

PRELIMINARY FOUNDATION INVESTIGATION AND
DESIGN REPORT – SWAMP CROSSINGS
FOUNDATION INVESTIGATION – 2
HIGHWAY 69 ROUTE SELECTION STUDY
3.5 km NORTH OF HIGHWAY 559 TO 3.8 km NORTH OF HIGHWAY 522
G.W.P. 5377-02-00, HIGHWAY 69
MTO GEOCREs No. 41H-58

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1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC), Consulting Foundation, Construction Quality Control and Environmental Engineers, was retained by the Ministry of Transportation (Northeastern Region) to conduct a foundation investigation for Highway 69 Route Selection Study, from 3.5 km North of Highway 559 to 3.8 km North of Highway 522 (68.0 km) in Ontario.

A preliminary foundation investigation and design study had been carried out by Trow Associates Inc. (TROW, ref. brge00140201a dated 12 September 2005), on behalf of the Ministry of Transportation (MTO), for some of the structures and swamp crossings for the proposed four-laning of Highway 69. Additional soil information was required to determine the preferred route of the new four-lane highway. Twenty-five (25) locations for additional investigation in swamp areas were specified by MTO in the Terms of Reference as outlined in the Request for Quotation (Agreement Number: 5005-E-0033 dated 15 December 2005). Authorization to proceed with this investigation was signed by the Regional / Branch Director of MTO dated 19 December 2005. The work was carried out by AMEC according to the MTO Terms of Reference and AMEC's Proposal dated 28 November 2005.

This report (Foundation Investigation – 2) should be considered as “supplementary” to TROW's report (ref. brge00140201a dated 12 September 2005). As such, any information already provided in TROW's report that may be needed will only be referred and / or briefly discussed in this supplementary report.

The investigation was carried out by means of a limited number of boreholes, in-situ tests and laboratory tests on selected samples. Based on AMEC's interpretation of the data obtained, preliminary recommendations for swamp crossings are provided. The results of the investigation and preliminary foundation design for structures are provided in a separate report (AMEC Report No. TT53126 - Structures dated 27 July 2006).

2.0 SITE DESCRIPTION

The site for the foundation investigation extends along the existing Highway 69 (north of Parry Sound) - from 3.5 km north of Highway 559 (Township of Carling) to 3.8 km north of Highway 522 (Grundy Lake Provincial Park), with a total length of approximately 68 km. The general site location is shown on Figure No. 1 in Appendix B. Some sections of the proposed Highway 69 would pass through the First Nations' lands which belong to the Shawanaga First Nation, the Magnetewan First Nation and the Henvey Inlet First Nation. A few private lands would also be passed by the new highway.

The existing Highway 69 within the site for the foundation investigation is generally a two-lane undivided highway. The planned new four-lane Highway 69 within the site predominantly follows the alignment of the existing Highway 69. A significant change of the highway alignment under consideration is in the section of the existing highway located within Henvey Township (close to the northern study limit at Grundy Lake Provincial Park). The new highway alignment in that section could be in the order of 1 km from the existing highway alignment. Three alternative alignments in this section are presently under consideration by the Ministry of Transportation. Four possible interchange locations are also under consideration. An overall outline of the planned alignment of the new Highway 69 is shown on Figure No. 2 in Appendix B.

The topography of the site for the foundation investigation is generally undulating and covered by wooded areas and water bodies (lakes, rivers, and swamps). Rock outcrops and excavated rock slopes are visible in a number of sections along the existing highway. At the time of the foundation investigation, the majority of the site was covered by snow. Access to some of the borehole locations had to be prepared by an excavator for the drilling rig. In some borehole locations, snowmobiles were used to gain access.

3.0 QUATERNARY AND BEDROCK GEOLOGY

The physiography and geology of the site have been described in TROW's report (ref. brge00140201a). Brief descriptions of quaternary geology and bedrock geology are provided below.

3.1 Quaternary Geology

According to the Quaternary Geology of Ontario – Southern Sheet, the areas along Highway 69 are covered with a variety of deposits, the majority of which are as follows:

Glaciofluvial outwash deposits – gravel and sand; includes proglacial river and deltaic deposits.

Glaciolacustrine deposits – silt and clay, minor sand, basin and quiet water deposits.

Organic deposits – peat, muck and marl.

3.2 Bedrock Geology

According to the Bedrock Geology of Ontario – Southern Sheet, the bedrock along Highway 69 consists of the following rock types:

- Gneisses of metasedimentary origin;
- Migmatitic rocks and gneisses;
- Felsic igneous rocks (tonalite, granodiorite, monzonite, granite, syenite, derived gneisses);
- Tectonite unit (tectonites, various gneisses).

4.0 INVESTIGATION PROCEDURES

4.1 Field Investigation

In accordance with the Terms of Reference for this investigation, twenty-five (25) locations in swamp areas were to be investigated as listed in Table 1 of Appendix A. However, two of the twenty-five locations were placed in the Henvey Inlet First Nation's lands and permission to enter the lands was not granted for investigation. Thus, twenty-three (23) of the twenty-five (25) locations were investigated.

The fieldwork was performed from 16 January 2006 to 8 March 2006, starting with the staking out of the borehole locations followed by preparing access for a drilling rig, and drilling the boreholes using a track-mounted drilling rig or a portable drilling equipment. The borehole locations were surveyed and staked out in the field by an Ontario Land Surveyor firm (L.U. Maughan Co. Ltd.) according to the coordinates provided in the Terms of Reference (as listed in Table 1 of Appendix A referred to MTM Zone 10 NAD 83 coordinate system).

A few boreholes specified in the Terms of Reference were slightly relocated with the approval of MTO (ref. e-mail from MTO to AMEC dated 23 January 2006) since they were located within the existing Highway 69 road surface where the soil conditions were known to be competent. Due to the possible variation in soil and groundwater conditions at the specified borehole locations, additional test holes were normally put down in the vicinity of the specified borehole locations.

Due to rolling terrain and heavily-wooded areas, an excavator was used to prepare access to some of the borehole locations. As rock outcrops were visible at or near some borehole locations, the excavator was used to excavate test pits in the vicinity of those areas to determine and / or confirm the presence of bedrock. A track-mounted drilling rig (CME 55) was used to drill the boreholes where accessible and the ground could support the drilling rig. For the boreholes that were located on ice-covered areas (particularly major swamps), portable drilling equipment was used to drill the boreholes. The portable drilling equipment and crew typically reached the borehole locations by snowmobiles and / or on foot. The boreholes were drilled / investigated to depths ranging from about 0.2 m to 25 m below the existing ground surface.

The borehole locations established in the field by the survey crew are presented on Sheet Nos. 1 to 12 in Appendix B. The coordinates and the geodetic ground surface elevations at the specified borehole locations were surveyed by the surveyor and confirmed by a hand-held GPS unit prior to drilling. The coordinates of the boreholes / test holes which were in addition to the boreholes specified by the Terms of Reference were surveyed by the hand-held GPS unit.

The boreholes were advanced using solid-stem continuous-flight augers with a track-mounted power-auger drilling rig, where accessible. Other boreholes were advanced by portable drilling equipment using wash-boring through a 100 mm diameter casing. At a few locations, another

.../...

portable drilling equipment operated manually (hand drilling) was used. The borehole investigation was under the full-time supervision of experienced foundation personnel from AMEC.

The boreholes were advanced at least to the anticipated depth shown in the Terms of Reference unless auger refusal was reached first. If the anticipated borehole depth was exceeded, further borehole investigation was carried out by either Standard Penetration Testing (SPT) or Dynamic Cone Penetration Testing (DCPT). Where shallow possible bedrock was encountered, additional location(s) close to the specified borehole location was (were) investigated by DCPT or test pits in order to confirm the presence of bedrock.

Soil samples were normally taken at 1.5 m intervals to a depth of 15 m and subsequently at 3 m intervals beyond 15 m during the performance of Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg (140 lbs.) hammer for a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter O.D. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) was recorded as SPT 'N' value of the soil which indicated the consistency of cohesive soils or the relative density of non-cohesive soils. The 63.5 kg (140 lbs.) hammer was used in both the track-mounted drilling rig and the portable drilling equipment using wash-boring, except the hand drilling portable equipment that used a 70 lb (31.8 kg) hammer. The SPT 'N' values presented in the Record of Boreholes were corrected from the 70 lb (31.8 kg) hammer to 140 lb (63.5 kg) hammer. The majority of the boreholes were terminated due to auger refusal on possible bedrock, or SPT 'N' value in excess of 100 blows per 0.30 m.

The dynamic cone penetration test (DCPT) was carried out by advancing a steel cone into the ground with a 63.5 kg (140 lbs.) hammer. The number of blows per 0.3 m required to advance the cone was recorded as presented in the Record of Boreholes / Test Holes (Appendix C).

The test holes carried out at each location specified by the Terms of Reference are summarized in Table 2 (Appendix A).

Where soft clayey soils were encountered, MTO Field Vane Test was carried intermittently in the boreholes drilled by the track-mounted drilling rig. A smaller field vane was used in the boreholes advanced by the portable drilling equipment using the wash boring technique.

Soil samples were normally collected for each soil layer exposed in the test holes for laboratory inspection and testing.

Upon completion of drilling, the test holes were backfilled with bentonite in accordance with the general requirements of Ministry of the Environment Regulation 903 as indicated in the Record of Boreholes.

The soil samples were transported to AMEC's Advanced Soil Laboratory in Scarborough (Toronto) for further examination and laboratory soil testing. The program of laboratory testing included, where applicable, grain size analysis, Liquid and Plastic Limit test, and in-situ water content determination.

The results of the in-situ and laboratory tests are presented on the corresponding Record of Boreholes / Test Holes (Appendix C) and Laboratory Test Results - Appendix D.

4.2 Laboratory Tests

Representative soil samples were subject to laboratory testing in AMEC's Advanced Soil Laboratory in Scarborough (Toronto) for soil classification. The following tests were conducted:

- Natural water content determination (40);
- Grain size distribution analysis (29); and
- Liquid and Plastic Limits (19).

The results of the laboratory tests are included in the Record of Boreholes / Test Holes in Appendix C. The grain size distribution curves and Liquid / Plastic Limits are shown in Figure Nos.1 to 8 in Appendix D.

5.0 SUB-SURFACE CONDITIONS

The sub-surface soil conditions encountered at the specified borehole locations are summarized in Table 2 (Appendix A). The presence of bedrock was generally confirmed by test pit excavation and / or possible bedrock was confirmed by refusal to split-spoon / dynamic cone penetration at other test locations adjacent to or near the specified borehole location. The following nomenclatures are used to identify the borehole / test hole and the associated test methods used:

- SW-X denotes Borehole No. X for a swamp area as specified by the Terms of Reference (Table 1 in Appendix A).
- ST-X denotes Borehole No. X for a structure area as specified by the Terms of Reference.
- SW-FN-X denotes Borehole No. X for a swamp area as specified by the Terms of Reference that is located in the First Nation's land.
- SW-X(A) denotes Borehole No. XA for a swamp area that was drilled in addition to the borehole (SW-X) specified by the Terms of Reference.
- SW-X (TP) denotes a test pit for a swamp area that was in addition to the specified borehole (SW-X).
- SW-X (DCPT) denotes a dynamic cone penetration test for a swamp area that was in addition to the specified borehole (SW-X).

The stratigraphic units and groundwater conditions for each borehole location are discussed in the following sections. Where necessary, the subsoil information encountered in the test holes that were carried out in addition to the specified borehole locations is also discussed. Detailed information is provided in the Record of Boreholes / Test Holes (Appendix C).

The groundwater level in each open test hole was observed during drilling and measured upon completion of drilling. The measured groundwater levels are shown in the Records of Boreholes / Test Holes (Appendix C). It should be noted that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

The following summary is to assist the designers of the project with an understanding of the anticipated soil conditions across the site. However, it should be noted that the soil and groundwater conditions may vary between the test hole locations.

5.1 Shawanaga - New Shebeshekong Road Interchange (Drawing Sheets 1 and 2)

The new Shebeshekong Road Interchange to be located in the Township of Shawanaga and Shawanaga First Nation, in the vicinity of Tucker's Road, was investigated by four (4) boreholes in the swamp areas. The boreholes were located at the following locations:

- SW-1 Station 14+354 Offset 0
- SW-2 Station 14+750 Offset 18.75 R
- SW-FN-3 Station 15+704 Offset 0
- SW-FN-4 Station 16+500 Offset 0

All test holes for this location are listed in Table 2.

Ice and Water

The surfaces of Boreholes SW-1 and SW-2 were covered with ice and water. The ice was about 0.2 m thick at Borehole SW-1 while the ice and water layer was about 0.34 m thick at Borehole SW-2.

Peat / Topsoil

Borehole SW-FN-3 encountered a 0.2 m thick peat deposit at the ground surface. A peat deposit, about 1 m thick, was found in SW-1 underneath the ice layer. The peat is generally fibrous and wet.

Topsoil, approximately 0.23 m in thickness, was encountered at the ground surface of Borehole SW-FN-4.

It should be noted that a peat deposit, about 4.6 m thick, was found in SW-FN-3B located about 12 m north and 1 m east of SW-FN-3.

Silty Sand / Sandy Silt / Sand

Silty sand / sandy silt deposits were encountered in Boreholes SW-1, SW-2 and SW-FN-3, underlying the peat in SW-1 and SW-FN-3, and the ice and water layer in SW-2. Sand was encountered in SW-FN-4 below the topsoil. The silty sand / sandy silt / sand deposits extended to a depth of about 4.3 m below the existing grade (Elevation 208.6 m) in SW-1, 8.0 m (Elevation 198.8 m) in SW-2, 0.3 m (Elevation 208.3 m) in SW-FN-3 and 9.6 m (Elevation 192.7 m) in SW-FN-4.

The SPT 'N' values of the silty sand / sandy silt / sand deposits vary widely from 4 to more than 50 blows per 0.3 m, indicating a loose to very dense relative density.

The results of the laboratory tests from soil samples in the silty sand / sandy silt / sand deposits are summarized as follows:

Natural moisture content (%):	13 to 33
Grain size (six samples):	Gravel (%): 0
	Sand (%): 36 – 96
	Silt (%): 23 – 60
	Clay (%): 4 – 10 (two samples)
	Silt and clay (%): 4 – 59 (four samples)

The grain size distribution curves are shown on Figure No.7 in Appendix D.

Sand and Gravel

In Borehole SW-1, a sand and gravel deposit was found underlying the silty sand / sandy silt and extended to a depth of about 4.8 m (Elevation 208.1 m). The SPT 'N' value is more than 50 blows per 0.3 m, indicating a very dense relative density.

Bedrock

The presence of bedrock underlying the silty sand / sandy silt / sand deposits was confirmed by test pits in the vicinity of Boreholes SW-1, SW-2 and SW-FN-3. At Borehole SW-FN-4, the possible presence of bedrock underlying the sand deposit was confirmed by refusal to Standard Penetration Test advance in SW-FN-4 and dynamic penetration in another location (SW-FN-4 (DCPT)) close to SW-FN-4. The depths to the bedrock or possible bedrock are as follows:

SW-1:	0.5 m to 4.8 m	(Elevation 208.1 m to 211.5 m)
SW-2:	2.6 m to 9.8 m	(Elevation 197.1 m to 204.2 m)
SW-FN-3:	surface to 10 m	(Elevation 198.0 m to 208.2 m)
SW-FN-4:	9.6 m to 10.2 m	(Elevation 192.1 m to 192.7 m)

Groundwater

Groundwater levels observed during the investigation within the vicinity of the test holes were as follows:

SW-1:	Ground surface	(Elevation 212.9 m)
SW-2:	1.8 m depth	(Elevation 205 m)
SW-FN-3:	Ground surface	(Elevation 208.0 m to 208.6 m)
SW-FN-4:	Ground surface	(Elevation 202.3 m)

5.2 Township of The Archipelago (Drawing Sheet 3)

One borehole, SW-5 (Station 21+852, offset 18.75L), was located near Moose Lake in the Township of The Archipelago. All test holes for this location are listed in Table 2.

Peat

A peat deposit was found in Borehole SW-5 from the ground surface to a depth of about 1.4 m (Elevation 203.6 m). The peat is fibrous and wet. The natural moisture content measured is 419 %.

Silty Sand

Underlying the peat deposit was a silty sand that extended to a depth of about 2.2 m (Elevation 202.8 m), below the existing ground surface. The silty sand is grey in colour and contains some gravel. The SPT 'N' values of the silty sand are 0 blows per 0.3 m (i.e., very loose relative density) at a depth of about 1.8 m and greater than 100 blows per 0.3 m (i.e., very dense relative density) at a depth of about 2 m.

Bedrock

Auger refusal on possible bedrock was encountered at a depth of about 2.2 m (Elevation 202.8 m) in Borehole SW-5 and refusal to DCPT at about 2.9 m (Elevation 202.1 m) in SW-5 (DCPT).

Groundwater

Groundwater level was measured to be at a depth of 0.3 m (Elevation 204.7 m) upon completion of drilling.

5.3 Wallbridge Township - Harris Lake Road Interchange (Drawing Sheet 4)

One borehole, SW-6 (Station 11+712, offset 143R), was drilled at the proposed ramp of the Harris Lake Road Interchange in the Wallbridge Township, close to the existing Harris Lake Road. All test holes for this location are listed in Table 2.

Ice and Water

Ice underlying by water was encountered at the location of SW-6. The ice was about 0.2 m thick and the underlying water extended to be a depth of about 0.9 m (Elevation 191.1 m).

Bedrock

Bedrock was found below the ice and water at a depth of about 0.9 m (Elevation 191.1 m). The presence of the bedrock was confirmed by the refusal to excavation by an excavator at SW-6

and SW-6 (TP1) to SW-6 (TP3). The surface of the bedrock was at Elevation 190.0 m to 194.1 m.

Groundwater

The borehole location was covered with ice and water at the surface Elevation of 192.0 m.

5.4 Wallbridge Township / Magnetawan First Nation – Highway 529 Interchange (Drawing Sheets 5 and 6)

The proposed Highway 529 Interchange to be located in the Wallbridge Township and Magnetawan First Nation land, in the vicinity of Magnetawan River, was investigated at the following four locations:

- | | | |
|-----------|----------------|---------------|
| • SW-FN-7 | Station 20+150 | Offset 0 |
| • SW-FN-8 | Station 20+976 | Offset 18.75R |
| • SW-9 | Station 22+326 | Offset 0 |
| • SW-10 | Station 22+600 | Offset 18.75R |

All test holes for this location are listed in Table 2.

Ice and Water

At SW-9, the ground surface was covered by ice and water to a depth of about 0.7 m (Elevation 195.1 m).

Topsoil and Peat

The ground surface at SW-FN-7, SW-FN-8 and SW-10 was covered with topsoil of which the thickness ranged approximately from 0.05 m to 0.30 m. At SW-10, the 0.3 m thick topsoil was underlain by a 0.5 m thick peat deposit.

Silty Clay / Clayey Silt

In the vicinity of SW-FN-7 and SW-FN-8, silty clay / clayey silt deposits were encountered underlying the topsoil in SW-FN-7(A), SW-FN-7(B), SW-FN-8(A) and SW-FN-8(B). The silty clay / clayey silt deposits extended to depths ranging from 0.5 m to 1.7 m (Elevation 189.3 m to 194.5 m). The SPT 'N' values of the silty clay / clayey silt in SW-FN-7A and SW-FN-8B ranged from 4 to more than 100 blows 0.3 m, indicating a soft to hard consistency.

The results of laboratory tests conducted on a sample from the silty clay / clayey silt in SW-FN-8(B) are as follows:

Natural moisture content (%):	32
Liquid / Plastic Limits:	35 / 17
Grain size (one sample):	Gravel (%): 0
	Sand (%): 4
	Silt (%): 61
	Clay (%): 35

The natural moisture content measured on a sample of clayey silt in SW-FN-7C is 29 %. The grain size distribution curve is presented in Figure No. 8 and the liquid limit is plotted on the plasticity chart (Figure No. 4 in Appendix D).

Sandy Silty Clay

In the vicinity of SW-FN-7, sandy silty clay was encountered underlying the silty clay in SW-FN-7A. The sandy silty clay deposit extended to a depth of about 1.2 m (Elevation 193.3 m). The SPT 'N' value of the sandy silty clay is 15 blows per 0.3 m (stiff consistency).

The results of laboratory tests conducted on a sample from the sandy silty clay in SW-FN-7A are as follows:

Natural moisture content (%):	36
Liquid / Plastic Limits:	33 / 16
Grain size (one sample):	Gravel (%): 1
	Sand (%): 49
	Silt (%): 32
	Clay (%): 18

The grain size distribution curve is presented in Figure No. 7 and the liquid limit is plotted on the plasticity chart (Figure No. 1 in Appendix D).

Bedrock

The presence of bedrock or possible bedrock was confirmed by refusal to borehole advance and / or test pit excavation at the four locations and their vicinity investigated at the following depths:

SW-FN-7:	0 m to 1.2 m	(Elevation 193.3 m to 196.8 m)
SW-FN-8:	0.1 m to 1.7 m	(Elevation 189.3 m to 193.0 m)
SW-9:	0 m to 0.7 m	(Elevation 195.1 m to 195.7 m)
SW-10:	0.4 m to 0.8 m	(Elevation 197.2 m to 197.6 m)

Groundwater

Groundwater levels encountered at the test hole locations and their vicinity are as follows:

SW-FN-7:	0.2 m to 0.3 m	(Elevation 194.2 m to 194.8 m)
SW-FN-8:	0.6 m to 1.2 m	(Elevation 189.8 m to 191.4 m)
SW-9:	0.3 m	(Elevation 195.5 m)
SW-10:	Ground surface	(Elevation 198.0 m)

5.5 I1-K2a / PIC# 3 – Still River (Drawing Sheets 7 and 8)

The alternative alignment (I1-K2a / PIC# 3) for the new Highway 69 located in the Henvey Township near Still River was investigated at three (3) locations in swamp areas as follows:

- SW-11 Station 10+371 Offset 0
- SW-12 Station 10+718 Offset 0
- SW-13 Station 10+980 Offset 0

All test holes for this location are listed in Table 2.

Ice and Water

The ground surface at SW-12 and SW-13 was covered by ice and water that extended to a depth of about 0.8 m (Elevation 186.1 m) in SW-12 and 0.8 m (Elevation 185.2 m) in SW-13. In the vicinity of SW-11 (i.e., SW-11(TP1) to SW-11(TP3)), ice and water was found at the ground surface and extended to a depth of about 0.2 m to 0.4 m (Elevation 191.6 m to 191.8 m).

Topsoil

At SW-11, the ground surface was covered by topsoil with a thickness of about 0.15 m (to Elevation 192.2 m).

Peat

At SW-12, a peat deposit was found underlying the ice and water and extended to a depth of about 1.4 m (Elevation 185.5 m). The peat is dark brown, fibrous and wet. The natural moisture content of the peat measured is 356 %.

Silty Sand

A silty sand deposit was encountered in SW-13A from the ground surface to a depth of about 1.5 m (Elevation 184.4 m). A 0.1 m thick silty sand, possibly a pocket, was found in SW-12 underlying the peat.

Clay and Silt

At SW-13A, clay and silt was found underlying the silty sand and extended to a depth of about 2.6 m (Elevation 183.3 m). The SPT 'N' value of the clay and silt measured is 5 blows per 0.3 m, indicating a firm consistency. The field vane strength measured is 110 kPa with a sensitivity of 2.9.

The results of the laboratory tests carried on a sample of the clay and silt are as follows:

Natural moisture content (%):	32
Liquid / Plastic Limits:	46 / 17
Grain size (one sample):	Gravel (%): 0
	Sand (%): 2
	Silt (%): 42
	Clay (%): 56

The grain size distribution curve is presented in Figure No. 8 and the liquid limit is plotted on the plasticity chart (Figure No. 4 in Appendix D).

Silt

A silt deposit was encountered underlying the silty sand pocket in SW-12 and underlying the clay and silt in SW-13A. The bottom of the silt deposit was found to be a depth of about 3.4 m (Elevation 183.5 m) in SW-12 and 3.5 m (Elevation 182.4 m) in SW-13A. The SPT 'N' values of the silt deposit measured are 4 and 5 blows per 0.3 m in SW-12 (soft to firm consistency) and greater than 50 blows per 0.3 m in SW-13A (very dense). The field vane shear strength measured in SW-12 is 48 kPa with a sensitivity of 1.9.

The results of the silt with clay found in SW-12 are as follows:

Natural moisture content (%):	26
Liquid / Plastic Limits:	25 / 15

Grain size (one sample):	Gravel (%):	0
	Sand (%):	12
	Silt (%):	63
	Clay (%):	25

The grain size distribution curve is presented in Figure No. 6 and the liquid limit is plotted on the plasticity chart (Figure No. 1 in Appendix D).

The results of the silt (non-plastic) found in SW-13A are as follows:

Natural moisture content (%):	23	
Grain size (one sample):	Gravel (%):	0
	Sand (%):	8
	Silt (%):	85
	Clay (%):	7

The grain size distribution curve is presented in Figure No. 6 in Appendix D.

Silty Clay

A silty clay deposit was encountered in SW-12 underlying the silt and extended to a depth of about 11.1 m (Elevation 175.8 m). The SPT 'N' values of the silty clay range generally from 0 to 3 blows per 0.3 m (very soft consistency) except a SPT value of 10 blows per 0.3 m (stiff consistency) measured near the top of the silty clay deposit. The two field vane shear strengths measured are 16 kPa (sensitivity of 1.5) and 21 kPa (sensitivity of 1.5).

The results of laboratory tests conducted on one sample are as follows:

Natural moisture content (%):	59
Liquid / Plastic Limits:	58 / 21
Grain size (one sample):	Gravel (%): 0
	Sand (%): 0
	Silt (%): 33
	Clay (%): 67

The grain size distribution curve is presented in Figure No. 8 and the liquid limit is plotted on the plasticity chart (Figure No. 5 in Appendix D).

Bedrock

The presence of bedrock or possible bedrock was confirmed at the investigated locations and their vicinity by refusal to borehole advance, dynamic cone penetration and / or test pit excavation. The bedrock / possible bedrock depths are:

SW-11:	0.2 m to 0.6 m	(Elevation 191.4 m to 192.2 m)
SW-12:	1.5 m to 14.6 m	(Elevation 172.3 m to 185.4 m)
SW-13:	2.5 m to 3.8 m	(Elevation 182.1 m to 183.3 m)

Groundwater

Groundwater levels encountered at the test hole locations and their vicinity are as follows:

SW-11:	Ground surface to 0.3 m	(Elevation 191.7 m to 192.0 m)
SW-12:	0.2 m	(Elevation 186.7 m)
SW-13:	Ground surface to 0.6 m	(Elevation 184.9 m to 185.9 m)

5.6 K2 Revised – Still River (Drawing Sheet 7)

The alternative alignment (K2 Revised) for the new Highway 69 located in the Henvey Township near Still River was investigated by one borehole (SW-14) located in a swamp area (Station 11+250, Offset 0). All test holes at this location are listed in Table 2.

Topsoil

The ground surface at SW-14 was covered with 0.1 m thick topsoil.

Silty Clay / Clayey Silt / Silt and Clay

The topsoil was underlain by silty clay / clayey silt / silt and clay deposits that extended to a depth of at least 11.1 m (Elevation 171.4 m) as confirmed by standard penetration testing. Below that depth, the silty clay / clayey silt / silt and clay deposits were likely present until Elevation 161.5 m or lower as indicated by dynamic cone penetration testing which measured 61 blows per 0.3 m at a depth of 21 m (Elevation 161.5 m). A pocket / seam of silty sand was encountered from a depth of about 3.7 m to 4.5 m (Elevation 178.1 m to 178.9 m).

The SPT 'N' values of the silty clay / clayey / silt and clay silt deposits generally range from 0 to 2 blows per 0.3 m, indicating a very soft consistency. However, higher SPT 'N' values were measured, i.e., 5 blows per 0.3 m (firm consistency) near the ground surface and 11 blows per 0.3 m (stiff consistency) at a depth of about 1.7 m and 4.5 m. The resistance to dynamic cone penetration gradually increases with depth. Cone resistances are higher than 30 blows per 0.3 m below a depth of about 17.4 m (Elevation 165.2 m) until the termination of dynamic cone

penetration testing at a depth of 21.0 m (Elevation 161.5 m) with a cone resistance of 61 blows per 0.3 m.

The field vane shear strengths measured range from 17 kPa to 27 kPa with a sensitivity range of 1.2 to 1.5.

The results of laboratory tests conducted on one sample of the silty clay / clayey silt are as follows:

Natural moisture content (%):	40
Liquid / Plastic Limits:	30 / 16
Grain size (one sample):	Gravel (%): 0
	Sand (%): 1
	Silt (%): 65
	Clay (%): 34

The grain size distribution curve is presented in Figure No. 8 and the liquid limit is plotted on the plasticity chart (Figure No. 1 in Appendix D).

The results of laboratory tests conducted on one sample of the silt and clay are as follows:

Natural moisture content (%):	70
Liquid / Plastic Limits:	44 / 17
Grain size (one sample):	Gravel (%): 0
	Sand (%): 2
	Silt (%): 49
	Clay (%): 49

The grain size distribution curve is presented in Figure No. 8 and the liquid limit is plotted on the plasticity chart (Figure No. 4 in Appendix D).

Silty Sand

A pocket / seam of silty sand was found within the silty clay / clayey silt / silt and clay deposits at a depth of about 3.7 m to 4.5 m (Elevation 178.1 m to 178.9 m).

The results of laboratory tests conducted are as follows:

Natural moisture content (%):	22
Grain size (one sample):	Gravel (%): 0
	Sand (%): 54
	Silt (%): 36
	Clay (%): 10

The grain size distribution curve is presented in Figure No. 7 in Appendix D.

Bedrock

Bedrock was confirmed by a test pit (SW-14 (TP)) excavated about 20 m west of SW-14. The bedrock is located at a depth of about 5.5 m (Elevation 177.1 m).

Groundwater

Groundwater was noticed in SW-14 at a depth of 2.6 m (Elevation 180.0 m), which may not be representative due to wash boring. Based on the change in soil color from brown to grey with depth, the groundwater level at the location of SW-14 should be at a depth of about 3 m (Elevation 179.5 m). In the test pit SW-14 (TP) located about 20 west of SW-14, groundwater was encountered at a depth of about 1.2 m (Elevation 181.4 m).

