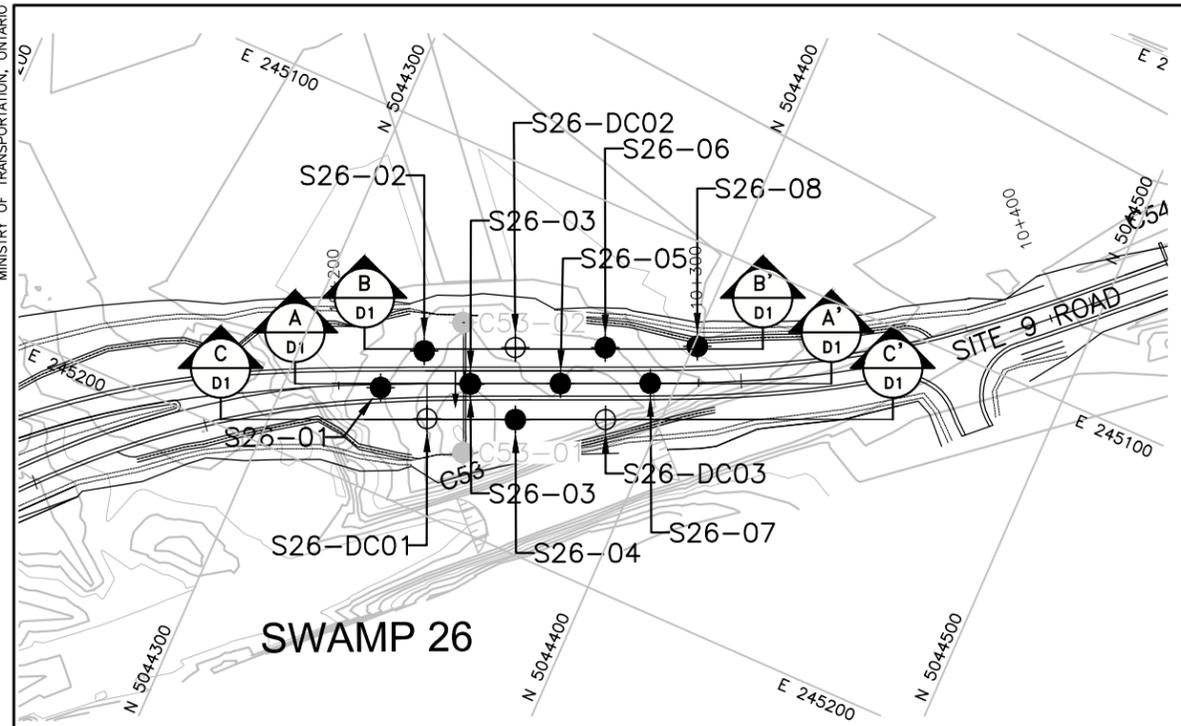
Golder Associates

Date: 31-Jul-15

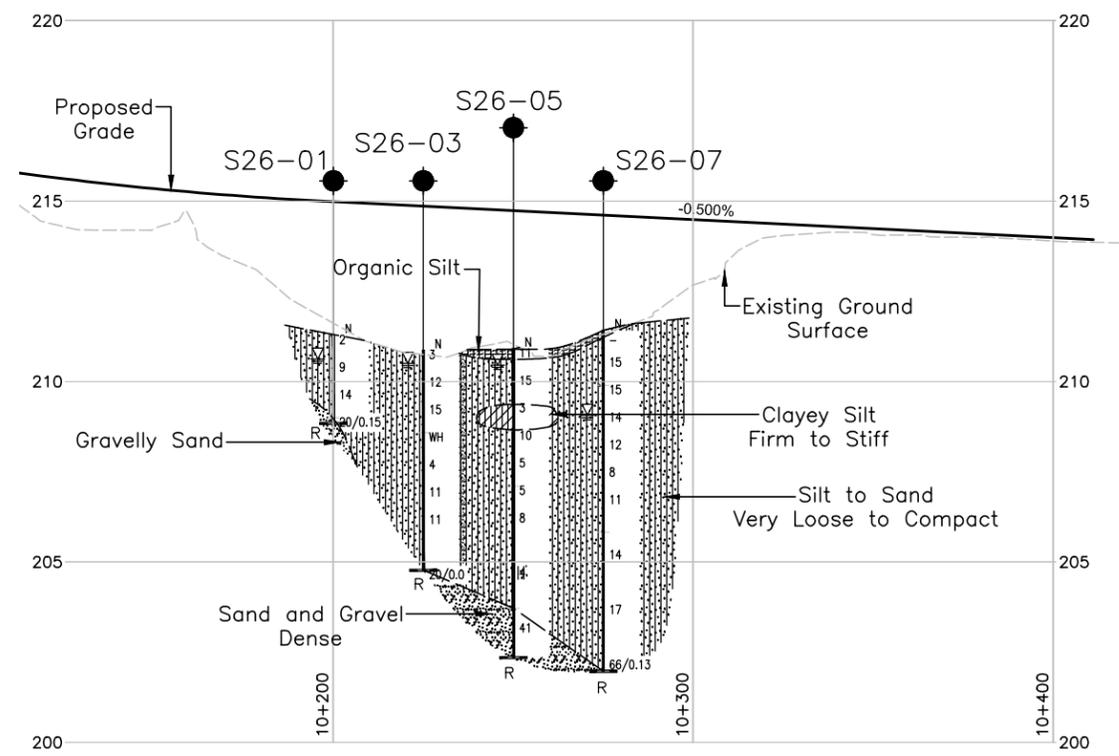


APPENDIX D

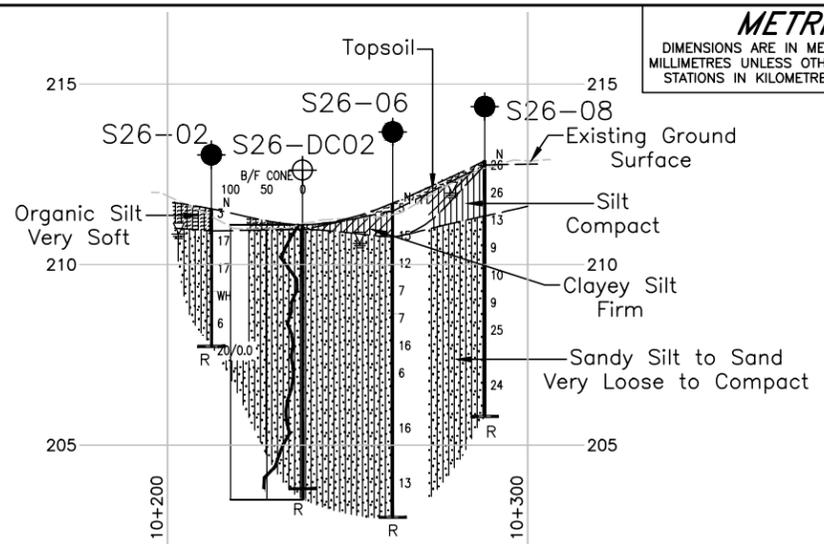
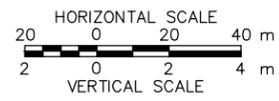
Site 9 Road – STA 10+225 to 10+300 (Swamp 26)



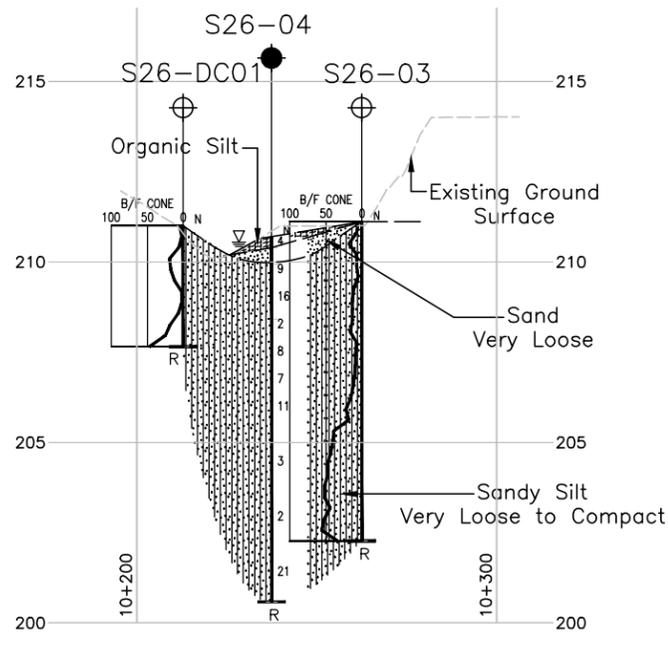
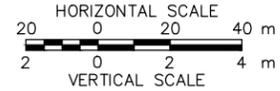
SWAMP 26



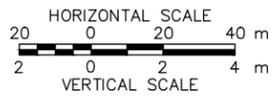
A-A D1 CENTRELINE PROFILE SITE 9 ROAD



