

**FOUNDATION INVESTIGATION REPORT
FOR
PROPOSED RETAINING WALL
FERN GLEN ROAD AND N-E/W RAMP
HIGHWAY 11-FERN GLEN ROAD INTERCHANGE
HIGHWAY 11 FOUR LANING PROJECT
EMSDALE TO BURK'S FALLS
DISTRICT 52, HUNTSVILLE
W.P. 466-93-00**

Submitted To:

**Delcan Corporation
133 Wynford Drive
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Submitted By:

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**12 August 2002
TT22811**

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1.0 INTRODUCTION

AMEC Earth & Environmental Limited (formerly AGRA Earth & Environmental Limited), Consulting Geotechnical, Materials Quality Control and Environmental Engineers, has been retained by Delcan Corporation to conduct a foundation investigation at the site of proposed retaining wall along a new alignment adjacent to N-E/W Ramp at the northwest quadrant of the proposed Highway 11 – Fern Glen Road Interchange. The proposed work is part of the Highway 11 Four Laning Project, from Emsdale to Burk's Falls, W.P. 466-93-00, District 52, Huntsville, Ontario. The site location is as shown on the Key Plan (Figure 1).

A geotechnical investigation was previously carried out at the site along an initially proposed alignment in September, 2001, when four boreholes (Boreholes RW1 to RW4) were drilled, as shown in Drawing No. 1. A draft report was submitted for this investigation, however, since that time, a revised alignment (where new Boreholes RW5 to RW9 were drilled, as shown in Drawing No. 1) was proposed.

The purpose of this investigation is to determine the sub-surface conditions at the site of the new alignment for the proposed retaining wall by means of a number of boreholes, in-situ tests and laboratory tests on selected samples.

The preliminary plan and sections (received on 28 March, 2002) for the proposed retaining wall were provided to us by Delcan Corporation.

2.0 SITE DESCRIPTION AND PHYSIOGRAPHY

2.1 Site Description

The site is located near the Village of Emsdale, about 170 m west of the existing intersection of Fern Glen Road with Highway 11, in the Township of Perry, Lot 16, Concession 8 in MTO District 52-Huntsville. The proposed retaining wall will be positioned along the west side of the N-E/W Ramp that will carry the traffic from southbound lanes of Highway 11 to Fern Glen Road. The wall is about 55 m long and starts approximately from Station 18+670, 12m Lt N-E/W Ramp C/L to Station 18+725, 22m Lt N-E/W Ramp C/L. The existing ground surface elevations at the south and north ends of the retaining wall are at about 350.5 m and 349.0 m, respectively. Beyond the north end of the proposed retaining wall, the ground slopes down towards an existing sand and gravel pit. To the east and west of the wall, the existing ground is relatively level. The surrounding area at the two ends of the wall is moderately wooded with trees and open area in the middle section of the proposed wall.

2.2 Physiography

Based on available geologic information, the site is in an area of glaciolacustrine sediments. Generally after the last glacial withdrawal, ice-contact sediments (sands and gravels) followed by glaciofluvial sediments (ranging from deltaic and near shore sands and gravels to prodeltaic and lake bottom silts and clays) were deposited on top of the existing sandy glacial till or Precambrian bedrock. The area was then inundated by glacial Lake Algonquin, depositing sands, silts and clays in low-lying areas. The bedrock generally consists of strongly foliated gneissic to migmatic rocks of the Central Gneiss Belt, which is part of the Grenville Province (a structural subdivision of the Canadian Shield).

3.0 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out during the period of 26 February, 2002 to 02 March, 2002, and consisted of drilling and sampling five boreholes (Boreholes RW5 to RW9, inclusive) to depths of 8.4 m to 17.8 m below the existing ground surface.

The location plan of the boreholes advanced in the investigations is shown on Drawing No. 1. The stratigraphic profile is shown on Drawing No. 2. The cross-sections through each borehole are presented in Drawing Nos. 3, 4 and 5. Details of sub-surface conditions encountered at each borehole location, including the results of in-situ and laboratory testing, are presented on the Record of Borehole sheets. Logs of Boreholes RW1 to RW4 from the previous investigation are also included on the Record of Borehole Sheets.

The boreholes were advanced, using a combination of solid stem continuous flight augers, hollow stem continuous flight augers, NW casings, Tri-Cone wash boring and NQ coring equipment, with a track-mounted power auger drill rig (Diedrich 50) owned and operated by Master Soil Drilling Incorporated, under the full-time supervision of experienced geotechnical personnel from AMEC Earth & Environmental Limited.

Sampling in the boreholes were carried out at regular intervals of 0.75 m to 1.5 m depth by the Standard Penetration Test Method, as specified in American Standards for Testing and Materials Method Number: D-1586. This consists of freely dropping a 63.5 kilogram hammer for a vertical distance of 0.76 m to drive a 51 mm diameter outside diameter split barrel (split-spoon) sampler into the ground. The number of blows of the hammer to drive the sampler into the relatively undisturbed ground for a vertical distance of 0.3 m is recorded as the Standard Penetration Resistance or the 'N'-values of the soil, and this gives an indication of the relative density of the soil deposit.

In order to advance the boreholes through cobbles and boulders and to prove bedrock, rotary core drilling was carried out in Boreholes RW5, RW7, RW8 and RW9 utilizing NW size casings and NQ core barrel.

The soil samples and rock cores were transported to our Advanced Soil Laboratory in Toronto (Scarborough) for further examination and classification. A laboratory testing programme, consisting of natural moisture content determinations, grain size analyses and rock core compression tests, was performed on selected representative soil and rock samples. The results of the laboratory tests are presented on the appropriate Record of Borehole Sheets and also on Figure Nos. 2 to 7, inclusive. The results of the grain size analysis on a sample from Borehole RW1 from the previous investigation, are also included in this report and are presented on Figure No. 2.

Groundwater conditions in the open boreholes were observed throughout and immediately after the drilling operations. Groundwater was also checked in the existing piezometer in Borehole RW1 from the previous investigation. All boreholes were adequately backfilled with auger cuttings on completion of the fieldwork.

The borehole locations were established in the field by Dearden and Stanton Limited, surveyors for the project. Also, the borehole locations in terms of northing and easting co-ordinates, stationing, and elevations were surveyed by Dearden and Stanton Limited. We understand that these elevations are referenced to the Geodetic datum. The locations, elevations, stations and co-ordinates of the boreholes are shown on Drawing Nos. 1 and 2; the co-ordinates, stations and elevations are also indicated on the Record of Borehole Sheets.

4.0 SUB-SURFACE CONDITIONS

The sub-surface conditions along the current proposed retaining wall were explored at six borehole locations (Borehole Nos. RW1, RW5, RW6, RW7, RW8 and RW9). The plan locations of the boreholes along with the stratigraphic profile along the proposed retaining wall are shown on Drawing Nos. 1 and 2. The cross-sections along each borehole are also shown in Drawing Nos. 3, 4 and 5. Details of sub-surface conditions encountered at each borehole location, including the results of in-situ testing, groundwater observations and laboratory test results are presented on the Record of Borehole Sheets. The sub-surface conditions are summarized in the following sections.

In general, the subsurface stratigraphy comprises surficial topsoil overlying loose to dense sand, which is in turn underlain by dense to very dense sand to gravelly sand with occasional cobbles and boulders (in Boreholes RW6 and RW7), and a layer of boulders and cobbles, followed by the Precambrian granitic gneiss bedrock. The granitic gneiss bedrock surface dips towards the north at a slope of 3 to 5H : 1V, within the project limits. Difficult augering was observed during borehole drilling (at Boreholes RW6 and

RW7) indicating the presence of cobbles and boulders in the subsoil. It should be noted that cobbles and boulders greater than 35 mm could not be sampled with the spoon sampler.

4.1 Topsoil

Topsoil was encountered in all the Boreholes, ranging in thickness from 0.15 m to 0.3 m.

It should be noted that the thickness of topsoil may vary in between and beyond the borehole locations.

4.2 Sand

Below the surficial topsoil, a predominant sand deposit was encountered in all boreholes. The sand extended to depths of 2.3 m in Borehole RW5 to 10.4 m in Borehole RW9.

The sand contains traces to some gravel and silt. It is also interbedded with occasional gravelly sand layer. The grain size analyses curves for the sand deposit are presented on Figure Nos. 2 through 6, inclusive, which indicate:

Gravel:	2 – 32%
Sand:	63 – 85%
Silt:	2 – 24%

Measured 'N'-values within the surficial 1± m in this deposit range from 4 to 19 blows per 0.3 m, indicating a loose to compact relative density. Below this depth, measured 'N'-values in this deposit generally range from 11 blows to greater than 50 blows per 0.3 m, indicating a compact to very dense relative density. Measured moisture contents range from about 3% to 14%.

4.3 Sand to Gravelly Sand with Cobbles and Boulders

In Boreholes RW6 and RW7, the sand layer is underlain by a cohesionless sand to gravelly sand deposit with occasional cobbles and boulders, which was encountered at depths of about 2.4 and 3.8 m, respectively. This layer extends to a depth of about 6.0 m, where refusal to augering was encountered.

Measured 'N'-values within this sand to gravelly sand deposit are in excess of 50 blows per 0.3 m indicating a very dense relative density. The high 'N'-values measured may be attributed to probable cobbles and / or boulders in the deposit. It is noted that the cobbles and boulders could not be sampled with the spoon sampler.

The grain size analysis curves for soil samples from this layer are presented on Figure No. 7, which indicate:

Gravel:	20 to 22%
Sand:	63 to 69%
Silt:	9 to 17%

Measured moisture contents range from about 4% to 6%.

4.4 Boulders and Cobbles

In Boreholes RW1, RW5, RW7, RW8 and RW9, auger refusal was encountered at the surface of the boulders and cobbles layer at depths between about 2.3 m and 10.3 m, below existing ground surface. Coring of the boulders and cobbles was carried out to determine the approximate thickness of this layer which was found to be about 2 to 4 m thick.

4.5 Bedrock

Below the boulders and cobbles, bedrock was encountered and cored in all the boreholes between depths of about 4.1 m in Borehole RW1 and 14.9 m in Borehole RW9 (Elevations 346.5 m to 334.0 m), respectively, below existing ground surface. The recovered core samples show that the Precambrian bedrock consists of a fresh, grey to dark grey, fine to coarse-grained Granitic Gneiss bedrock. Visual examination of the cores also indicates that the surface of the rock is generally unweathered.

In Borehole RW1, the bedrock is widely jointed from 4.1 m to 6.1 m depth (between Elevation 346.6 and 344.4 m) and close to moderately close jointed from 6.1 m to 7.2 m depth (between Elevation 344.4 and 343.3 m). Close to moderately close jointing can also be seen from 5.9 to 8.4 m depth (between Elevation 343.8 and 341.3 m) in Borehole RW5.

In the boreholes, the percentage of Total Core Recovery (TCR) ranges from 75% to 100% while the percentage of Solid Core Recovery ranges between 68 and 100%.

The Rock Quality Designation (RQD) values for the rock cores were measured and these are presented in Table 1 given at the end of this report. These RQD values ranges from 42 to 98% indicating that the bedrock, in general, has fair to excellent quality. Above Elevation 342 m, where the bedrock is expected to be exposed by rock cut in the area of Boreholes RW1, RW5 and RW6, the RQD values are considered good to excellent in Boreholes RW1 and RW5; while the RQD is fair to excellent in Borehole RW6.

The Fracture Index (number of cracks per 1.5 m length) of the cores and the dip of the joints or discontinuities (angle measured from the vertical axis of the rock core) with respect to the core axis were also determined and these are shown in Table 2. It should be noted that this table (together with the borehole logs) indicates that, in general, the dip angle of the joints or discontinuities above Elevation 343.5 m (generally within the exposed rock after excavation) is approximately 45 degrees.

Laboratory uniaxial compression tests were carried out on solid rock core samples obtained from Borehole RW1 at 6.7 m depth and from Borehole RW5 at 6.3 m depth, and the compressive strengths were measured at 59 and 89 MPa, respectively. The test results are presented in the Record of Borehole Sheets.

Based on the RQD in Table 1 and Fracture Indices in Table 2 and visual examination of the cores, the rock is considered to be of fair to excellent quality.

4.6 Groundwater Conditions

Groundwater conditions in the open boreholes were observed throughout and immediately after the drilling operations. All boreholes were found dry during drilling and prior to rock coring of each borehole. On 02 March, 2002, the existing piezometer in Borehole RW1 from the previous investigation was checked and no water was observed in this piezometer.

Based on the visual and tactile examinations and the measured moisture contents of the soil samples, the groundwater level at the site was considered below the surface of the bedrock, at the time of the investigation.