5.7 K2a / I1-K2a – Still River (Drawing Sheet 9)

The alternative alignments (K2a and I1-K2a) for the new Highway 69 located in the Henvey Township near Still River were investigated by one borehole (SW-15 for K2a) and two boreholes (SW-19 and SW-20 for I1-K2a) in swamp areas. The boreholes were located as follows:

- SW-15 Station 13+750 Offset 18.75 R
- SW-19 Station 16+163 Offset 18.75L
- SW-20 Station 16+163 Offset 18.75R

All test holes for this location are listed in Table 2.

Ice

The ground surface at SW-19 was covered with 0.2 m thick ice.

Topsoil

The ground surface at SW-15 was covered with topsoil, about 0.15 m thick.

Peat

Peat was found underlying the ice in SW-19 and at the ground surface at SW-20. The peat deposits extended to a depth of about 0.8 m (Elevation 188.0 m) at SW-19 and 0.8 m (Elevation 187.5 m) at SW-20. The peat is fibrous and wet.

Silty Clay / Clayey Silt

At SW-19 and SW-20, silty clay / clayey silt deposits were encountered underlying the peat and extended to a depth of about 2.9 m (Elevation 185.8 m) in SW-19 and 3.8 m (Elevation 184.5 m) in SW-20. The SPT 'N' values measured range from 9 to 23 blows per 0.3 m, indicating a stiff to very stiff consistency.

At SW-15, silty clay / clayey silt deposits were found underlying the topsoil and silt from a depth of about 1.5 m to 10.2 m (Elevation 172.2 m). The SPT 'N' values of the silty clay / clayey silt measured range from 2 to 4 blows per 0.3 m (very soft consistency), except for a SPT 'N' value of 10 blows per 0.3 m measured at a depth of about 1.8 m (stiff consistency). The field vane shear strengths are in the range of 10 kPa to 16 kPa with a sensitivity of 1.3 to 1.5.

The results of laboratory tests conducted on one sample are as follows:

Natural moisture content (%):	46
Liquid / Plastic Limits:	37 / 16
Grain size (one sample):	Gravel (%): 0
	Sand (%): 1
	Silt (%): 59
	Clay (%): 40

The grain size distribution curve is presented in Figure No. 8 and the liquid limit is plotted on the plasticity chart (Figure No. 4 in Appendix D).

Silt

At SW-15, silt was encountered underlying the topsoil and overlying the silty clay / clayey silt deposits at a depth of about 1.5 m (Elevation 180.9 m). The silt deposit was again found in SW-15 underlying the silty clay / clayey silt at a deeper depth of about 10.2 m and extended to at least a depth of about 11.7 m as confirmed by standard penetration testing.

At SW-19, silt was encountered underlying the silty clay / clayey silt and extended to a depth of about 4.7 m (Elevation 184.1 m).

The SPT 'N' values of the silt deposit vary from 4 to 6 blows per 0.3 m (soft consistency), except in SW-19 at a depth of about 4.7 m (Elevation 184.1 m) where a SPT 'N' value of more than 50 blows per 0.3 m is measured near the end of the borehole. The field vane shear strength measured is 17 kPa (sensitivity of 1.5) in SW-15 at a depth of about 11.6 m.

The results of laboratory tests conducted on three samples are as follows:

Natural moisture content (%):	20 to 29
Liquid / Plastic Limits:	16 to 23 / 13 to 14
Grain size (three samples):	Gravel (%): 0
	Sand (%): 11 to 22
	Silt (%): 58 to 74
	Clay (%): 8 to 20

The grain size distribution curves are presented in Figure No. 6 and the liquid limits are plotted on the plasticity chart (Figure Nos. 1 and 3 in Appendix D).

Bedrock

Bedrock or possible bedrock was indicated by refusal to borehole advance, dynamic cone penetration and / or test pit excavation. The depths to bedrock or possible bedrock in the vicinity of the boreholes are as follows:

SW-15:	possibly deeper than 20 m to 25 m (Elevation 157.2 m to 162.4 m)
SW-19:	4.7 m to 7.5 m (Elevation 181.2 m to 184.1 m)
SW-20:	2.3 m to 3.8 m (Elevation 184.5 m to 186.0 m)

Groundwater

Groundwater levels encountered at the test hole locations and their vicinity are as follows:

SW-15:	about 6 m (Elevation 176 m to 177 m) – may not be representative due to wash boring. (Based on the natural moisture contents of the soils which are higher than the liquid limits, the groundwater level should be close to the existing ground surface.)
SW-19:	2.4 m (Elevation 186.3 m)
SW-20:	1.1 m (Elevation 187.3 m)

5.8 K2a / I1-K2a – Straight Lake (Drawing Sheets 11 and 12)

The alternative alignments (K2a / I1-K2a) for the new Highway 69 at the proposed K2a Beckanon Interchange located in Henvey Township near Straight Lake were investigated by four (4) boreholes (SW-16 to SW-18 for K2a and SW-25 for I1-K2a) in swamp areas. The boreholes were located as follows:

- | | | |
|---------|----------------|---------------|
| • SW-16 | Station 19+170 | Offset 18.75R |
| • SW-17 | Station 19+675 | Offset 225L |
| • SW-18 | Station 10+096 | Offset 0 |
| • SW-25 | Station 19+700 | Offset 406L |

All test holes for this site are listed in Table 2.

Topsoil / Peat

The ground surface at SW-16 and SW-25 was covered by topsoil with a thickness of about 0.3 m and 0.5 m, respectively. The ground surface at SW-17 and SW-18 was covered by peat with a thickness of about 0.3 m.

Silty Sand / Silt / Sand / Sandy Silt

Deposits of silty sand / silt / sand were found underlying the topsoil in SW-16 to a depth of about 1.5 m (Elevation 190.4 m). Sandy silt was encountered in SW-17 underlying the peat and extended to a depth of about 2.3 m (Elevation 191.9 m). Silt was found in SW-18 from a depth of about 8.8 m (Elevation 185.6 m) to 10.2 m (Elevation 184.2 m).

In the vicinity of SW-25 at the location of SW-25(A) which was drilled 20 m west of SW -25, silt (plastic to non plastic) was encountered from the ground surface to 2.7 m depth (Elevation 189.5 m to 186.8 m) followed by silty sand / sandy silt to the borehole termination depth of 5.6 m (Elevation 183.9 m). Silty sand was also encountered in SW-25 (TP1) underlying silty clay in from a depth of about 2.6 m to 3.5 m and in SW-25 (TP3) underlying the topsoil from a depth of about 0.2 m to 2.5 m.

The SPT 'N' values are generally in the range of 3 to 14 blows per 0.3 m (stiff consistency / loose to compact relative density). A SPT 'N' value of more than 100 blows per 0.3 m (very dense relative density) is measured in the sand found in SW-16 at a depth of about 1.5 m (Elevation 190.4 m).

The results of laboratory tests conducted on four samples of silt are as follows:

Natural moisture content (%):	19 to 26
Liquid / Plastic Limits:	20 and 26 / 14 (one sample in SW-16 and one in SW-25 (A))
Grain size (two samples):	Gravel (%): 0 to 1 Sand (%): 15 to 24 Silt (%): 58 to 72 Clay (%): 10 to 25 Silt and clay (%): 76 in SW-25 (A) Sample SS3

The grain size distribution curves are presented in Figure No. 6 and the liquid limits are plotted on the plasticity chart (Figure Nos. 1 and 2 in Appendix D).

The results of laboratory tests conducted on a sample of silty sand are as follows:

Natural moisture content (%):	25
Grain size:	Gravel (%): 0 Sand (%): 66 Silt and clay (%): 34

The grain size distribution curve is presented in Figure No. 7 in Appendix D.

Silty Clay / Clayey Silt / Silt and Clay

In SW-18, silty clay / clayey silt / silt and clay deposits were encountered underlying the surficial peat deposits and extended to a depth of about 8.8 m (Elevation 185.6 m). In SW-17, silty clay / clayey silt was encountered underlying sandy silt from a depth of 2.3 m to 9.6 m (Elevation 184.5 m).

In SW-25, silty clay was encountered from a depth of about 0.5 m to 0.8 m (Elevation 186.9 m). However in SW-25 (TP1) located about 20 m south of SW-25, silty clay was encountered underlying the topsoil and extended to a depth of about 2.6 m (Elevation 184.4 m). In SW-25 (TP3), silty clay was encountered underlying silty sand from a depth of 2.5 m to 7.6 m (Elevation 181.0 m).

The SPT 'N' values measured range from 2 to 15 blows per 0.3 m, indicating a very soft to stiff consistency. The field vane shear strengths measured vary from 20 kPa to 50 kPa with a sensitivity range of 2.1 to 4.0, except at a depth of about 2.4 m in SW-18 where the vane shear strength exceeds 120 kPa (sensitivity of 5.4).

The results of laboratory tests are as follows:

Natural moisture content (%):	37 to 85
Liquid / Plastic Limits:	38 to 60 / 16 to 22
Grain size (five samples):	Gravel (%): 0
	Sand (%): 1 to 4
	Silt (%): 29 to 57
	Clay (%): 39 to 70

The grain size distribution curves are presented in Figure No. 8 and the liquid limits are plotted on the plasticity chart (Figure Nos. 4 and 5 in Appendix D).

Bedrock

The presence of bedrock or possible bedrock in the vicinity of the boreholes was identified by refusal to borehole advance, dynamic cone penetration and / or test pit excavation. The depths to bedrock or possible bedrock are as follows:

SW-16:	1.2 m to 2.0 m	(Elevation 189.4 m to 191.2 m)
SW-17:	9.8 m	(Elevation 184.4 m)
SW-18:	10.2 m	(Elevation 184.2m)
SW-25:	ground surface to 6.1 m	(Elevation 181.5 m to 189.7 m)

Groundwater

Groundwater levels encountered at the test hole locations and their vicinity are as follows:

SW-16:	1.0 m to 1.5 m	(Elevation 189.9 m to 191.4 m)
SW-17:	0.6 m to 2.0 m	(Elevation 192.1 m to 193.5 m)
SW-18:	1.4 m to 5.5 m	(Elevation 189.8 m to 193.0 m)
SW-25:	0.6 m to 2.9 m	(Elevation 185.0 m to 187.6 m)

5.9 I1-K2a / PIC# 3 – Bekanon Road (Drawing Sheet 10)

Two locations (SW-21 and SW-22) were investigated for the I1-K2a alternative route (according to the Terms of Reference). Another two locations (SW-FN-23 and SW-FN-24) were planned for the PIC# 3 alternative route (according to the Terms of Reference). However, the two locations were located in the Henvey Inlet First Nation land and permission to enter the land for drilling was not granted. The two locations (SW-FN-23 and SW-FN-24) were therefore cancelled by MTO from the investigation program. The test holes investigated were located as follows:

- SW-21 Station 17+525 Offset 18.75R
- SW-22 Station 17+746 Offset 18.75L

All test holes for this site are listed in Table 2.

Topsoil

The locations of SW-21 and SW-22 were covered with topsoil. The thickness of the topsoil was approximately 0.2 m at SW-21 and 0.1 m at SW-22.

Bedrock

The topsoil was underlain by bedrock in both locations (SW-21 and SW-22).

At SW-21, bedrock was found at a depth of about 0.2 m below the existing grade (Elevation 193.7 m). Bedrock at shallow depths in the vicinity of SW-21 was confirmed in SW-21 (TP1) and SW-21 (TP2).

At SW-22, the topsoil was underlain by rock fragments to a depth of about 0.4 m (Elevation 189.3 m) below which solid bedrock was encountered. Bedrock at shallow depths in the vicinity of SW-22 was confirmed in SW-22 (TP1) and SW-22 (TP2).

Groundwater

Groundwater was not encountered at both locations.

6.0 DISCUSSIONS AND RECOMMENDATIONS

The current foundation investigation discussed in this report is the second foundation investigation for the Highway 69 Route Selection Study. The first investigation was carried out by Trow Associates Inc. (ref. Trow Report - brge00140201a dated 12 September 2005 – Swamp Crossings). The borehole locations investigated in the current investigation program were specified by MTO's Terms of Reference as listed in Table 1 (Appendix A). The discussions and recommendations provided herein are therefore site specific that are applicable only to the locations investigated. Furthermore, the details of the new highway design at all the swamp locations investigated are not available at the time of report preparation. The recommendations provided in this report are therefore preliminary and general in nature.

For swamp crossings, it is considered that highway embankments will be constructed by filling portions of the swamps such that a new Highway 69 can be built. Topographic contour maps and the design profile grades of the new Highway 69 at all the swamp locations investigated are not available for information at the time of report preparation, except the design profile grades of PIC # 3 Route Revised and K2 Route in the Henvey Township. The discussions and recommendations provided in this report are therefore concentrated on embankment construction across swamps, where applicable. In general, embankments should be designed following to the requirements shown in Ontario Provincial Standard Drawing (OPSD – 203.010) – Embankments Over Swamp – New Construction. Accordingly, a 2H:1V earth embankment or a 1.25H:1V rock embankment can be constructed over a swamp after excavating incompetent soil in the swamp and backfilling with “competent” soil up to a depth of about twice the height of the embankment. The “competent” soil for supporting the fill embankment would, in general, be engineered fill consisting of fill soils that can be compacted to a minimum of 95 % Standard Proctor Maximum Dry Density, or equivalent (e.g., rock fill).

Shallow bedrock has been found in some borehole locations investigated. New highway pavement structure can be constructed over the bedrock with or without a fill embankment, depending on the final design grade. In a few borehole locations, deep deposits of incompetent soils (e.g., very soft to soft silty clay, loose sand, etc.) have been found. Such incompetent soil deposits are not suitable for highway construction and ground improvement methods should be considered. The ground improvement method that is likely to be successful at each specific site is discussed in the following sections, where applicable.

6.1 Embankment Design

The following discussions and recommendations are provided for each location specified in the Terms of Reference (Table 1 in Appendix A). The heights of fill embankment at these locations, if required, are generally not known at the time of preparing this report.

6.1.1 Shawanaga - New Shebeshekong Road Interchange (Drawing Sheets 1 and 2)

The four (4) borehole locations, i.e., SW-1, SW-2, SW-FN-3 and SW-FN-4, are shown in the aerial photograph mosaic (prepared by McCormick Rankin Corporation dated 25 November 2005) to be located in swamp areas that are not interconnected. The soil conditions in the four borehole locations are therefore quite variable.

The design profile grades at the interchange and its vicinity are not available for information at the time of preparing this report.

SW-1 (Station 14+354)

The soil profile encountered consisted of 0.2 m thick ice overlying peat, compact silty sand, and very dense sand and gravel, in descending order. The sand and gravel was underlain by possible bedrock at a depth of about 4.8 m below the existing grade. The compact silty sand is however considered to be unsuitable for supporting a road embankment due to a low SPT 'N' value of 11 blows per 0.3 m measured. The presence of bedrock in the vicinity of SW-1 was confirmed by test pits at SW-1 (TP1) to SW-1 (TP3) where bedrock was found at a depth of less than 4.8 m below the existing grade. The peat, approximately 1 m in thickness, and the silty sand / sandy silt should be removed and a soil / rock fill embankment can be constructed on the bedrock. Granular backfill should be used after removing the incompetent soils under the water in the swamp or dewatering should be implemented in order to properly compact the backfill soils. The construction of fill embankment, if required, should follow the recommendations provided in Section 6.2.

SW-2 (Station 14+750)

The soil profile encountered consisted of 0.30 m thick ice and water overlying sand and silty sand / sandy silt deposits. The upper 2 m of the sandy / silty deposit was in a loose condition while the lower 3 m of the deposit was in a compact condition with relatively low SPT 'N' values of 11 and 13 blows per 0.3 m. However, Borehole SW-2A drilled in the vicinity of SW-2 encountered a loose silty sand / sandy silt with a thickness of about 7 m, overlying a firm silty clay with a thickness of about 1 m. The loose sand / silty sand / sandy silt soils and the firm silty clay would cause high settlement or slope instability of a fill embankment. These soils should be excavated, possibly up to 8 m in depth, and replaced with an engineered fill / rock fill. The high water level will have to be lowered for the construction of engineered fill. Otherwise, rock / granular fill under water after removing the loose sandy / silty soils and firm silty clay should be considered. Ground improvement methods (e.g., vibro-flotation, dynamic compaction, etc.) may also be considered in order not to remove a thick deposit of loose sandy / silty soils. The construction of fill embankment, if required, should follow the procedures recommended in Section 6.2.

SW-FN-3 (Station 15+704)

At the location of SW-FN-3, bedrock was found at a depth of about 0.3 m below the existing grade. In the vicinity of SW-FN-3, bedrock was also found at the ground surface in SW-FN-3 (TP2), at a depth of about 0.4 m below the existing grade in SW-FN-3 (TP1), and at a depth of about 1.1 m in SW-FN-3A. However, a peat deposit, up to about 4.6 m in thickness, was encountered in SW-FN-3B, overlying a compact to dense sand deposit that extended to the borehole termination depth of 10 m. The peat overlying the shallow bedrock and the 4.6 m deep peat deposit found in SW-FN-3B need to be removed and replaced with rock fill or engineered fill. Fill embankment can then be constructed on the rock fill or the bedrock, if required. The high water level will have to be lowered by proper dewatering in order to construct an engineered fill or backfilling with rock / granular fill under water will be required. Fill embankment, if required, should be constructed according to the recommendations provided in Section 6.2.

SW-FN-4 (Station 16+500)

The soil conditions at SW-FN-4 comprised 0.2 m thick topsoil overlying compact to dense sand overlying compact to dense sand. However, at a depth of about 3.2 m below the existing grade, a loose sand deposit was encountered. Such a loose deposit was confirmed by the dynamic cone penetration testing at SW-FN-4 (DCPT) conducted near SW-FN-4. Furthermore, a possible loose deposit was also found in SW-FN-4 (DCPT) at depths ranging from about 6 m to 8 m below the existing grade. As a minimum, the upper 4 m of the sand silt should be removed and replaced with rock / granular backfill or engineered fill in order to support a fill embankment. The water level is at the existing ground surface and needs to be lowered to a minimum of 0.6 m below the bottom of the excavation prior to backfilling in order to construct the engineered fill. Fill embankment, if required, should be constructed according to the recommendations provided in Section 6.2.

6.1.2 Township of The Archipelago (Drawing Sheet 3)

The design profile grades at this location are not available for information at the time of preparing this report.

One borehole, SW-5, was drilled at Station 21+852. The soil profile consisted of 1.4 m thick peat overlying very loose silty sand to a depth of about 2 m below the existing grade. Bedrock could exist at a depth of about 2.2 m below the existing grade. Dynamic cone penetration testing conducted at SW-5 (DCPT) near SW-5 confirmed the presence of possible bedrock at a depth of about 2.9 m below the existing grade.

The peat and the very loose silty sand should be removed to the possible bedrock or competent soil subgrade located at a depth of 2 m to 3 m below the existing grade. Rock fill or engineered fill should be used to construct the highway embankment. Water level is near the existing

.../...

ground surface and dewatering will be required to construct the engineered fill which should consist of granular soils compacted according to the recommendations provided in Section 6.2.

6.1.3 Wallbridge Township - Harris Lake Road Interchange (Drawing Sheet 4)

The design profile grades at this location are not available for information at the time of preparing this report.

One test hole, SW-6, was located at Station 11+712. The test hole location was covered with ice and water to a depth of about 0.9 m, at which depth bedrock was confirmed. Bedrock at a depth of about 0.9 m underneath ice and water, or bedrock at the ground surface, was confirmed in the vicinity of SW-6 by test pits.

Rock fill or engineered fill can be supported by the bedrock. Dewatering will be necessary for the construction of engineered fill below the water level. The engineered fill should preferably consist of granular fill compacted according to the recommendations provided in Section 6.2.

6.1.4 Wallbridge Township / Magnetawan First Nation – Highway 529 Interchange (Drawing Sheets 5 and 6)

The Highway 529 Interchange was investigated at four locations (SW-FN-7, SW-FN-8, SW-9 and SW-10). The design profile grades are not available for information at the time of preparing this report. It should be noted that fill embankment, if required, should be constructed according to the recommendations provided in Section 6.2.

SW-FN-7 (Station 20+150)

At SW-FN-7, bedrock was found underlying a thin layer of topsoil. In the vicinity of SW-FN-7, bedrock was exposed at the ground surface (SW-FN-7 (TP1) and SW-FN-7 (TP2)) and possible bedrock was located at a depth of about 0.5 m to 1.2 m below the existing grade as encountered in SW-FN-7A to SW-FN-7C. The topsoil and overburden soil overlying the bedrock / possible bedrock should be removed and backfilled with rock fill or granular engineered fill in order to support the road embankment.

SW-FN-8 (Station 20+976)

At SW-FN-8, bedrock was encountered underlying a thin layer of topsoil. In the vicinity of SW-FN-8, bedrock / possible bedrock was identified at a depth ranging from 0.3 m to 1.7 m below the existing ground surface. The topsoil and overburden soil overlying the bedrock / possible bedrock should be removed and backfilled with rock fill or granular engineered fill in order to support the road embankment.

SW-9 (Station 22+326)

At SW-9, bedrock was confirmed underneath a 0.7 m thick ice and water layer. Bedrock was visible in the vicinity of SW-9. Rock fill should be placed under the water or granular engineered fill should be constructed with dewatering in order to support the road embankment.

SW-10 (Station 22+600)

At SW-10, bedrock was confirmed underlying topsoil and peat with a total thickness of about 0.8 m. In the vicinity of SW-10, bedrock underlying peat was confirmed to be at a depth ranging from 0.4 m to 0.6 m below the existing ground surface. The peat and any overburden soil overlying the bedrock should be removed and backfilled with rock fill or granular engineered fill in order to support the road embankment.

6.1.5 I1-K2a / PIC# 3 – Still River (Drawing Sheets 7 and 8)

Three locations (SW-11 to SW-13) were investigated for the alternative alignments of the new Highway 69.

SW-11 (Station 10+371)

According to the design profile grades, the design low point elevation is at Elevation 188.385 m. The existing ground elevations at SW-11 and its vicinity are about Elevation 192 m. The existing grades would therefore be cut by about 2 m to 4 m. However, the water level was measured to be at about Elevation 192 m. The design profile grades should therefore be revised in order to avoid the high water level in this area or drainage should be provided.

At the location of SW-11, bedrock was confirmed to be underneath 0.15 m thick topsoil. In the vicinity of SW-11, bedrock was confirmed underneath an ice and water layer at a depth ranging from 0.3 m to 0.6 m below the existing ground surface. A thin peat deposit was found overlying the bedrock in the vicinity of SW-11 at SW-11 (TP1). The topsoil and peat should be removed and backfilled with rock / granular fill to support the road embankment. Excavation of the bedrock would likely require impact hammers and / or blasting.

SW-12 (Station 10+718)

Based on the design profile, the design grade at SW-12 is in the order of Elevation 191 m. The existing ground elevations at SW-12 and its vicinity are at about Elevation 187 m. The existing grades would therefore be raised by about 5 m.

The soil profile at SW-12 consisted of ice and water overlying peat, loose silty sand, soft to firm silt, and very soft silty clay, in descending order, to a depth of about 13 m below the existing ground surface. Competent soil for a road embankment was found below a depth of about 13 m

confirmed by DCPT which measured 80 blows per 0.3 m or higher. At the location SW-12 (TP) near SW-12 which was excavated at an offset of 10 m north and 35 m west of SW-12, bedrock was confirmed to be at a depth of about 1.5 m below the existing grade. The peat, very loose silty sand and very soft silty clay soils are not suitable to support a road embankment and should be removed to a depth of about 13 m and backfilled with rock / granular fill in order to support the road embankment. It should be noted that the existing very soft silty clay from a depth of about 3.4 m to 12.0 m would not be capable of supporting any embankment that is higher than 2 m to 3 m without slope instability and / or significant settlement. Ground improvement of the very soft silty clay that requires a high embankment, e.g., preloading with or without prefabricated vertical drains, is unlikely to be successful.

After removing the incompetent soils up to 13 m below the existing grades and backfilling with rock / granular fill, the existing grades may be raised to the design grades by rock fill or engineered fill embankment. The embankment should be constructed according to the recommendations provided in Section 6.2. The total thickness of the fill embankment and the backfill at the location of SW-12 could be about 18 m to 20 m. Settlements of the fill and backfill rocks / soils could range from 0.2 m to 1.0 m, depending on the backfilling and compacting procedures. The fill and backfill rocks / soils should be left to settle for at least 6 months prior to paving the highway surface.

SW-13 (Station 10+980)

According to the design profile, the design grade at SW-13 is at Elevation of about 196 m. The existing grades at SW-13 and its vicinity are at about Elevation 186 m. The existing grades will therefore be raised by about 10 m.

The location at SW-13 was covered by a 0.8 m deep ice and water layer. At SW-13A, the soil profile consisted of silty sand overlying firm clay and silt and very dense silt deposits. Competent soil, i.e., very dense silt, was found at a depth of about 3 m below the existing ground surface / water level. All soils located above a depth of about 3 m should be removed and backfilled with rock / granular fill in order to support a road embankment.

The embankment construction should follow the recommendations provided in Section 6.2. Settlements of the 10 m high fill embankment constructed over 3 m thick backfill rock / granular soils would be in the range of 0.1 m to 0.5 m, depending on the backfilling and compacting procedures. The fill and backfill rocks / soils should be left to settle for at least 6 months prior to paving the highway surface in order to reduce the post-construction settlement.

6.1.6 K2 Revised – Still River (Drawing Sheet 7)

Based on the design profile, the design grade of the highway is at Elevation of about 198 m. The existing grade at the borehole (SW-14) drilled at this location is at Elevation of about 183 m. The existing grade will therefore be raised by about 15 m.

One location, i.e., SW-14 at Station 11+250, was drilled. The soil profile consisted of a thin layer of topsoil overlying a thick layer of very soft silty clay / clayey silt / silt and clay deposits, except the top 2 m which may be effected by freezing temperature. The soft clayey layer extended to a depth of about 17 m below the existing ground surface where a thick layer of competent soil, possibly clayey soil, was identified with a resistance to dynamic cone penetration of more than 30 blows per 0.3 m. The very soft silty clay / clayey silt / silt and clay deposits are not capable of supporting any high embankment and should be removed and replaced with rock / granular backfill in order to support the road embankment. Ground improvement of the very soft clayey deposits that requires a high embankment, e.g., preloading with or without prefabricated vertical drains, is unlikely to be successful.

A highway bridge structure may be required at the location of SW-14, instead of constructing a 15 m high embankment with a 17 m deep excavation to replace the poor native soils.

6.1.7 K2a / I1-K2a – Still River (Drawing Sheet 9)

Three locations (SW-15, SW-19 and SW-20) were investigated at this section of the proposed Highway 69. SW-19 and SW-20 were located approximately 37 m apart at the same station (Station 16+163).

Based on the design profile, the design grade at SW-15 is at Elevation of about 195 m while the design grade at SW-19 and SW-20 is at Elevation of about 194 m. The existing ground elevations at SW-15 and its vicinity are at Elevation of about 182 m and those at SW-19 and SW-20 are at Elevations 188 m to 189 m. The existing grades at these locations will therefore be raised approximately by 13 m at SW-15 and 5 m to 6 m at SW-19 and SW-20.

SW-15 (Station 13+750)

The soil profile at SW-15 consisted of a thin layer of topsoil overlying silt / silty clay / clayey silt that extended to a depth of at least 20 m below the existing ground surface. The upper 16 m of the silt / silty clay / clayey silt deposits is very soft to firm in consistency. The presence of the very soft to firm silty clay to a depth of about 15 m is confirmed at another borehole location (SW-15A). The very soft to firm clayey / silty deposits are not likely to be capable of supporting an embankment with a height of more than 2 m without slope instability or significant settlement. Nevertheless if such a low embankment is to be built, the existing clayey / silty deposits should be improved prior to supporting any road embankment. Preloading with prefabricated vertical drains should be considered. The height of the preloading embankment and the duration of the preloading should be investigated in detail. The depth of the prefabricated drains should be in the order of 16 m and the duration for preloading should not be less than 6 months.

It should be noted that if the existing site grade has to be raised by about 13 m at this location, a highway bridge structure should be considered instead of a rock fill or earth fill embankment.

SW-19 and SW-20 (Station 16+163)

The soil profile at SW-19 and SW-20 consisted of ice / peat overlying firm to stiff silty clay / clayey silt / silt that extended to a depth of about 3.8 m to 4.7 m where possible bedrock was encountered. The bedrock / possible bedrock was identified to be at a depth ranging from about 2.3 m to 7.5 m in the vicinity of the two boreholes. However, competent soil strata suitable for supporting a road embankment are located about 0.5 m to 1.5 m above the bedrock / possible bedrock. The peat and the firm clayey / silty soils should be removed to a depth ranging from 1.5 m to 4 m below the existing ground / water surface and backfilled with rock / granular fill in order to support a road embankment. A 5 m to 6 m high embankment can then be constructed in accordance with the recommendations provided in Section 6.2. The embankment settlements could range from 0.025 m to 0.050 m, depending on the actual construction procedures.

6.1.8 K2a / I1-K2a – Straight Lake (Drawing Sheets 11 and 12)

Four locations (SW-16 to SW-18 and SW-25) were investigated at this section of the new Highway 69.

According to the design profile, the design grade is approximately at Elevation 197 m at SW-16, while the design profiles at the other investigated locations are not available at the time of preparing this report. The existing ground surface at SW-16 and its vicinity is approximately at Elevation 192 m. A raise in the existing grades of about 5 m will therefore be required.

SW-16 (Station 19+170)

The soil profile at SW-16 consisted of topsoil overlying silty sand / silt / sand deposits that extended to a depth of about 1.5 m below the existing ground surface. Bedrock was confirmed to be at a depth ranging from 1.2 m to 2.0 m in the vicinity of SW-16. The sandy / silty deposits located at about 1 m depth overlying the bedrock should be capable of supporting a road embankment. For a 5 m high road embankment, the overburden soils above the bedrock should be removed and backfilled with rock / granular fill in order to support the road embankment in accordance with the recommendations provided in Section 6.2. The settlement of the 5 m high embankment could be in the range of 0.025 m to 0.05 m.

SW-17 (Station 19+675)

The soil profile at SW-17 comprised peat overlying compact sandy silt and very soft to stiff silty clay / clayey silt. The stiff silty clay / clayey silt should be capable of supporting a road embankment up to 3 m in height without failure, although road settlement may be high due to the high natural moisture content which is at or higher than the liquid limit of the soil. As a minimum, the upper 4 m of the existing soils should be removed and backfilled with rock /

granular fill in order to support a road embankment. Slope stability and settlement analyses should be carried out in order to design the road embankment.