B-B D1 EMBANKMENT TOE PROFILE SITE 9 ROAD



C-C D1 EMBANKMENT TOE PROFILE SITE 9 ROAD

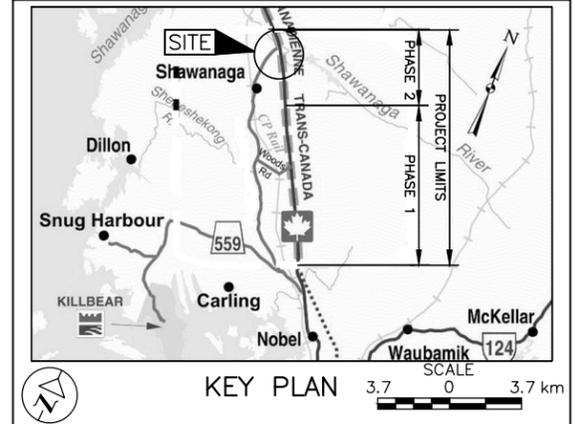


METRIC
 DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 5111-07-00

SITE 9 ROAD STA 10+225 TO 10+300

BOREHOLE LOCATIONS AND SOIL STRATA



LEGEND

- Borehole - Current Investigation
- ⊕ Dynamic Cone Penetration Test
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling
- R Refusal