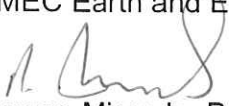
It should, however, be pointed out that the groundwater at the site could fluctuate seasonally and in response to major weather events.

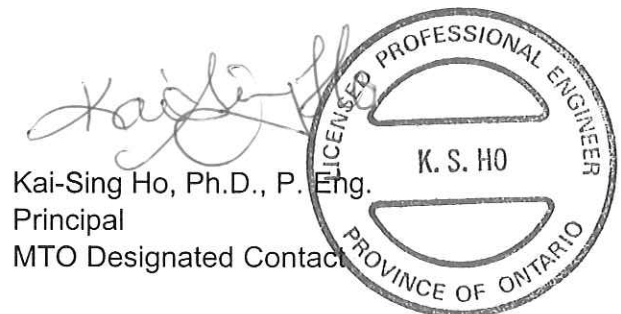
5.0 CLOSURE

The Report Limitations is an integral part of this Report.

Sincerely,

AMEC Earth and Environmental Limited


Ramon Miranda, P. Eng.
Head, Transportation Department



Kai-Sing Ho, Ph.D., P. Eng.
Principal
MTO Designated Contact

AMEC Earth and Environmental Limited

REPORT LIMITATIONS

The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Sub-surface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, and development, etc.

TABLES

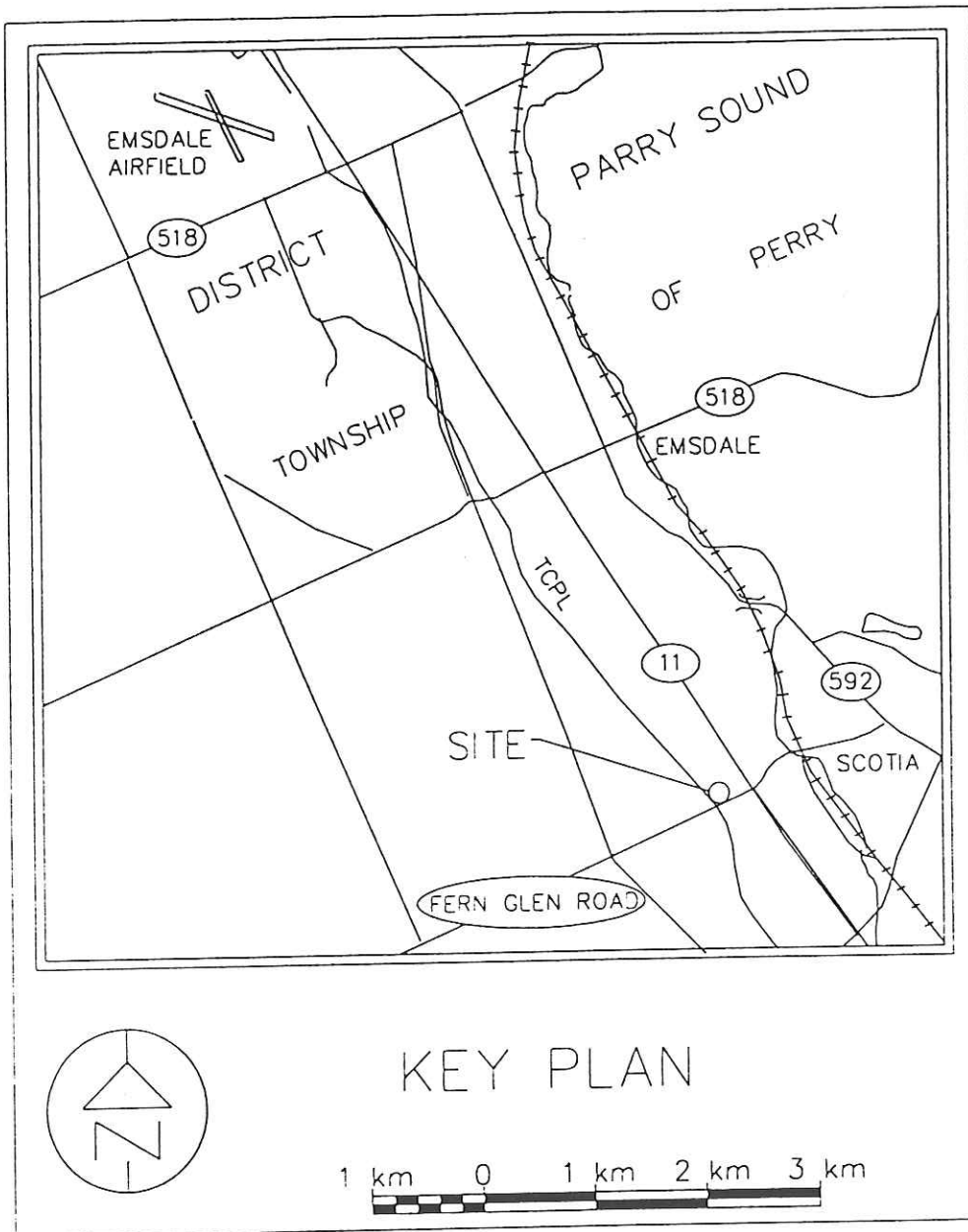
Table 1: Rock Quality Designation (RQD)

APPROX. ELEVATION (m)	RQD (%)					
	RW1	RW5	RW6	RW7	RW8	RW9
346	100					
345						
344	84					
343		97	56			
342		96	98			
341						
340			79	68		
339				90		
338				42	77	
336					71	
334						69
332						87

Table 2: Fracture Index

APPROX. ELEVATION (m)	Fracture Index (per 1.5 m) and Joint Dip Angles (in bracket)					
	RW1	RW5	RW6	RW7	RW8	RW9
346	0					
345						
344	6 [40°, 45°, 50°, 50°, 50°]					
343		4 [50°, 90°]	8 [60°, 90°, 60°, 25°, 90°]			
342		2 [90°, 50°]	2 [90°, 90°]			
341						
340			1 [90°]	3 [90°, 90°]		
339				7 [30°, 30°, 0° & 90°, 0° & 90°, 50°, 90°, 90°]		
338				17 [dips range from 20° to 90°]	4 [dips range from 30° to 90°]	
336					6 [dips range from 0° to 90°]	
334						2 [70°, 30°]
332						5 [dips Range from 40° to 90°]