SW-18 (Station 10+096)

The soil profile at SW-18 consisted of a thin peat deposit overlying a thick layer of very soft silt and clay to a depth of about 8.8 m below the existing ground surface, except at the top 4 m where firm silt and clay was encountered. A compact silt deposit was found underlying the silt and clay and overlying a possible bedrock at a depth of about 10.2 m. The presence of a thick layer of clayey soil (silty clay) was confirmed in SW-18 (TP1) and SW-18 (TP2). The very soft silt and clay is not capable of supporting a road embankment and should be removed and backfilled with rock / granular fill. Ground improvement that requires a high embankment for preloading with or without prefabricated vertical drains is unlikely to be successful.

SW-25 (Station 19+700)

At the location of SW-25, possible bedrock was encountered at a depth of about 0.8 m, underlying topsoil and silty clay. At SW-25A, silt and silty sand / sandy silt overlying possible bedrock at a depth of about 5.6 m was encountered. The upper 3 m of the silt and silty sand / sandy silt was in a firm consistency and considered to be unsuitable for supporting a road embankment. Bedrock / possible bedrock in the vicinity of SW-25 vary from the ground surface to more than 7.6 m in depth. As a minimum, the upper 3 m of the existing soils should be removed and backfilled with rock / granular fill or engineered fill in order to support a road embankment. For a road embankment that is more than 3 m in height, deeper removal of incompetent soil may be necessary in order to support the road embankment on bedrock / possible bedrock.

6.1.9 I1-K2a / PIC# 3 – Bekanon Road (Drawing Sheet 10)

Two borehole locations were investigated, i.e., SW-21 at Station 17+525 and SW-22 at Station 17+746. Based on the design profile, the design grade is approximately Elevation 201 m at SW-21 and Elevation 202 m at SW-22. The existing grade is approximately Elevation 194 m at SW-21 and Elevation 190 m at SW-22. The existing grades will therefore be raised by about 7 m to 12 m.

At both locations, bedrock was found at a depth of about 0.2 m to 0.4 m below the existing grade, underlying a thin layer of topsoil and rock fragments (found only in SW-22). Bedrock was found at a maximum depth of about 0.5 m below the existing grade in the vicinity of the two boreholes.

The topsoil should be removed and fill embankment can be constructed on the bedrock. The fill embankment should be constructed according to the recommendations provided in Section 6.2.

The settlement of the embankment should be in the range of 0.05 m to 0.10 m, depending on the actual construction procedures.

6.2 Embankment Construction

All organic matters, peat and other unsuitable soils should be removed, as per Ministry of Transportation of Ontario's current practice, with an envelope given by a gradient not steeper than 1H:1V away from the toe of the proposed embankment. For above water construction, the exposed subgrade should be inspected, approved and properly compacted from the surface, to a minimum of 95 % Standard Proctor Maximum Dry Density (SPMDD), under the supervision of qualified foundation personnel. Any soft spots identified during stripping and/or recompacting should be sub-excavated and replaced with compacted engineered fill. Care should be exercised to minimize disturbance to the subgrade during preparation and the construction of embankment. For under water construction, all organic matters / peat and /or soft / loose soils should be removed and backfilled with rock / granular soils until the backfill level is above the water level. Otherwise, dewatering is required for placing an engineered fill.

For an engineered fill, the fill materials used for construction of the conventional earth fill embankment, or for the purposes of backfilling, should consist of approved, clean earth fill (e.g. Select Subgrade Materials – Ontario Provincial Standards Specifications Number: 1010). The fill may be imported for this purpose or the excavated soils may be reused provided that they do not contain organic matters and can be compacted to the specifications. The fill materials should be placed in accordance with Ontario Provincial Standards Specifications Number: 501. Each lift should not exceed 300 mm before compaction and each lift should be uniformly compacted to at least 95 % of the Standard Proctor Maximum Dry Density (SPMDD) of the materials. The degree of compaction within the top 0.6 m of the fill (i.e., the subgrade immediately beneath the granular sub-base) should be increased to 98 % SPMDD. The selection, placement and compaction of the fill should be carried out under a foundation control program.

Provided that all surficial organic matters / peat, loose / very soft soils, and otherwise unsuitable materials are removed and the subgrade is properly compacted from the surface as detailed above, the total long-term settlement of the foundation materials (including the settlement of the embankment material under its own weight) should be relatively small. The actual amount of long-term settlement will depend on the subgrade conditions and the height of the embankment.

For the fill embankment at this site, using properly compacted and acceptable inorganic fill material, the side slopes should not be steeper than 2H:1V for earth fill embankment and 1.25H:1V for rock fill embankment. Proper erosion control measures should be implemented both during construction and on a permanent basis. This can be achieved by immediate seeding or sodding (Ontario Provincial Standards Specification Number: 572) or equivalent.

The slope in front of swamps will have to be protected against erosion due to possible current and ice movement.

The time rate of settlement of the fill forming the embankment will depend on the material used for construction. For granular fills, the fill settlement should substantially be completed during the construction or within a few weeks thereafter (i.e. should be essentially elastic). Clayey fill materials can be expected to consolidate over a longer period of time.

7.0 SUGGESTED FURTHER INVESTIGATION

Based on the field observation of the existing ground conditions along the proposed alignments of the new Highway 69, a number of locations should be further investigated for the route selection study or detailed design as suggested in Table 3 (Appendix A). It should be noted that only the locations that may be swamps near the locations investigated in this study are mentioned. The actual swamps are difficult to identify in some areas during winter as they are covered with ice and / or snow. The suggested locations for further investigation are therefore limited to the areas that appear to be swamps during this investigation and no previous investigation has been carried out by Trow Associates Inc. (ref. brge00140201a dated 12 September 2005).

8.0 CLOSURE

The sub-soil information and recommendations contained in this report should be used solely for the purpose of preliminary foundation assessment of this site.

AMEC should be retained to review the recommendations provided in this report, once the details of the development are finalized and prior to the final design stage of the project.

The attached Report Limitations is an integral part of this report.

Sincerely,

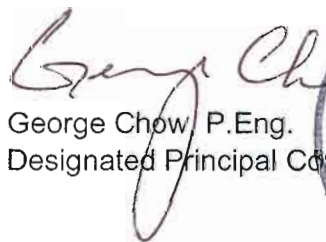
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REPORT LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the testhole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the testholes.

The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC Earth & Environmental accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

APPENDIX A

TABLES

TABLE 1
BOREHOLE LOCATIONS AS PROVIDED IN THE TERMS OF REFERENCE BY MTO (SWAMP AREAS)

BOREHOLE NUMBER	Township	Approx. STATION	Approx. OFFSET	Approx. Northing	Approx. Easting	Swamp Type	Estimated Borehole Depth (m) (depth to competent material/refusal/ bedrock)	Notes
SW - 1	SHAWANAGA	14+354	0	5043482	245843	Major-Unconfirmed	10	CL
SW - 2	SHAWANAGA	14+750	18.75R	5043746	245551	Major	10	NBL
SW-FN-3	SHAWANAGA (First Nation)	15+704	0	5044340	244802	Major	15	CL
SW-FN-4	SHAWANAGA (First Nation)	16+500	0	5044960	244306	Major	15	CL
SW - 5	THE ARCHIPELAGO	21+852	18.75L	5053999	235423	Minor	10	SBL
SW - 6	WALLBRIDGE	11+712	143R	5061773	230933	Major	10	Interchange Ramp
SW-FN-7	WALLBRIDGE (First Nation)	20+150	0	5069523	227601	Major-Unconfirmed	15	CL
SW-FN-8	WALLBRIDGE (First Nation)	20+976	18.75R	5070337	227454	Major-Unconfirmed	10	NBL
SW - 9	WALLBRIDGE	22+326	0	5071629	227083	Major-Unconfirmed	10	CL
SW - 10	WALLBRIDGE	22+600	18.75R	5071867	226943	Major-Unconfirmed	10	NBL
SW - 11	I1-K2a, PIC# 3	10+371	0	5073159	225316	Major-Unconfirmed	10	CL
SW - 12	I1-K2a, PIC# 3	10+718	0	5073243	224977	Major-Unconfirmed	10	CL
SW - 13	I1-K2a, PIC# 3	10+980	0	5073255	224715	Major-Unconfirmed	10	CL
SW - 14	K2 Revised	11+250	0	5074246	225320	Major-Unconfirmed	10	CL
SW - 15	K2a	13+750	18.75R	5076366	224063	Major-Unconfirmed	15	NBL
SW - 16	K2a	19+170	18.75R	5080589	222900	Major-Unconfirmed	10	NBL
SW - 17	K2a	19+675	225 L	5081130	222832	Major-Unconfirmed	10	Interchange Ramp
SW - 18	K2a	10+096	0	5081689	223250	Major-Unconfirmed	10	CL
SW - 19	I1-K2a	16+163	18.75L	5077729	223379	Major-Unconfirmed	10	SBL
SW - 20	I1-K2a	16+163	18.75R	5077744	223416	Major-Unconfirmed	10	NBL
SW - 21	I1-K2a	17+525	18.75R	5078983	222851		10	NBL
SW - 22	I1-K2a	17+746	18.75L	5079177	222734		10	SBL
SW -FN-23	PIC#3 (First Nation)	18+157	40L	5079601	221985	Major-Unconfirmed	10	Interchange Ramp
SW-FN-24	PIC#3 (First Nation)	18+627	76L	5080069	221964	Major	15	Interchange Ramp
SW - 25	I1-K2a	19+700	406L	5081204	222668	Major-Unconfirmed	10	Service Road

**TABLE 2
TEST HOLES INVESTIGATED IN SWAMP AREAS**

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
Shawanaga	SW-1 SW-1 (TP1) SW-1 (TP2) SW-1 (TP3)	14+354	0	0.5 – 1.2	Not encountered	0.5 – 4.8	1
Shawanaga	SW-2 SW-2(A) SW-2 (TP)	14+750	18.75 R	0 – 1.2	0 – 8.4	2.6 – 9.8	1
Shawanaga First Nation	SW-FN-3 SW-FN-3(A) SW-FN-3(B) SW-FN-3 (TP1) SW-FN-3 (TP2)	15+704	0	0 – 4.6	0 – 4.6	0 – 10	1
Shawanaga First Nation	SW-FN-4 SW-FN-4 (DCPT)	16+500	0	0 – 0.2	Not encountered	9.6 – 10.2	2

TABLE 2 (Continued)
TEST HOLES INVESTIGATED IN SWAMP AREAS

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
The Archipelago	SW-5 SW-5 (DCPT)	21+852	18.75L	0 – 1.4	2.0 – 2.4	2.2 – 2.9	3
Wallbridge	SW-6 SW-6 (TP1) SW-6 (TP2) SW-6 (TP3)	11+712	143R	Not encountered	Not encountered	0 – 0.9	4
Wallbridge First Nation	SW-FN-7 SW-FN-7(A) SW-FN-7(B) SW-FN-7(C) SW-FN-7 (TP1) SW-FN-7 (TP2)	20+150	0	0 – 0.3	0 – 0.6	0 – 1.2	5

TABLE 2 (Continued)
TEST HOLES INVESTIGATED IN SWAMP AREAS

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
Wallbridge First Nation	SW-FN-8 SW-FN-8(A). SW-FN-8(B) SW-FN-8(C) SW-FN-8 (TP1) SW-FN-8 (TP2) SW-FN-8 (TP3)	20+976	18.75R	0.1 – 0.8	0 – 0.8	0.1 – 1.7	5
Wallbridge	SW-9 SW-9 (TP1) SW-9 (TP2)	22+326	0	Not encountered	Not encountered	0 – 0.7	6
Wallbridge	SW-10 SW-10 (TP1) SW-10 (TP2) SW-10 (TP3) SW-10 (TP4)	22+600	18.75R	0.4 – 0.8	0.4 – 0.8	0.4 – 0.8	6

TABLE 2 (Continued)
TEST HOLES INVESTIGATED IN SWAMP AREAS

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
I1-K2a PIC #3	SW-11 SW-11 (TP1) SW-11 (TP2) SW-11 (TP3)	10+371	0	0.2 – 0.6	0 – 0.6	0.2 – 0.6	7
I1-K2a PIC #3	SW-12 SW-12 (TP)	10+718	0	0 – 1.4	0 - 12	1.5 – 14.6	8
I1-K2a PIC #3	SW-13 SW-13(A) SW-13 (DCPT) SW-13 (TP)	10+980	0	0 – 0.6	0 – 2.6	2.5 – 3.8	8
K2 Revised	SW-14 SW-14 (TP)	11+250	0	0.1 – 0.6	17	5.5 - 21	7
K2a	SW-15 SW-15(A)	13+750	18.75R	0.2	14 - 16	19.8 – 25.3	9

TABLE 2 (Continued)
TEST HOLES INVESTIGATED IN SWAMP AREAS

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
K2a	SW-16 SW-16 (TP1) SW-16 (TP2) SW-16 (TP3)	19+170	18.75R	0.3 – 0.4	0 – 0.6	1.2 – 2	11
K2a	SW-17 SW-17 (TP)	19+675	225L	0.3	0 - 4	8 – 9.8	11
K2a	SW-18 SW-18 (TP1) SW-18 (TP2)	10+096	0	0.3	0.3 – 8.8	8 – 10.2	11
I1-K2a	SW-19 SW-19 (DCPT) SW-19 (TP)	16+163	18.75L	0.4 – 0.8	0 – 5.2	4.7 – 7.5	9
I1-K2a	SW-20 SW-20 (DCPT)	16+163	18.75R	0.8	0.8 – 2.2	2.4 – 3.8	9

TABLE 2 (Continued)
TEST HOLES INVESTIGATED IN SWAMP AREAS

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
I1-K2a	SW-21 SW-21 (TP1) SW-21 (TP2)	17+525	18.75R	0.2 – 0.3	Not encountered	0.2 – 0.3	10
I1-K2a	SW-22 SW-22 (TP1) SW-22 (TP2)	17+746	18.75L	0.1 – 0.5	Not encountered	0.2 – 0.5	10
PIC#3	SW-FN-23 (Cancelled)	18+157	40L	-	-	-	10
PIC#3	SW-FN-24 (Cancelled)	18+627	76L	-	-	-	10

TABLE 2 (Continued)
TEST HOLES INVESTIGATED IN SWAMP AREAS

Township	Test Hole Designations	Station (km)	Offset (m)	Approximate Peat / Topsoil Thickness (m)	Approximate Depth to Bottom of Soft / Loose* Deposit (m)	Approximate Depth to Possible Bedrock (m)	Drawing Sheet No.
I1-K2a	SW-25 SW-25(A) SW-25 (DCPT) SW-25 (TP1) SW-25 (TP2) SW-25 (TP3)	19+700	406L	0 – 0.5	2.7 – 6.1	0 – >6.1	11

* - “soft / loose” means “incompetent to support embankment”

Notes:

- SW-X denotes Borehole No. X for a swamp area as specified by the Terms of Reference (Table 1 in Appendix A).
- SW-FN-X denotes Borehole No. X for a swamp area as specified by the Terms of Reference that is located in the First Nation’s land.
- SW-X (A) denotes Borehole No. X (A) for a swamp area that was drilled in addition to the borehole (SW-X) specified by the Terms of Reference.
- SW-X (TP) denotes a test pit for a swamp area that was in addition to the specified borehole (SW-X).
- SW-X (DCPT) denotes a dynamic cone penetration test for a swamp area that was in addition to the specified borehole (SW-X).

**TABLE NO. 3
SWAMP LOCATIONS FOR FURTHER INVESTIGATIONS**

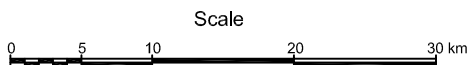
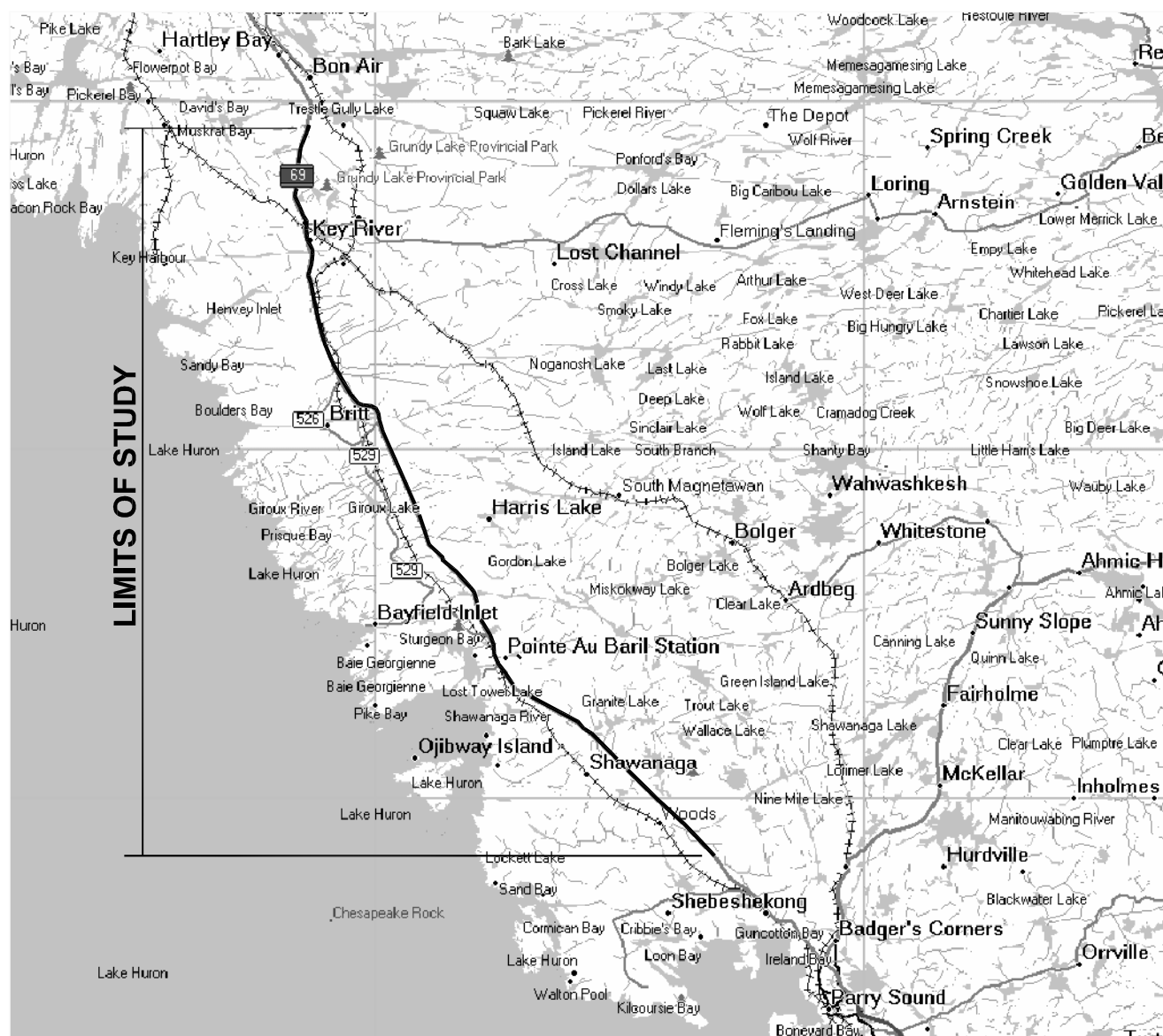
Township	Location	Proposed Borehole No.	Station ¹	Offset ¹	Coordinates ¹		Estimated Depth of Boreholes (m) ²
					Northing	Easting	
Shawanaga First Nation	North of Rock Island Lake	SW-FN-A	16+360	246 L	5044843	244142	10
Wallbridge	North of Harris Lake Road Interchange	SW-B	12+111	43.4 R	5062090	230675	10
Wallbridge	North of Harris Lake Road Interchange	SW-C	14+483	40 R	5064290	229802	5
Magnetawan First Nation	South of Magnetawan River	SW-D	20+715	55 (L)	5070077	227433	10
Henvey Inlet First Nation	South of Key River North of Straight Lake	SW-FN-E	12+400	0	5083886	222669	10
Mowat	South of Clear Lake	SW-F	13+200	0	5087101	221502	10



¹ Station, Offset and Coordinates are approximate and are taken from the digital drawing of the proposed route provided by MTO

² Depths of the proposed boreholes are approximate

APPENDIX B

FIGURES AND DRAWINGS



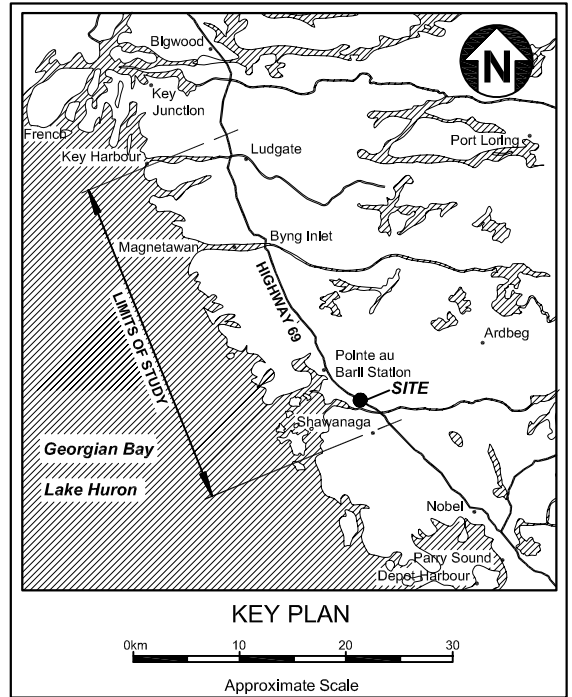
AMEC Earth & Environmental a Division of AMEC Americas Limited 104 Crockford Blvd, Scarborough, Ontario, M1R 3C3				MINISTRY OF TRANSPORTATION ONTARIO MTO GEOCREs No. 41H-58	
TITLE SITE MAP		DWN BY: KW	DATUM: NAD83	DATE: March 2006	
PROJECT FOUNDATION INVESTIGATION FOR HIGHWAY 69 ROUTE SELECTION STUDY Parry Sound, Ontario		CHK'D BY: PB	REV. NO.: A	PROJECT NO: TT53126	
		PROJECTION: MTM Zone 10	SCALE: AS SHOWN	FIGURE No. 1	

METRIC
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AGREEMENT No.
5005-E-0033
G.W.P. No.
5377-02-00
FOUNDATION INVESTIGATION FOR
HIGHWAY 69 ROUTE SELECTION STUDY
STA 14+300 TO STA 15+800

SHEET
1

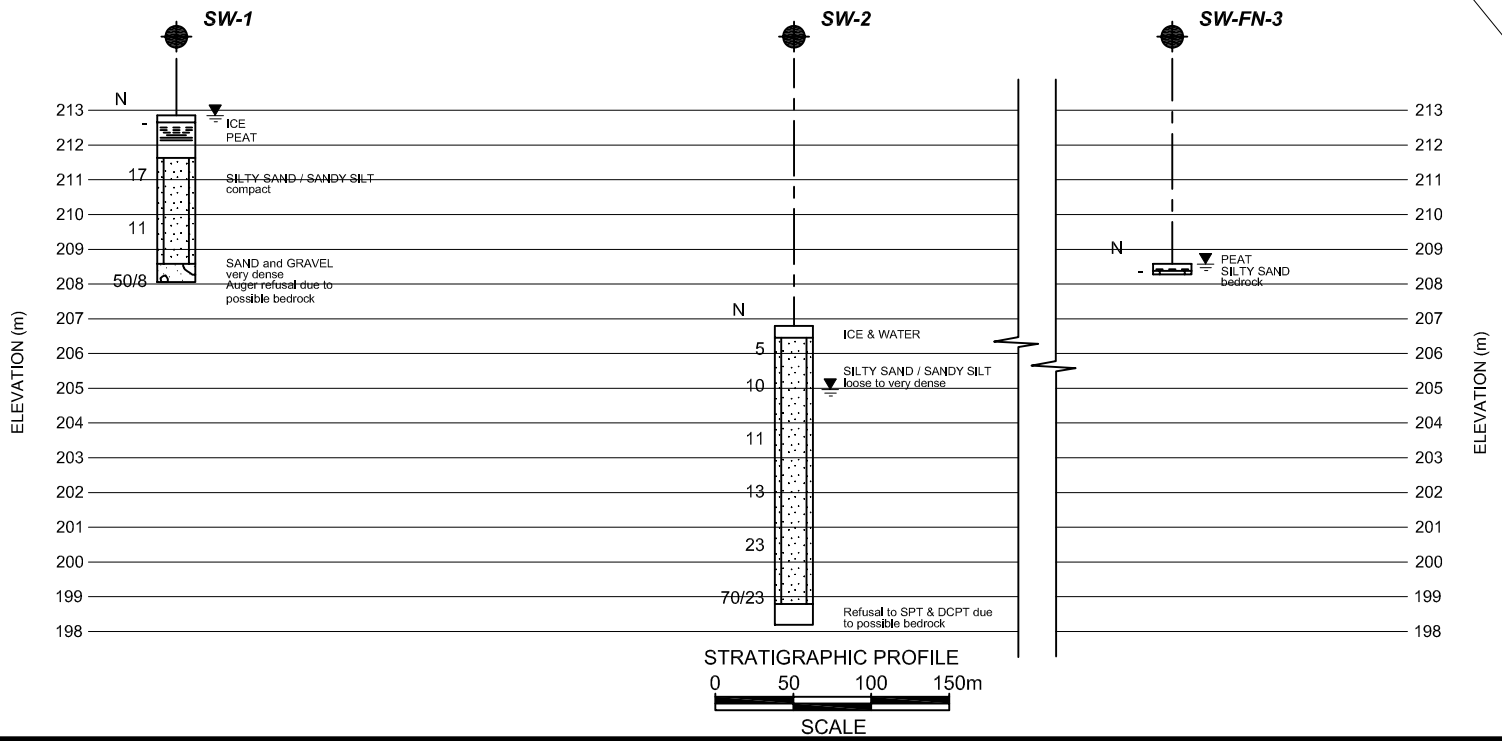
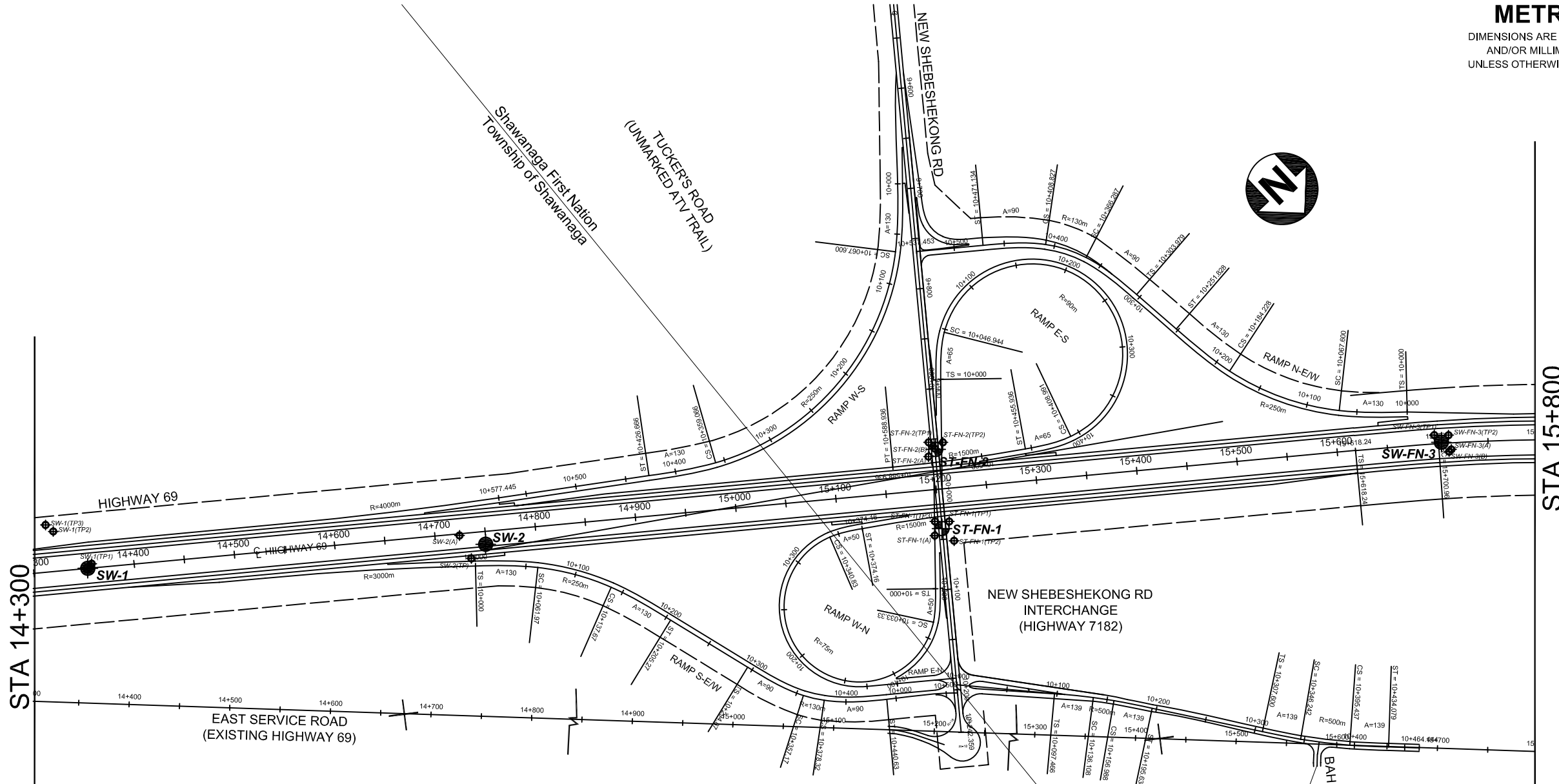
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- LEGEND**
- BOREHOLE IN STRUCTURAL AREA
 - BOREHOLE IN SWAMP AREA
 - (TP) - TEST PIT
 - (A) - ADDITIONAL BOREHOLE

BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-1	5043482	245843	212.85
SW-1(TP1)	5043482	245837	212.80
SW-1(TP2)	5043432	245837	212.00
SW-1(TP3)	5043422	245837	212.00
SW-2	5043746	245551	206.79
SW-2(TP)	5043740	245571	206.79
SW-2(A)	5043736	245581	206.80
SW-FN-3	5044340	244802	208.58
SW-FN-3(TP1)	5044330	244802	208.20
SW-FN-3(TP2)	5044340	244792	208.20
SW-FN-3(A)	5044352	244800	208.00
SW-FN-3(B)	5044352	244803	208.00

NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.