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
S26-01	211.3	5044325.0	245172.5
S26-02	211.5	5044332.1	245158.3
S26-03	210.9	5044347.5	245161.6
S26-04	211.7	5044347.5	245161.6
S26-05	210.7	5044362.9	245165.6
S26-06	210.9	5044370.4	245151.4
S26-07	211.4	5044377.8	245137.3
S26-08	212.9	5044393.2	245141.3
S26-DC01	211.0	5044401.1	245126.7
S26-DC02	211.1	5044410.1	245175.2
S26-DC03	211.1	5044354.9	245147.3
S26-DC03	211.1	5044385.9	245155.5

NOTES

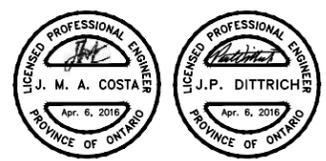
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans contours and centreline profile provided in digital format by MMM, drawing file nos. S6878-330-001SGA.dwg, dated November 2013, s6878xb02 contours.dwg, h6878_PHASE2_XD1 grading.dwg and h6878_PHASE2_XN1.dwg, received November 10, 2014, 6878 jh Sheb Tie In at IC Profile-May 14, 2015.dwg received May 14, 2015.



NO.	DATE	BY	REVISION

Geocres No. 41H-161

HWY. 69	PROJECT NO. 07-1111-0029	DIST. .
SUBM'D. AJS	CHKD. CN	DATE: 5/21/2015
DRAWN: MR	CHKD. CN	APPD. JPD/JMAC

DWG. D1

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S26-01	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044325.0 ; E 245172.5</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Continuous Flight 108 mm I.D. Hollow Stem Augers</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>January 29, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
211.3	GROUND SURFACE																
0.0	SILT and SAND, some gravel, trace clay, clayey silt seam at 1.5 m depth Very loose to compact Brown to grey Wet		1	SS	2	▽	211										
			2	SS	9		210										
			3	SS	14												
209.0							209										
2.4	Gravelly SAND, some silt, trace clay Grey Wet SPOON AND AUGER REFUSAL END OF BOREHOLE NOTE: 1. Water level in open borehole measured at a depth of 0.6 m below ground surface (Elev. 210.7 m) upon completion of drilling.		4	SS	20/0.15												24 52 20 4

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S26-02** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044332.1 ; E 245158.3 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Continuous Flight 108 mm I.D. Hollow Stem Augers COMPILED BY KD/MR
 DATUM Geodetic DATE January 30, 2015 CHECKED BY AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60		GR SA SI CL	
211.5	GROUND SURFACE															
0.0	ORGANIC SILT, some sand Very soft Dark brown Wet		1	SS	3									○	OC = 6.1%	
210.9																
0.6	SAND, some silt, trace organics Compact Brown to grey Moist to wet		2	SS	17											
			3	SS	17									○		
209.2																
2.3	Sandy SILT, trace clay, trace organics, trace wood fragments Very loose to loose Brown to grey Wet		4	SS	WH									○		
			5	SS	6									○		
207.7																
3.8	SPOON AND AUGER REFUSAL END OF BOREHOLE		6	SS	20/0.0										0 25 71 4 Non-Plastic	
	NOTE: 1. Water level in open borehole measured at a depth of 0.7 m below ground surface (Elev. 210.8 m) upon completion of drilling.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S26-03	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044347.5; E 245161.6</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Continuous Flight 108 mm I.D. Hollow Stem Augers</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>January 30, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L	GR	SA	SI	CL	
210.9 0.0	GROUND SURFACE Silty SAND, trace clay, trace organics to a depth of 0.8 m Very loose to compact Brown to grey Wet		1	SS	3	▽	210						○						
			2	SS	12														
			3	SS	15		209						○						0 69 28 3
208.6 2.3	Sandy SILT, trace clay Very loose to compact Brown to grey Wet		4	SS	WH		208												
			5	SS	4														
			6	SS	11		207						○						0 22 75 3
			7	SS	11		206						○						
204.8 6.1	SPOON AND AUGER REFUSAL END OF BOREHOLE NOTE: 1. Water level in open borehole measured at a depth of 0.3 m below ground surface (Elev. 210.6 m) upon completion of drilling.		8	SS	20/0.0		205												