FIGURES



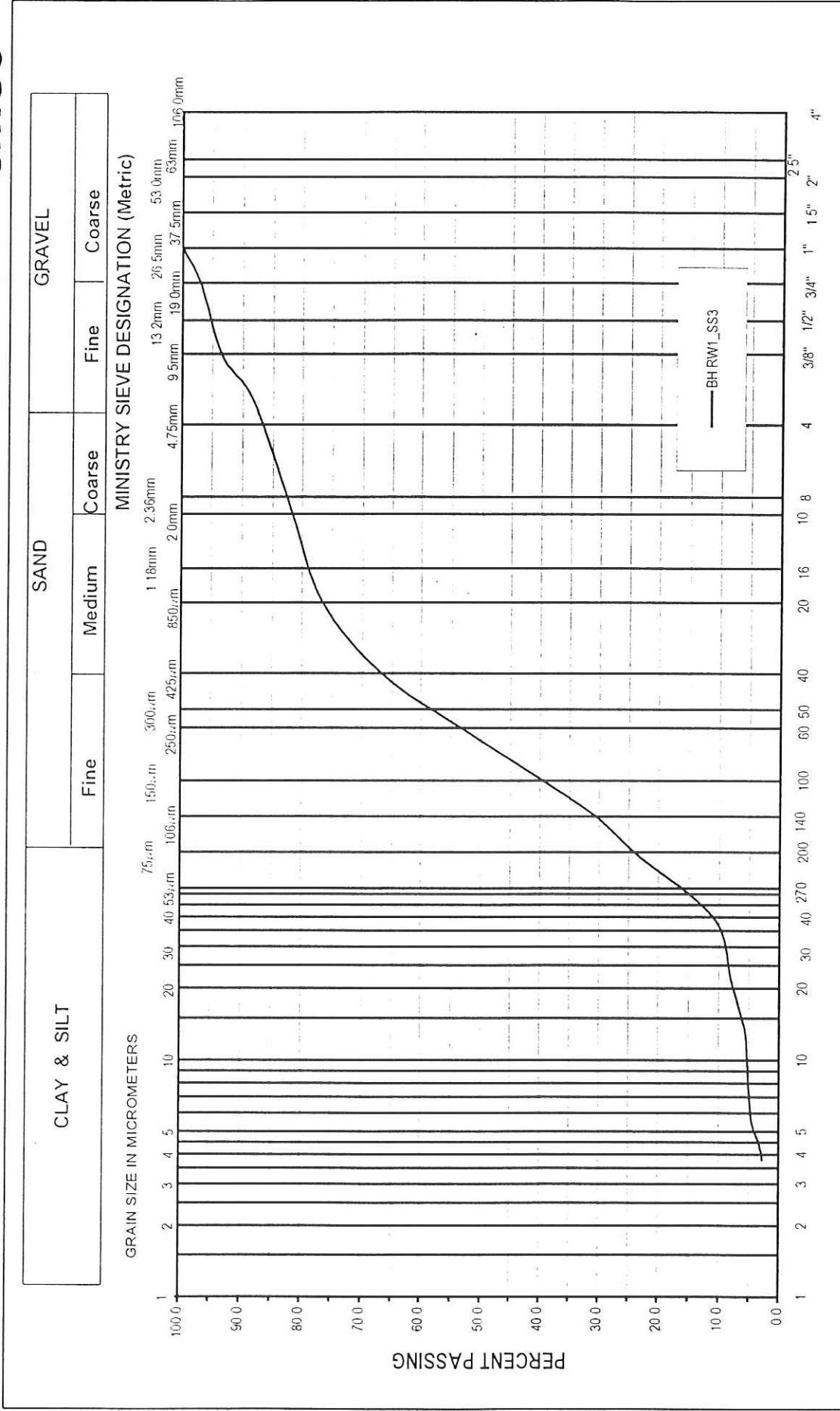
KEY PLAN

1 km 0 1 km 2 km 3 km

FERN GLEN, N-E/W RAMP RETAINING WALL
KEY PLAN

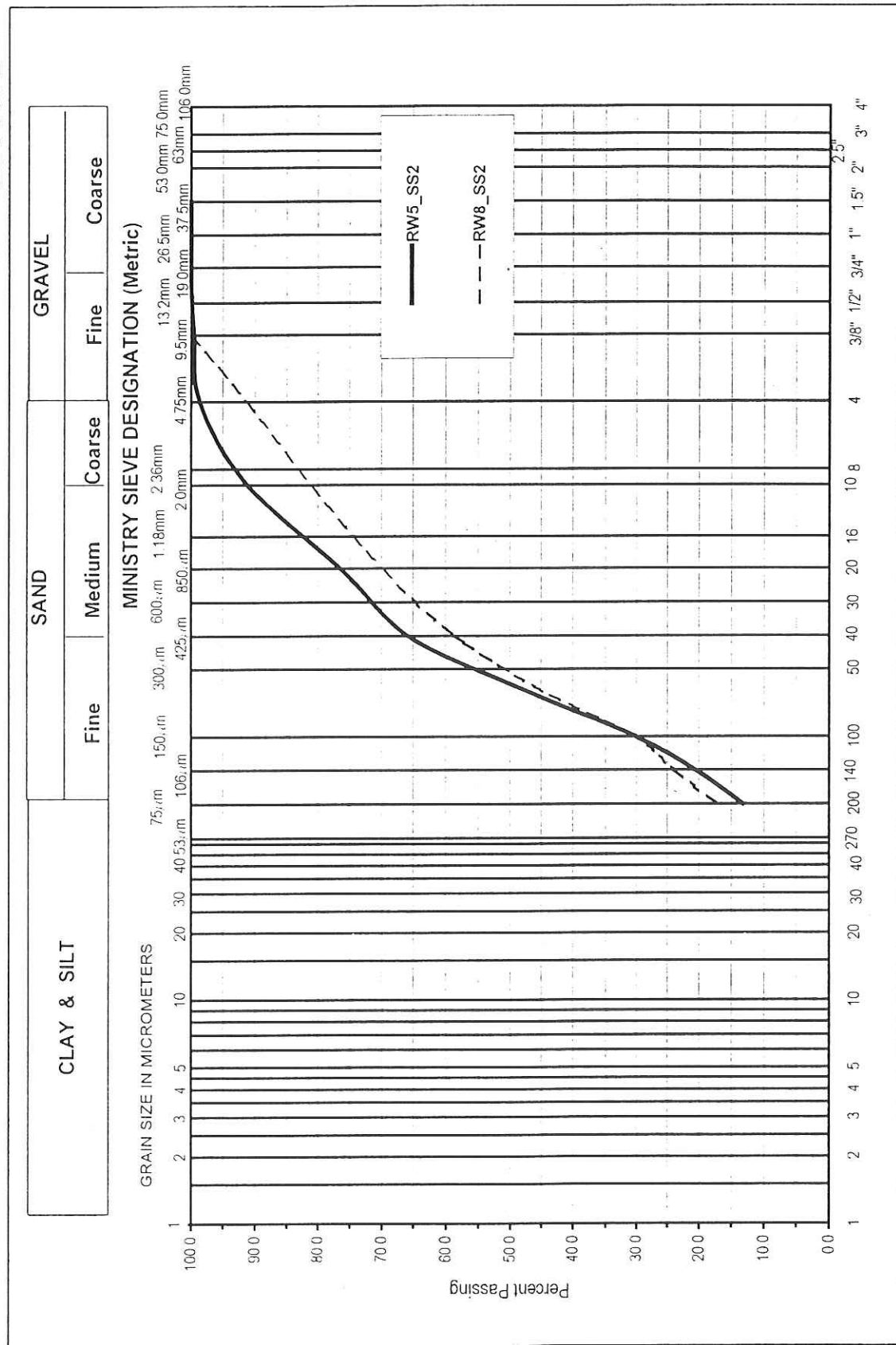
Figure No 1

amec



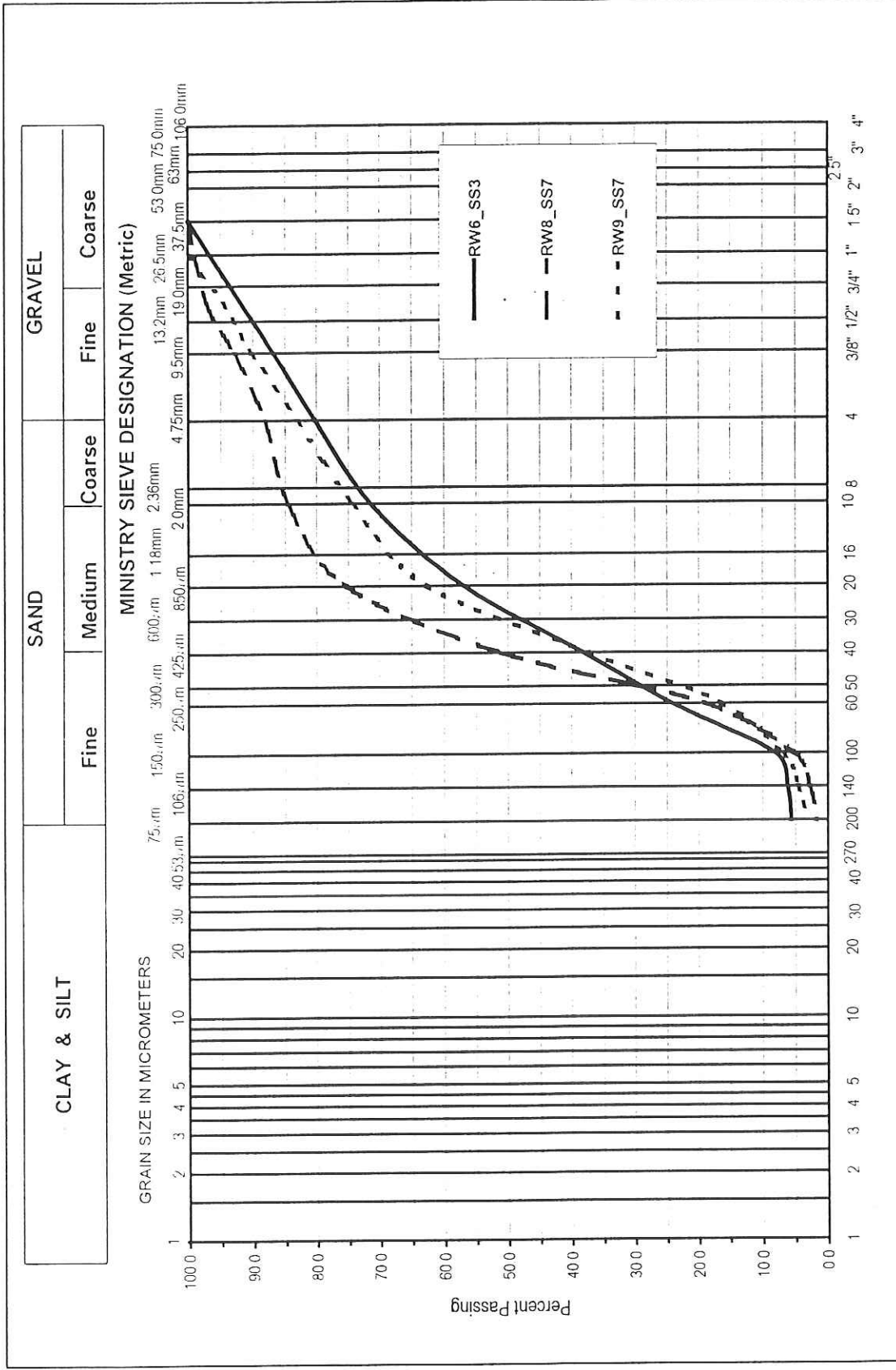
AMEC Earth & Environmental Limited 104 Crockford Blvd., Scarborough, Ontario Canada, M1R 3C6 Tel +1 (416) 751 6565, Fax +1 (416) 751 7592 www.amec.com	JOB: TT98820.3 WP No. 466-93-00		MINISTRY SIEVE DESIGNATION (Imperial) GRAIN SIZE DISTRIBUTION		Client: DELCAN	Date: 20-10-01
			SAND		Project: N-EW Ramp Retaining Wall	
			some Gravel and Silt		Location: Fern Glen, HWY11, Ontario	

FIGURE 2



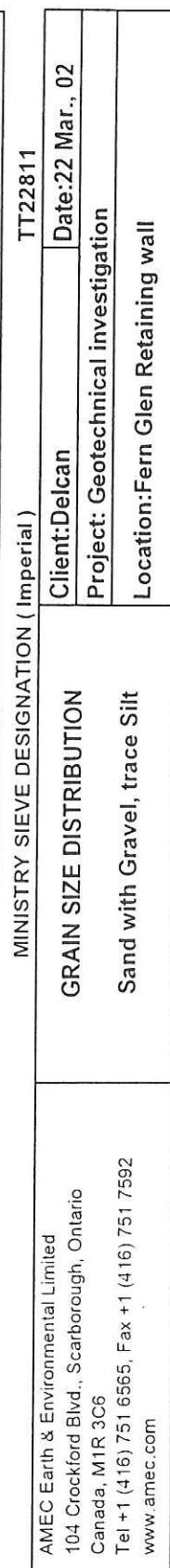
AMEC Earth & Environmental Limited 104 Crockford Blvd., Scarborough, Ontario Canada, M1R 3C6 Tel +1 (416) 751 6565, Fax +1 (416) 751 7592 www.amec.com		MINISTRY SIEVE DESIGNATION (Imperial)		TT22811
		Client: Delcan		Date: 22 Mar., 02
		Project: Geotechnical Investigation		
		Location: Fern Glen Retaining wall		

Figure 3

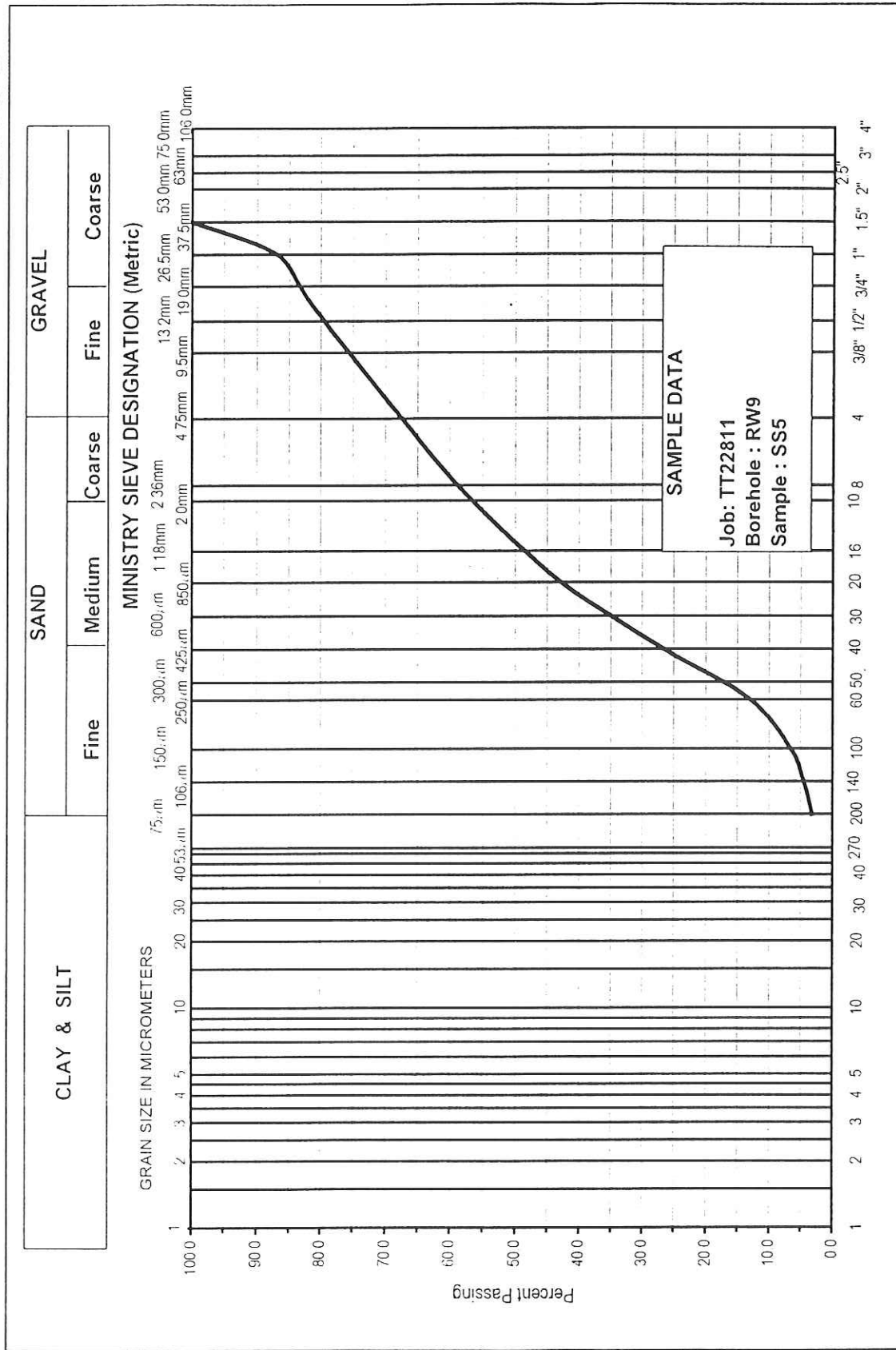


MINISTRY SIEVE DESIGNATION (Imperial)		TT22811
Client: Delcan		Date: 22 Mar., 02
Project: Geotechnical investigation		
Location: Fern Glen Retaining wall		
AMEC Earth & Environmental Limited 104 Crockford Blvd., Scarborough, Ontario Canada, M1R 3C6 Tel +1 (416) 751 6565, Fax +1 (416) 751 7592 www.amec.com		