SHAWANAGA
FIRST NATION

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STA 15+800 TO STA 17+300
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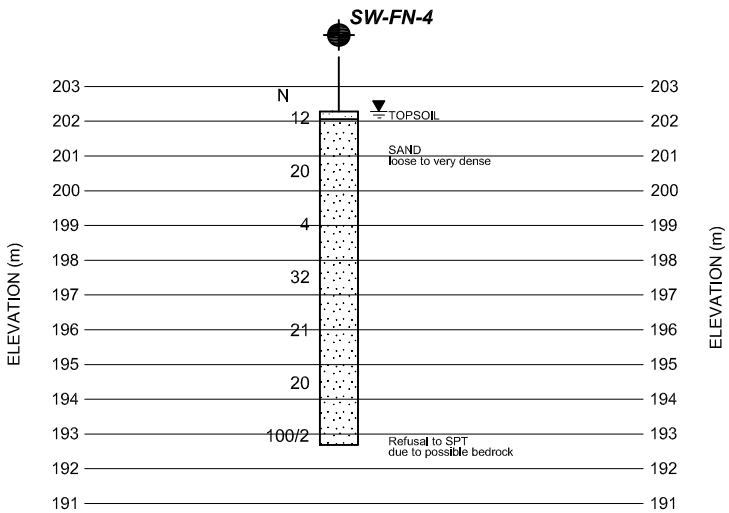
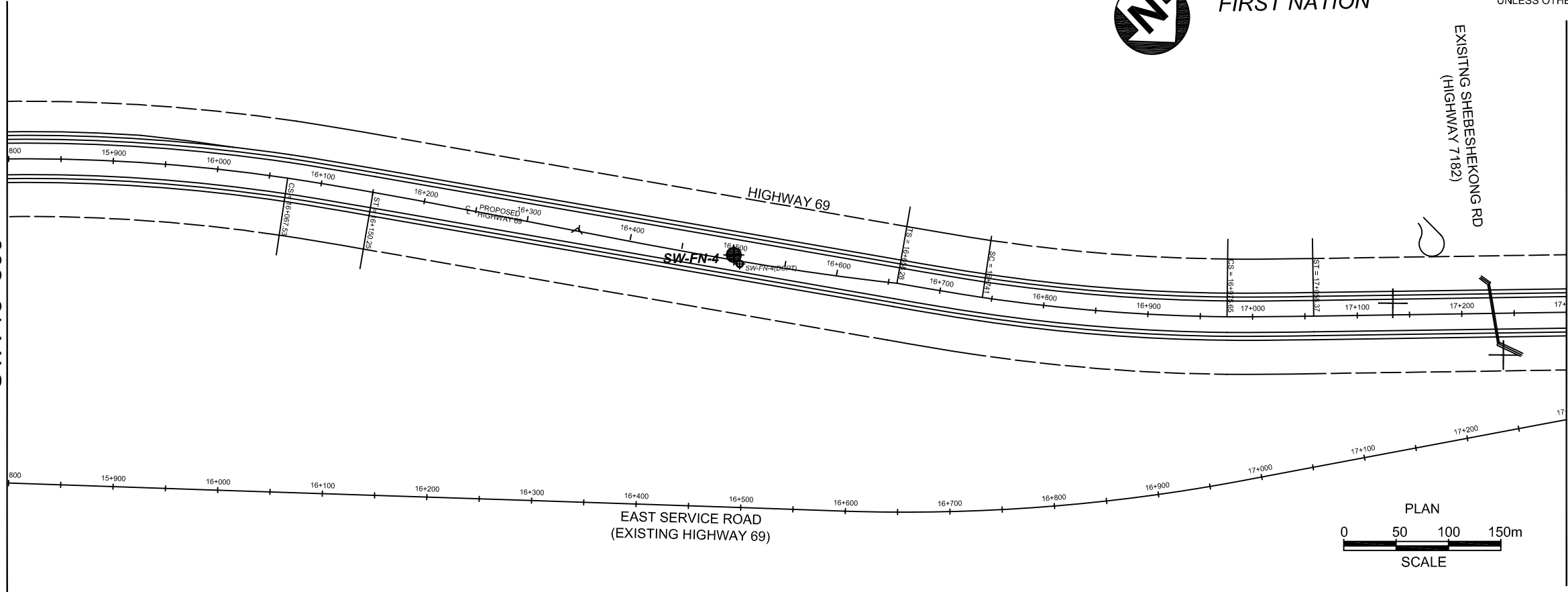


SHEET
2

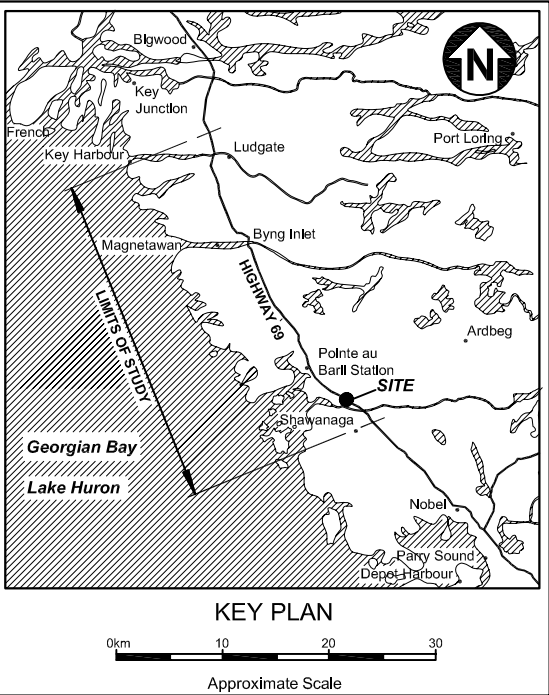
STA 15+800

STA 17+300

EXISTING SHEBESHEKONG RD
(HIGHWAY 7182)



STRATIGRAPHIC PROFILE
0 10 20 30m
SCALE



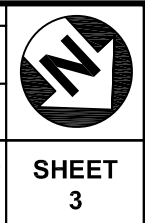
LEGEND			
	BOREHOLE IN STRUCTURAL AREA		
	BOREHOLE IN SWAMP AREA		
	(DCPT) - DYNAMIC CONE PENETRATION TEST		
BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-FN-4	5044960	244306	202.29
SW-FN-4(DCPT)	5044970	244308	202.20

NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.

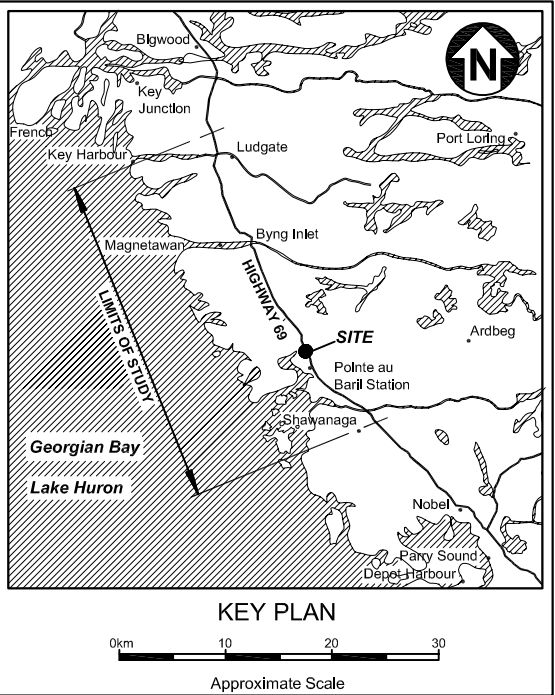


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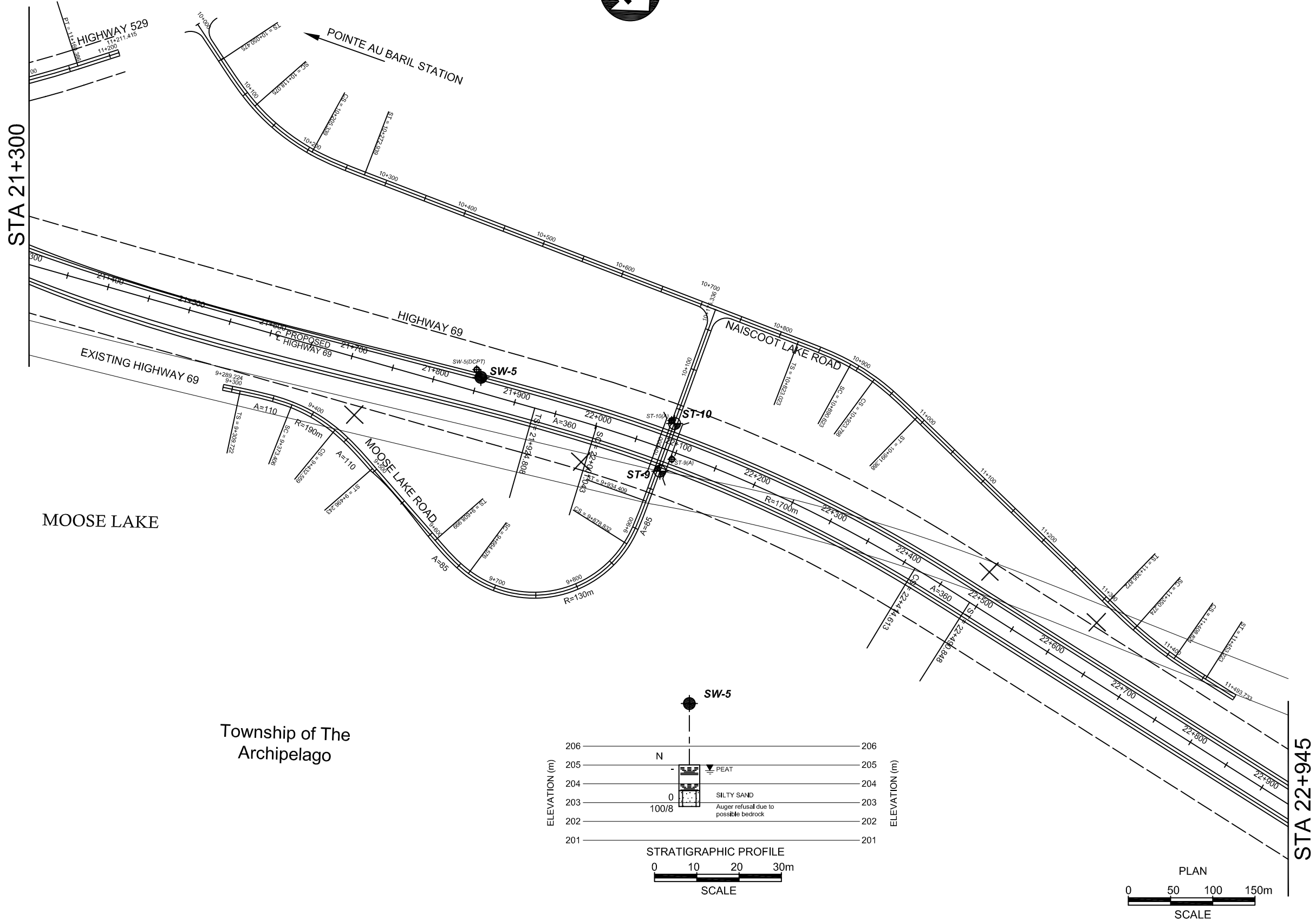
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5005-E-0033
G.W.P. No.
5377-02-00
FOUNDATION INVESTIGATION FOR HIGHWAY 69 ROUTE SELECTION STUDY
STA 21+300 TO STA 22+945



SHEET
3

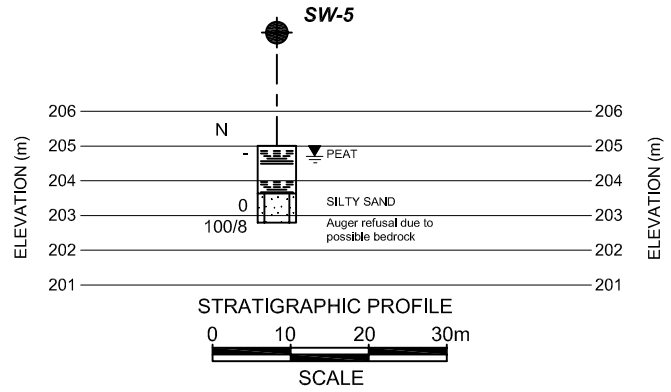


LEGEND			
	BOREHOLE IN STRUCTURAL AREA		
	BOREHOLE IN SWAMP AREA		
	(DCPT) - DYNAMIC CONE PENETRATION TEST		
BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-5	5053999	235423	205.01
SW-5(DCPT)	5053985	235420	205.00



MOOSE LAKE

Township of The Archipelago



NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.

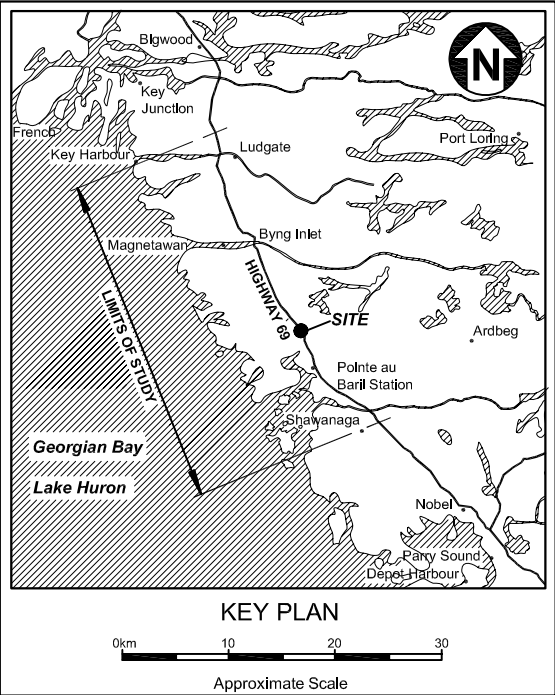
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METRIC
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G.W.P. No.
5377-02-00
FOUNDATION INVESTIGATION FOR
HIGHWAY 69 ROUTE SELECTION STUDY
STA 10+700 TO STA 12+325

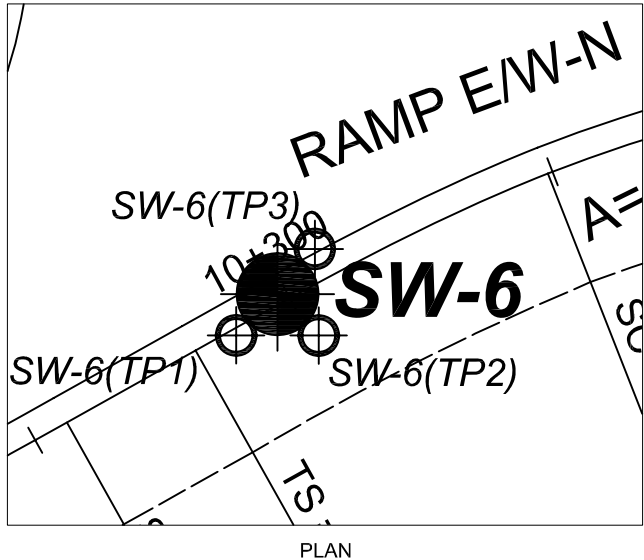
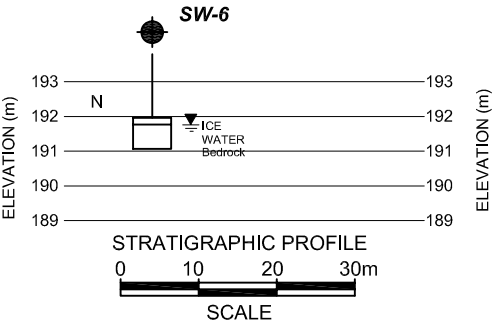
SHEET
4

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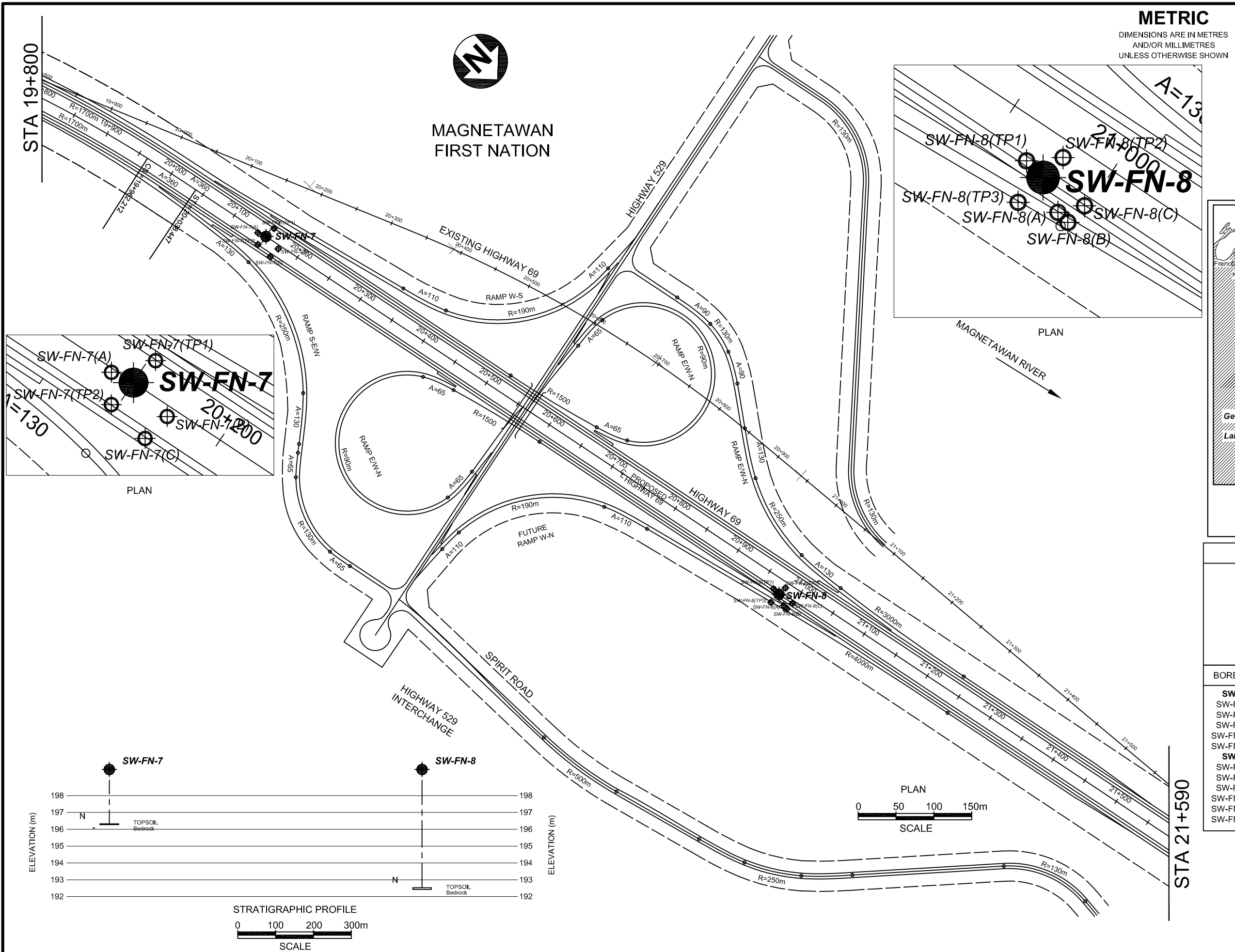


- LEGEND**
- BOREHOLE IN STRUCTURAL AREA
 - BOREHOLE IN SWAMP AREA
 - (TP) - TEST PIT

BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-6	5061773	230933	191.96
SW-6(TP1)	5061773	230943	191.96
SW-6(TP2)	5061783	230933	194.06
SW-6(TP3)	5061772	230923	190.86



NOTES
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refer to AMEC's report. Ref.: TT53126-Structures.



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5377-02-00

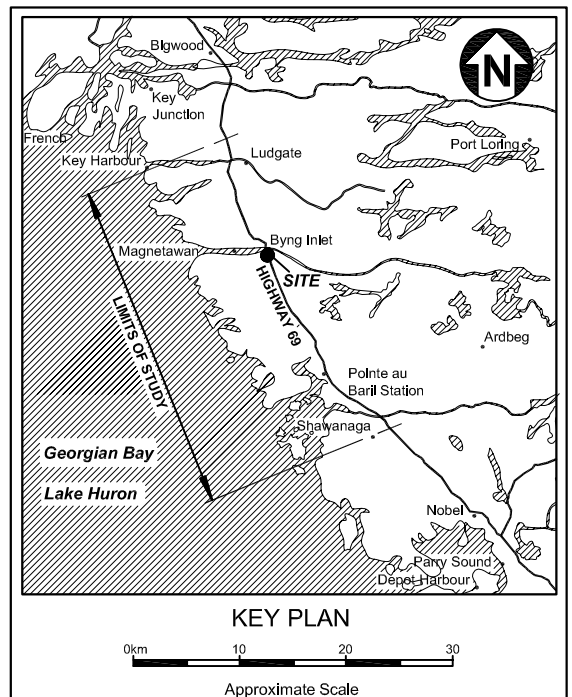
FOUNDATION INVESTIGATION FOR
HIGHWAY 69 ROUTE SELECTION STUDY

STA 19+800 TO STA 21+590



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SHEET
5




LEGEND

 BOREHOLE IN STRUCTURAL AREA

 BOREHOLE IN SWAMP AREA

 (TP) - TEST PIT

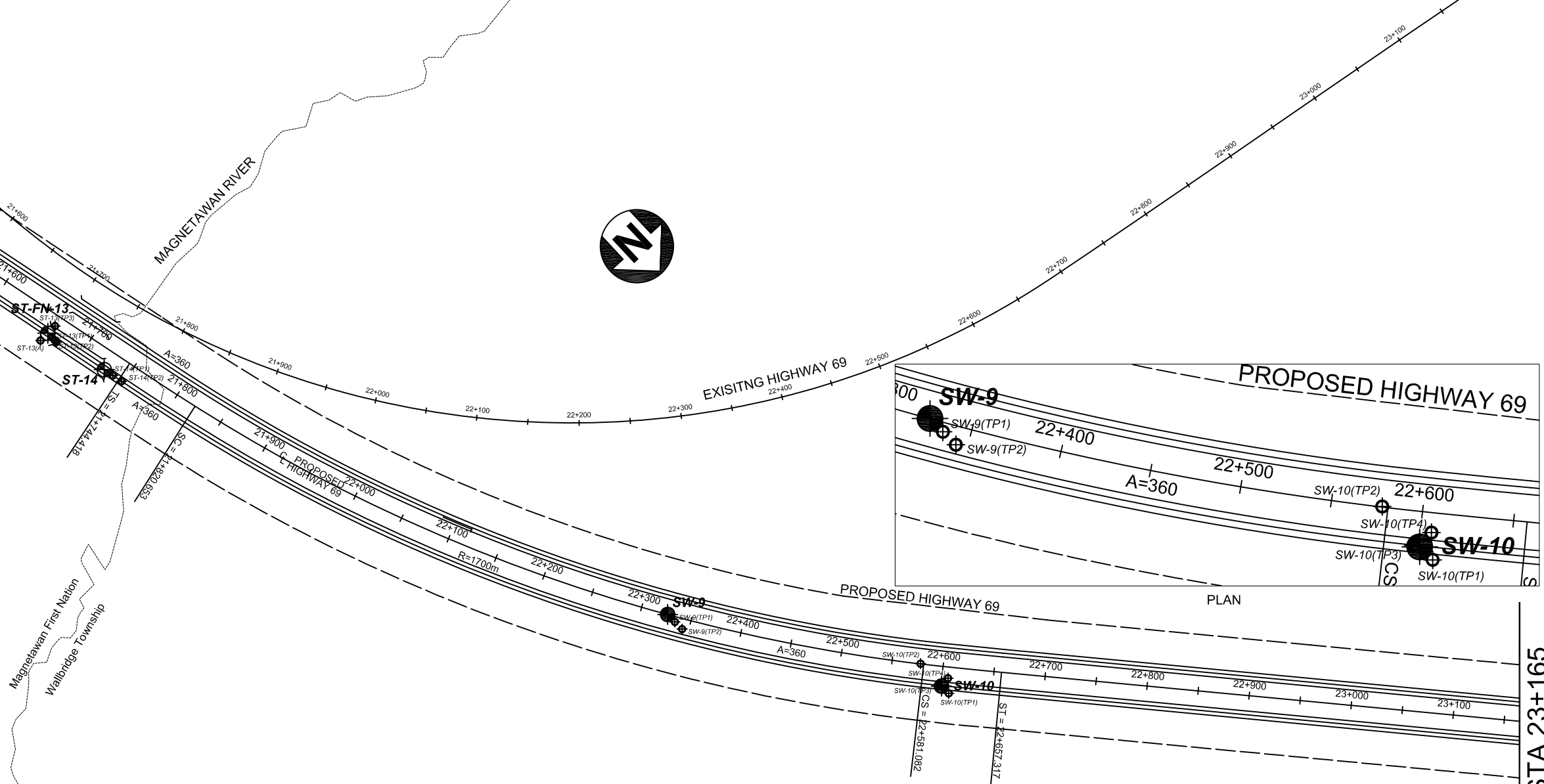
 (A) - ADDITIONAL BOREHOLE

BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-FN-7	5069523	227601	196.33
SW-FN-7(A)	5069512	227605	194.55
SW-FN-7(B)	5069546	227601	195.00
SW-FN-7(C)	5069546	227616	195.00
SW-FN-7(TP1)	5069523	227586	196.80
SW-FN-7(TP2)	5069523	227616	195.80
SW-FN-8	5070337	227454	192.53
SW-FN-8(A)	5070352	227460	191.14
SW-FN-8(B)	5070358	227460	191.00
SW-FN-8(C)	5070358	227450	190.20
SW-FN-8(TP1)	5070327	227454	193.20
SW-FN-8(TP2)	5070337	227442	192.00
SW-FN-8(TP3)	5070337	227469	193.41

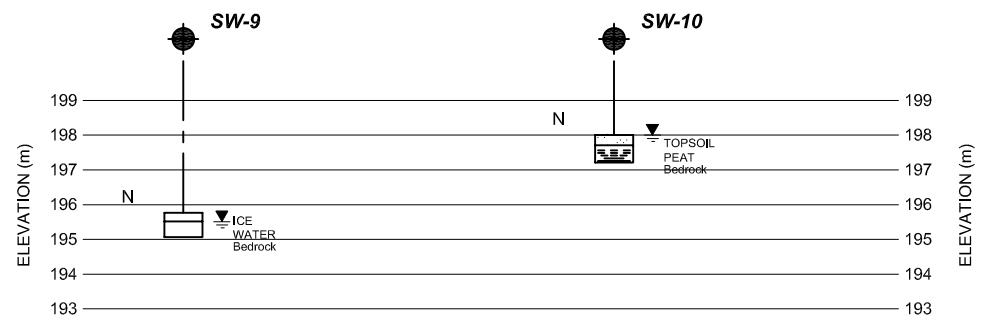
NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.

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STA 21+590



Magnetawan First Nation
Wallbridge Township



STRATIGRAPHIC PROFILE
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SCALE

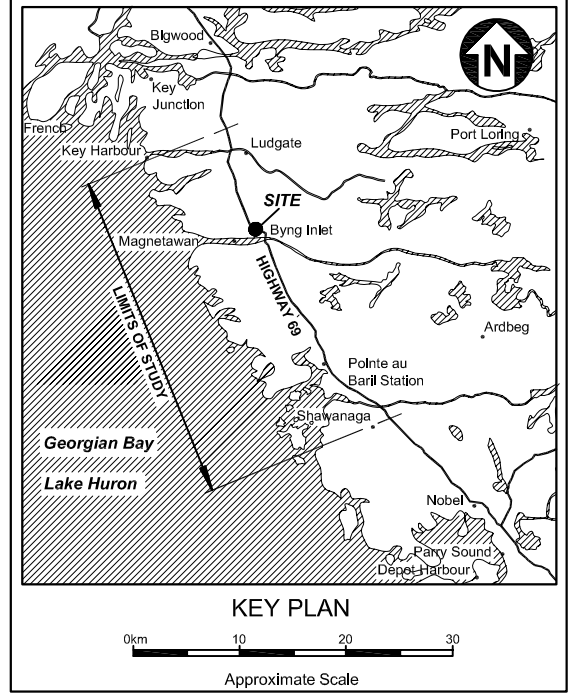
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5377-02-00
FOUNDATION INVESTIGATION FOR HIGHWAY 69 ROUTE SELECTION STUDY
STA 21+590 TO STA 23+165



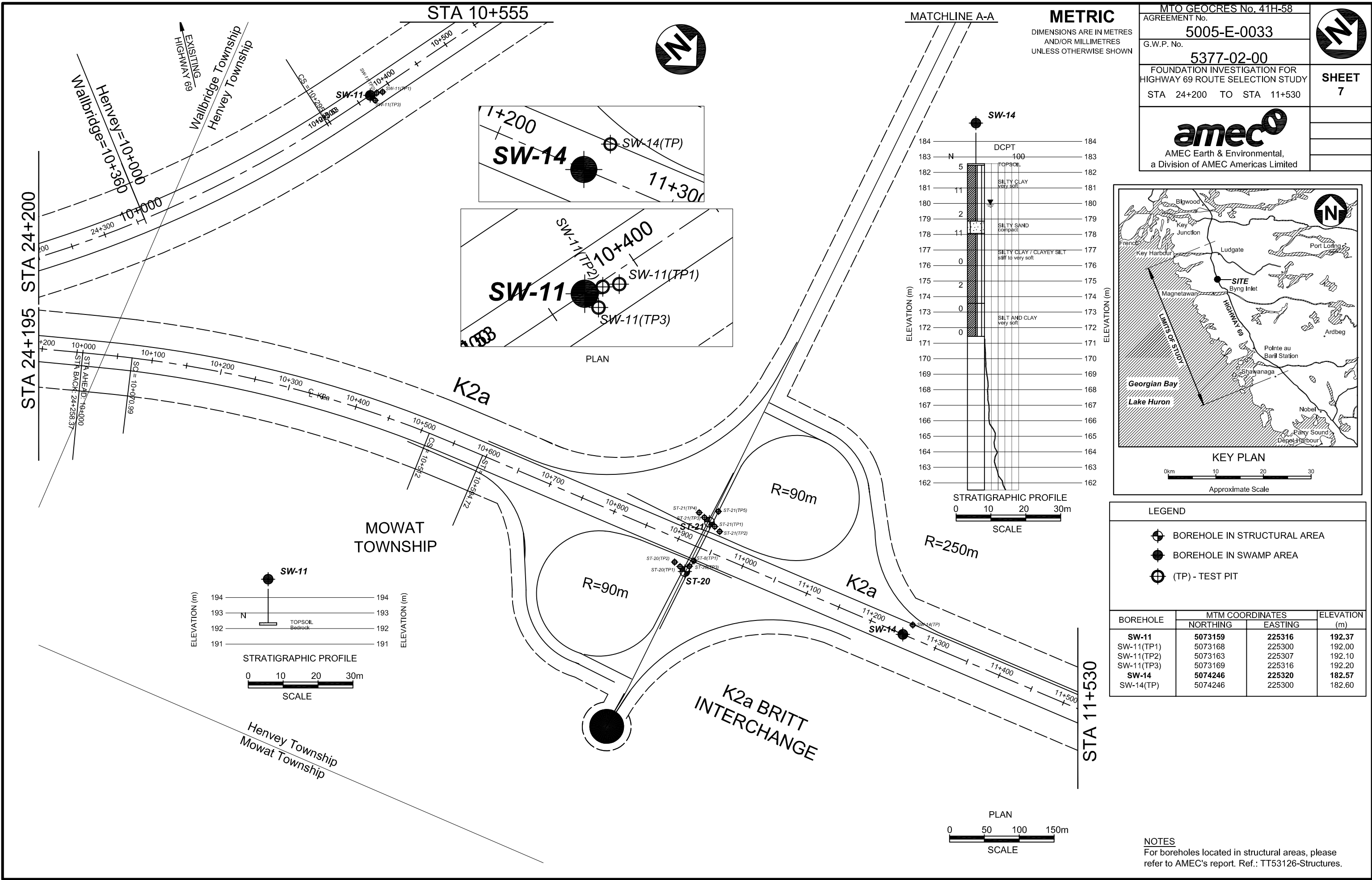
SHEET
6

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LEGEND			
	BOREHOLE IN STRUCTURAL AREA		
	BOREHOLE IN SWAMP AREA		
	(TP) - TEST PIT		
BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-9	5071629	227083	195.77
SW-9(TP1)	5071639	227083	195.30
SW-9(TP2)	5071649	227083	195.70
SW-10	5071867	226943	198.01
SW-10(TP1)	5071877	226943	198.00
SW-10(TP2)	5071837	226942	198.00
SW-10(TP3)	5071864	226945	198.00
SW-10(TP4)	5071866	226933	198.00

NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.