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S26-04** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044362.9 ; E 245165.6 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Continuous Flight 108 mm I.D. Hollow Stem Augers COMPILED BY KD/MR
 DATUM Geodetic DATE February 2, 2015 CHECKED BY AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)		
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
210.7	GROUND SURFACE																		
0.0	ORGANIC SILT		1A	SS	4														
0.3	SAND, trace organics Very loose Brown Wet		1B	SS	4														
209.9			2	SS	9														
0.8	Silty SAND Loose to compact Brown to grey Wet		3	SS	16														
208.4			4	SS	2														
2.3	Sandy SILT, trace to some gravel, trace clay Very loose to compact Grey Wet		5	SS	8														
			6	SS	7														
			7	SS	11														
			8	SS	3														
			9	SS	2														
		10	SS	21															
200.6	AUGER REFUSAL END OF BOREHOLE																		
10.1	NOTE: 1. Water level in open borehole measured at a depth of 0.2 m below ground surface (Elev. 210.5 m) upon completion of drilling.																		

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S26-05** SHEET 1 OF 1 **METRIC**
W.P. 5111-07-00 **LOCATION** N 5044370.4 ; E 245151.4 **ORIGINATED BY** ID
DIST HWY 69 **BOREHOLE TYPE** Continuous Flight 108 mm I.D. Hollow Stem Augers **COMPILED BY** KD/MR
DATUM Geodetic **DATE** February 3, 2015 **CHECKED BY** AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)	
						20	40	60	80	100	20	40	60	188	GR	SA	SI	CL
210.9	GROUND SURFACE																	
210.0	ORGANIC SILT		1A	SS	11													
0.3	Silty SAND, trace organics Compact Brown to grey Moist to wet		1B	SS	11													OC = 0.8%
209.4			2	SS	15													
1.5	CLAYEY SILT, trace sand Firm to stiff Grey Moist		3	SS	3		7											
208.6								5										
2.3	SILT and SAND Loose to compact Brown Wet		4	SS	10													
			5	SS	5													
207.1																		
3.8	SAND, trace to some gravel, trace silt Loose Brown to grey Wet		6	SS	5													8 88 4 0
			7	SS	8													
			8	SS	4													
203.7																		
7.2	SAND and GRAVEL, trace silt Compact Dense Brown to grey Wet		9	SS	41													
202.3																		
8.6	AUGER REFUSAL END OF BOREHOLE																	
	NOTES: 1. An additional borehole advanced 1.1 m south of Borehole S26-05 to carry out in situ field vanes at depths of 1.7 m and 2.0 m. 2. Water level in open borehole measured at a depth of 0.4 m below ground surface (Elev. 210.5 m) upon completion of drilling.																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.LCPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S26-06	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044377.8 ; E 245137.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Continuous Flight 108 mm I.D. Hollow Stem Augers</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>February 4, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
211.7	GROUND SURFACE																		
0.0	TOPSOIL																		
0.2	CLAYEY SILT Firm Brown to grey Moist		1A	SS	5														
				1B															
210.8	Sandy SILT, trace clay Loose to compact Brown to grey Wet		2A																
0.9			2B	SS	15														
				3	SS	12													
				4	SS	7													
208.7	Silty SAND Loose to compact Brown to grey Moist to wet		5	SS	7														
3.0			6	SS	16														
				7	SS	6													
				8	SS	16													
			9	SS	13														
203.0	AUGER REFUSAL END OF BOREHOLE																		
8.7																			

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1111-0029 **RECORD OF BOREHOLE No S26-07** SHEET 1 OF 1 **METRIC**
 W.P. 5111-07-00 LOCATION N 5044393.2 ; E 245141.3 ORIGINATED BY ID
 DIST HWY 69 BOREHOLE TYPE Continuous Flight 108 mm I.D. Hollow Stem Augers COMPILED BY KD/MR
 DATUM Geodetic DATE February 5, 2015 CHECKED BY AJS/MCK