Figure 4

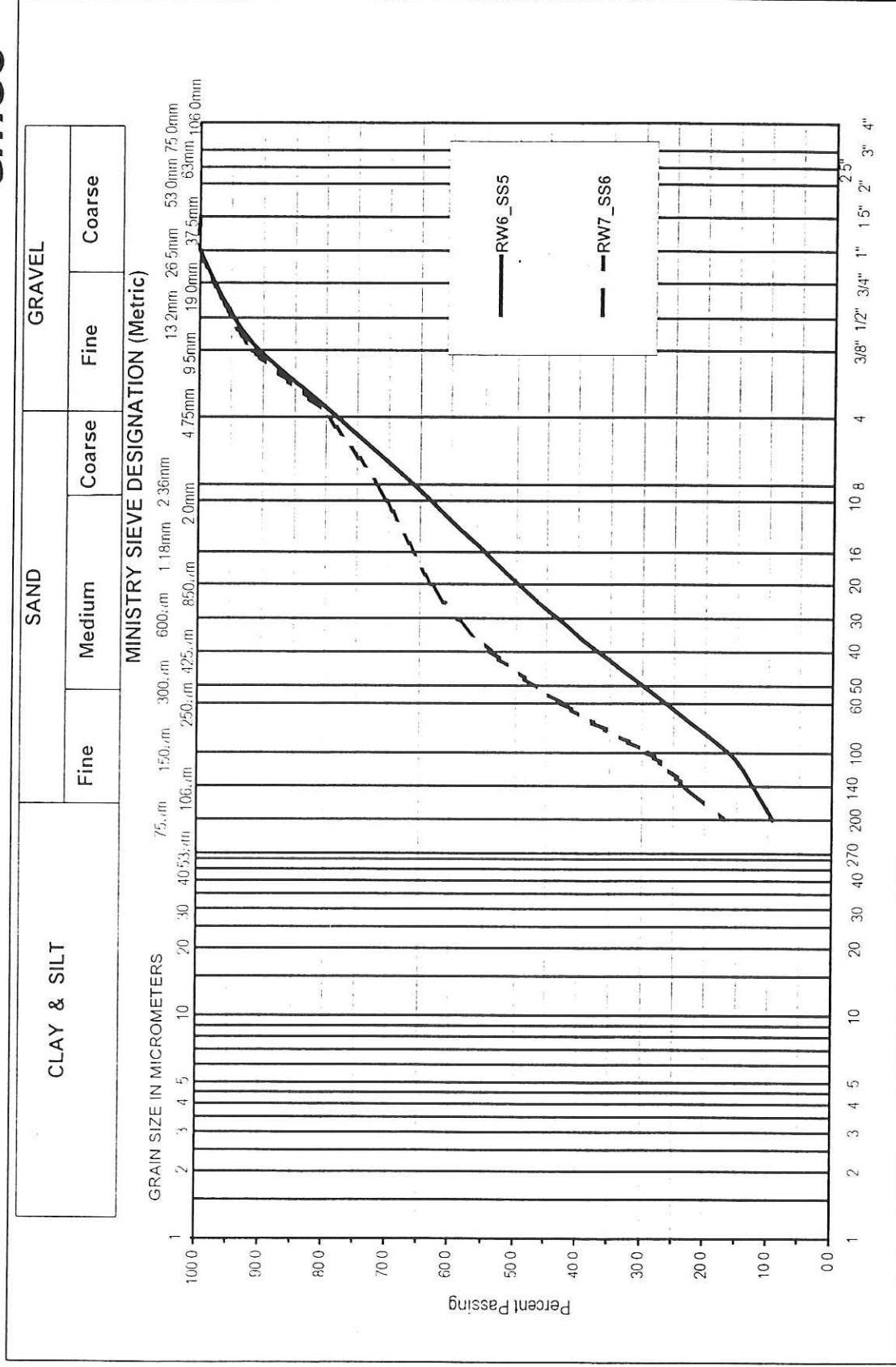


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AMEC Earth & Environmental Limited 104 Crockford Blvd., Scarborough, Ontario Canada, M1R 3C6 Tel +1 (416) 751 6565, Fax +1 (416) 751 7592 www.amec.com		MINISTRY SIEVE DESIGNATION (Imperial)	
GRAIN SIZE DISTRIBUTION Gravelly Sand, trace silt		Client: Delcan	Date: 22 Mar., 02
		Project: Geotechnical investigation	
		Location: Fern Glen Retaining wall	

Figure 6



MINISTRY SIEVE DESIGNATION (Imperial) TT22811		MINISTRY SIEVE DESIGNATION (Metric)	
GRAIN SIZE DISTRIBUTION Sand with Gravel some Silt		Client: Delcan Date: 22 Mar., 02	
AMEC Earth & Environmental Limited 104 Crockford Blvd., Scarborough, Ontario Canada, M1R 3C6 Tel +1 (416) 751 6565, Fax +1 (416) 751 7592 www.amec.com		Project: Geotechnical investigation Location: Fern Glen Retaining wall	

Figure 7

DRAWINGS

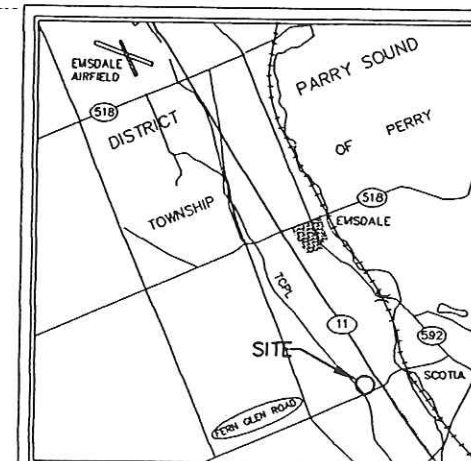


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES - METRES.

W.P. No. 466-93-00

STATION 18+667 to 18+730 N-E/W RAMP
BOREHOLE LOCATIONS

AMEC Earth & Environmental Limited



KEY PLAN



- LEGEND
- AMEC Borehole (Feb. 2002)
 - AMEC Borehole (Sep. 2001)
 - 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
 - CONE Blows/0.3m (60° Cone, 475 J/blow)
 - WL at time of investigation
 - WL in Piezometer
 - Piezometer
 - End of Borehole

No	ELEVATION	STATION	OFFSET	CO-ORDINATES	
				NORTHING	EASTING
BH RW1	350.54	18+667 N-E/W Ramp CL	11.2 Lt	5041295	319728
BH RW2	349.10	18+688 N-E/W Ramp CL	11.9 Lt	5041315	319724
BH RW3	349.07	18+709 N-E/W Ramp CL	13.0 Lt	5041336	319719
BH RW4	349.41	18+730 N-E/W Ramp CL	15.6 Lt	5041358	319715
BH RW5	349.72	18+680 N-E/W Ramp CL	13.7 Lt	5041307	319724
BH RW6	349.13	18+690 N-E/W Ramp CL	15.2 Lt	5041317	319720
BH RW7	349.10	18+700 N-E/W Ramp CL	16.8 Lt	5041327	319717
BH RW8	348.99	18+710 N-E/W Ramp CL	18.6 Lt	5041337	319714
BH RW9	348.90	18+724 N-E/W Ramp CL	22.1 Lt	5041349	319708

-NOTE-

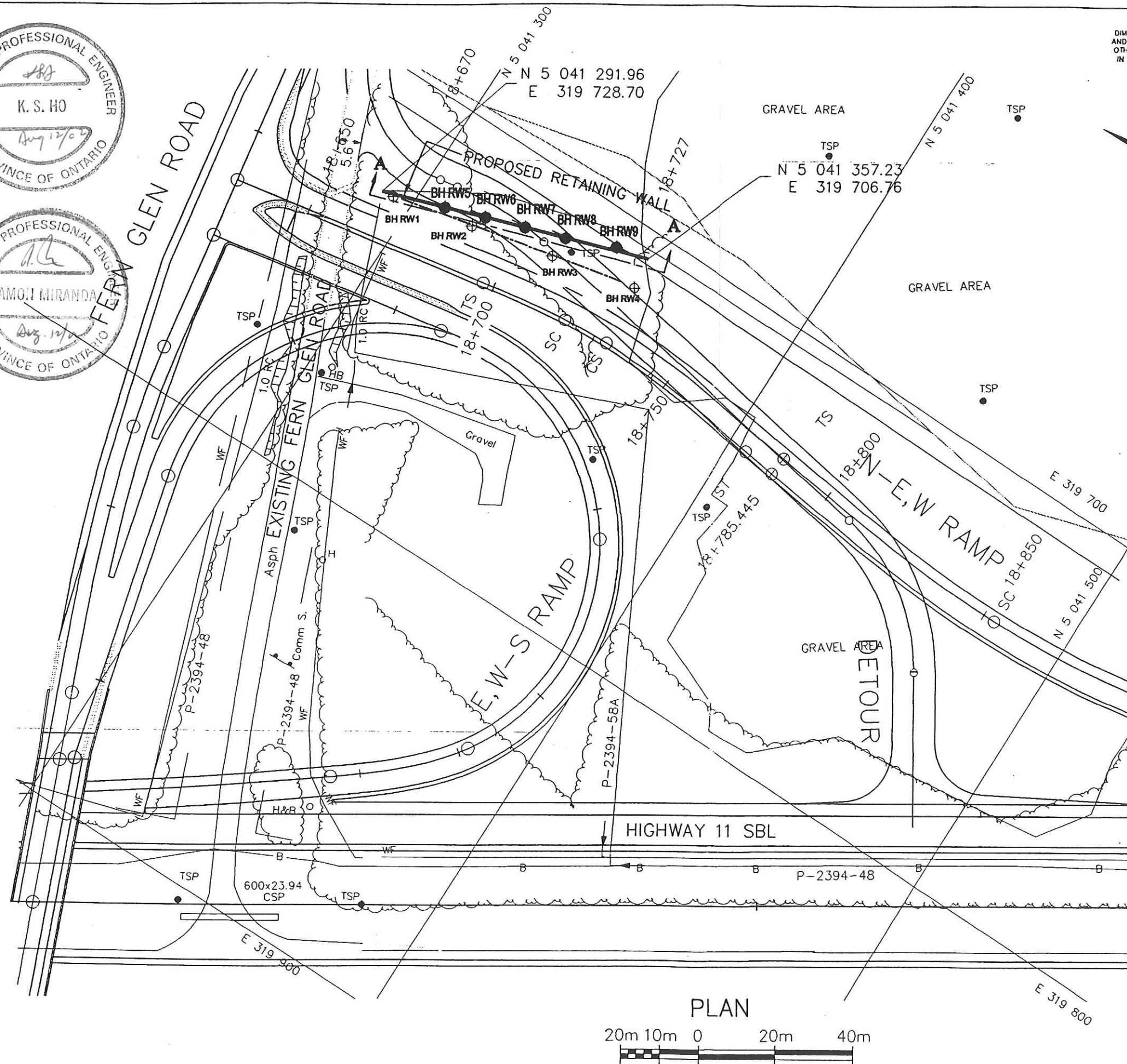
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

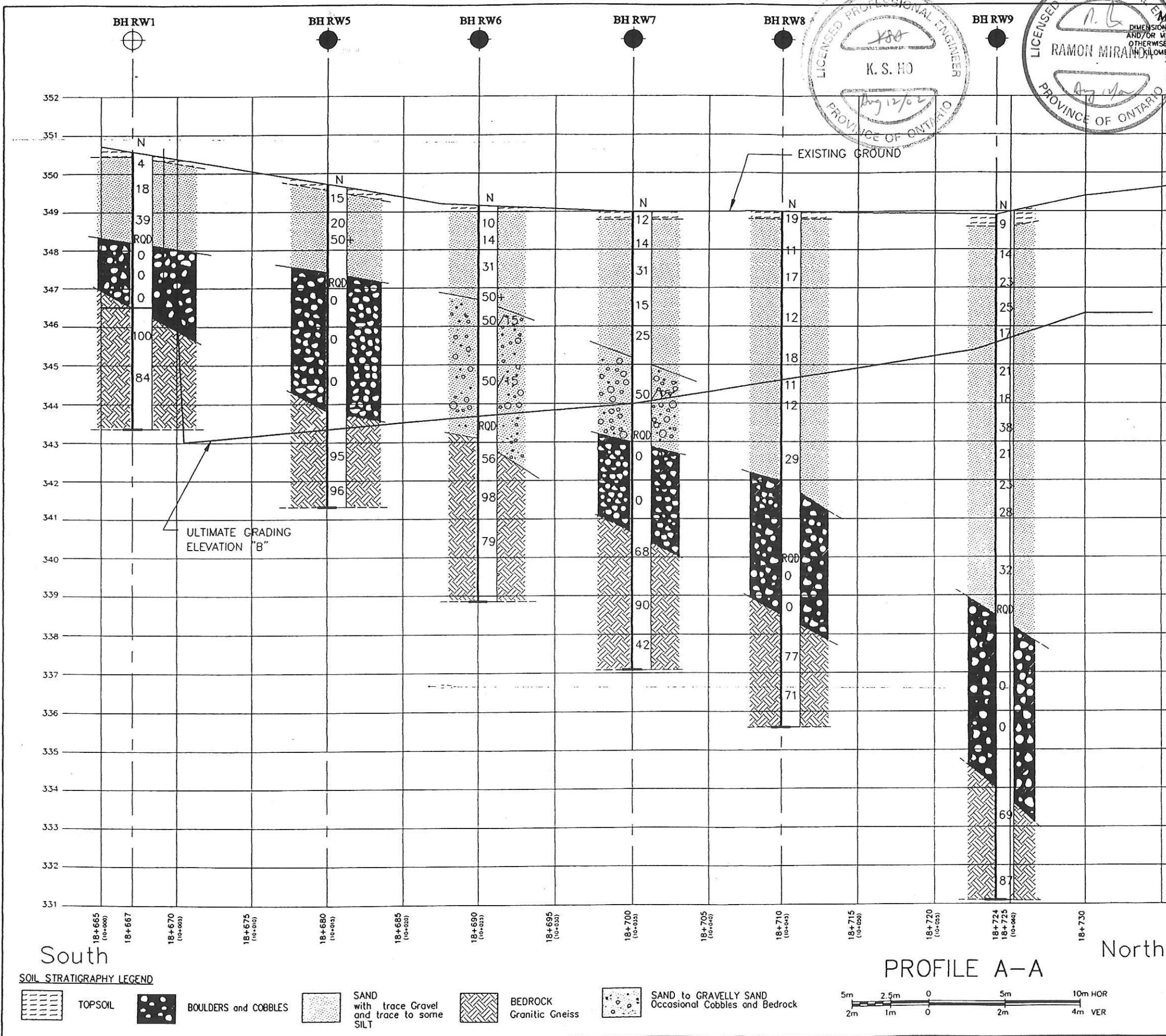
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC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