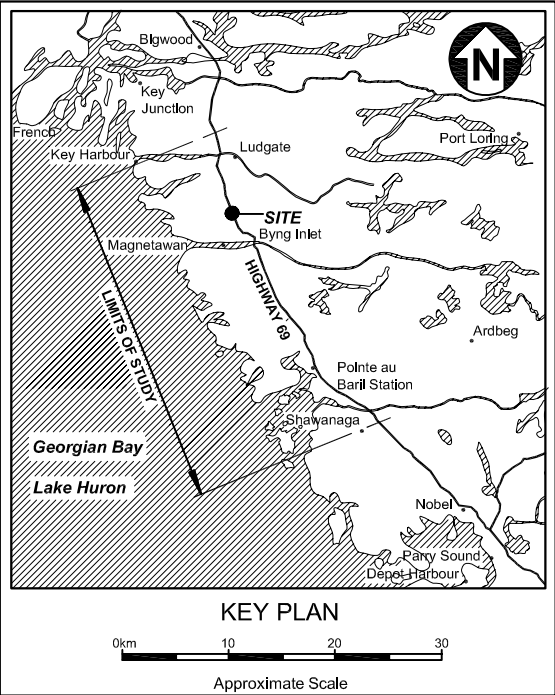


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AGREEMENT No.
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5377-02-00
FOUNDATION INVESTIGATION FOR HIGHWAY 69 ROUTE SELECTION STUDY
STA 24+200 TO STA 11+530

SHEET
7

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LEGEND

- BOREHOLE IN STRUCTURAL AREA
- BOREHOLE IN SWAMP AREA
- (TP) - TEST PIT

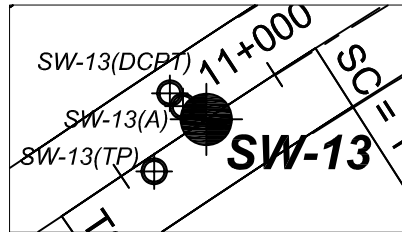
BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-11	5073159	225316	192.37
SW-11(TP1)	5073168	225300	192.00
SW-11(TP2)	5073163	225307	192.10
SW-11(TP3)	5073169	225316	192.20
SW-14	5074246	225320	182.57
SW-14(TP)	5074246	225300	182.60

NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.

STA 24+700

Wallbridge Township
Henvey Township

HIGHWAY 526 (EXISTING HIGHWAY 69)



PLAN



METRIC

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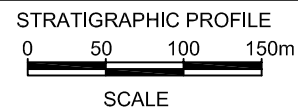
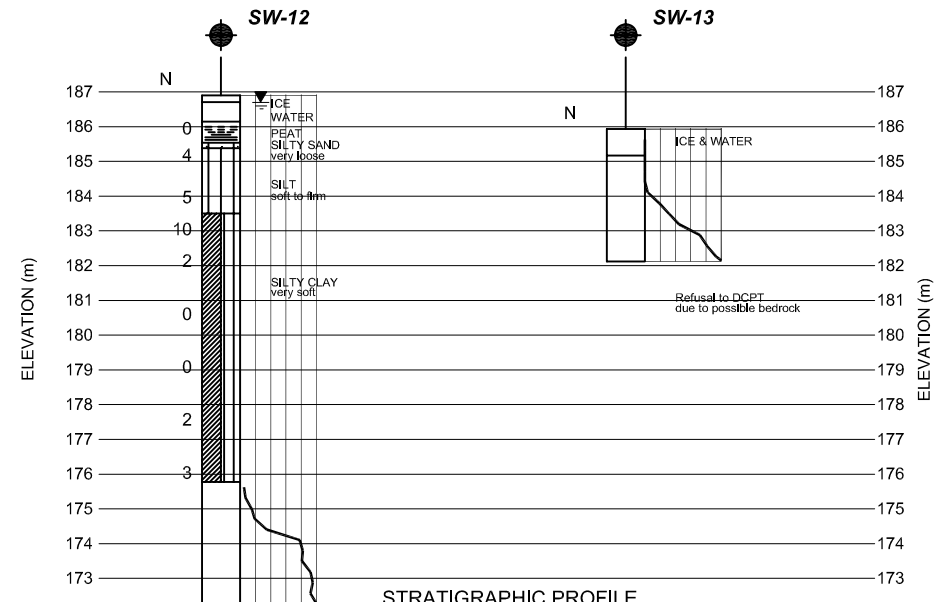
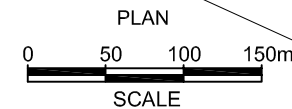
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STA 11+905

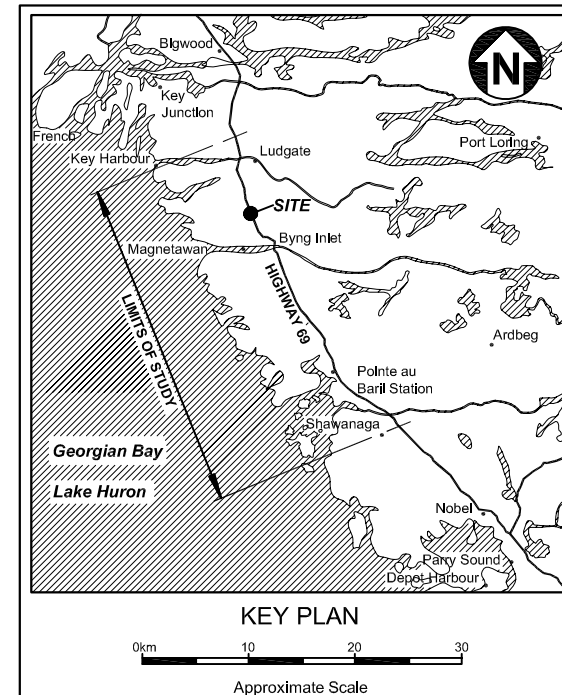
STA 10+555

HIGHWAY 69

MATCHLINE A-A

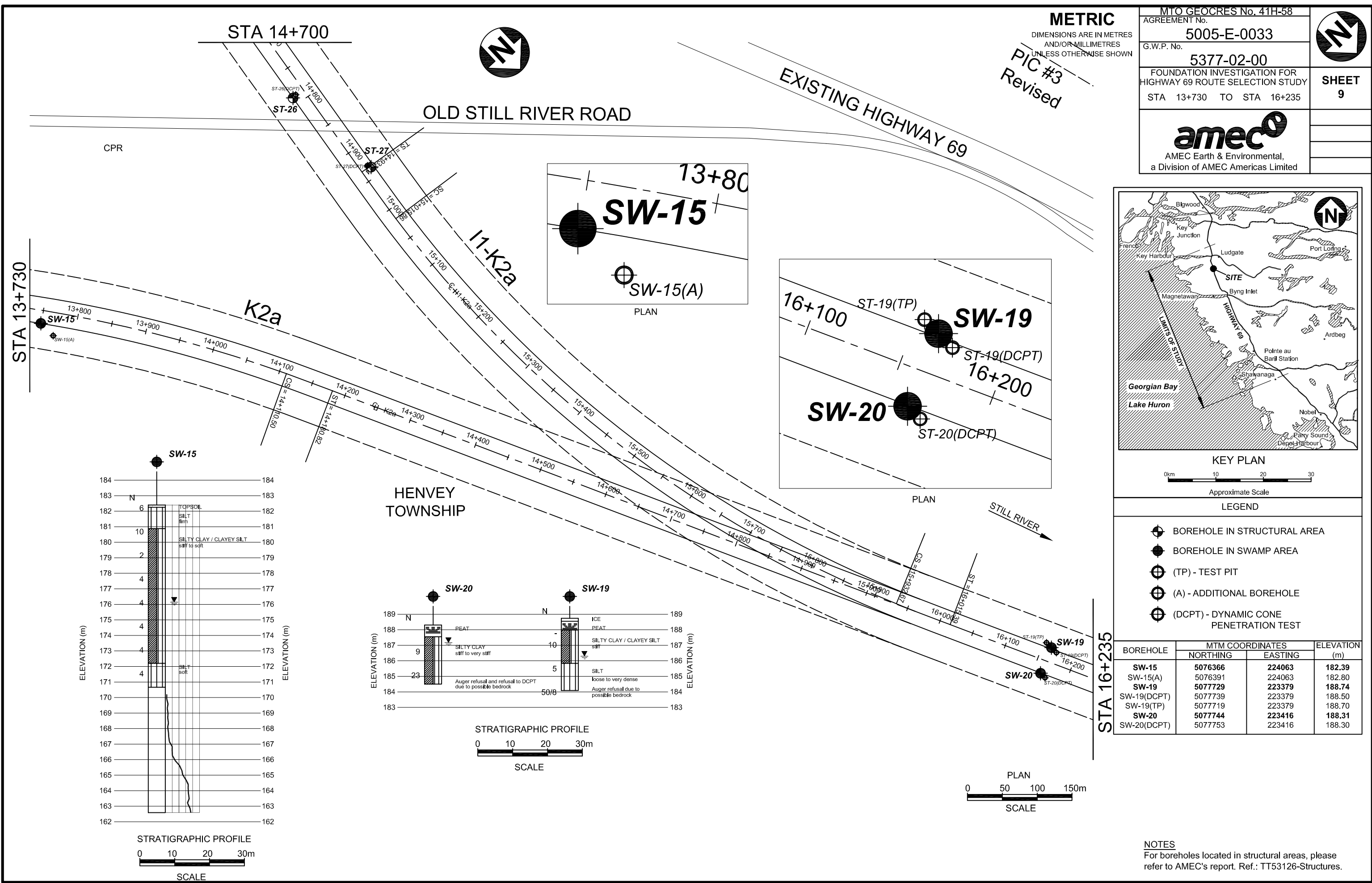


C METRES RES SHOWN	MTO GEOCRES No. 41H-58	
	AGREEMENT No.	
	5005-E-0033	SHEET 8
	G.W.P. No.	
	5377-02-00	
	FOUNDATION INVESTIGATION FOR HIGHWAY 69 ROUTE SELECTION STUDY	
	STA 10+555 TO STA 11+905	
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LEGEND			
	BOREHOLE IN STRUCTURAL AREA		
	BOREHOLE IN SWAMP AREA		
	(TP) - TEST PIT		
	(A) - ADDITIONAL BOREHOLE		
	(DCPT) - DYNAMIC CONE PENETRATION TEST		
BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-12	5073243	224977	186.90
SW-12(TP)	5073253	224942	186.90
SW-13	5073255	224715	185.93
SW-13(DCPT)	5073243	224717	185.93
SW-13(TP)	5073280	224745	185.53
SW-13(A)	5073248	224717	185.93

NOTES
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PIC #3
Revised

MTO GEOCRES No. 41H-58

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G.W.P. No.

5377-02-00

FOUNDATION INVESTIGATION FOR
HIGHWAY 69 ROUTE SELECTION STUDY

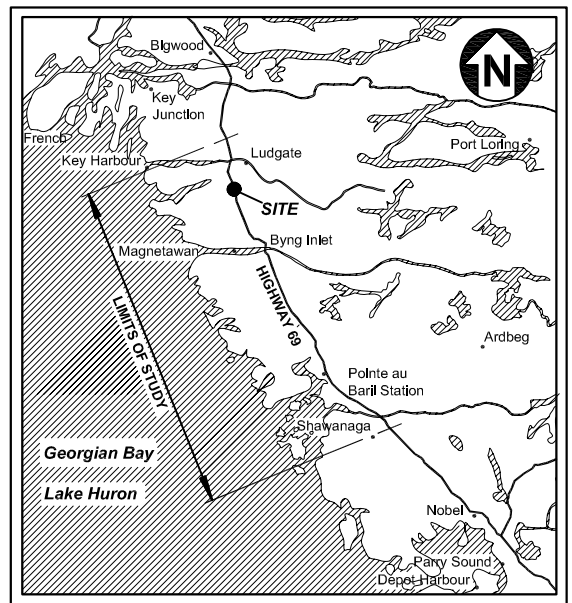
STA 13+730 TO STA 16+235

amtec

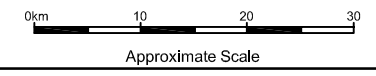
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SHEET

9



KEY PLAN

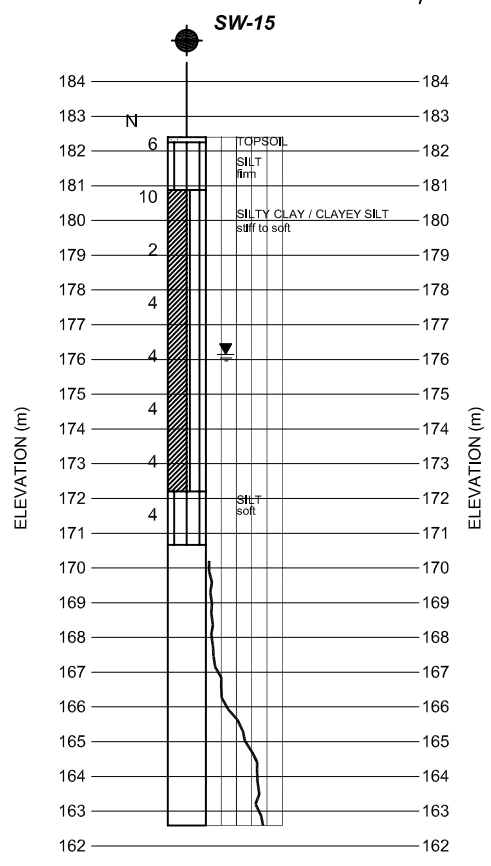


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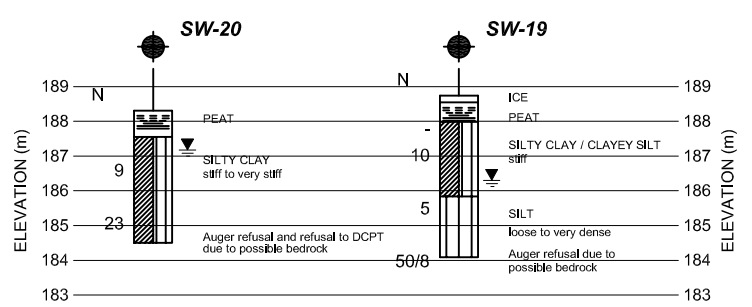
LEGEND

- BOREHOLE IN STRUCTURAL AREA
- BOREHOLE IN SWAMP AREA
- (TP) - TEST PIT
- (A) - ADDITIONAL BOREHOLE
- (DCPT) - DYNAMIC CONE PENETRATION TEST

BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-15	5076366	224063	182.39
SW-15(A)	5076391	224063	182.80
SW-19	5077729	223379	188.74
SW-19(DCPT)	5077739	223379	188.50
SW-19(TP)	5077719	223379	188.70
SW-20	5077744	223416	188.31
SW-20(DCPT)	5077753	223416	188.30



STRATIGRAPHIC PROFILE



STRATIGRAPHIC PROFILE

NOTES
For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.

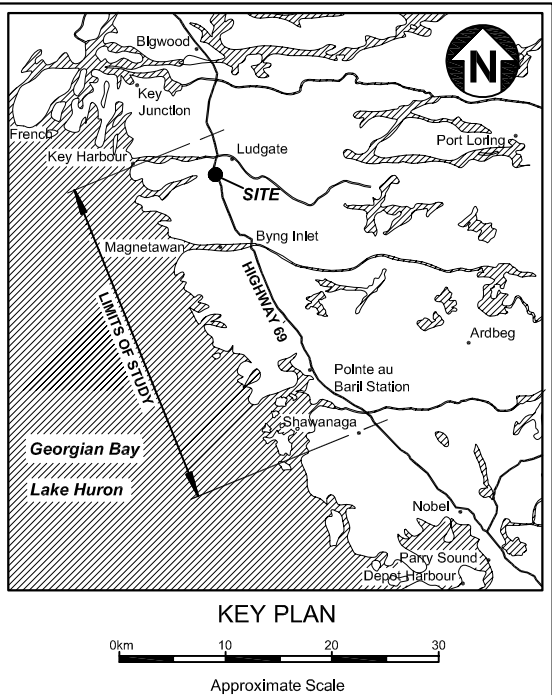
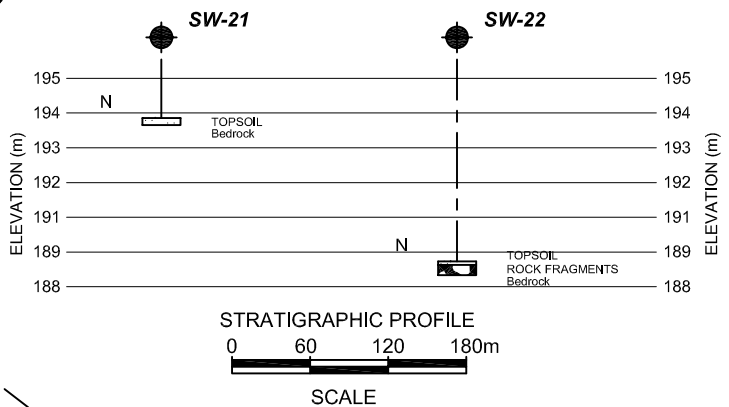
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FOUNDATION INVESTIGATION FOR
HIGHWAY 69 ROUTE SELECTION STUDY
STA 17+450 TO STA 18+475



**SHEET
10**

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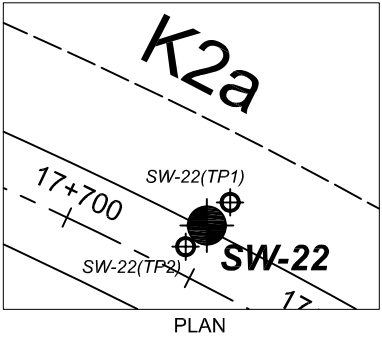
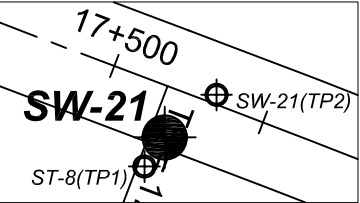
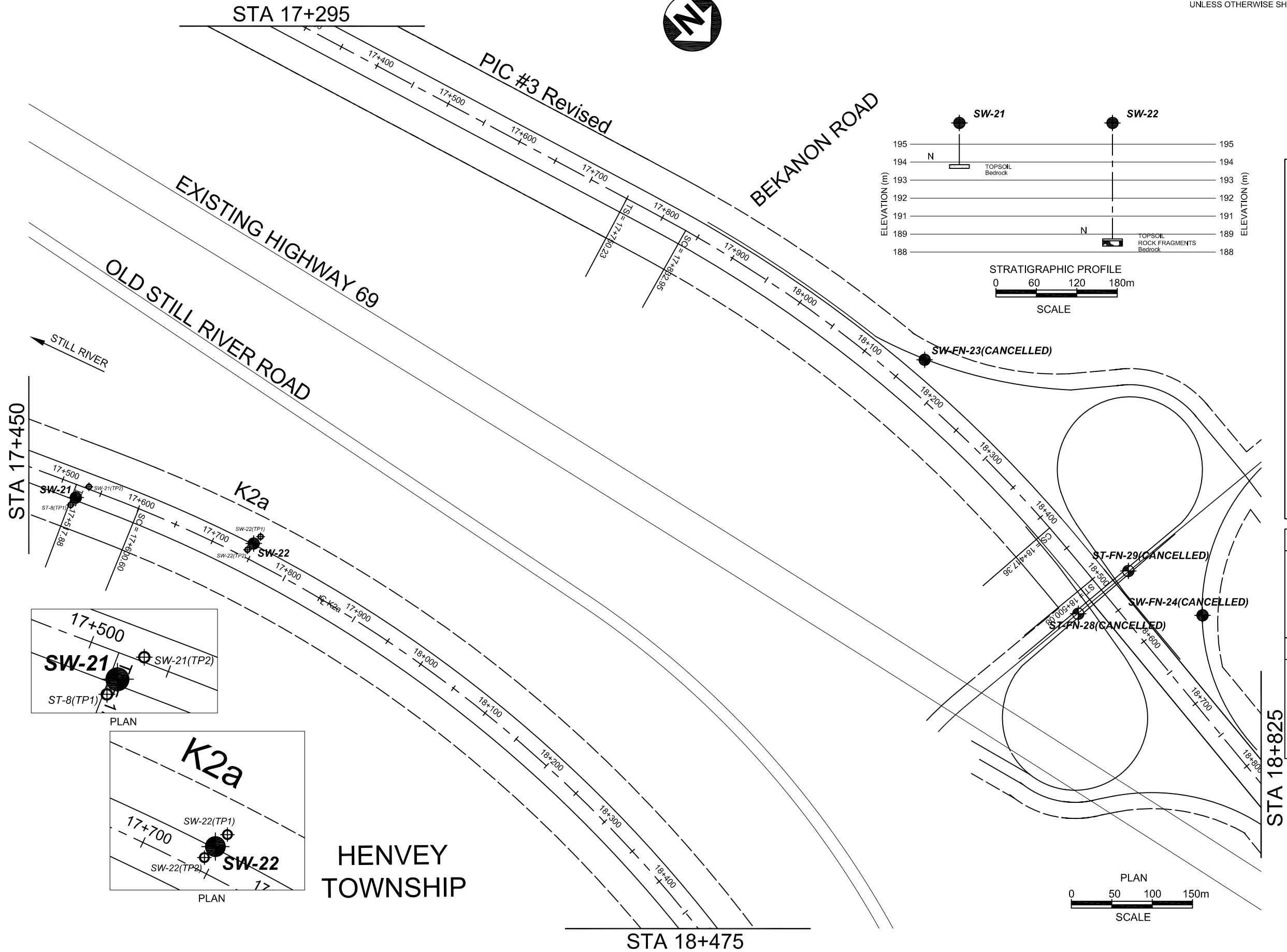
LEGEND

- BOREHOLE IN STRUCTURAL AREA
- BOREHOLE IN SWAMP AREA
- (TP) - TEST PIT

BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-21	5078983	222851	193.86
SW-21(TP1)	5078985	222862	192.00
SW-21(TP2)	5078985	222830	194.96
SW-22	5079177	222734	189.73
SW-22(TP1)	5079177	222722	188.00
SW-22(TP2)	5079177	222745	191.90
SW-FN-23(CANCELLED)	5079601	221985	-
SW-FN-24(CANCELLED)	5080069	221964	-

NOTES

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METRIC

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UNLESS OTHERWISE SHOWN

MTO GEORES No. 41H-58

AGREEMENT No.

5005-E-0033

G.W.P. No.

5377-02-00

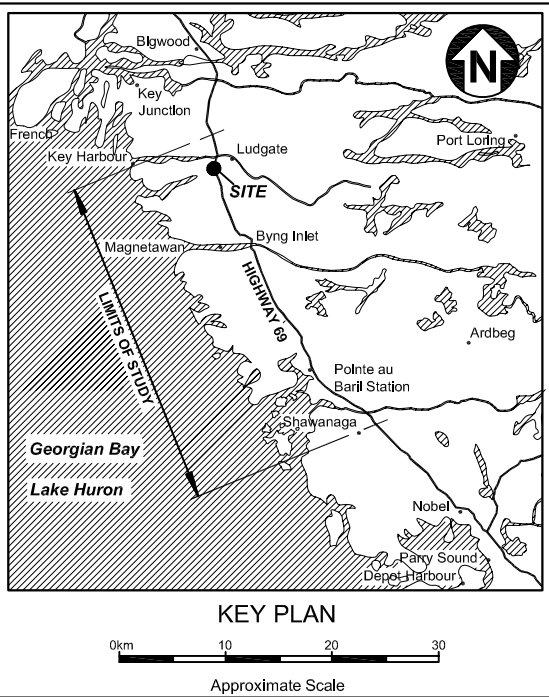
FOUNDATION INVESTIGATION FOR
HIGHWAY 69 ROUTE SELECTION STUDY

STA 19+150 TO STA 10+150

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SHEET
11



LEGEND

- BOREHOLE IN STRUCTURAL AREA
- BOREHOLE IN SWAMP AREA
- (TP) - TEST PIT
- (A) - ADDITIONAL BOREHOLE
- (DCPT) - DYNAMIC CONE PENETRATION TEST

BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
SW-16	5080589	222900	191.91
SW-16(TP1)	5080587	222900	191.90
SW-16(TP2)	5080593	222878	191.40
SW-16(TP3)	5080578	222910	192.40
SW-17	5081130	222832	194.14
SW-17(TP)	5081130	222822	194.14
SW-18	5081689	223250	194.44
SW-18(TP1)	5081709	223252	195.30
SW-18(TP2)	5081669	223250	195.00
SW-25	5081204	222668	187.61
SW-25(DCPT)	5081201	222668	187.61
SW-25(TP1)	5081184	222668	187.00
SW-25(TP2)	5081204	222688	189.70
SW-25(TP3)	5081239	222628	188.60
SW-25(A)	5081204	222648	189.50

NOTES

For boreholes located in structural areas, please refer to AMEC's report. Ref.: TT53126-Structures.