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
211.4	GROUND SURFACE															
0.0	ORGANIC SILT		1A	AS	-											OC = 24.6%
0.2	SILT, some sand Compact Brown, becoming grey at a depth of 0.8 m Moist to wet		1B													
			2	SS	15											
209.9																
1.5	SAND, trace to some silt, trace clay, trace gravel Loose to compact Brown to grey Wet		3	SS	15											0 82 17 1
			4	SS	14											
			5	SS	12											
			6	SS	8											
			7	SS	11											1 98 1 0
205.8																
5.6	Silty SAND, some gravel Compact Brown to grey Wet		8	SS	14											
			9	SS	17											
202.0			10	SS	66/0.13											
9.4	SPOON AND AUGER REFUSAL END OF BOREHOLE															
	NOTE: 1. Water level in open borehole measured at a depth of 2.3 m below ground surface (Elev. 209.1 m) upon completion of drilling.															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF BOREHOLE No S26-08	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044401.1 ; E 245126.7</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Continuous Flight 108 mm I.D. Hollow Stem Augers</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>February 5, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)	
						20	40	60	80	100	20	40	60	GR	SA	SI	CL	
212.9	GROUND SURFACE																	
0.0	TOPSOIL		1A															
0.2	SILT, some sand Compact Light brown with reddish pockets Wet		1B	SS	26						○							0 14 82 4
			2	SS	26													
211.4																		
1.5	SAND, some silt, trace gravel Loose to compact Brown to grey Wet		3	SS	13													
			4	SS	9													
			5	SS	10						○							
			6	SS	9						○							1 80 19 0
			7	SS	25													
			8	SS	24						○							
205.8	AUGER REFUSAL END OF BOREHOLE																	
7.1	NOTE: 1. Water level in open borehole measured at a depth of 0.9 m below ground surface (Elev. 212.0 m) upon completion of drilling.																	

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II\CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S26-DC01	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044340.3 ; E 245175.2</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration Test</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>January 25, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
211.0 0.0	GROUND SURFACE Dynamic Cone Penetration Test (DCPT)																
207.4 3.6	END OF DCPT Refusal to Further Penetration																

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S26-DC02	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044354.9 ; E 245147.3</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration Test</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>January 29, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			ELEVATION SCALE	SHEAR STRENGTH kPa								
							20	40	60	80	100					
211.1	GROUND SURFACE					211										
0.0	Dynamic Cone Penetration Test (DCPT)					210										
						209										
						208										
						207										
						206										
						205										
						204										
203.5	END OF DCPT															
7.6	Refusal to Further Penetration (Hammer Bouncing)															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.GPJ GAL-GTA.GDT 03/25/16 DD/SAC

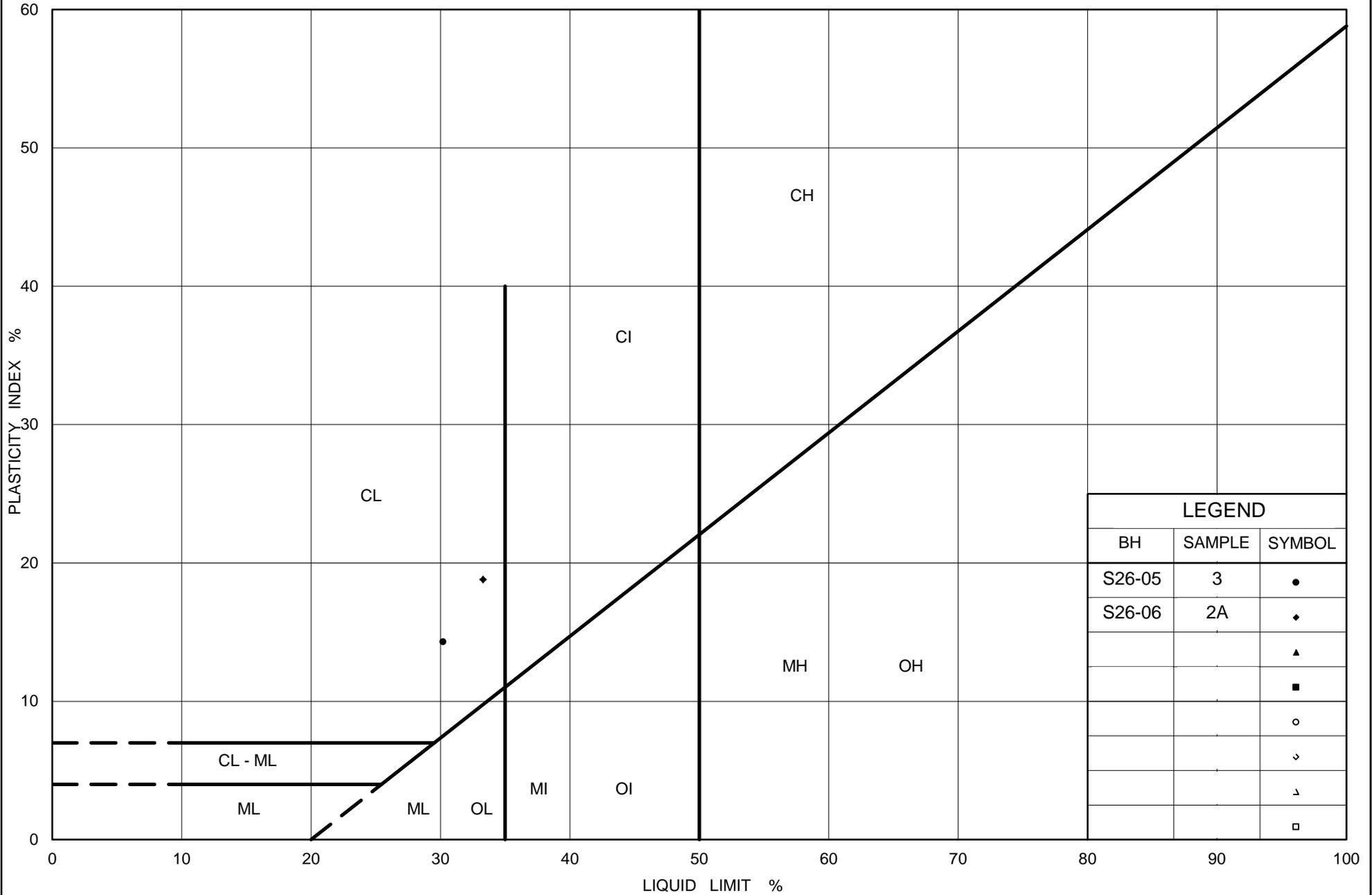
+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1111-0029</u>	RECORD OF DCPT No S26-DC03	SHEET 1 OF 1	METRIC
W.P. <u>5111-07-00</u>	LOCATION <u>N 5044385.9 ; E 245155.5</u>	ORIGINATED BY <u>ID</u>	
DIST <u>HWY 69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration Test</u>	COMPILED BY <u>KD/MR</u>	
DATUM <u>Geodetic</u>	DATE <u>January 29, 2015</u>	CHECKED BY <u>AJS/MCK</u>	