REV	DATE	BY	DESCRIPTION

HWY 11-FERN GLEN RETAINING WALL	DIST
CHKD RM	DATE MARCH, 2002
DRAWN NS	DWG 1

FILE: K:\GEO-TRANSPORT\PROJECTS\2002\1122811\DRAWINGS



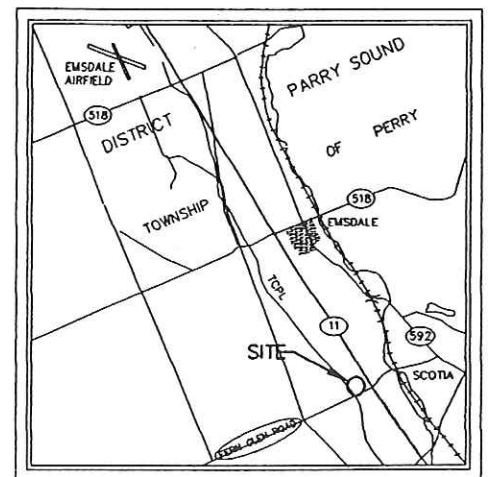


G.W.P. No. 466-93-00

STATION 18+667 to 18+730 N-E/W RAMP

SOIL STRATA

AMEC Earth & Environmental Limited



LEGEND

- AMEC Borehole (Feb. 2002)
- AMEC Borehole (Sep. 2001)
- 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation
- WL in Piezometer
- Piezometer
- End of Borehole

No	ELEVATION	STATION	CO-ORDINATES
			OFFSET NORTHING EASTING
BH RW1	350.54	18+667 N-E/W Ramp CL	11.2 Lt 5041295 319728
BH RW2	349.10	18+688 N-E/W Ramp CL	11.9 Lt 5041315 319724
BH RW3	349.07	18+709 N-E/W Ramp CL	13.0 Lt 5041336 319719
BH RW4	349.41	18+730 N-E/W Ramp CL	15.6 Lt 5041358 319715
BH RW5	349.72	18+680 N-E/W Ramp CL	13.7 Lt 5041307 319724
BH RW6	349.13	18+690 N-E/W Ramp CL	15.2 Lt 5041317 319720
BH RW7	349.10	18+700 N-E/W Ramp CL	16.8 Lt 5041327 319717
BH RW8	348.99	18+710 N-E/W Ramp CL	18.6 Lt 5041337 319714
BH RW9	348.90	18+724 N-E/W Ramp CL	22.1 Lt 5041349 319708

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REV	DATE	BY	DESCRIPTION

HWY 11-FERN GLEN RETAINING WALL	DIST
SUBM'D NTK CHECKED RM	DATE MARCH, 2002 SITE
DRAWN NS CHECKED	DWG 2

FILE: K:\GEO-TRANSPORT\PROJECTS\2002\1122811\DRAWINGS

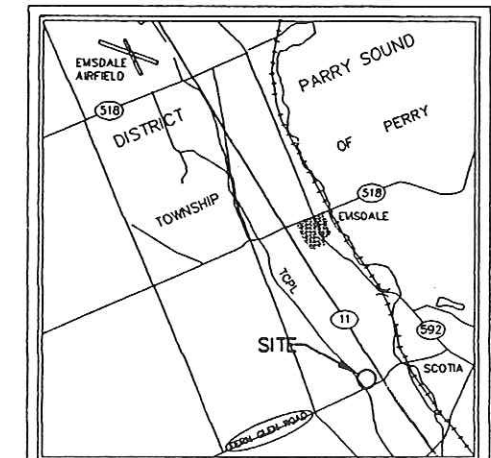


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES - METRES.

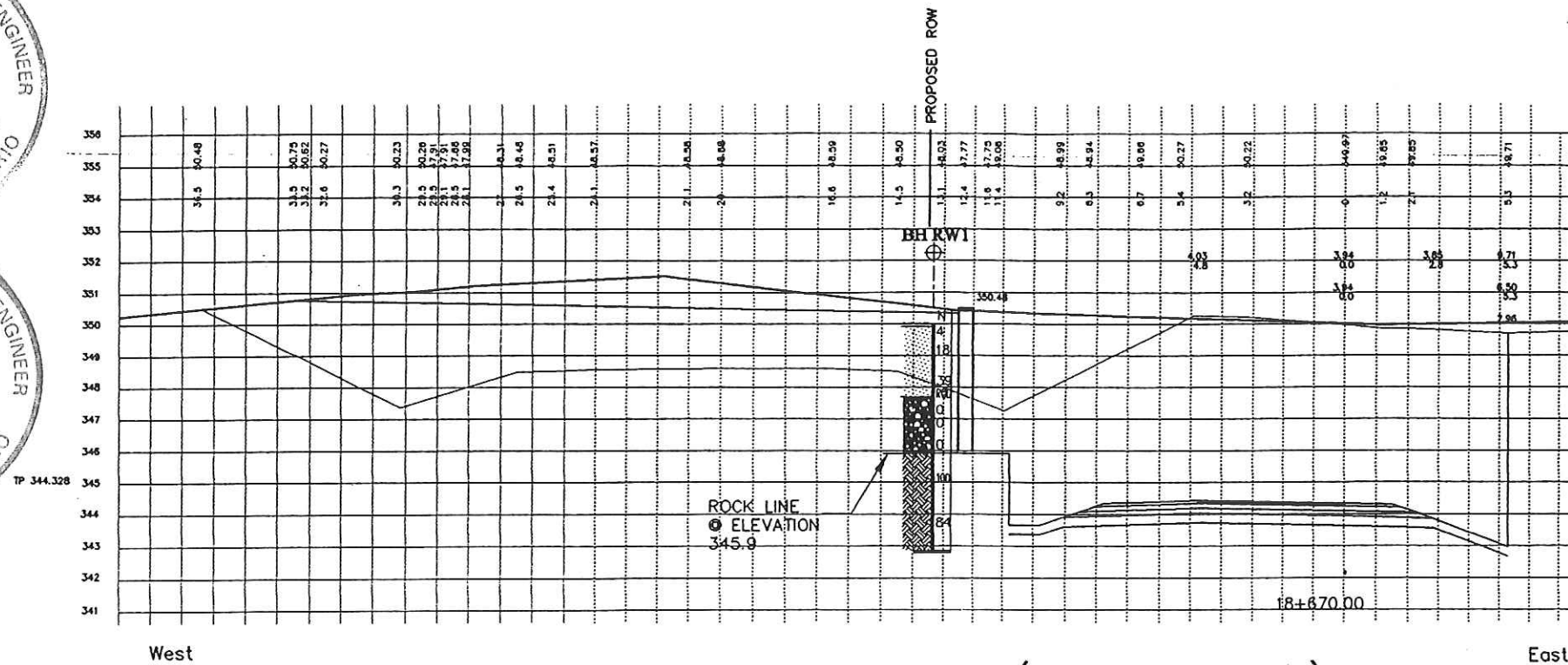
G.W.P. No. 466-93-00

CROSS SECTIONS AT STATION 18+670 &
18+680 N-E/W RAMP

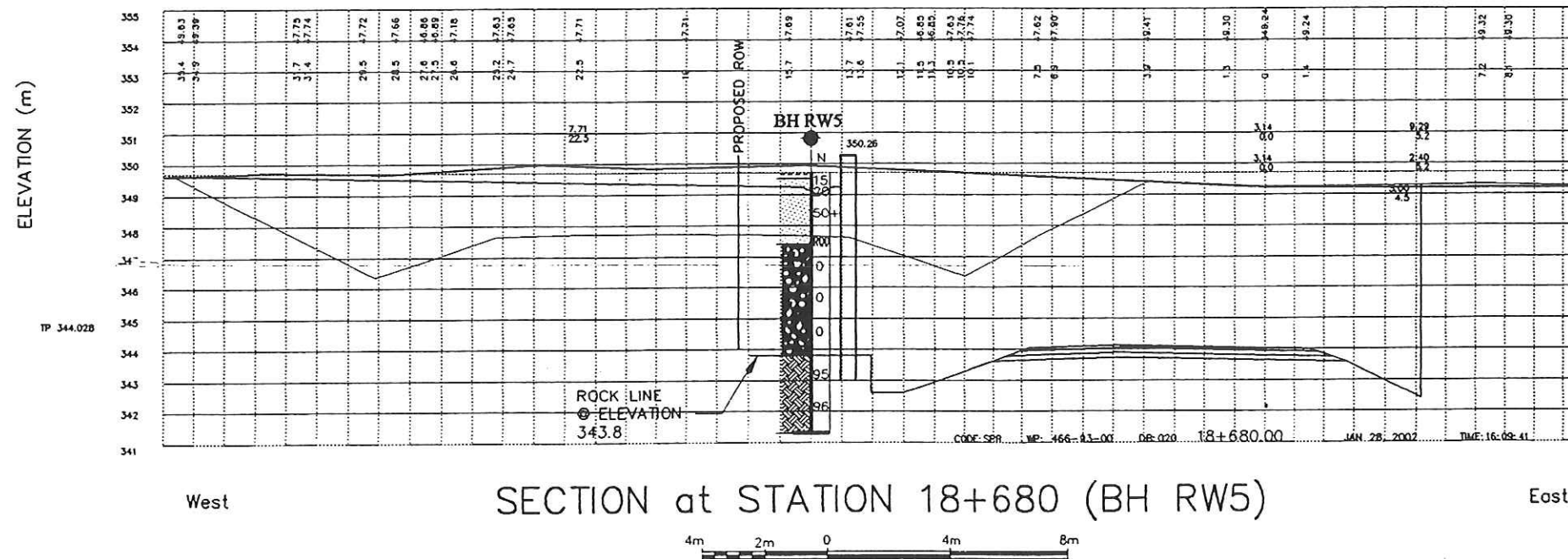
AMEC Earth & Environmental Limited



KEY PLAN

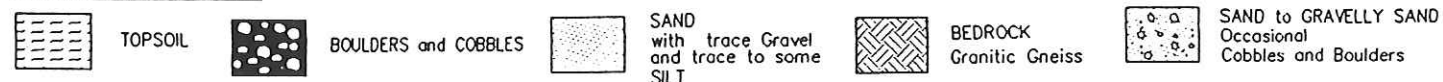


SECTION at STATION 18+670 (NEAR BH RW1)



SECTION at STATION 18+680 (BH RW5)

SOIL STRATIGRAPHY LEGEND



NOTE:

For clarity, the position of the boreholes are offset from their actual location along the proposed retaining wall alignment.

- LEGEND
- AMEC Borehole (FEB.2002)
 - AMEC Borehole (Sep.2001)
 - 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
 - CONE Blows/0.3m (60° Cone, 475 J/blow)
 - WL at time of investigation
 - WL in Piezometer
 - Piezometer
 - End of Borehole

No	ELEVATION	STATION	OFFSET	CO-ORDINATES
				NORTHING EASTING
BH RW1	350.54	18+667	11.2 Lt	5041295 319728
		N-E/W		
		Ramp Cl		
BH RW2	349.10	18+688	11.9 Lt	5041315 319724
		N-E/W		
		Ramp Cl		
BH RW3	349.07	18+709	13.0 Lt	5041336 319719
		N-E/W		
		Ramp Cl		
BH RW4	349.41	18+730	15.6 Lt	5041358 319715
		N-E/W		
		Ramp Cl		
BH RW5	349.72	18+680	13.7 Lt	5041307 319724
		N-E/W		
		Ramp Cl		
BH RW6	349.13	18+690	15.2 Lt	5041317 319720
		N-E/W		
		Ramp Cl		
BH RW7	349.10	18+700	16.8 Lt	5041327 319717
		N-E/W		
		Ramp Cl		
BH RW8	348.99	18+710	18.6 Lt	5041337 319714
		N-E/W		
		Ramp Cl		
BH RW9	348.90	18+724	22.1 Lt	5041349 319708
		N-E/W		
		Ramp Cl		

-NOTE-

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REV	DATE	BY	DESCRIPTION
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HWY 11-FERN GLEN RETAINING WALL	DIST
SUBM'D NNN CHECKED RM	DATE MARCH, 2002 SITE
DRAWN NS CHECKED	APPROVED DWG 3

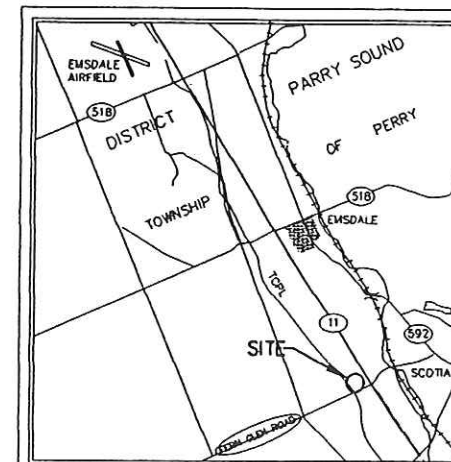


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES - METRES.