EXISTING
HIGHWAY 69

PIC #3 Revised

OLD STILL RIVER ROAD

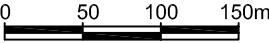
CPR

K2a BECKANON
INTERCHANGE

STA 19+150

STA 10+150

PLAN

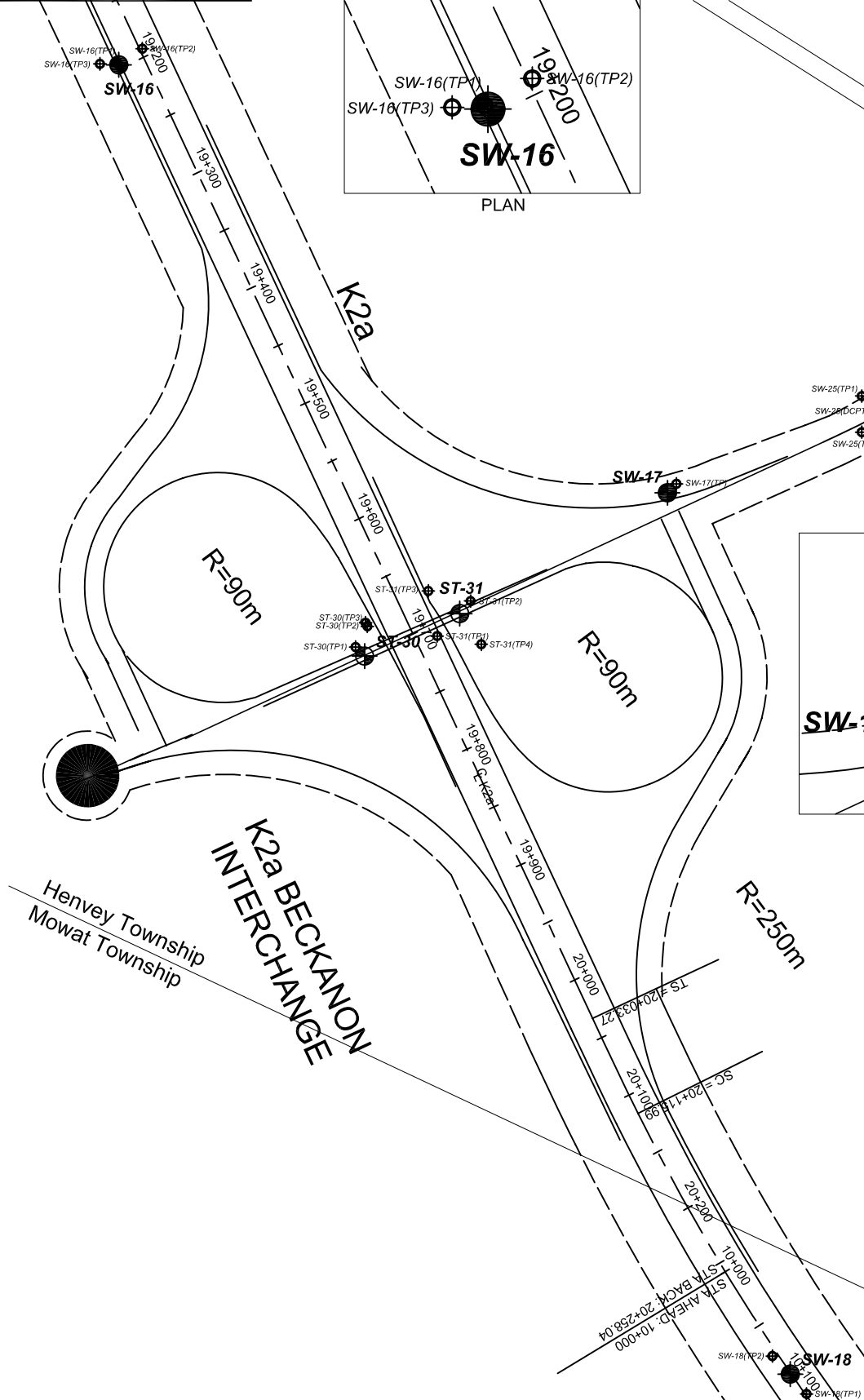
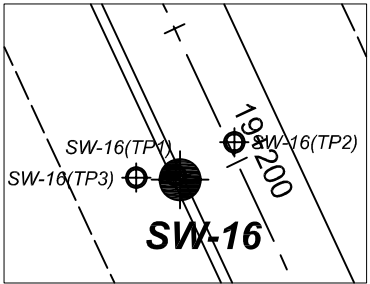
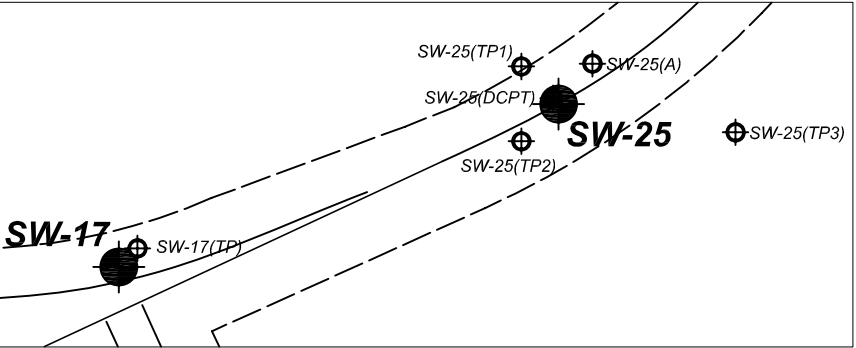
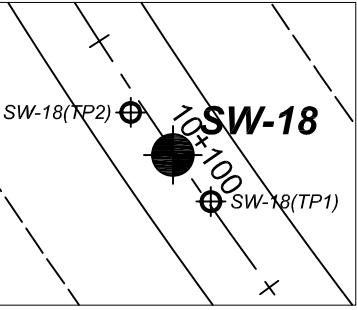


SCALE

PLAN

PLAN

PLAN



APPENDIX C
RECORD OF BOREHOLES / TEST HOLES

AMEC EARTH AND ENVIRONMENTAL NOTES TO BOREHOLE LOGS

DRILLING DATA

Method:		
SolSt Augering	-	Solid Stem Augering
HolSt Augering	-	Hollow Stem Augering
WB	-	Washed Boring

SAMPLES

TYPE:		
SS	-	Split Spoon
AS	-	Auger Sample
GS	-	Grab Sample
TW	-	Thinwall Open
TP	-	Thinwall Piston
WS	-	Washed Sample
BS	-	Block Sample
RC	-	Rock Core
PH	-	Sample Advanced Hydraulically
PM	-	Sample Advanced Manually

LABORATORY DATA

WP	-	Plastic Limit
W	-	Water Content (%)
WL	-	Liquid Limit
γ	-	Natural Unit Weight (kN/m ³)
UNDR STRNG or C_u	-	Undrained Shear Strength (kPa)
		Field Vane: St-sensitivity
pp	-	Pocket Penetrometer
UC	-	Unconfined Compression
UU	-	Unconsolidated Undrained at Overburden Pressure
CU	-	Consolidated Undrained
CD	-	Consolidated Drained
TOV	-	Total Organic Vapours

Standard Penetration Test: The Standard Penetration Test (SPT) 'N'-values are the number of blows required to cause a standard 51 millimetres o.d. split barrel sampler to penetrate 0.3 metre into undisturbed ground in a borehole when driven by a hammer with a mass of 63.5 kilograms falling freely a distance of 0.76 metre. For penetrations of less than 0.3 metre, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimetres penetration).

Dynamic Cone Penetration Test: Continuous penetration of a conical steel point (51 millimetres o.d. 60° cone angle) driven by 475 J impact energy on a size drill rods. The resistance to cone penetration is measured as the number of blows for each 0.3 metre advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency or relative density

CONSISTENCY: Cohesive soils are described on the basis of their undrained shear strength (C_u) or 'N'-values as follows:

C_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
N (blows/0.3 metres)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30

RELATIVE DENSITY: Cohesionless soils are described on the basis of relative density as indicated by 'N'-values as follows:

N (blows/0.3 metres)	0 - 4	4 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

Rocks are described by their composition and structural features and/or strength

RECOVERY: Sum of all recovered rock core pieces from a coring run expressed as a percent of the total length of the coring run.

ROCK QUALITY

DESIGNATION (RQD): Sum of those intact core pieces, 100 millimetres in length expressed as a percent of the length of the coring run. Classification of a rock based on the RQD value as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50 millimetres	50 - 300 millimetres	0.3 - 1.0 metre	1.0 - 3.0 metres	>3.0 metres
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

G.W.P. 5377-02-00	LOCATION	South of Tucker's Road, Township of Shawanaga.	ORIGINATED BY	MAH
DIST 54 HWY 69	BOREHOLE TYPE	Co-ords: 5043482 N; 245843 E Solid Stem Augering	COMPILED BY	SN
DATUM Geodetic	DATE	30 January 2006	CHECKED BY	IH
PROJECT	Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO.	TT53126

[illegible]

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

RECORD OF BOREHOLE No SW-1 (TP1)

1 OF 1

G.W.P. 5377-02-00	LOCATION South of Tucker's Road, Township of Shawanaga, Co-ords: 5043482 N; 245837 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 25 January 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	20						40	60	80
212.8 0.0	about 600 mm TOPSOIL dark brown / black, wet		1	GS	-																
212.2 0.6	PEAT some silt, clay and rootlets dark brown, moist		2	GS	-		212														
211.7 1.1	SILTY CLAY some sand brown, moist		3	GS	-		1														
211.0 1.8	SANDY SILT / SILTY SAND grey, fine grained, wet		4	GS	-		211														
			5	GS	-		2														
209.3 3.5	End of Test Pit Refusal to excavation at 3.5 m depth due to bedrock Groundwater in open test pit on completion: 1.1 m SW-1 (TP1) was excavated 6 m west of SW-1.																				

RECORD OF BOREHOLE No SW-1 (TP2)

1 OF 1

G.W.P. 5377-02-00	LOCATION South of Tucker's Road, Township of Shawanaga, Co-ords: 5043432 N; 245837 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 25 January 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)			
212.0									20	40	60	80	100						GR	SA	SI	CL
0.0	about 400 mm TOPSOIL dark brown, moist																					
211.6																						
0.4	SILTY SAND some organics dark brown, wet																					
211.2																						
0.8	SILTY CLAY some sand reddish brown, wet						1	211														
210.7																						
1.3	SILTY SAND grey, fine grained, wet																					
	some clay grey																					
209.8							2	210														
2.2	End of Test Pit																					
	Refusal to excavation at 2.2 m depth due to bedrock																					
	Groundwater in open test pit on completion: 1.0 m																					
	SW-1 (TP2) was excavated 50 m south & 6 m west of SW-1.																					

RECORD OF BOREHOLE No SW-1 (TP3)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of Tucker's Road, Township of Shawanaga, Co-ords: 5043422 N; 245837 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 25 January 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
212.0																		
0.0	about 500 mm TOPSOIL																	
211.5																		
0.5	End of Test Pit Refusal to excavation at 0.5 m depth due to bedrock No noticeable groundwater in open test pit on completion SW-1 (TP3) was excavated 60 m south & 6 m west of SW-1.																	

RECORD OF BOREHOLE No SW-FN-23

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Bikanon Road, Henvey Inlet First Nation, Co-ords: 5079601 N; 221985 E ORIGINATED BY
DIST 54 HWY 69 BOREHOLE TYPE COMPILED BY
DATUM Geodetic DATE CHECKED BY
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

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

G.W.P.	5377-02-00	LOCATION	South of Tucker's Road, Township of Shawanaga.	ORIGINATED BY	JF
DIST	54	BOREHOLE TYPE	Co-ords: 5043746 N; 245551 E Portable Drilling Equipment - Wash Boring	COMPILED BY	SN
DATUM	Geodetic	DATE	22 February 2006	CHECKED BY	IH
PROJECT	Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO.	TT53126

[illegible]

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

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	20						40
8.0	End of Borehole Refusal to Standard Penetration Test at 8 m depth due to possible bedrock														
198.2															
8.6	Groundwater in open borehole on completion at 1.8 m depth (may not be representative due to wash boring) Depth of cave-in on completion: 3.8m Dynamic Cone Penetration Test (DCPT) was conducted below 8 m depth. End of DCPT Refusal to Dynamic Cone Penetration Test at 8.6 m depth due to possible bedrock Another borehole SW-2(A) was drilled at 10 m south & 30 m east of SW2. A test pit SW-2 (TP) was investigated at 6 m south & 20 m east of SW-2. Borehole was backfilled with bentonite.						198							DCPT blow count = 100 at 8.59 m	

[illegible]

[illegible]

RECORD OF BOREHOLE No SW-2 (TP)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of Tucker's Road, Township of Shawanaga, Co-ords: 5043740 N; 245571 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 25 January 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
206.8	ICE																	
206.6	WATER																	
206.1	PEAT fibrous dark brown to black		1	GS	-		1	206										
205.6	SILTY SAND trace to some clay dark brown, wet																	
204.2	End of Test Pit Refusal to excavation at 2.6 m depth due to bedrock Groundwater in open test pit on completion: on surface SW-2 (TP) was excavated 6 m south & 20 m east of SW-2.																	

RECORD OF BOREHOLE No SW-FN-3

1 OF 1





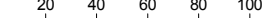
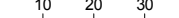
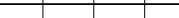

G.W.P. 5377-02-00 LOCATION North of Bah Sah Gim Road, Shawanaga First Nation, Co-ords: 5044340 N; 244802 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 5 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
208.6									20	40	60	80	100					
0.0									○ UNCONFINED	+	FIELD VANE							
208.4									● QUICK TRIAXIAL	×	LAB VANE							
208.2									20	40	60	80	100					
0.3														10	20	30		
	<div>PEAT with sand, silt, rootlets and woods dark brown, wet</div> <div>SILTY SAND some rootlets brown, wet</div> <div>End of Borehole</div> <div>Refusal to excavation at 0.3 m depth due to bedrock</div> <div>Groundwater in open test pit on completion: at surface</div> <div>Additional 2 boreholes and 2 test pits were investigated as follows:</div> <div>SW-FN-3(A) - 12 m north & 2 m west of SW-FN-3</div> <div>SW-FN-3(B) - 12 m north & 1 m east of SW-FN-3</div> <div>SW-FN-3 (TP1) - 10 m south of SW-FN-3</div> <div>SW-FN-3 (TP2) - 10 m west of SW-FN-3</div>		1A	GS	-												For GS1A: w _n =215%	
			1B	GS	-													
								208										

RECORD OF BOREHOLE No SW-FN-3(A)

1 OF 1

G.W.P. 5377-02-00	LOCATION North of Bah Sah Gim Road, Shawanaga First Nation, Co-ords: 5044352 N, 244800 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Portable Drilling Equipment	COMPILED BY SN
DATUM Geodetic	DATE 5 March 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
208.0									20	40	60	80	100						○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL
0.0	PEAT fibrous with wood pieces dark brown, wet		1	SS	21								For SS2: w _n =566%								
206.9			2	SS	31									1	207						
1.1	End of Borehole Refusal to Standard Penetration Test at 1.1 m depth Groundwater in open borehole on completion: at surface SW-FN-3(A) was drilled 12 m north & 2 m west of SW-FN-3. Borehole was backfilled with bentonite.																				

RECORD OF BOREHOLE No SW-FN-3(B)

1 OF 2

G.W.P. 5377-02-00 LOCATION North of Bah Sah Gim Road, Shawanaga First Nation, Co-ords: 5044352 N; 244803 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment - Wash Boring COMPILED BY SN
DATUM Geodetic DATE 5 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100		
208.0	PEAT some silt and wood fragments dark brown, wet		1	SS	8										
			2	SS	13		1	207							
			3	SS	0		2	206							
			4	SS	0		3	205							
	SAND trace silt brown, compact to dense, wet		5	SS	30		4	204							
203.4							5	203							
4.6			6	SS	32		6	202							
			7	SS	25		7	201							

Continued Next Page

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

For SS2:
w_p=586%

0 96 (4)

2 OF 2

G.W.P. 5377-02-00	LOCATION	North of Bah Sah Girm Road, Shawanaga First Nation.	2 OF 2	ORIGINATED BY	JF
DIST 54	HWY 69	Co-ords: 5044352 N; 244803 E		COMPILED BY	SN
DATUM Geodetic	DATE	5 March 2006		CHECKED BY	IH
PROJECT	Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO.	TT53126

[illegible]

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

RECORD OF BOREHOLE No SW-FN-3 (TP1)

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Bah Sah Gim Road, Shawanaga First Nation, Co-ords: 5044330 N; 244802 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 5 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
208.2									20	40	60	80	100					
0.0	about 400 mm TOPSOIL							208										
207.8																		
0.4	End of Test Pit Refusal to excavation at 0.4 m depth due to bedrock No noticeable groundwater in open test pit on completion SW-FN-3 (TP1) was excavated 10 m south of SW-FN-3.																	

RECORD OF BOREHOLE No SW-FN-3 (TP2)

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Bah Sah Gim Road, Shawanaga First Nation, Co-ords: 5044340 N; 244792 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE COMPILED BY SN
DATUM Geodetic DATE 5 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	<div><div>DYNAMIC CONE PENETRATION RESISTANCE PLOT</div><div><div><div>20406080100</div><div><div><div></div></div></div><div>SHEAR STRENGTH kPa</div><div><div>○ UNCONFINED</div><div>● QUICK TRIAXIAL</div><div>+ FIELD VANE</div><div>× LAB VANE</div></div></div></div></div>	<div><div>PLASTIC LIMIT</div><div>NATURAL MOISTURE CONTENT</div><div>LIQUID LIMIT</div></div> <div><div>W_p</div><div>W</div><div>W_L</div></div> <div>WATER CONTENT (%)</div>	UNIT WEIGHT <div>γ</div> kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) <div>GR SA SI CL</div>	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
208.2													
0.0	Bedrock at surface												
	SW-FN-3 (TP2) was located at 10 m west of SW-FN-3.												

RECORD OF BOREHOLE No SW-FN-4

1 OF 2

G.W.P. 5377-02-00 LOCATION South of Shebeshekong Road (HWY 7182), Shawanaga First Nation, Co-ords: 5044960 N; 244306 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment - Wash Boring COMPILED BY SN
DATUM Geodetic DATE 6 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100		
202.3															
0.0	about 230 mm TOPSOIL														
202.1															
0.2	SAND some clay in SS1 grey, loose to very dense, wet		1	SS	12		202								
							1								
							201								
			2	SS	20		2								
							200								
							3								
			3	SS	4		199								
							4								
							198								
							5								
	with silt		4	SS	32		197								
							6								
							196								
			5	SS	21		7								
							195								
	trace silt and clay		6	SS	20										

Continued Next Page

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

[illegible]

1 OF 2

G.W.P.	5377-02-00	LOCATION	South of Shebeshekong Road (HWY 7182), Shawanaga First Nation.	ORIGINATED BY	JF
DIST	54	HWY	69	BOREHOLE TYPE	Dynamic Cone Penetration
DATUM	Geodetic	DATE	6 March 2006	CHECKED BY	IH
PROJECT	Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO.	TT53126

[illegible]

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

RECORD OF BOREHOLE No SW-FN-4 (DCPT)

2 OF 2








G.W.P. 5377-02-00 LOCATION South of Shebeshekong Road (HWY 7182), Shawanaga First Nation. ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration Co-ords: 5044970 N; 244308 E COMPILED BY SN
 DATUM Geodetic DATE 6 March 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
	DCPT							SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
								WATER CONTENT (%)						
								PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L						
192.1														
10.2	End of DCPT Refusal to Dynamic Cone Penetration Test at 10.2 m depth due to possible bedrock SW-FN-4 (DCPT) was located at 10 m north & 2 m east of SW-FN-4.													DCPT blow count = 110/13 cm at 10.2 m

RECORD OF BOREHOLE No SW-5

1 OF 1

G.W.P. 5377-02-00 LOCATION Near Moose Lake Road, Township of the Archipelago, Co-ords: 5053999 N; 235423 E ORIGINATED BY HSU
DIST 54 HWY 69 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN
DATUM Geodetic DATE 10 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
									20 40 60 80 100										w _p w w _L		
205.0																					
0.0	PEAT fibrous black, wet		1	AS	-		1	204									419	For AS1: w _n =419%			
																					
																					
																					
																					
203.6	SILTY SAND some gravel grey, wet		2	SS	0		2	203													
1.4																					
202.8	End of Borehole Auger refusal at 2.2 m depth due to possible bedrock Groundwater in open borehole on completion: 0.3 m DCPT was conducted in another location SW-5 (DCPT) located at 14 m south & 3 m west of SW-5. Borehole was backfilled with bentonite.		3	SS	100/8																
2.2																					

RECORD OF BOREHOLE No SW-5 (DCPT)

1 OF 1

G.W.P. 5377-02-00 LOCATION Near Moose Lake Road, Township of the Archipelago, Co-ords: 5053985 N; 235420 E ORIGINATED BY HSU
DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration COMPILED BY SN
DATUM Geodetic DATE 10 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa												
205.0																		
0.0	Dynamic cone penetration testing (DCPT) from ground surface																	

RECORD OF BOREHOLE No SW-6

1 OF 1

G.W.P. 5377-02-00 LOCATION Harris Lake Road Interchange, Wallbridge Township. ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit Co-ords: 5061773 N; 230933 E COMPILED BY SN
 DATUM Geodetic DATE 25 January 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
192.0																		
0.0	ICE					▽												
191.8																		
0.2	WATER																	
191.1																		
0.9	End of Test Pit							191										
	Refusal to excavation at 0.9 m depth due to bedrock																	
	Groundwater in open test pit on completion: 0.2 m																	
	Additional 3 test pits were investigated as follows:																	
	SW-6 (TP1) - 10 m east of SW-6																	
	SW-6 (TP2) - 10 m north of SW-6																	
	SW-6 (TP3) - 1 m south & 10 m west of SW-6																	

RECORD OF BOREHOLE No SW-6 (TP1)

1 OF 1

G.W.P. 5377-02-00 LOCATION Harris Lake Road Interchange, Wallbridge Township. ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit Co-ords: 5061773 N; 230943 E COMPILED BY SN
 DATUM Geodetic DATE 25 January 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
192.0																		
0.0	ICE					▽												
191.8	-----																	
0.2	WATER																	
191.1																		
0.9	End of Test Pit							191										
	Refusal to excavation at 0.9 m depth due to bedrock																	
	Groundwater in open test pit on completion: 0.2 m																	
	SW-6 (TP1) was excavated 10 m east of SW-6.																	

1 OF 1

G.W.P. 5377-02-00	LOCATION Harris Lake Road Interchange, Wallbridge Township,	ORIGINATED BY JF
DIST 54 HWY 69	Co-ords: 5061783 N; 230933 E BOREHOLE TYPE	COMPILED BY SN
DATUM Geodetic	DATE 25 January 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE					
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES	GROUND WATER CONDITIONS	DEPTH
194.1			NUMBER	"N" VALUES	
0.0					
	Bedrock at surface				
	SW-6 (TP2) was located at 10 m north of SW-6.				

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

RECORD OF BOREHOLE No SW-6 (TP3)

1 OF 1

G.W.P. 5377-02-00 LOCATION Harris Lake Road Interchange, Wallbridge Township. ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit Co-ords: 5061772 N; 230923 E COMPILED BY SN
 DATUM Geodetic DATE 25 January 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
190.9	ICE ----- WATER					▽	m	m	20	40	60	80	100	10	20	30	kN/m³	GR SA SI CL
0.0																		
190.7																		
0.2																		
190.0	End of Test Pit Refusal to excavation at 0.9 m depth due to bedrock Groundwater in open test pit on completion: 0.2 m SW-6 (TP3) was excavated 1 m south & 10 m west of SW-6.							190										
0.9																		

RECORD OF BOREHOLE No SW-FN-7

1 OF 1

G.W.P. 5377-02-00	LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5069523 N; 227601 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 3 March 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
196.3	about 50 mm TOPSOIL		1	GS														
196.3	End of Test Pit																	
196.3	Refusal to excavation at 0.05 m due to bedrock							196										
	No noticeable groundwater in open test pit on completion																	
	Additional 3 boreholes and 2 test pits were investigated as follows:																	
	SW-FN-7(A) - at 11 m south & 4 m east of SW-FN-7																	
	SW-FN-7(B) - at 23 m north of SW-FN-7																	
	SW-FN-7(C) - at 23 m north & 15 m east of SW-FN-7																	
	SW-FN-7 (TP1) - at 15 m west of SW-FN-7																	
	SW-FN-7 (TP2) - at 15 m east of SW-FN-7																	

RECORD OF BOREHOLE No SW-FN-7(A)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5069512 N, 227605 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa						
194.5									20 40 60 80 100						
194.4	about 76 mm TOPSOIL								○ UNCONFINED + FIELD VANE						
0.1	SILTY CLAY		1	SS	4				● QUICK TRIAXIAL × LAB VANE						
193.9	trace to some sand and gravel								20 40 60 80 100						
0.6	SANDY SILTY CLAY		2	SS	15		1	194							1 49 32 18
	brown to grey, stiff to hard, low plasticity, wet CL														
193.3															
1.2	End of Borehole														
	Refusal to Standard Penetration Test at 1.2 m depth due to possible bedrock														
	Groundwater in open borehole on completion: 0.3 m														
	SW-FN-7(A) was drilled 11 m south & 4 m east of SW-FN-7.														
	Borehole was backfilled with bentonite.														

RECORD OF BOREHOLE No SW-FN-7(B)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5069546 N, 227601 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
195.0									20	40	60	80	100					
0.0	about 250 mm TOPSOIL																	
194.8	CLAYEY SILT		1	SS	14													
0.3	trace sand																	
194.5	dark brown to grey, stiff, wet		2	SS	100/2													
0.5	End of Borehole																	
	Refusal to Standard Penetration Test at 0.5 m depth due to possible bedrock																	
	Groundwater in open borehole on completion: 0.3 m																	
	SW-FN-7(B) was drilled 23 m north of SW-FN-7.																	
	Borehole was backfilled with bentonite.																	

RECORD OF BOREHOLE No SW-FN-7(C)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5069546 N, 227616 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									WATER CONTENT (%)			GR	SA	SI	CL
195.0									20	40	60	80	100					○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL				
0.0	CLAYEY SILT some sand dark brown to grey, very stiff, wet		1	SS	16		—	—																
194.5			2	SS	100/4		—	—																
0.5	End of Borehole Refusal to Standard Penetration Test at 0.5 m depth due to possible bedrock Groundwater in open borehole on completion: 0.2 m SW-FN-7(C) was drilled 23 m north & 15 m east of SW-FN-7. Borehole was backfilled with bentonite.																							

RECORD OF BOREHOLE No SW-FN-7 (TP1)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5069523 N; 227586 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				20	40	60	80	100		
196.8								SHEAR STRENGTH kPa						
0.0	Bedrock at surface							<div> <div> <div>○ UNCONFINED</div> <div>● QUICK TRIAXIAL</div> </div> <div> <div>+ FIELD VANE</div> <div>× LAB VANE</div> </div> </div>						
	SW-FN-7 (TP1) was located at 15 m west of SW-FN-7.													

1 OF 1

G.W.P.	5377-02-00	LOCATION	South of HWY 529, Magnetawan First Nation, Co-ords: 5069523 N; 227616 E	ORIGINATED BY	JF
DIST	54	HWY	69	COMPILED BY	SN
DATUM	Geodetic	DATE	3 March 2006	CHECKED BY	IH
PROJECT	Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO.	TT53126

[illegible]

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

RECORD OF BOREHOLE No SW-FN-8

1 OF 1




G.W.P. 5377-02-00	LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070337 N; 227454 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 3 March 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
									20	40	60	80	100						○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL
192.5																					
192.4																					
0.1																					

RECORD OF BOREHOLE No SW-FN-8(A)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070352 N, 227460 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)					
191.1									20	40	60	80	100						
0.0	about 460 mm TOPSOIL		1	SS	12			191											
190.7																			
0.5	SILTY CLAY																		
190.4	trace sand and gravel		2	SS	100/0														
0.8	brown and grey, stiff to hard, moist																		
	End of Borehole																		
	Refusal to Standard Penetration Test and Dynamic Cone Penetration Test at 0.8 m depth due to possible bedrock																		
	No noticeable groundwater in open borehole on completion																		
	SW-FN-8(A) was drilled 15 m north & 6 m east of SW-FN-8.																		

RECORD OF BOREHOLE No SW-FN-8(B)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070358 N, 227460 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
191.0 0.0	about 250 mm TOPSOIL								20 40 60 80 100									
190.8 0.3	SILTY CLAY / CLAYEY SILT dark brown to grey, stiff to hard, medium plasticity, moist CI trace sand, gravel and rootlets		1	SS	8				○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
			2	SS	18		1	190										
			3	SS	100/27													
189.3 1.7	End of Borehole Refusal to Standard Penetration Test and Dynamic Cone Penetration Test at 1.7 m depth due to possible bedrock Groundwater in open borehole on completion: 1.2 m SW-FN-8(B) was drilled 21 m north & 6 m east of SW-FN-8. Borehole was backfilled with bentonite.																	

RECORD OF BOREHOLE No SW-FN-8(C)

1 OF 1

G.W.P. 5377-02-00	LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070358 N, 227450 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Portable Drilling Equipment	COMPILED BY SN
DATUM Geodetic	DATE 3 March 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
190.2																		
0.0	about 610 mm TOPSOIL		1	SS	10		190											
189.6			2	SS	100/0													
0.6	End of Borehole Refusal to Standard Penetration Test at 0.6 m depth due to bedrock No noticeable groundwater in open borehole on completion SW-FN-8(C) was drilled 21 m north & 4 m west of SW-FN-8.																	

RECORD OF BOREHOLE No SW-FN-8 (TP1)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070327 N; 227454 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
193.2																		
0.0	about 300 mm TOPSOIL							193										
192.9																		
0.3	End of Test Pit																	
	Refusal to excavation at 0.3 m depth due to bedrock																	
	Test pit was wet on completion																	
	SW-FN-8 (TP1) was excavated 10 m south of SW-FN-8.																	

RECORD OF BOREHOLE No SW-FN-8 (TP2)

1 OF 1

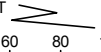


G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070337 N; 227442 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
192.0									○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										20 40 60 80 100		
0.0	about 760 mm TOPSOIL		1	GS	-											149	For GS1: w _n =149%				
191.2																					
0.8	End of Test Pit Refusal to excavation at 0.8 m depth due to bedrock Groundwater in open test pit on completion: 0.6 m SW-FN-8 (TP2) was excavated 12 m west of SW-FN-8.																				

RECORD OF BOREHOLE No SW-FN-8 (TP3)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of HWY 529, Magnetawan First Nation, Co-ords: 5070337 N; 227469 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 3 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa													
193.4							m	m														
									○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)								
									20	40	60	80	100		10	20	30	kN/m³	GR	SA	SI	CL
0.0	about 380 mm TOPSOIL																					
193.0																						
0.4	End of Test Pit Refusal to excavation at 0.4 m depth due to bedrock Test pit was wet on completion SW-FN-8 (TP3) was excavated 15 m east of SW-FN-8.							193														

RECORD OF BOREHOLE No SW-9

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Magnetawan River Road, Wallbridge Township, Co-ords: 5071629 N; 227083 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 26 January 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
195.8									20	40	60	80	100					
0.0	ICE																	
195.5																		
0.3	WATER																	
195.1																		
0.7	End of Test Pit							195										
	Refusal to excavation at 0.7 m depth due to bedrock																	
	Groundwater in open test pit on completion: 0.3 m																	
	Additional 2 test pits were investigated as follows:																	
	SW-9 (TP1) - 10 m north of SW-9																	
	SW-9 (TP2) - 20 m north of SW-9																	

1 OF 1

G.W.P. 5377-02-00	LOCATION North of Magnetawan River Road, Wallbridge Township.	ORIGINATED BY JF
DIST 54 HWY 69	Co-ords: 5071639 N; 227083 E BOREHOLE TYPE	COMPILED BY SN
DATUM Geodetic	DATE 26 January 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

[illegible]

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

1 OF 1

G.W.P. 5377-02-00	LOCATION	North of Magnetawan River Road, Wallbridge Township.	ORIGINATED BY	JF
DIST 54	HWY 69	Co-ords: 5071649 N; 227083 E	COMPILED BY	SN
DATUM Geodetic	DATE	26 January 2006	CHECKED BY	IH
PROJECT	Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO.	TT53126

SOIL PROFILE					
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES	GROUND WATER CONDITIONS	DEPTH
			NUMBER	TYPE	"N" VALUES
195.7					
0.0	Bedrock at surface				
	SW-9 (TP2) was located 20 m north of SW-9.				

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

RECORD OF BOREHOLE No SW-10

1 OF 1



G.W.P. 5377-02-00	LOCATION North of Magnetawan River Road, Wallbridge Township, Co-ords: 5071867 N; 226943 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 1 February 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa						
198.0									20 40 60 80 100						
0.0	about 300 mm TOPSOIL mixed with Peat								○ UNCONFINED + FIELD VANE						
197.7	wet								● QUICK TRIAXIAL × LAB VANE						
0.3	PEAT fibrous dark brown to black, wet								20 40 60 80 100						
197.2															
0.8	End of Test Pit														
	Refusal to excavation at 0.8 m depth due to bedrock														
	Groundwater in open test pit on completion: on surface														
	Additional 4 test pits were investigated as follows:														
	SW-10 (TP1) - 10 m north of SW-10														
	SW-10 (TP2) - 30 m south & 1 m west of SW-10														
	SW-10 (TP3) - 3 m south & 2 m east of SW-10														
	SW-10 (TP4) - 1 m south & 10 m west of SW-10														

RECORD OF BOREHOLE No SW-10 (TP1)

1 OF 1



G.W.P. 5377-02-00	LOCATION North of Magnetawan River Road, Wallbridge Township, Co-ords: 5071877 N; 226943 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 1 February 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
198.0									20	40	60	80	100						20	40	60
0.0	PEAT fibrous dark brown to black, wet																				
197.4																					
0.6	End of Test Pit Refusal to excavation at 0.6 m depth due to bedrock Groundwater in open test pit on completion: on surface SW-10 (TP1) was excavated 10 m north of SW-10.																				