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION	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									
						20	40	60	80	100						
211.1	GROUND SURFACE															
0.0	Dynamic Cone Penetration Test (DCPT)					211										
						210										
						209										
						208										
						207										
						206										
						205										
						204										
						203										
						202										
201.8	END OF DCPT															
9.3	Refusal to Further Penetration (Hammer Bouncing)															

GTA-MTO 001 T:\PROJECTS\2007\07-1111-0029 (MRC, PARRY SOUND)\LOG\07-1111-0029-SWAMP-PHASE II.CPJ GAL-GTA.GDT 03/25/16 DD/SAC

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt

Site 9 Road STA 10+225 to 10+300

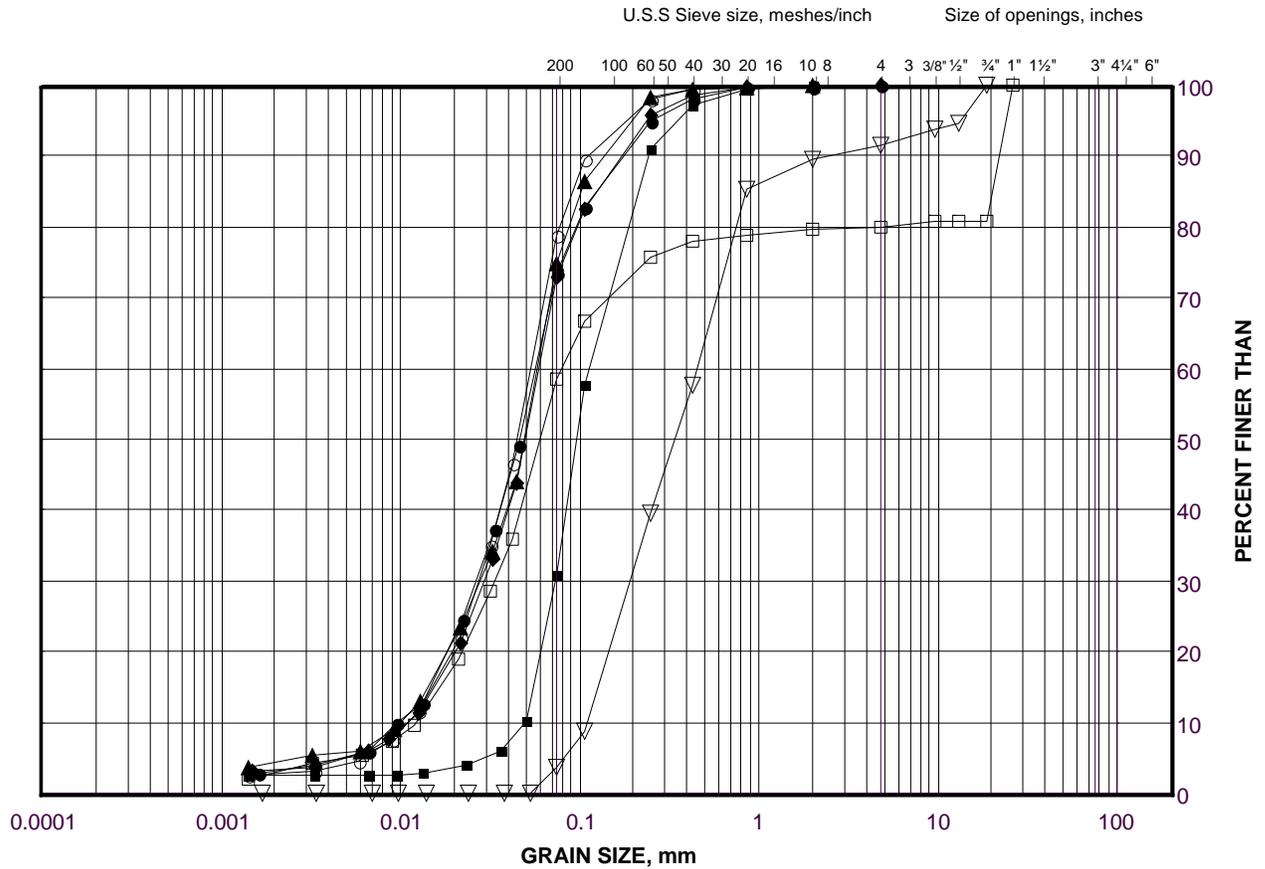
Figure No. D.S26-1

Project No. 07-1111-0029

Checked By: CN

GRAIN SIZE DISTRIBUTION
 Sandy Silt to Sand
 Site 9 Road STA 10+225 to 10+300

FIGURE D.S26-2A



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S26-06	3	209.9
■	S26-03	3	209.1
◆	S26-04	4	208.1
▲	S26-02	5	208.2
▽	S26-05	6	206.8
○	S26-03	6	206.8
□	S26-04	7	205.9

Project Number: 07-1111-0029

Checked By: CN

Golder Associates

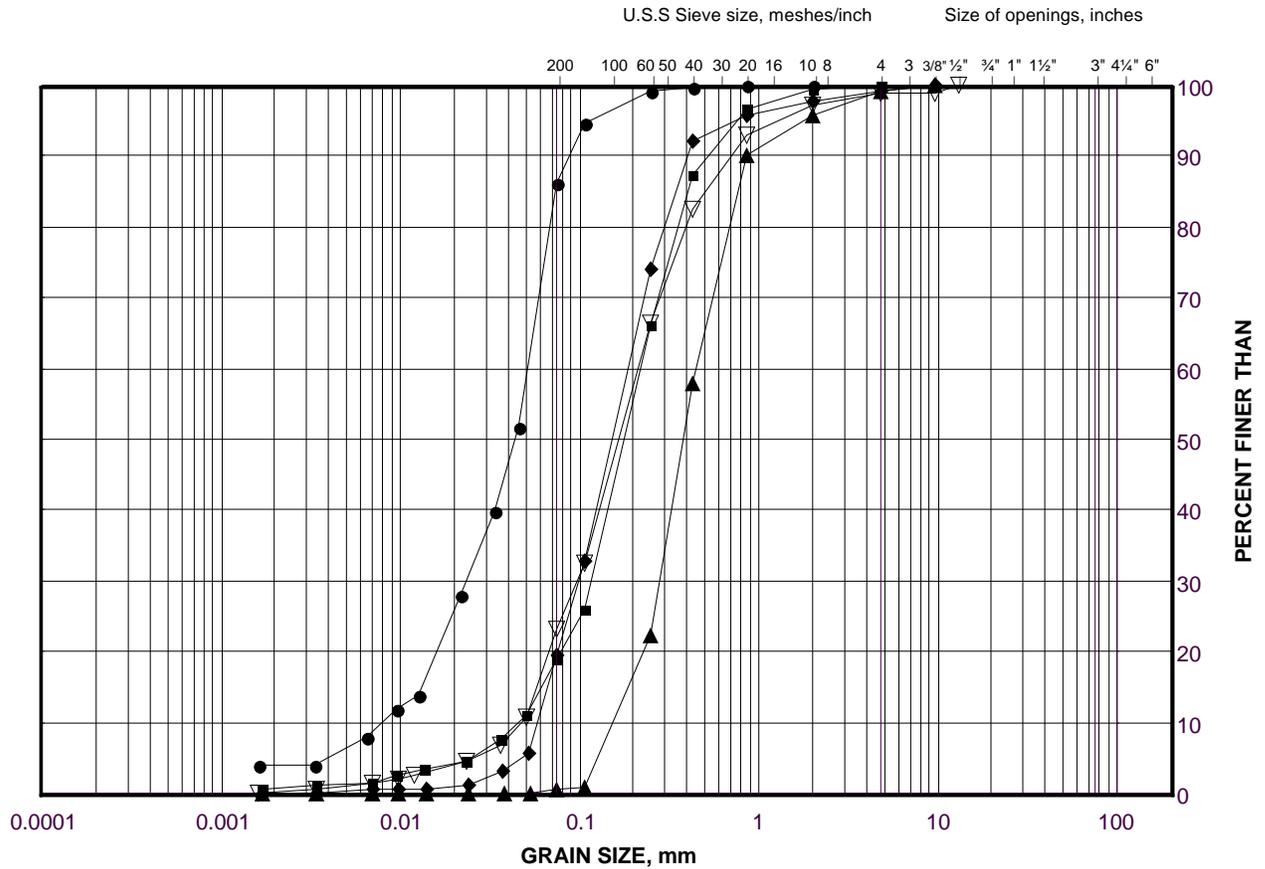
Date: 22-May-15

GRAIN SIZE DISTRIBUTION

Silt to Sand

Site 9 Road STA 10+225 to 10+300

FIGURE D.S26-2B



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S26-08	1B	212.4
■	S26-07	3	209.6
◆	S26-08	6	208.8
▲	S26-07	7	206.5
▽	S26-06	8	205.3