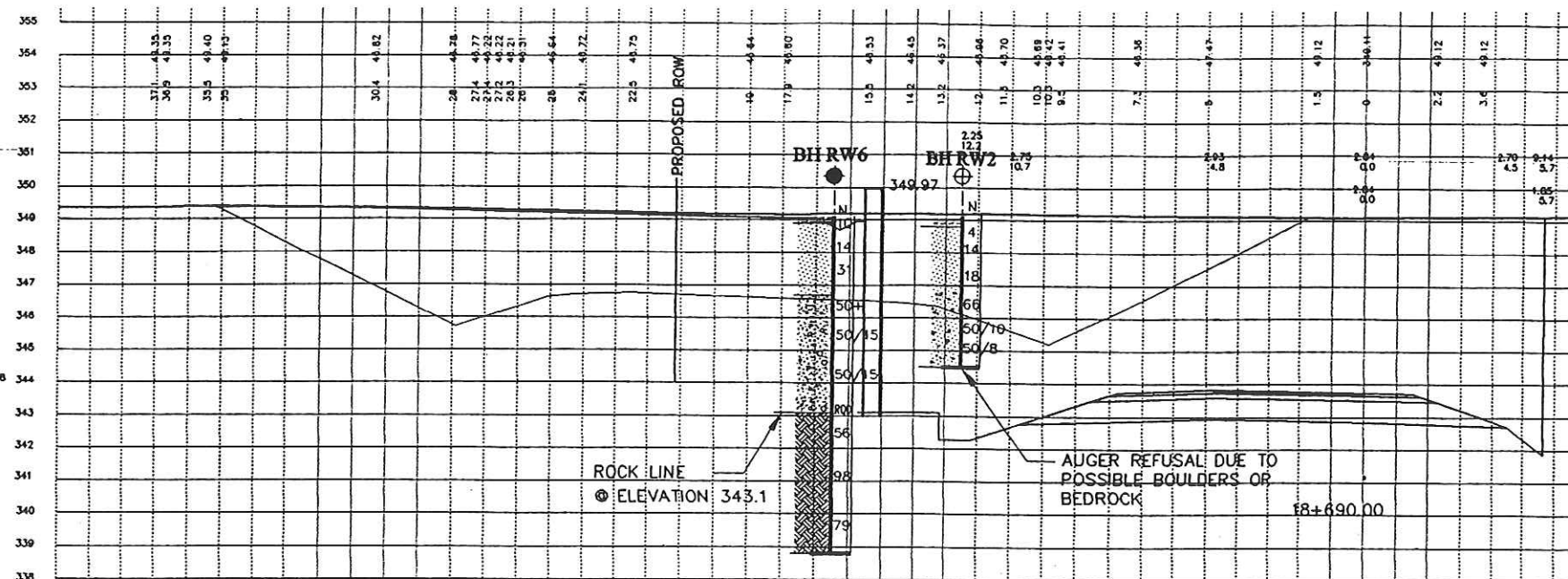
G.W.P. No. 466-93-00

CROSS SECTIONS AT STATION 18+690 &
18+700 N-E/W RAMP

AMEC Earth & Environmental Limited



KEY PLAN



West

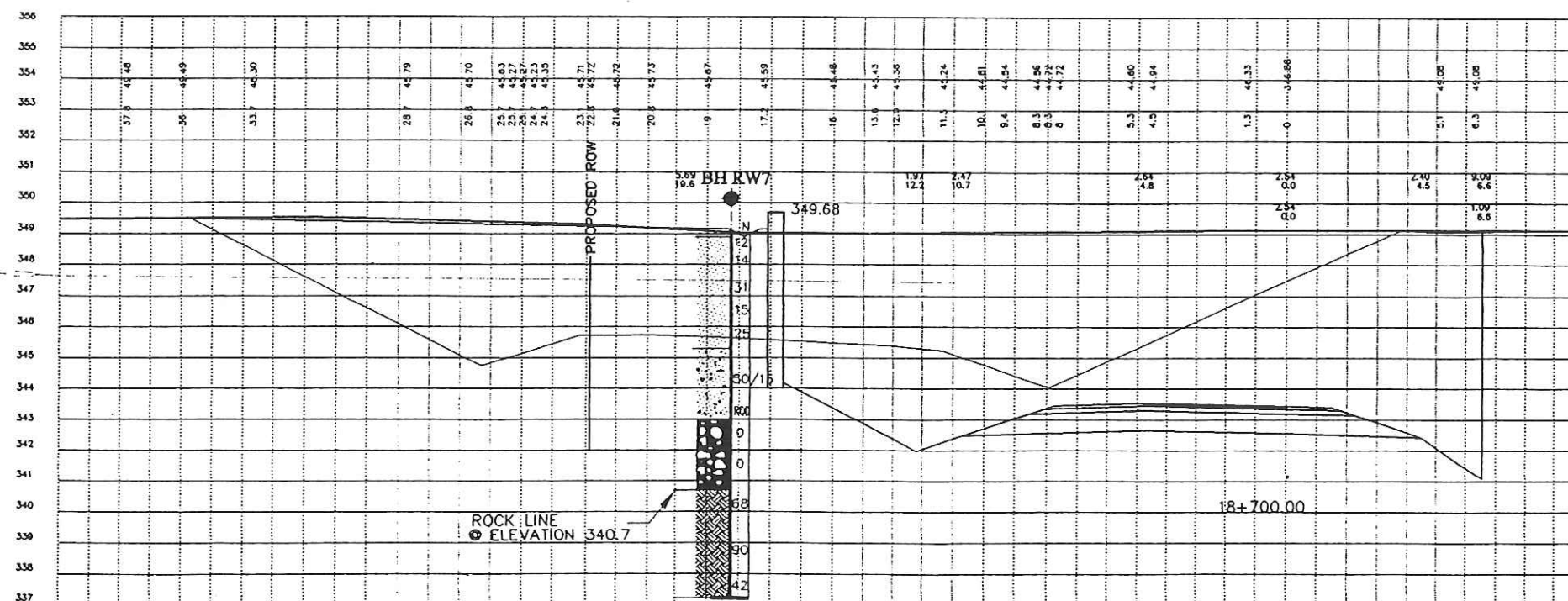
East

SECTION at STATION 18+690 (BH RW6 & BH RW2)



ELEVATION (m)

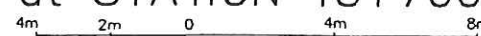
TP 343.428



West

East

SECTION at STATION 18+700 (BH RW7)



SOIL STRATIGRAPHY LEGEND



TOPSOIL



BOULDERS and COBBLES



SAND
with trace Gravel
and trace Silt



BEDROCK
Granitic Gneiss



SAND to GRAVELLY SAND
Occasional
Cobbles and Boulders

NOTE:

For clarity, the position of the boreholes
are offset from their actual location
along the proposed retaining wall
alignment.

LEGEND

- AMEC Borehole (FEB.2002)
- AMEC Borehole (Sep.2001)
- 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation
- WL in Piezometer
- Piezometer
- End of Borehole

No	ELEVATION	STATION	OFFSET	CO-ORDINATES NORTHING EASTING
BH RW1	350.54	18+657 N-E/W Ramp Cl	11.2 Lt	5041295 319728
BH RW2	349.10	18+688 N-E/W Ramp Cl	11.9 Lt	5041315 319724
BH RW3	349.07	18+709 N-E/W Ramp Cl	13.0 Lt	5041336 319719
BH RW4	349.41	18+730 N-E/W Ramp Cl	15.6 Lt	5041358 319715
BH RW5	349.72	18+680 N-E/W Ramp Cl	13.7 Lt	5041307 319724
BH RW6	349.13	18+690 N-E/W Ramp Cl	15.2 Lt	5041317 319720
BH RW7	349.10	18+700 N-E/W Ramp Cl	16.8 Lt	5041327 319717
BH RW8	348.99	18+710 N-E/W Ramp Cl	18.6 Lt	5041337 319714
BH RW9	348.90	18+724 N-E/W Ramp Cl	22.1 Lt	5041349 319708

-NOTE-

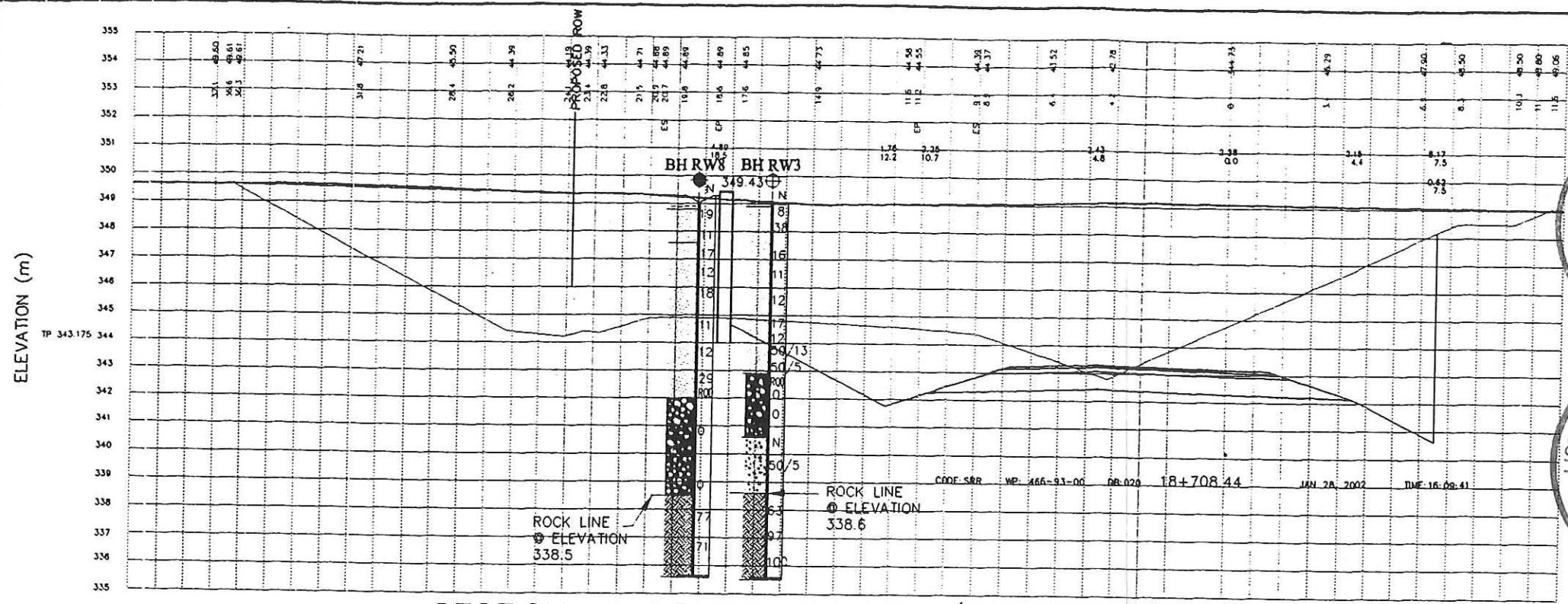
The boundaries between soil strata have been established
only at Bore Hole locations. Between Bore Holes the
boundaries are assumed from geological evidence.