RECORD OF BOREHOLE No SW-10 (TP2)

1 OF 1

G.W.P. 5377-02-00	LOCATION North of Magnetawan River Road, Wallbridge Township, Co-ords: 5071837 N; 226942 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 1 February 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
									○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×						LAB VANE		
198.0									20	40	60	80	100								
0.0	PEAT fibrous dark brown to black, wet																				
197.6																					
0.4	End of Test Pit Refusal to excavation at 0.4 m depth due to bedrock Groundwater in open borehole on completion: on surface SW-10 (TP2) was excavated 30 m south & 1 m west of SW-10.																				

RECORD OF BOREHOLE No SW-10 (TP3)

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Magnetawan River Road, Wallbridge Township, Co-ords: 5071864 N; 226945 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 1 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
198.0																		
0.0	PEAT fibrous dark brown to black, wet																	
197.5																		
0.5	End of Test Pit Refusal to excavation at 0.5 m depth due to bedrock Groundwater in open test pit on completion: on surface SW-10 (TP3) was excavated 3 m south & 2 m east of SW-10.																	

RECORD OF BOREHOLE No SW-10 (TP4)

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Magnetawan River Road, Wallbridge Township, Co-ords: 5071866 N; 226933 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 1 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
198.0																		
0.0	PEAT fibrous dark brown to black, wet																	
197.5																		
0.5	End of Test Pit Refusal to excavation at 0.5 m depth due to bedrock Groundwater in open test pit on completion: on surface SW-10 (TP4) was excavated 1 m south & 10 m west of SW-10.																	

RECORD OF BOREHOLE No SW-11

G.W.P. 5377-02-00	LOCATION South of Station Road, Henvey Township, Co-ords: 5073159 N; 225316 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 27 January 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	<div>DYNAMIC CONE PENETRATION RESISTANCE PLOT</div> <div><div><div>20406080100</div><div><div><div></div></div></div><div>SHEAR STRENGTH kPa</div><div><div>○ UNCONFINED</div><div>● QUICK TRIAXIAL</div><div>+ FIELD VANE</div><div>× LAB VANE</div></div></div></div> <div><div>PLASTIC LIMIT</div><div>NATURAL MOISTURE CONTENT</div><div>LIQUID LIMIT</div></div> <div><div>W_p</div><div>W</div><div>W_L</div></div> <div>WATER CONTENT (%)</div> <th rowspan="2">UNIT WEIGHT γ kN/m³</th> <th rowspan="2">REMARKS & GRAIN SIZE DISTRIBUTION (%) <div>GRSA SICL</div></th>	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) <div>GRSA SICL</div>				
DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES												
ELEV DEPTH (m)																
192.4																
192.2	about 150 mm TOPSOIL (frozen)															
0.2	End of Test Pit															
	Refusal to excavation at 0.2 m depth due to bedrock															
	No noticeable groundwater in open test pit on completion															
	Additional 3 test pits were investigated as follows:															
	SW-11 (TP1) - 9 m north & 16 m west of SW-11															
	SW-11 (TP2) - 4 m north & 9 m west of SW-11															
	SW-11 (TP3) - 10 m north of SW-11															

RECORD OF BOREHOLE No SW-11 (TP1)

G.W.P. 5377-02-00	LOCATION South of Station Road, Henvey Township, Co-ords: 5073168 N; 225300 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 27 January 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	<div><div>DYNAMIC CONE PENETRATION RESISTANCE PLOT</div><div><div><div>20406080100</div><div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><div><div><div></div></div></div><di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RECORD OF BOREHOLE No SW-11 (TP2)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of Station Road, Henvey Township, Co-ords: 5073163 N; 225307 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
 DATUM Geodetic DATE 27 January 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
192.1						▽	m	m	20	40	60	80	100					
0.0	ICE & Water							192										
191.8																		
0.3	End of Test Pit																	
	Refusal to excavation at 0.3 m depth due to bedrock																	
	Groundwater in open test pit on completion: on surface																	
	SW-11 (TP2) was excavated 4 m north & 9 m west of SW-11.																	

RECORD OF BOREHOLE No SW-11 (TP3)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of Station Road, Henvey Township, Co-ords: 5073169 N; 225316 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
 DATUM Geodetic DATE 27 January 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100					
192.2																		
0.0	ICE																	
192.0																		
0.2	WATER																	
191.8	with topsoil																	
0.4	End of Test Pit																	
	Refusal to excavation at 0.4 m depth due to bedrock																	
	Groundwater in open test pit on completion: 0.2 m																	
	SW-11 (TP3) was excavated 10 m north of SW-11.																	

RECORD OF BOREHOLE No SW-12

1 OF 2

G.W.P. 5377-02-00 LOCATION South of Station Road, Henvey Township, Co-ords: 5073243 N; 224977 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment - Wash Boring COMPILED BY SN
 DATUM Geodetic DATE 1 March 2006 - 2 March 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa		W _p	W	W _L			WATER CONTENT (%)
186.9 0.0	ICE								20 40 60 80 100							
186.7 0.2	WATER															
186.1 0.8	PEAT fibrous dark brown, wet		1	SS	0		1	186								For SS1: w _n =356%
185.5 1.4	SILTY SAND trace peat															
185.4 1.5	dark grey, very loose, wet SILT with clay, some sand grey, soft to firm, low plasticity, wet CL		2	SS	4											
			3	SS	5		3	184								0 12 63 25
183.5 3.4	SILTY CLAY trace sand grey, very soft, stiff at SS4, high plasticity, wet CH		4	SS	10		4	183								
			5	SS	2		5	182								

Continued Next Page

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

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Station Road, Henvey Township, Co-ords: 5073243 N; 224977 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Drilling Equipment - Wash Boring</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>1 March 2006 - 2 March 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

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

RECORD OF BOREHOLE No SW-12 (TP)

G.W.P. 5377-02-00	LOCATION South of Station Road, Henvey Township, Co-ords: 5073253, N: 224942 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 27 January 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT <div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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RECORD OF BOREHOLE No SW-13

G.W.P. 5377-02-00 LOCATION South of Station Road, Henvey Township, Co-ords: 5073255 N; 224715 E 1 OF 1 ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment and Dynamic Cone Penetration COMPILED BY SN
DATUM Geodetic DATE 1 March 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa				WATER CONTENT (%)								
185.9																		
0.0	ICE & WATER																	
185.2	Dynamic cone penetration testing (DCPT) from ground surface						1	185										
0.8							2	184										
							3	183										
182.1	End of DCPT															DCPT blow count = 102/15 cm at 3.81 m		
3.8	Refusal to Dynamic Cone Penetration Test at 3.8 m depth due to possible bedrock Additional borehole, DCPT and test pit were investigated as follows: SW-13(A) - 7 m south & 2 m east of SW-13 SW-13 (DCPT) - 12 m south & 2 m east of SW-13 SW-13 (TP) - 25 m north & 30 m east of SW-13																	

RECORD OF BOREHOLE No SW-13(A)

G.W.P. 5377-02-00 LOCATION South of Station Road, Henvey Township, Co-ords: 5073248 N; 224717 E 1 OF 1 ORIGINATED BY HSU
DIST 54 HWY 69 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN
DATUM Geodetic DATE 11 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa								
185.9 0.0	SILTY SAND dark brown and grey, wet		1	AS	-												
184.4 1.5	CLAY AND SILT trace sand grey, firm, medium plasticity, moist CI		2	SS	5												0 2 42 56 For SS2: w _L =46
183.3 2.6	SILT trace sand and clay grey, very dense, wet		3	SS	51/8												0 8 85 7 very hard augering
182.4 3.5	End of Borehole Auger refusal at 3.5 m depth due to possible bedrock Groundwater in open borehole on completion: at surface Depth of cave-in on completion: 2.7 m Borehole SW-13(A) was located 7 m south & 2 m east of SW-13. Borehole was backfilled with bentonite.		4	AS	100/0												

RECORD OF BOREHOLE No SW-13 (DCPT)

G.W.P. 5377-02-00	LOCATION South of Station Road, Henvey Township, Co-ords: 5073243 N; 224717 E	1 OF 1	ORIGINATED BY HSU
DIST 54 HWY 69	BOREHOLE TYPE Dynamic Cone Penetration	COMPILED BY SN	
DATUM Geodetic	DATE 11 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO.	TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa				WATER CONTENT (%)										
185.9						○ UNCONFINED				+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	20						40	60
0.0	Dynamic cone penetration testing (DCPT) from ground surface																			
183.3	End of DCPT Refusal to Dynamic Cone Penetration Test at 2.6 m depth due to possible bedrock SW-13 (DCPT) was located at 12 m south 2 m east of SW-13.																DCPT blow count = 100/15 cm & bouncing			
2.6																				

RECORD OF BOREHOLE No SW-13 (TP)

G.W.P. 5377-02-00 LOCATION South of Station Road, Henvey Township, Co-ords: 5073280 N; 224745 E 1 OF 1
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit ORIGINATED BY JF
 DATUM Geodetic DATE 27 January 2006 COMPILED BY SN
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 CHECKED BY IH
 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT <div><div><div></div><div>20406080100</div></div><div>SHEAR STRENGTH kPa</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES									
185.5 0.0	ICE													
185.3 0.3	about 340 mm TOPSOIL trace rootlets dark brown, moist													
184.9 0.6	SAND trace silt grey, wet		1	GS	-		1	185						
184.0 1.5	SILTY CLAY trace sand brown, moist		2	GS	-		2	184						
183.4 2.1	SANDY SILT grey, wet													
183.0 2.5	End of Test Pit Refusal to excavation at 2.5 m depth due to bedrock Groundwater in open test pit on completion: 0.6 m SW-13 (TP) was excavated 25 m north & 30 m east of SW-13.													

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Still River, Henvey Township, Co-ords: 5074246 N: 225320 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Drilling Equipment - Wash Boring</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>26 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)								
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									WATER CONTENT (%)							
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE													
									20	40	60	80						100	10	20	30	GR	SA	SI	CL
182.6																									
182.5	about 100 mm TOPSOIL																								
0.1	SILTY CLAY		1	SS	5																				
	trace sand and rootlets																								
	brown and grey, very soft, firm at SS1 (possibly frozen), moist																								
								182																	
								1																	
	stiff (possibly frozen)		2	SS	11			181																	
								2																	
								180																	
	grey		3	SS	2			3																	
178.9	SILTY SAND							179																	
3.7	trace clay							4																	
	grey, compact, moist																								
178.1	SILTY CLAY / CLAYEY SILT		4	SS	11			178								0 54 36 10									
4.5	trace sand															0 1 65 34									
	brown, stiff to very soft, low plasticity, moist to wet CL							5																	
								177																	
								6																	
			5	SS	0																				
								176																	
								7																	
								175																	
			6	SS	2																				

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

G.W.P. 5377-02-00	LOCATION South of Still River, Henvey Township, Co-ords: 5074246 N; 225320 E	3 OF 3	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Portable Drilling Equipment - Wash Boring		COMPILED BY SN
DATUM Geodetic	DATE 26 February 2006		CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

[illegible]

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

RECORD OF BOREHOLE No SW-14 (TP)

G.W.P. 5377-02-00	LOCATION South of Still River, Henvey Township, Co-ords: 5074246 N; 225300 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 26 January 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
182.6 0.0	about 600 mm TOPSOIL dark brown								20	40	60	80	100					
182.0 0.6	SILTY CLAY / CLAYEY SILT some sand, trace rootlets grey, moist to wet								20	40	60	80	100					
			1	GS	-													
			2	GS	-													
177.8 4.8	SILTY SAND grey, wet		3	GS	-													
177.1 5.5	End of Test Pit Refusal to excavation at 5.5 m depth due to bedrock Groundwater in open test pit on completion: 1.2 m SW-14 (TP) was excavated 20 m west of SW-14.																	

RECORD OF BOREHOLE No SW-15

1 OF 3

G.W.P. 5377-02-00 LOCATION East of Old Still River Road, Henvey Township, Co-ords: 5076366 N; 224063 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Portable Drilling Equipment - Wash Boring COMPILED BY SN
 DATUM Geodetic DATE 2 March 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100		
182.4															
182.2	about 150 mm TOPSOIL														
182.0	SILT with sand, some clay brown, firm, low plasticity, wet CL		1	SS	6		182								0 22 58 20
180.9							1								
180.9	SILTY CLAY / CLAYEY SILT trace sand brown to grey, stiff to soft, medium plasticity, wet CI		2	SS	10		2								
180.2							3								
179.9			3	SS	2		3								0 1 59 40
179.5							4								For SS3: w _n =46%
178.5							5								
177.5			4	SS	4		4								
177.0							5								
176.5							6								
176.0			5	SS	4		6								
175.5							7								
175.0			6	SS	4										

Continued Next Page

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

2 OF 3

G.W.P. <u>5377-02-00</u>	LOCATION <u>East of Old Still River Road, Henvey Township, Co-ords: 5076366 N: 224063 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Drilling Equipment - Wash Boring</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>2 March 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

Continued Next Page

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

RECORD OF BOREHOLE No SW-15

G.W.P. 5377-02-00	LOCATION East of Old Still River Road, Henvey Township, Co-ords: 5076366 N; 224063 E	3 OF 3	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Portable Drilling Equipment - Wash Boring	COMPILED BY SN	
DATUM Geodetic	DATE 2 March 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa										
						○ UNCONFINED ● QUICK TRIAXIAL				+ FIELD VANE × LAB VANE						
	DCPT															
162.6																
19.8	End of DCPT															
	Additional Borehole SW-15(A) was drilled at 25 m north of SW-15.															
	Borehole was backfilled with bentonite.															

1 OF 4

G.W.P. <u>5377-02-00</u>	LOCATION <u>East of Old Still River Road, Henvey Township, Co-ords: 5076391 N: 224063 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Drilling Equipment - Wash Boring</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>3 March 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

Continued Next Page

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

G.W.P. <u>5377-02-00</u>	LOCATION <u>East of Old Still River Road, Henvey Township, Co-ords: 5076391 N: 224063 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Drilling Equipment - Wash Boring</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>3 March 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

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

G.W.P. <u>5377-02-00</u>	LOCATION <u>East of Old Still River Road, Henvey Township, Co-ords: 5076391 N: 224063 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Portable Drilling Equipment - Wash Boring</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>3 March 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

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

RECORD OF BOREHOLE No SW-15(A)

G.W.P. 5377-02-00	LOCATION East of Old Still River Road, Henvey Township, Co-ords: 5076391 N; 224063 E	4 OF 4	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Portable Drilling Equipment - Wash Boring	COMPILED BY SN	
DATUM Geodetic	DATE 3 March 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa		WATER CONTENT (%)				
									20 40 60 80 100		W _p W W _L				GR SA SI CL
	DCPT														
157.5								158							
25.3	End of DCPT														
	Borehole SW-15(A) was drilled 25 m north of SW-15.														
	Borehole was backfilled with bentonite.														

RECORD OF BOREHOLE No SW-16

G.W.P. 5377-02-00 LOCATION South of Straight Lake, Henvey Township, Co-ords: 5080589 N; 222900 E 1 OF 1 ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Hand Drilling COMPILED BY SN
DATUM Geodetic DATE 27 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)				
191.9									20 40 60 80 100									
0.0	about 270 mm TOPSOIL dark brown, wet																	
191.6	SILTY SAND trace rootlets and organics dark brown to brown, very loose, damp		1	SS	3													
191.3	SILT with clay, some sand brown to grey, stiff, low plasticity, moist		2	SS	14													
0.6	CL																	
190.7	SAND trace silt		3	SS	100/17													
1.2	grey, very dense, wet																	
190.4	End of Borehole																	
1.5	Refusal to Standard Penetration Test at 1.5 m depth due to possible bedrock																	
	Groundwater in open borehole on completion: 1.1 m																	
	Additional 3 test pits were investigated as follows:																	
	SW-16 (TP1) - 2 m south of SW-16 SW-16 (TP2) - 4 m north & 22 m west of SW-16 SW-16 (TP3) - 10 m east & 11 m south of SW-16																	
	Borehole was backfilled with bentonite.																	

RECORD OF BOREHOLE No SW-16 (TP1)

1 OF 1

G.W.P. 5377-02-00	LOCATION South of Straight Lake, Henvey Township, Co-ords: 5080587 N; 222900 E	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN
DATUM Geodetic	DATE 10 February 2006	CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522		JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	20						40	60	80
191.9																	GR SA SI CL				
0.0	about 400 mm TOPSOIL dark brown, wet																				
191.5	SILTY SAND trace clay and rootlets brown to grey, fine grained, moist to wet		1	GS	-		1	191													
0.4	occasional cobbles		2	GS	-	▽								○			0 66 (34)				
189.9							2	190													
2.0	End of Test Pit Refusal to excavation at 2.0 m depth due to bedrock Groundwater in open test pit on completion: 1.5 m SW-16 (TP1) was excavated 2 m south of SW-16.																				

RECORD OF BOREHOLE No SW-16 (TP2)

G.W.P. 5377-02-00	LOCATION South of Straight Lake, Henvey Township, Co-ords: 5080593 N; 222878 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 10 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	<div>DYNAMIC CONE PENETRATION RESISTANCE PLOT</div> <div><div><div></div><div></div><div></div><div></div><div></div></div><div>20406080100</div></div> <div>SHEAR STRENGTH kPa</div> <div><div>○ UNCONFINED</div><div>● QUICK TRIAXIAL</div><div>+ FIELD VANE</div><div>× LAB VANE</div></div> <div>20406080100</div>	<div>PLASTIC LIMIT</div> <div>NATURAL MOISTURE CONTENT</div> <div>LIQUID LIMIT</div> <div><div><div></div><div></div><div></div></div><div><div>W_p</div><div>W</div><div>W_L</div></div><div>102030</div></div> <div>WATER CONTENT (%)</div>	UNIT WEIGHT <div>γ</div> kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) <div>GR SA SI CL</div>
<div>ELEV DEPTH (m)</div>	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
191.4 0.0	about 400 mm TOPSOIL dark brown, moist	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div><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RECORD OF BOREHOLE No SW-16 (TP3)

G.W.P. 5377-02-00	LOCATION South of Straight Lake, Henvey Township, Co-ords: 5080578 N; 222910 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 10 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa		WATER CONTENT (%)				
192.4									20 40 60 80 100		W _p	W	W _L	kN/m ³	GR SA SI CL
0.0	about 300 mm TOPSOIL dark brown, wet														
192.1	SANDY SILT / SILTY SAND grey, wet							192							
0.3															
191.2															
1.2	End of Test Pit Refusal to excavation at 1.2 m depth due to bedrock Groundwater in open test pit on completion: 1.0 m SW-16 (TP2) was excavated 11 m south & 10 m east of SW-16.														

[illegible]

G.W.P. 5377-02-00						LOCATION South of Straight Lake, Henvey Township, Co-ords: 5081130 N; 222832 E								ORIGINATED BY HSU								
DIST 54 HWY 69						BOREHOLE TYPE Solid Stem Augering								COMPILED BY SN								
DATUM Geodetic						DATE 12 February 2006								CHECKED BY IH								
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522														JOB NO. TT53126								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)												
	SILTY CLAY/CLAYEY SILT trace sand grey, stiff to hard, high plasticity, wet CH						186															
	occasional cobbles		7	SS	55		185															
184.5	End of Borehole																					
184.4	Auger refusal at 9.6 m depth due to possible bedrock																					
184.4	Groundwater in open borehole on completion: 0.6 m																					
9.8	Depth of cave-in on completion: 7.3m																					
	Dynamic Cone Penetration Test (DCPT) was conducted below 9.6 m depth.																					
	End of DCPT																					
	Refusal to Dynamic Cone Penetration Test at 9.8 m depth																					
	1 Test pit SW-17 (TP) was investigated at 10 m west of SW-17.																					
	Borehole was backfilled with bentonite.																					

RECORD OF BOREHOLE No SW-17 (TP)

1 OF 2

G.W.P. 5377-02-00 LOCATION South of Straight Lake, Henvey Township, Co-ords: 5071130 N; 222822 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
 DATUM Geodetic DATE 11 February 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20	40	60	80	100		
194.1															
0.0	about 300 mm TOPSOIL dark brown, moist							194							
193.8															
0.3	SANDY SILT trace to some clay brown, moist to wet		1	GS	-		1	193							
			2	GS	-		2	192							
191.1															
3.0	SILTY CLAY trace sand brown, moist		3	GS	-		3	191							
	grey		4	GS	-		4	190							
							5	189							
							6	188							
			5	GS	-		7	187							
186.1															

Continued Next Page

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

RECORD OF BOREHOLE No SW-17 (TP)














2 OF 2

G.W.P. 5377-02-00 LOCATION South of Straight Lake, Henvey Township, Co-ords: 5071130 N; 222822 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
 DATUM Geodetic DATE 11 February 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
8.0	End of Test Pit Groundwater in open test pit on completion: 2.0 m SW-17 (TP) was excavated at 10 m west of SW-17.													

1 OF 2

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Straight Lake, Henvey Township, Co-ords: 5081689 N; 223250 E</u>	ORIGINATED BY <u>HSU</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Solid Stem Augering</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>12 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa								WATER CONTENT (%)
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
194.4	PEAT																
0.0																	
194.1	SILT AND CLAY																
0.3	trace sand grey, firm to very soft, medium plasticity, damp to wet CI																
			1	AS	-		1										
			2	SS	7		2										
							3										
			3	SS	5		4										
							5										
			4	SS	2		6										
							7										
			5	SS	2		8										
							9										
			6	SS	3		10										

5.4

2.1

3

4

49

For SS6:
w_p=59%, w_L=49

Continued Next Page

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

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					
185.6	SILT AND CLAY trace sand grey, soft, medium plasticity, wet CI					186								
8.8	SILT some sand, trace gravel and clay grey, compact, wet		7	SS	11	9								
184.2	End of Borehole Auger refusal and refusal to Dynamic Cone Penetration Test at 10.2 m depth due to possible bedrock Groundwater in open borehole on completion: 1.4 m Depth of cave-in on completion: 5.6 m Additional 2 test pits were investigated as follows: SW-18 (TP1) - 20 m north & 2 m east of SW-18 SW-18 (TP2) - 20 m south of SW-18 Borehole was backfilled with bentonite.					10								

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Straight Lake, Henvey Township, Co-ords: 5081709 N; 223252 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Test Pit</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>12 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

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

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

2 OF 2

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Straight Lake, Henvey Township, Co-ords: 5081669 N; 223250 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Test Pit</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>12 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

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

RECORD OF BOREHOLE No SW-19

G.W.P. 5377-02-00	LOCATION South of Still River, Henvey Township, Co-ords: 5077729 N; 223379 E	1 OF 1	ORIGINATED BY HSU
DIST 54 HWY 69	BOREHOLE TYPE Solid Stem Augering	COMPILED BY SN	
DATUM Geodetic	DATE 9 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa				WATER CONTENT (%)				
188.7 0.0	ICE															GR SA SI CL	
188.5 0.2																	
188.0 0.8	SILTY CLAY / CLAYEY SILT brown, stiff, moist		1	AS	-												
			2	SS	10												
185.8 2.9	SILT some sand, trace clay grey, loose to very dense, wet ML		3	SS	5												
184.1 4.7	End of Borehole		4	SS	50/8												
<p>Auger refusal at 4.7 m depth due to possible bedrock</p> <p>Groundwater in open borehole on completion: 2.4 m</p> <p>DCPT was conducted in another location SW-19 (DCPT) located at 10 m north of SW-19.</p> <p>A test pit SW-19 (TP) was investigated at 10 m south of SW-19.</p> <p>Borehole was backfilled with bentonite.</p>																	

1 OF 1

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Still River, Henvey Township, Co-ords: 5077739 N: 223379 E</u>	ORIGINATED BY <u>HSU</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>9 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa				WATER CONTENT (%)							
						○ UNCONFINED					+ FIELD VANE	× LAB VANE					
188.5										20 40 60 80 100							
0.0	Dynamic cone penetration testing (DCPT) from ground surface									20 40 60 80 100							
							</										

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

G.W.P. 5377-02-00	LOCATION South of Still River, Henvey Township, Co-ords: 5077719 N; 223379 E	2 OF 2	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit		COMPILED BY SN
DATUM Geodetic	DATE 3 February 2006		CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

[illegible]

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

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

1 OF 1

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Still River, Henvey Township, Co-ords: 5077753 N: 223416 E</u>	ORIGINATED BY <u>HSU</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>9 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa				WATER CONTENT (%)							
188.3										20 40 60 80 100							GR SA SI CL
0.0	Dynamic cone penetration testing (DCPT) from ground surface																
186.0																	
2.3	End of DCPT Refusal to Dynamic Cone Penetration Test at 2.4 m depth due to possible bedrock SW-20 (DCPT) was located at 9 m north of SW-20.																DCPT blow count = 100/20 cm

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

[illegible]

RECORD OF BOREHOLE No SW-21 (TP1)

G.W.P. 5377-02-00	LOCATION South of Beganon Road, Henvey Township, Co-ords: 5078985 N; 222862 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 3 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)				
192.0										20 40 60 80 100								
0.0	about 180 mm TOPSOIL									20 40 60 80 100								
191.8																		
0.2	End of Test Pit																	
	Refusal to excavation at 0.2 m depth due to bedrock																	
	No noticeable groundwater in open test pit on completion																	
	SW-21 (TP1) was excavated 2 m north & 11 m east of SW-21.																	

RECORD OF BOREHOLE No SW-21 (TP2)

G.W.P. 5377-02-00	LOCATION South of Bikanon Road, Henvey Township, Co-ords: 5078985 N; 222830 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 3 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa													
195.0																			
0.0	about 300 mm TOPSOIL																		
194.7																			
0.3	End of Test Pit																		
	Refusal to excavation at 0.3 m depth due to bedrock																		
	No noticeable groundwater in open test pit on completion																		
	SW-21 (TP2) was excavated 2 m north & 21 m west of SW-21.																		

RECORD OF BOREHOLE No SW-22

G.W.P. 5377-02-00	LOCATION South of Bikanon Road, Henvey Township, Co-ords: 5079177 N; 222734 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 3 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	<div><div>DYNAMIC CONE PENETRATION RESISTANCE PLOT</div><div><div><div>20406080100</div><div></div></div><div>SHEAR STRENGTH kPa</div><div><div>○ UNCONFINED</div><div>+ FIELD VANE</div><div>● QUICK TRIAXIAL</div><div>× LAB VANE</div></div></div></div> <div><div>PLASTIC LIMIT</div><div>NATURAL MOISTURE CONTENT</div><div>LIQUID LIMIT</div></div> <div><div>W_p</div><div>W</div><div>W_L</div></div> <div>WATER CONTENT (%)</div> <div>102030</div> <div>kN/m³</div> <th rowspan="2">UNIT WEIGHT γ</th> <th rowspan="2">REMARKS & GRAIN SIZE DISTRIBUTION (%)</th>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GR							SA	SI	CL				
ELEV DEPTH (m)																		
189.7																		
189.6	about 100 mm TOPSOIL																	
0.1	ROCK FRAGMENTS																	
189.3																		
0.4	End of Test Pit																	
	Refusal to excavation at 0.4 m depth due to bedrock							189										
	No noticeable groundwater in open test pit on completion																	
	Additional 2 test pits were investigated as follows:																	
	SW-22 (TP1) - 12 m west of SW-22																	
	SW-22 (TP2) - 11 m east of SW-22																	

RECORD OF BOREHOLE No SW-22 (TP1)

G.W.P. 5377-02-00 LOCATION South of Beganon Road, Henvey Township, Co-ords: 5079177 N; 222722 E 1 OF 1 ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
DATUM Geodetic DATE 3 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
188.0									20	40	60	80	100						○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL
0.0	about 500 mm TOPSOIL (frozen)																				
187.5	End of Test Pit																				
0.5	Refusal to excavation at 0.5 m depth due to bedrock																				
	No noticeable groundwater in open test pit on completion																				
	SW-22 (TP1) was excavated 12 m west of SW-22.																				

RECORD OF BOREHOLE No SW-22 (TP2)

G.W.P. 5377-02-00	LOCATION South of Bikanon Road, Henvey Township, Co-ords: 5079177 N; 222745 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Test Pit	COMPILED BY SN	
DATUM Geodetic	DATE 3 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)									
191.9											20	40	60	80	100	W _p	W	W _L		
191.8	about 150 mm TOPSOIL										20	40	60	80	100					
0.2	End of Test Pit																			
	Refusal to excavation at 0.2 m depth due to bedrock																			
	No noticeable groundwater in open test pit on completion									191										
	SW-22 (TP2) was excavated 11 m east of SW-22.																			

RECORD OF BOREHOLE No SW-FN-23

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Bikanon Road, Henvey Inlet First Nation, Co-ords: 5079601 N; 221985 E ORIGINATED BY
DIST 54 HWY 69 BOREHOLE TYPE COMPILED BY
DATUM Geodetic DATE CHECKED BY
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
0.0	CANCELLED																

RECORD OF BOREHOLE No SW-FN-24

1 OF 1

G.W.P. 5377-02-00 LOCATION North of Bikanon Road, Hervey Inlet First Nation, Co-ords: 5080069 N; 221964 E ORIGINATED BY
DIST 54 HWY 69 BOREHOLE TYPE COMPILED BY
DATUM Geodetic DATE CHECKED BY
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)				
									20	40	60	80	100	W _p	W	W _L		
0.0	CANCELLED																	






RECORD OF BOREHOLE No SW-25

G.W.P. 5377-02-00		LOCATION South of Straight Lake, Henvey Township, Co-ords: 5081204 N; 222668 E		1 OF 1		ORIGINATED BY JF	
DIST 54 HWY 69		BOREHOLE TYPE Solid Stem Augering		COMPILED BY SN			
DATUM Geodetic		DATE 12 February 2006		CHECKED BY IH			
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522						JOB NO. TT53126	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									
187.6									20	40	60	80	100					
0.0	about 460 mm TOPSOIL		1	AS	-				○ UNCONFINED	+	FIELD VANE							
187.2									● QUICK TRIAXIAL	×	LAB VANE							
0.5	SILTY CLAY grey, wet		2	AS	-	▽		187	20	40	60	80	100					
186.9																		
0.8	End of Borehole																	
	Auger refusal at 0.8 m depth due to possible bedrock																	
	Groundwater in open borehole on completion: 0.6 m																	
	Another borehole SW-25(A) was drilled at 20 m west of SW-25.																	
	DCPT was done in another location SW-25 (DCPT) located at 3 m south of SW-25.																	
	Additional 3 test pits were investigated as follows:																	
	SW-25 (TP1) - 20 m south of SW-25																	
	SW-25 (TP2) - 20 m east of SW-25																	
	SW-25 (TP3) - 35 m north & 40 m west of SW-25																	
	Borehole was backfilled with bentonite.																	