Project Number: 07-1111-0029

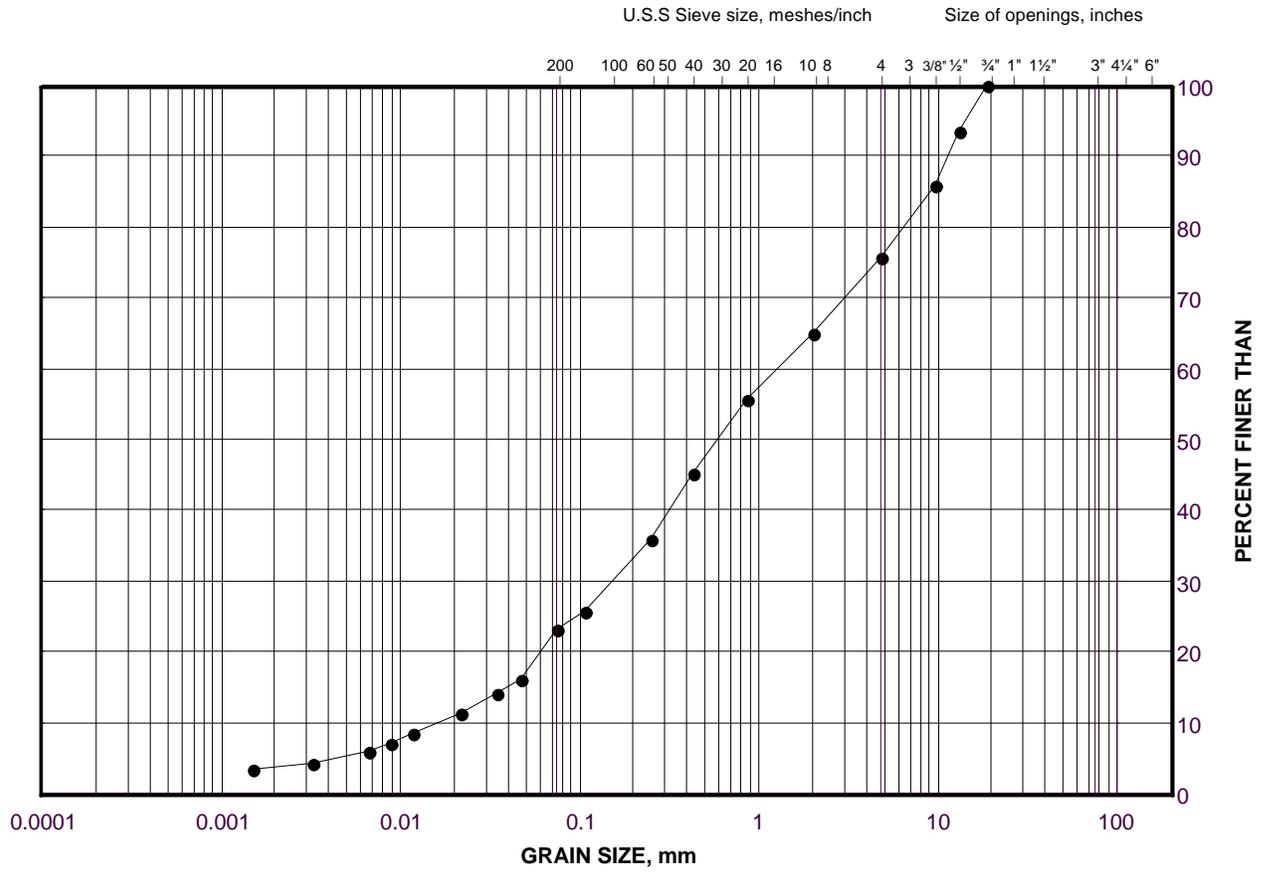
Checked By: CN

Golder Associates

Date: 22-May-15

GRAIN SIZE DISTRIBUTION
Gravelly Sand
Site 9 Road STA 10+225 to 10+300

FIGURE D.S26-3



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	S26-01	4	208.9

Project Number: 07-1111-0029

Checked By: CN

Golder Associates

Date: 22-May-15

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com



Golder Associates Ltd.
2390 Argentia Road
Mississauga, Ontario, L5N 5Z7
Canada
T: +1 (905) 567 4444