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

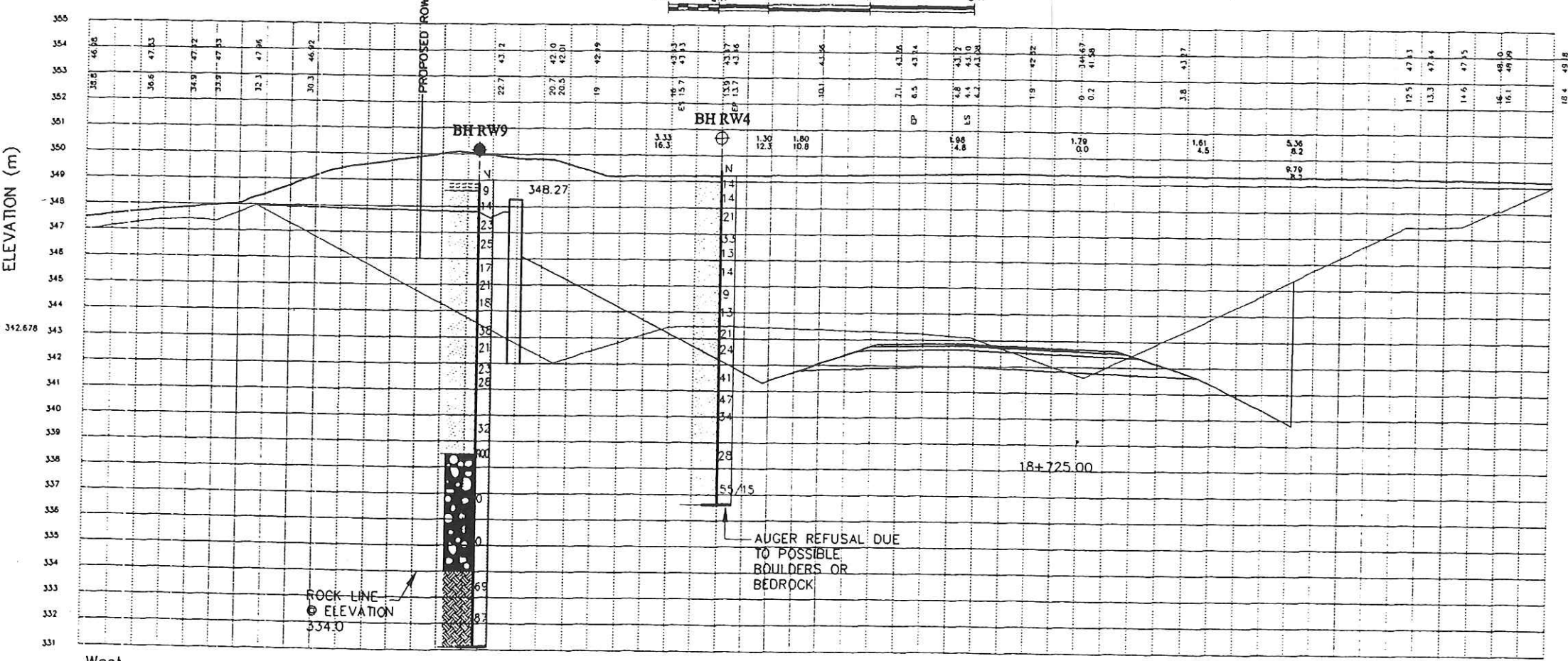
REV	DATE	BY	DESCRIPTION
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HWY 11-FERN GLEN RETAINING WALL	DIST
SUBM'D NAK CHECKED RM	DATE MARCH, 2002
DRAWN NS CHECKED	SITE
	DWG 4

FILE: K:\GEO-TRANSPORT\PROJECTS\2002\1122811\DRAWINGS



SECTION at STATION 18+710 (BH RW8 & BH RW3)



SECTION at STATION 18+724 (BH RW9)

SOIL STRATIGRAPHY LEGEND

- TOPSOIL
- BOULDERS and COBBLES
- SAND with trace Gravel and trace Silt
- BEDROCK: Granitic Gneiss
- SAND to GRAVELLY SAND Occasional Cobbles and Boulders

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

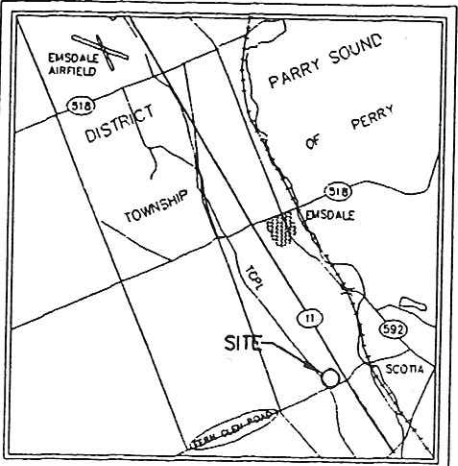
LICENSED PROFESSIONAL ENGINEER
K. S. HO
PROVINCE OF ONTARIO
Aug 12/02

LICENSED PROFESSIONAL ENGINEER
RAMON MIRANDA
PROVINCE OF ONTARIO
Aug 12/02

G.W.P. No. 466-93-00

CROSS SECTIONS AT STATION 18+710 &
18+724 N-E/W RAMP

AMEC Earth & Environmental Limited



KEY PLAN

- LEGEND
- AMEC Borehole (Feb. 2002)
 - AMEC Borehole (Sep. 2001)
 - Blows/0.3m (Std Pen Test, 475 J/blow)
 - Blows/0.3m (60' Cone, 475 J/blow)
 - WL at time of investigation
 - WL in Piezometer
 - Piezometer
 - End of Borehole

No	ELEVATION	STATION	CO-ORDINATES
			OFFSET NORTHING EASTING
BH RW1	350.54	18+667 N-E/W Ramp Cl	11.2 Lt 5041295 319728
BH RW2	349.10	18+668 N-E/W Ramp Cl	11.9 Lt 5041315 319724
BH RW3	349.07	18+709 N-E/W Ramp Cl	13.0 Lt 5041336 319719
BH RW4	349.41	18+730 N-E/W Ramp Cl	15.6 Lt 5041358 319715
BH RW5	349.72	18+680 N-E/W Ramp Cl	13.7 Lt 5041307 319724
BH RW6	349.13	18+690 N-E/W Ramp Cl	15.2 Lt 5041317 319720
BH RW7	349.10	18+700 N-E/W Ramp Cl	16.8 Lt 5041327 319717
BH RW8	348.99	18+710 N-E/W Ramp Cl	18.6 Lt 5041337 319714
BH RW9	348.90	18+724 N-E/W Ramp Cl	22.10 Lt 5041349 319708

NOTE: The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REV	DATE	BY	DESCRIPTION
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HWY 11-FERN GLEN RETAINING WALL	DIST
SUB'D NAK CHECKED BY	DATE MARCH, 2002
DRAWN BY	SITE
CHECKED	DWG'S

NOTE:
For clarity, the position of the boreholes are offset from their original location along the proposed retaining wall alignment.

RECORD OF BOREHOLE SHEETS

RECORD OF BOREHOLE No RW1

1 OF 1

W.P. 466-93-00 LOCATION N 5041295 E 319728, 18+667 O/S 11.2Lt N-E/W Ramp CL ORIGINATED BY PPM
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Augering and Rock Coring COMPILED BY IH
 DATUM Geodetic DATE 25 September 2001 - 25 September 2001 CHECKED BY AD
 PROJECT N-E/W Ramp Retaining Wall, Highway 11, Emsdale, Ontario JOB NO. TT98820.3

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							
350.5									20 40 60 80 100							
350.4	0.1m TOPSOIL		1	SS	4				○ UNCONFINED + FIELD VANE							
	light brown SAND								● QUICK TRIAXIAL x LAB VANE							
	trace silt								20 40 60 80 100							
	loose		2	SS	18		1									
	moist															
	compact to dense		3	SS	39		2									
	trace rootlets															
	damp															
	some gravel, with silt															
348.3	BOULDERS and COBBLES		4	RC	-		3									
2.3	Borehole continued for detailed rock coring description, on sheet 2.		5	RC	-		3									
			6	RC	-		4									
346.5	GRANITIC GNEISS BEDROCK		7	RC	-		5									
4.1	Borehole continued for detailed bedrock coring description, on sheet 2.		8	RC	-		6									
			9	RC	-		7									
343.3	End of Borehole															
7.2																

RECORD OF BOREHOLE No RW2

1 OF 1

W.P. 466-93-00 LOCATION N 5041315 E 319724, 18+688 O/S 11.9Lt N-E/W Ramp CL ORIGINATED BY PPM
 DIST 52 HWY 11 BOREHOLE TYPE Hollow / Solid Stem Augering COMPILED BY IH
 DATUM Geodetic DATE 25 September 2001 - 25 September 2001 CHECKED BY AD
 PROJECT N-E/W Ramp Retaining Wall, Highway 11, Emsdale, Ontario JOB NO. TT98820.3

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						
349.1																			
348.9	0.25m TOPSOIL		1	SS	4														
0.3	loose																		
	reddish brown																		
	light brown		2	SS	14														
	trace rootlets, organics																		
	SAND		3	SS	18														
347.0	trace gravel, trace silt																		
2.1	compact																		
	damp		4	SS	66														
	with gravel																		
	moist		5	SS	50/10														
	light brown																		
	GRAVELLY SAND																		
	some silt																		
	occasional cobbles		6	SS	50/8														
	damp																		
344.5	very dense																		
4.6	End of Borehole																		
	Auger Refusal at 4.6m																		
	Boulders or Possible Bedrock																		

RECORD OF BOREHOLE No RW3



1 OF 1

W.P. 466-93-00 LOCATION N 5041336 E 319719, 18+709 O/S 13.0L1 N-E/W Ramp CL ORIGINATED BY PPM
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Augering and Rock Coring COMPILED BY IH
 DATUM Geodetic DATE 24 September 2001 - 24 September 2001 CHECKED BY AD
 PROJECT N-E/W Ramp Retaining Wall, Highway 11, Emsdale, Ontario JOB NO. TT98820.3

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										10 20 30		
									○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
349.1									20	40	60	80	100								
348.6	0.15m TOPSOIL		1	SS	8		349														
	loose																				
	dense		2	SS	38		1	348													
	reddish brown to light brown SAND																				
	trace silt, trace gravel		3	SS	16		2	347												2 95 (3)	
	moist																				
	compact		4	SS	11		3	346													
			5	SS	12		4	345												19 79 (2)	
	some gravel, trace silt		6	SS	17		5	344													
			7	SS	12		6	343													
	very dense		8	SS	50/13		7	342													
			9	SS	50/5		8	341													
342.9	BOULDERS and COBBLES		10	RC	-		9	340												RC10: REC 0% RQD 0%	
6.2							10	339													
	Borehole continued for detailed rock coring description, on sheet 3.		11	RC	-		11	338												RC11: REC 0% RQD 0%	
							12	337													
340.6	brown SAND		11	RC	-		13	336													
8.5	with gravel, some silt						14														
	moist		12	SS	50/5		15													27 54 (19)	
	very dense																				
338.6	GRANITIC GNEISS BEDROCK		13	RC	-		11													RC13: REC 80% RQD 60%	
10.5							12														
	Borehole continued for detailed bedrock coring description, on sheet 4.		14	RC	-		13													RC14: REC 97% RQD 97%	
335.5	End of Borehole		15	RC	-															RC15: REC 100% RQD 100%	
13.6																				Groundwater in open bore on completion : none	

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

RECORD OF BOREHOLE No RW3



W.P. 466-93-00 LOCATION N 5041336 E 319719, 18+709 O/S 13.0Lt N-E/W Ramp CL 1 OF 1
 DIST 52 HWY 11 BOREHOLE TYPE TT98820.3 ORIGINATED BY PPM
 DATUM Geodetic DATE 24 September 2001 - 26 September 2001 COMPILED BY PPM
 PROJECT N-E/W Ramp Retaining Wall, Highway 11, Emsdale, Ontario CHECKED BY AD
 JOB NO. TT98820.3

ELEV DEPTH (m)	Drilling Record	DESCRIPTION	STRAT PLOT	Run Number	Penetration Rate (mm/min)	Colour Flush %Return	Recovery		RQD (%)	Fracture Index (per 1.5 m)	Discontinuity Data		Point Load Index (MPa)	GROUND WATER CONDITIONS	Remarks & Instrumentation & Water Levels	DEPTH m	ELEVATION SCALE m
							TCR (%)	SCR (%)			Dip (°) with respect to core axis	Type & Surface Description					
349.1	0.0																349
		See sheet 1 for detailed overburden description.															348
																	347
																	346
																	345
																	344
																	343
342.7	6.4	COBBLES and BOULDERS		1	0.23	Brown	53	33	0								342
		Intact Boulder from 7.25m to 7.78m		2	0.32	Brown	49	40	33								341
340.6	8.5	COBBLES and BOULDERS		2	0.32	Brown	49	40	33								340
		See sheet 2 for detailed overburden description.															339
338.6	10.5	Fresh, dark grey, Fine to Medium grained GRANITIC GNEISS BEDROCK, Aphanitic, foliated at 30° to core axis, 3-4mm thick Quartz veins perpendicular to foliation at 35° to core axis at 10.82m and 11.13m, fractures at 80-90° to core axis, three to five centimeters thick silt seams in fractures from 10.95m to 11.59m.		3	0.11	Mercky - Grey	79	74	63	5	90 90 80 80 80 & 50	smooth-stepped smooth-stepped smooth-stepped smooth-stepped smooth-stepped					338
		Fresh, grey, Medium to coarse grained GRANITIC GNEISS BEDROCK, Porphyritic, streaks of dark and light color, Pink feldspar phenocrysts, defined with strong foliation at 45-50° to core axis, Rusty fracture surfaces parallel and perpendicular to foliation, five centimeters thick silt seam at 12.17m, wide jointing.		4	0.10	Mercky	97	97	97	1	75	smooth-planar, rusty, silt seam					337
335.5	13.6	End of Borehole		5	0.09	Mercky	100	100	100								336