RECORD OF BOREHOLE No SW-25(A)

G.W.P. 5377-02-00 LOCATION South of Straight Lake, Henvey Township, Co-ords: 5081204 N; 222648 E 1 OF 1 ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN
DATUM Geodetic DATE 12 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									WATER CONTENT (%)		
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						20	40	60
189.5 0.0	SILT some sand and clay, trace rootlets grey to brown, low plasticity, wet CL-ML		1	AS	-												0 15 72 13			
			2	AS	-		189													
								1												
188.0 1.5	SILT with sand, trace to some clay grey, firm, wet		3	SS	5													0 24 (76)		
							2													
								188												
186.8 2.7	SILTY SAND / SANDY SILT grey, compact, wet																			
			4	SS	15			3												
								4												
								187												
			5	SS	11															
			6	AS	-															
184																				
183.9 5.6	End of Borehole Auger refusal and refusal to Dynamic Cone Penetration Test at 5.6 m depth due to possible bedrock Groundwater in open borehole on completion: 2.9 m Borehole SW-25(A) was drilled at 20 m west of SW-25. Borehole was backfilled with bentonite.																			

RECORD OF BOREHOLE No SW-25 (DCPT)

G.W.P. 5377-02-00	LOCATION South of Straight Lake, Henvey Township, Co-ords: 5081201 N; 222668 E	1 OF 1	ORIGINATED BY JF
DIST 54 HWY 69	BOREHOLE TYPE Dynamic Cone Penetration	COMPILED BY SN	
DATUM Geodetic	DATE 12 February 2006	CHECKED BY IH	
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522			JOB NO. TT53126

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa									
187.6															
0.0	Dynamic cone penetration testing (DCPT) from ground surface														

G.W.P. <u>5377-02-00</u>	LOCATION <u>South of Straight Lake, Henvey Township, Co-ords: 5081184 N; 222668 E</u>	ORIGINATED BY <u>JF</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Test Pit</u>	COMPILED BY <u>SN</u>
DATUM <u>Geodetic</u>	DATE <u>11 February 2006</u>	CHECKED BY <u>IH</u>
PROJECT <u>Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522</u>		JOB NO. <u>TT53126</u>

[illegible]

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

RECORD OF BOREHOLE No SW-25(TP2)

1 OF 1

G.W.P. 5377-02-00 LOCATION South of Straight Lake, Henvey Township, Co-ords: 5081204 N; 222688 E ORIGINATED BY JF
DIST 54 HWY 69 BOREHOLE TYPE COMPILED BY SN
DATUM Geodetic DATE 11 February 2006 CHECKED BY IH
PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				20	40	60	80	100		
189.7								SHEAR STRENGTH kPa						
0.0	Bedrock on surface							<div> <div> <div>○ UNCONFINED</div> <div>● QUICK TRIAXIAL</div> </div> <div> <div>+ FIELD VANE</div> <div>× LAB VANE</div> </div> </div>						
	SW-25 (TP2) was located at 20 m east of SW-25.													

RECORD OF BOREHOLE No SW-25(TP3)

1 OF 2

G.W.P. 5377-02-00 LOCATION South of Straight Lake, Henvey Township, Co-ords: 5081239 N; 222628 E ORIGINATED BY JF
 DIST 54 HWY 69 BOREHOLE TYPE Test Pit COMPILED BY SN
 DATUM Geodetic DATE 11 February 2006 CHECKED BY IH
 PROJECT Highway 69 Route Selection Study, from 3.5 km North of HWY 559 to 3.8 km North of HWY 522 JOB NO. TT53126

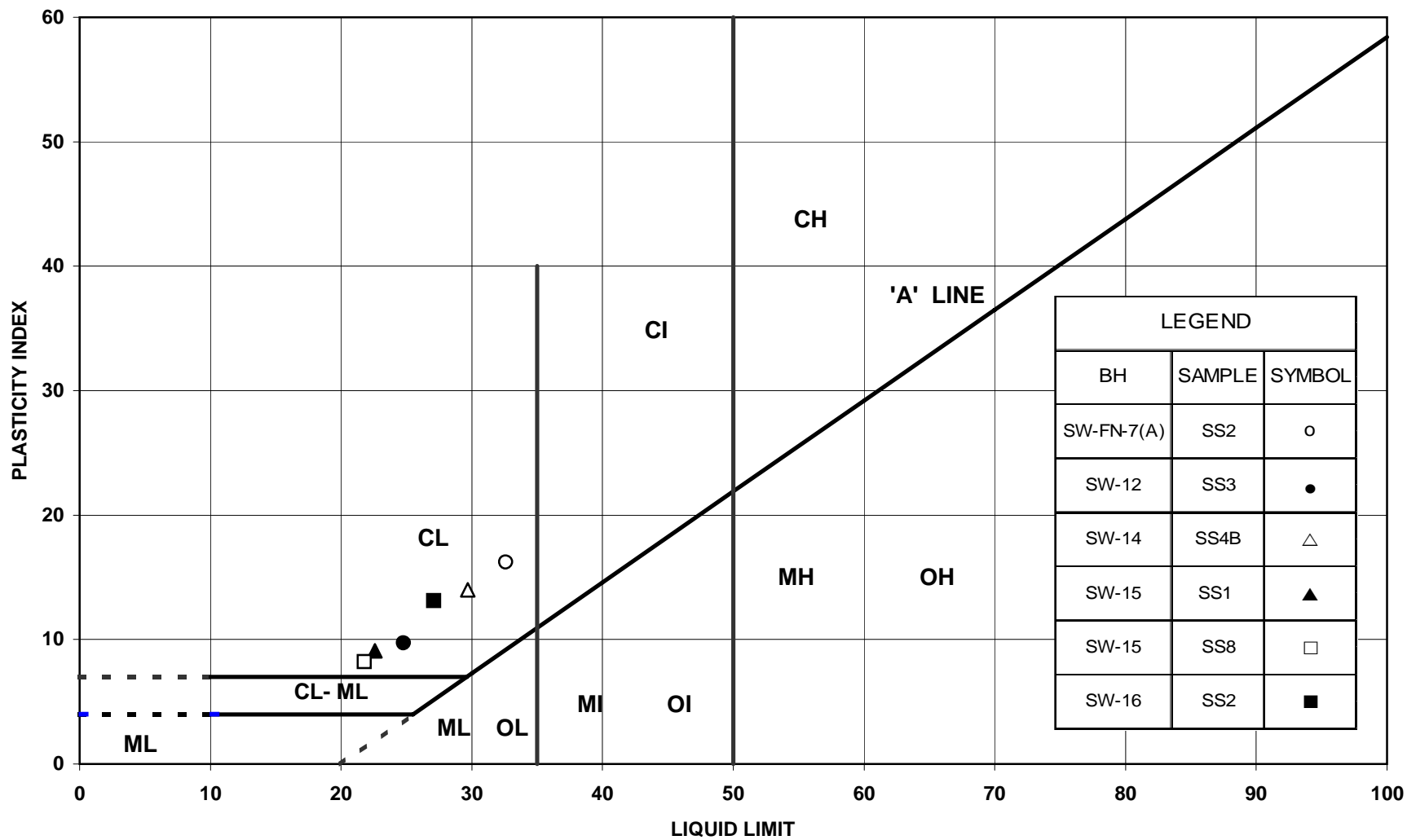
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)				
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p W W _L 10 20 30							
188.6 0.0	about 200 mm TOPSOIL dark brown, wet																	
188.4 0.2	SILTY SAND trace to some clay brown to grey, wet																	
							188											
							187											
							186											
186.1 2.5	SILTY CLAY trace sand grey, wet						185											
							184											
							183											
							182											
							181											
181.0 7.6	End of Test Pit Groundwater in open test pit on																	

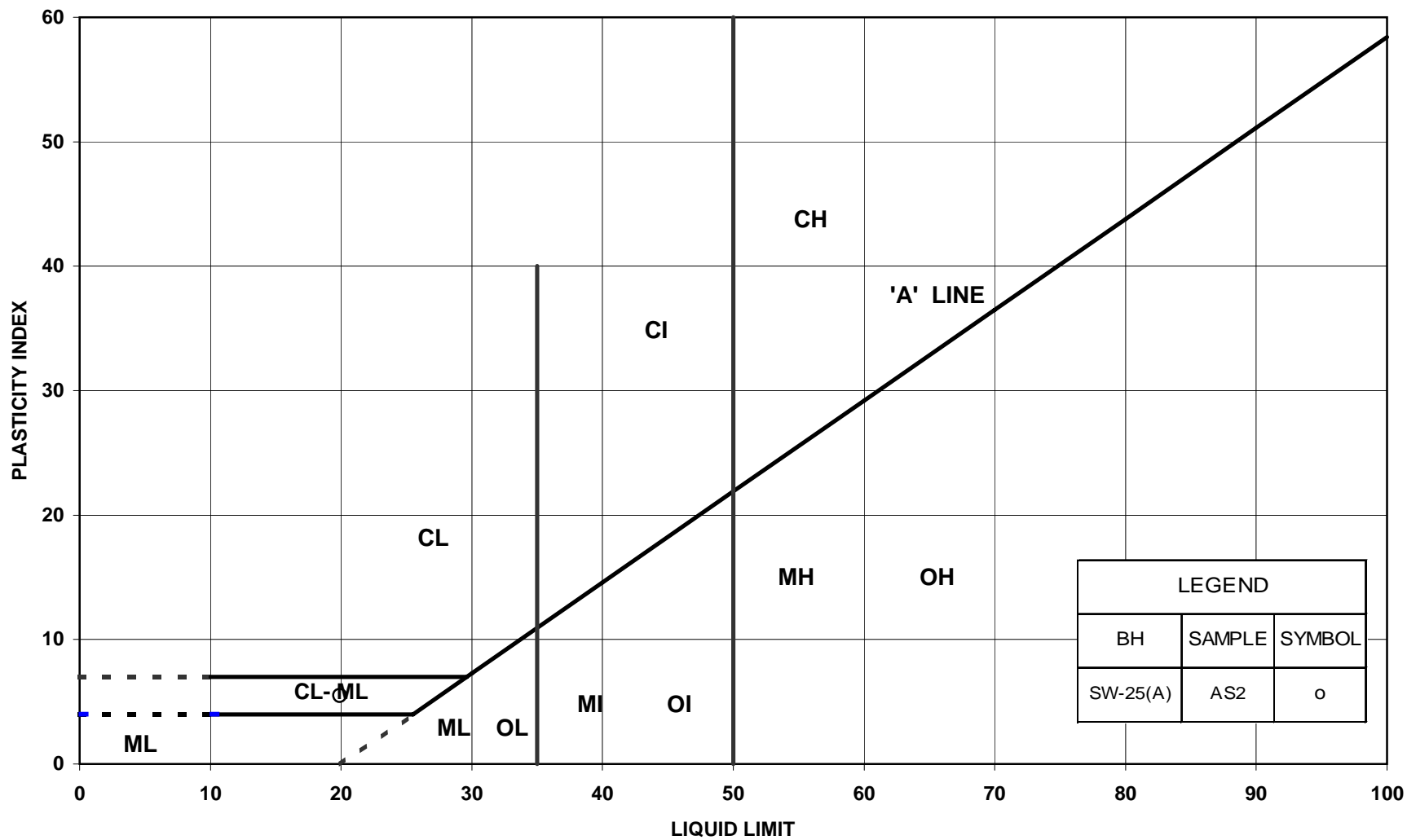
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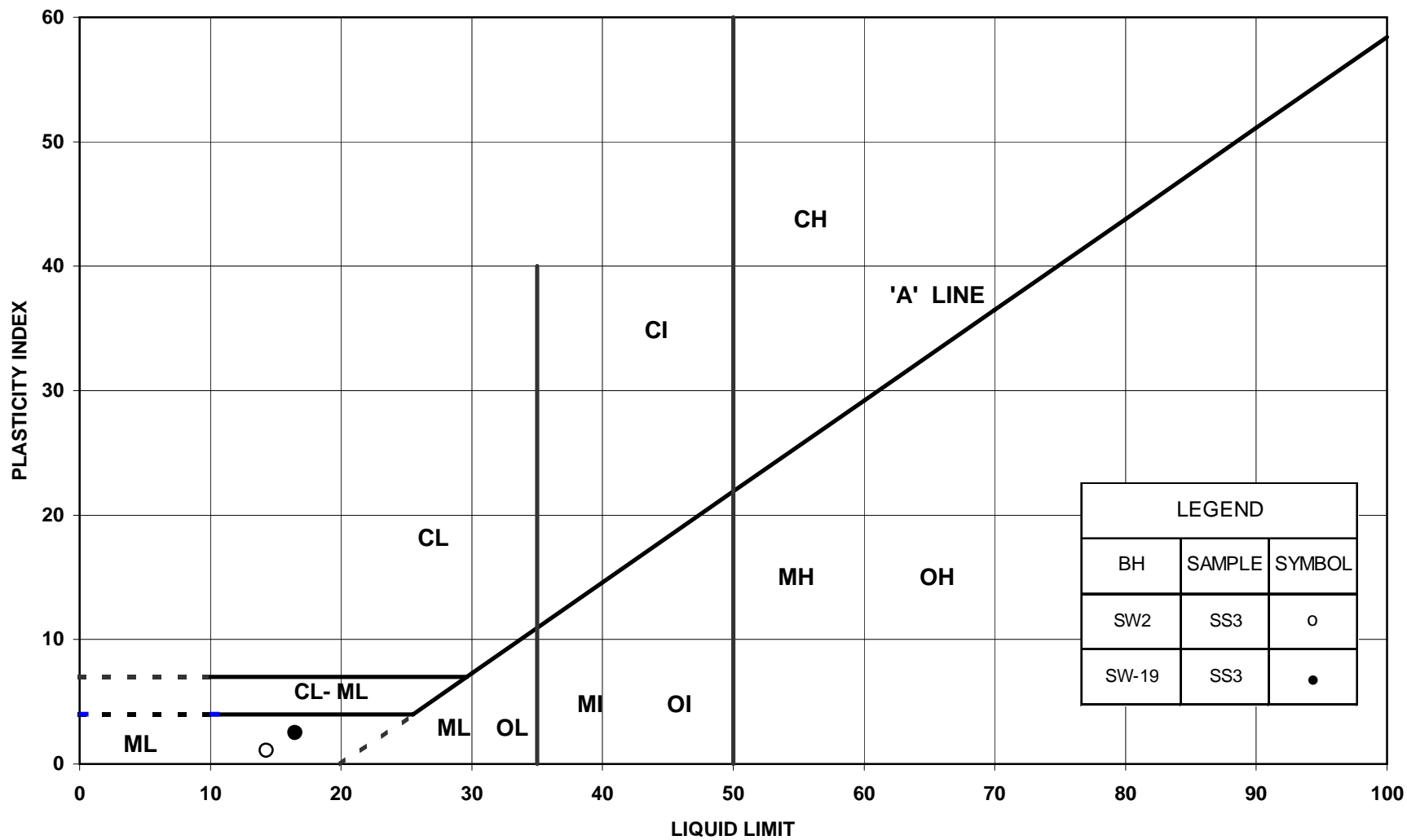
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

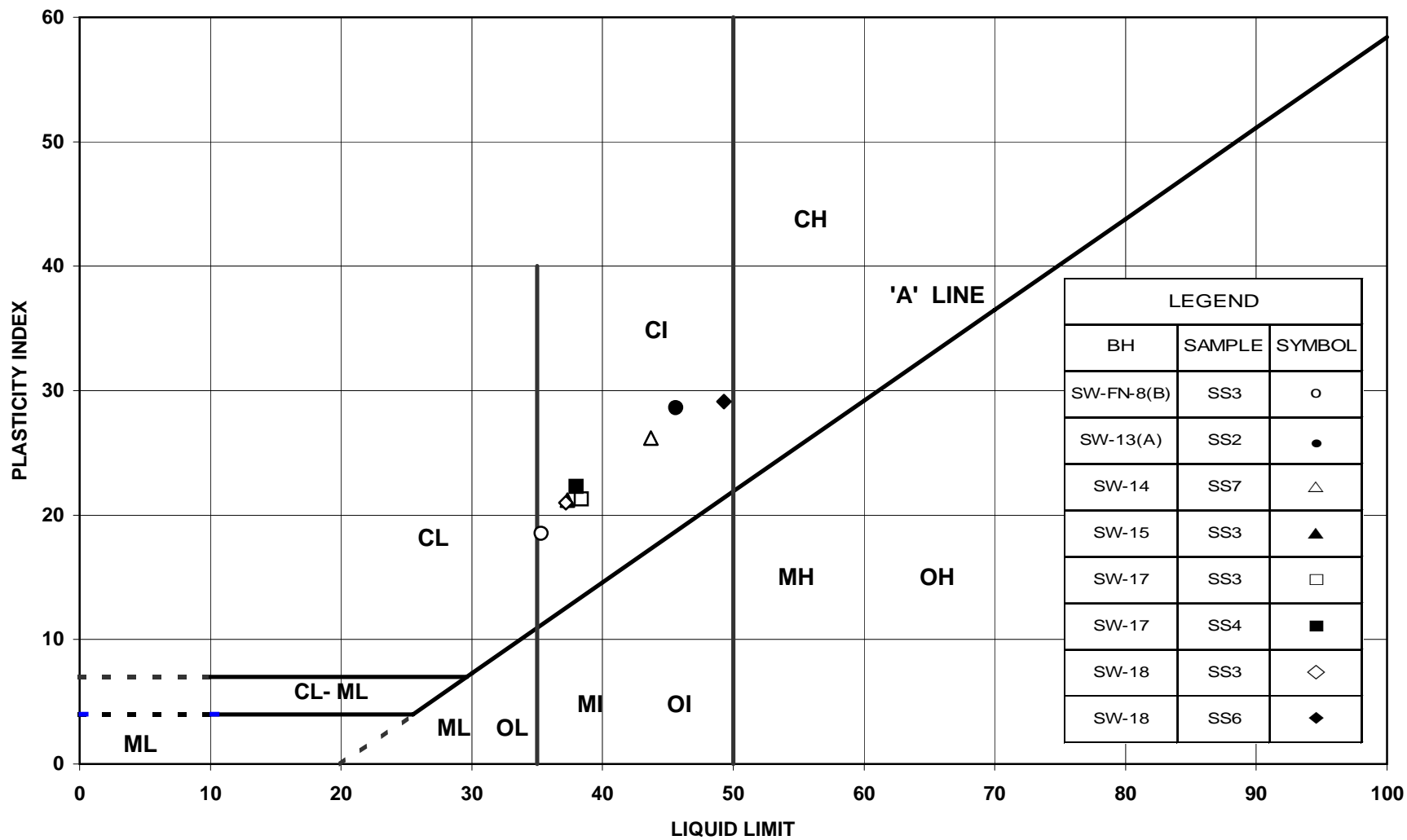
APPENDIX D

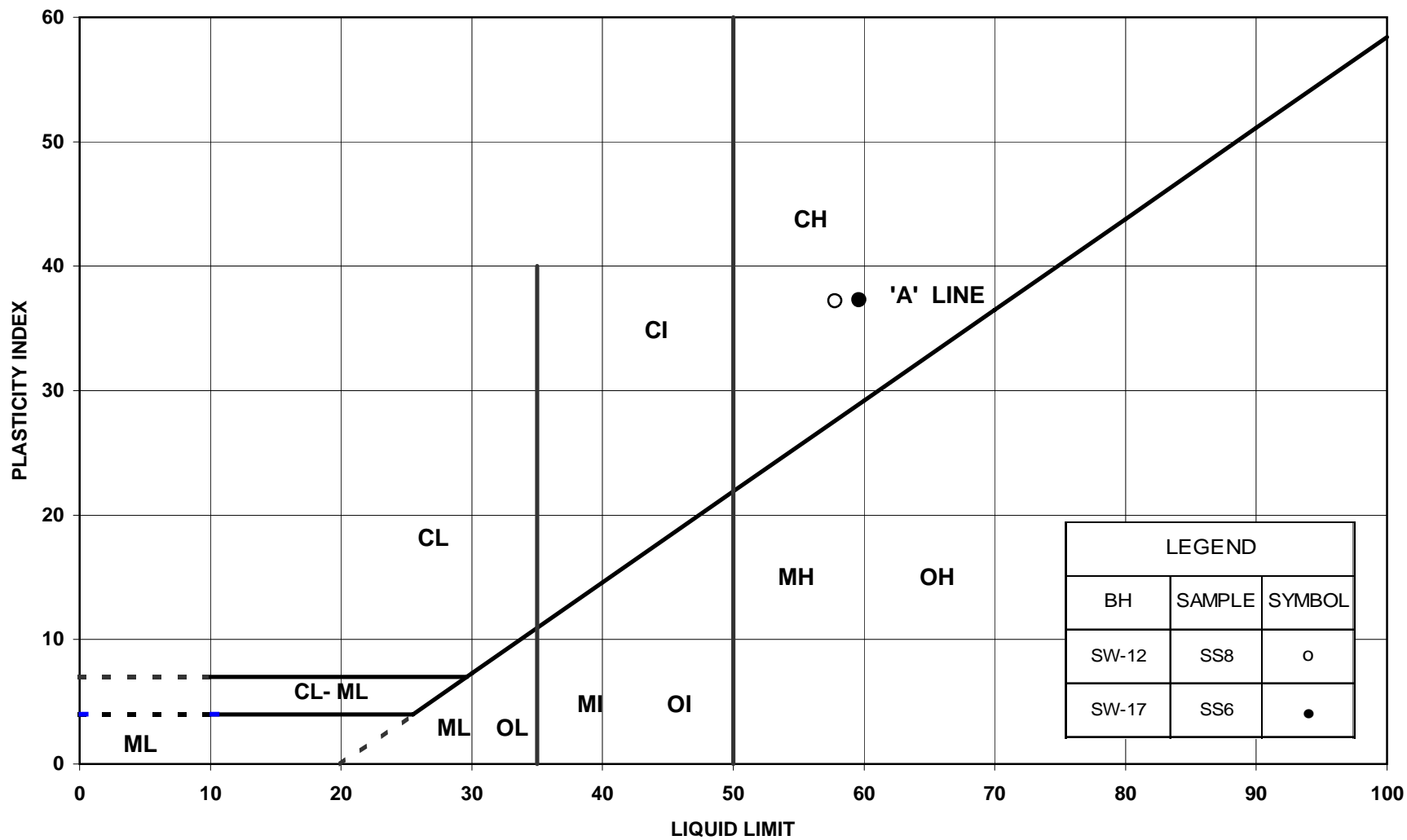
LABORATORY TEST RESULTS





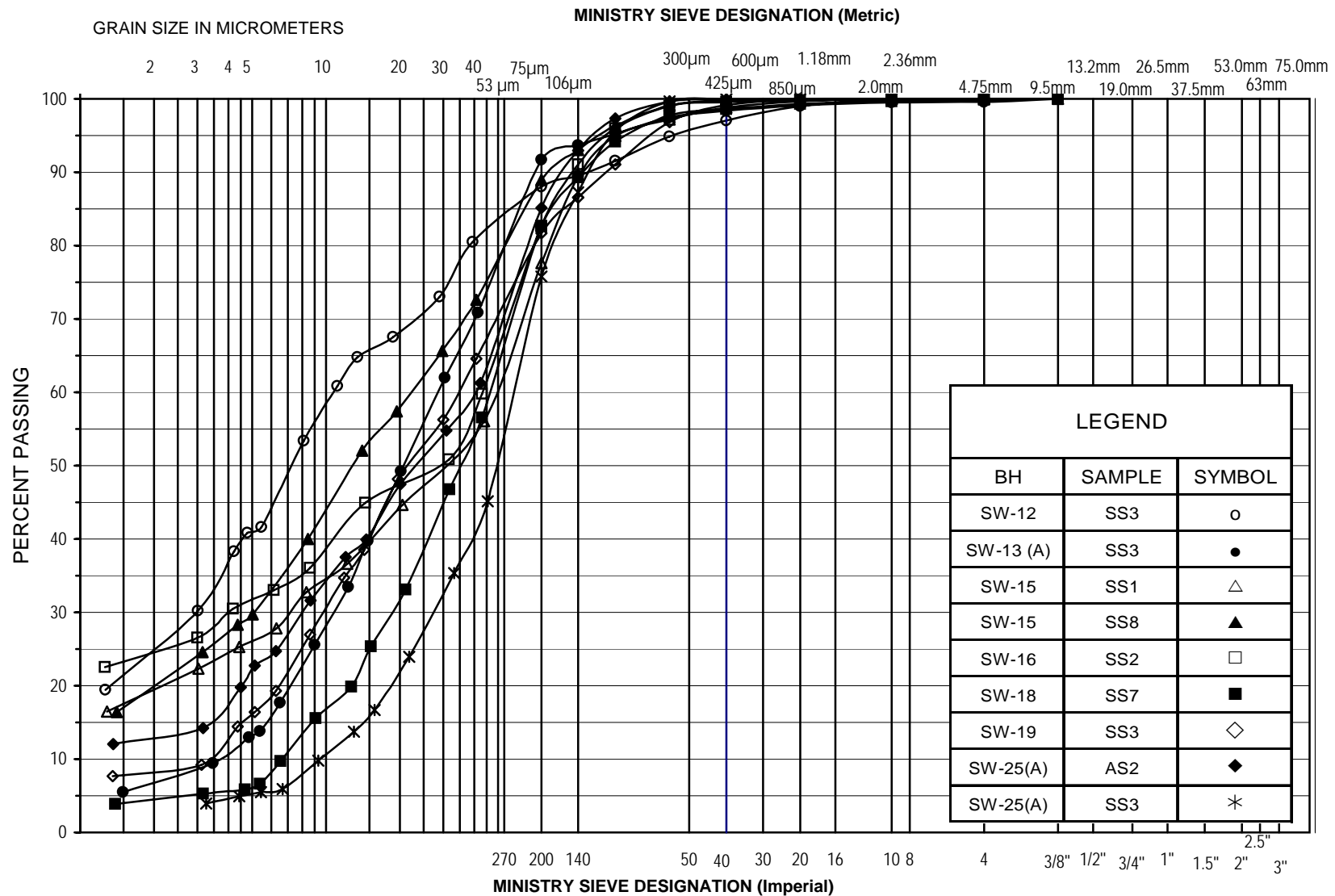






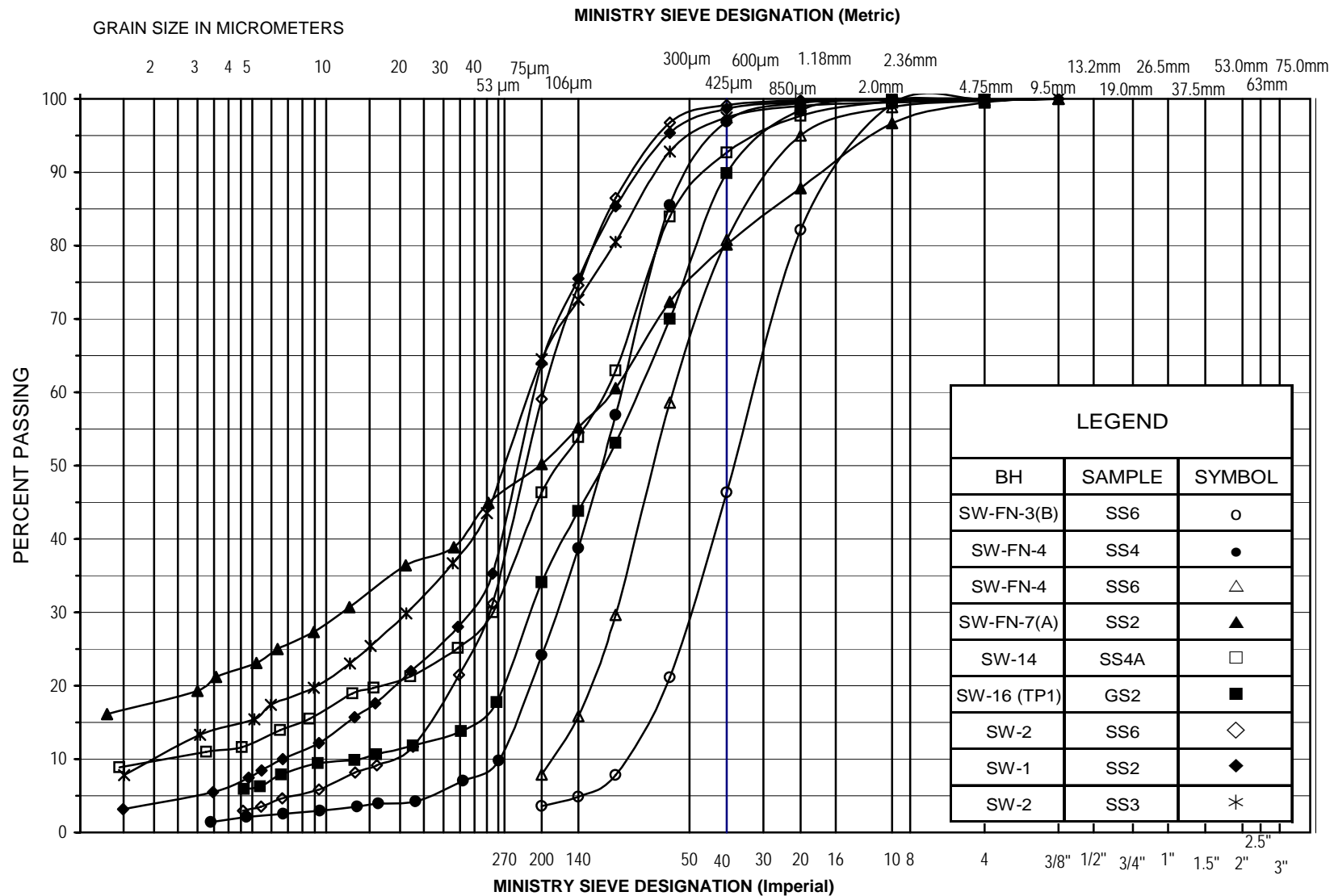
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



SAND / SILTY SAND / SILT AND SAND / SANDY SILT / SANDY SILTY CLAY

FIG. No. 7

G.W.P. 5377-02-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