RECORD OF BOREHOLE No RW4



1 OF 1

W.P. 466-93-00 LOCATION N 5041358 E 319715, 18+730 O/S 15.6Lt N-E/W Ramp CL ORIGINATED BY PPM
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Augering COMPILED BY IH
 DATUM Geodetic DATE 24 September 2001 - 24 September 2001 CHECKED BY AD
 PROJECT N-E/W Ramp Retaining Wall, Highway 11, Emsdale, Ontario JOB NO. TT98820.3

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 (%)		
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						20	40	60
349.4	0.15m TOPSOIL		1	SS	14															
349.2	some Silt		2	SS	14															
	light brown SAND with gravel		3	SS	21															
	compact	damp	4	SS	33															
	dense		5	SS	13												8 88 (4)			
	compact		6	SS	14															
			7	SS	9															
	loose		8	SS	13												6 91 (3)			
	compact		9	SS	21															
			10	SS	24												8 88 (4)			
			11	SS	41															
	dense		12	SS	47												27 67 (6)			
			13	SS	34															
			14	SS	28												0 92 (8)			
	compact		15	SS	55/15															
	very dense																			
336.6	End of Borehole																Groundwater in open bore on completion : none			
12.8	Auger Refusal at 12.8m Boulders or Possible Bedrock																			

+ 3 . X 3 : Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No RW5

1 OF 1

W.P. 466-93-00 LOCATION N 5041307 E 319724, 18+680 O/S 13.7 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 26 February 2002 - 26 February 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

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									
									20	40	60	80	100					
									20	40	60	80	100					
									20	40	60	80	100					
									20	40	60	80	100					
									20	40	60	80	100					
									20	40	60	80	100					
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									20	40	60	80	100					
				</														

amec

1 OF 1

[illegible]

RECORD OF BOREHOLE No RW6



W.P. 466-93-00 LOCATION N 5041317, E 319 720, 18+690 Q/S 15.2 Lt N-E/W Ramp CL 1 OF 1 ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 27 February 2002 - 27 February 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

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						
349.1 0.2	0.15 m TOPSOIL								20	40	60	80	100	10	20	30	GR SA SI CL	
	compact brown SAND		1	SS	10			349										
	trace Silt, some Gravel		2	SS	14			348									20 75 (5)	
	damp		3	SS	31			347									SS4: * Hammer bouncing on rock	
346.7 2.4	dense		4	SS	50+ *			346									22 69 (9)	
	Occasional Cobbles brown		5	SS	50/15			345										
	GRAVELLY SAND TO SAND							344										
	occasional Cobbles and Boulders		6	SS	50/15			343										
	v.dense							342										
	damp							341										
343.1 6.0	some Silt		7	RC	-			340									Auger refusal @ 6.0 m	
	GRANITIC GNEISS BEDROCK		8	RC	-			339									RC7: REC 83% RQD 56%	
			9	RC	-												RC8: REC 98% RQD 98%	
338.9 10.3	End of Borehole																RC9: REC 88% RQD 79%	
	Borehole dry prior to coring																Coring with NW Coring with NQ Core Barrel	

RECORD OF BOREHOLE No RW6



1 OF 1

W.P. 466-93-00 LOCATION N 5041 317 E 319720, 18+690 O/S 15.2 Lt N-E/W Ramp CL ORIGINATED BY NNN
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 27 February 2002 - 27 February 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

ELEV DEPTH (m)	Drilling Record	DESCRIPTION	STRAT PLOT	Run Number	Penetration Rate(m/min)	Colour Flush %Return	Recovery		RQD (%)	Fracture Index (per 1.5 m)	Discontinuity Data		Point Load Index (MPa)	GROUND WATER CONDITIONS	Remarks & Instrumentation & Water Levels	DEPTH m	ELEVATION SCALE m
							TCR (%)	SCR (%)			Dip (°) with respect to core axis	Type & Surface Description					
349.1 0.0		See sheet 1 for detailed overburden description															349
343.1 6.1		Fresh, grey, Medium to coarse grained GRANITIC GNEISS BEDROCK, rusty fracture surfaces, silt and mica present in fractures, close to moderately close jointing		1	0.2	murky	83	80	56	8	60 90 60 25 90 90 90	rough-undulating, rusty, silt rough-undulating, rusty, mica rough-undulating, rusty, mica rough-undulating, rusty, mica, silt rough-undulating, rusty rough-undulating, rusty rough-undulating, rusty, mica				6 7 8 9 10	343 342 341 340 339
338.8 10.3		End of Borehole									90	rough-undulating, rusty					

RECORD OF BOREHOLE No RW7



W.P. 466-93-00 LOCATION N 5041327 E 319717, 18+700 O/S 16.8 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 1 March 2002 - 1 March 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

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	x LAB VANE						
349.1									20	40	60	80	100		10	20	30	GR SA SI CL
348.9	0.2 m TOPSOIL							349										
0.2	Silty moist		1	SS	12										○			
	----- brown SAND		2	SS	14		1	348							○			
	Compact trace Gravel																	
	----- to		3	SS	31		2	347							○			25 71 (4)
	dense Gravelly																	
	----- some Gravel		4	SS	15		3	346							○			
	damp		5	SS	25		4	345							○			
345.3																		
3.8	brown SAND TO GRAVELLY SAND						4	345										
	v.dense damp		6	SS	50/15		5	344							○			20 63 (17)
	some Silt																	
	Occasional cobbles and Boulders						6	343										
343.0																		
6.1	COBBLES and BOULDERS with Sand and Gravel		7	RC	-		7	342										Auger refusal @ 6.1 m
																		RC7: REC 32% RQD 0%
			8	RC	-		8	341										RC8: REC 24% RQD 0%
340.7																		
8.4	GRANITIC GNEISS BEDROCK		9	RC	-		9	340										RC9: REC 75% RQD 68%
			10	RC	-		10	339										RC10: REC 100% RQD 90%
			11	RC	-		11	338										RC11: REC 99% RQD 42%
337.2																		
11.9	End of Borehole																	
	Borehole dry prior to coring																	

RECORD OF BOREHOLE No RW7



W.P. 466-93-00	LOCATION N 5041327 E 319717, 18+700 O/S 16.8 Lt N-E?W Ramp CL	1 OF 1	ORIGINATED BY NNK
DIST 52 HWY 11	BOREHOLE TYPE Hollow Stem Auger, Rock Coring		COMPILED BY NS
DATUM Geodetic	DATE 1 March 2002 - 1 March 2002		CHECKED BY RM
PROJECT Fern Glen Retaining Wall			JOB NO. TT22811

ELEV DEPTH (m)	Drilling Record	DESCRIPTION	STRAT PLOT	Run Number	Penetration Rate(m/min)	Colour Flush %Return	Recovery		RQD (%)	Fracture Index (per 1.5 m)	Discontinuity Data		Point Load Index (MPa)	GROUND WATER CONDITIONS	Remarks & Instrumentation & Water Levels	DEPTH m	ELEVATION SCALE m
							TCR (%)	SCR (%)			Dip (°) with respect to core axis	Type & Surface Description					
349.1 0.0		See sheet 1 for detailed overburden description														349	
343.0 6.1		COBBLES and BOULDERS with Sand and Gravel		1			32		0							343	
				2			26		0							342	
340.7 8.4		Fresh, grey, Medium to coarse grained GRANITIC GNEISS BEDROCK, rusty fracture surfaces, silt and mica present in fractures, very close to moderately close jointing		3	0.13	murky	75	68	68	3	90 90	rough-undulating, rusty rough-undulating, rusty				340	
				4	0.13	murky	100	100	90	7	30 30 0 & 90 0 & 90 50 90 90 90 90 20 50	rough-undulating, rusty rough-undulating, rusty rough-undulating, rusty rough-undulating, rusty rough-undulating, rusty smooth-undulating, rusty smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica				339	
				5	0.09	murky	99	99	42	17						338	
337.2 11.9		End of Borehole									50 20 80 55 60&30&50 30	smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica smooth-undulating, rusty, silt, mica					

RECORD OF BOREHOLE No RW8



1 OF 1

W.P. 466-93-00 LOCATION N 5041337 E 319 714, 18+710 O/S 18.6 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 2 March 2002 - 2 March 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

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									
349.0									20	40	60	80	100					
348.8	0.2 m TOPSOIL		1	SS	19													
0.2	brown SAND some Silt trace Gravel		2	SS	11		1	348										9 74 (17)
347.6	compact moist																	
1.4	brown SAND trace to some Gravel		3	SS	17		2	347										
	compact damp		4	SS	12													
			5	SS	18		3	346										
			6	SS	11		4	345										
			7	SS	12		5	344										12 86 (2)
			8	SS	29		6	343										
342.0	COBBLES and BOULDERS with Sand and Gravel						7	342										
7.0			9	RC			8	341										Auger refusal @ 7.6m Tricone drilling to 8.8 m, then rock coring with NW casing and NQ core barrel.
			10	RC			9	340										RC9: REC 85% RQD 0%
338.5	GRANITIC GNEISS BEDROCK		11	RC			10	339										RC10: REC 33% RQD 0%
10.5			12	RC			11	338										RC11: REC 100% RQD 77%
							12	337										
335.6	End of Borehole						13	336										RC12: REC 95% RQD 71%
13.4	Borehole dry prior to coring																	

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1 OF 1

ELEV DEPTH (m)	Drilling Record	DESCRIPTION	STRAT PLOT	Run Number	Penetration Rate(m/min)	Colour Flush %Return	Recovery		RQD (%)	Fracture Index (per 1.5 m)	Discontinuity Data		Point Load Index (MPa)	GROUND WATER CONDITIONS	Remarks & Instrumentation & Water Levels	DEPTH m	ELEVATION SCALE m
							TCR (%)	SCR (%)			Dip (°) with respect to core axis	Type & Surface Description					
349.0 0.0		See sheet 1 for detailed overburden description														1	348
																2	347
																3	346
																4	345
																5	344
																6	343
342.0 7.0		COBBLES and BOULDERS with Sand and Gravel														7	342
				1			85		0							8	341
				2			33		0							9	340
338.5 10.5		Fresh, grey, Medium to coarse grained GRANITIC GNEISS BEDROCK, rusty fracture surfaces, silt and mica present in fractures, veryclose to moderately close jointing		3	0.08	murky	100	85	77	5	30 90 60 70	rough-undulating, rusty, mica rough-undulating, rusty, mica rough-undulating, rusty, mica rough-undulating, rusty, mica				11	338
				4	0.1	murky	95	87	71	6	30 90 90 & 0 90 & 0	rough-undulating, rusty, mica rough-undulating, rusty, mica smooth-undulating, rusty, mica, silt smooth-undulating, rusty, mica smooth-undulating, rusty, mica				12	337
335.7 13.4		End of Borehole									90	smooth-undulating, rusty, mica smooth-undulating, rusty, silt				13	335

RECORD OF BOREHOLE No RW9

1 OF 2

W.P. 466-93-00 LOCATION N 5041349 E 319708, 18+724 O/S 22.1 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 2 March 2002 - 2 March 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

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									
348.9									20	40	60	80	100					
348.8	0.3 m TOPSOIL		1	SS	9													
0.3	brown SAND																	
	trace to some Gravel		2	SS	14		1	348										
	compact																	
	damp		3	SS	23		2	347										
	Gravelly		4	SS	25		3	346										
			5	SS	17												33 64	(3)
			6	SS	21		4	345										
	trace to some Gravel		7	SS	18		5	344									17 80	(3)
	dense		8	SS	38		6	343										
			9	SS	21													
	compact																	
			10	SS	23		7	342										
			11	SS	28		8	341										
							9	340										
	dense		12	SS	32		10	339										
338.5							11	338										
10.4	COBBLES and BOULDERS																	
	with Sand and Gravel																	
			13	RC	-		12	337										Auger refusal @ 10.7 m Tricone drilling to 11.7 m, then coring with NW casing and NQ core barrel. RC13: REC 67% RQD 0%
							13	336										
			14	RC	-		14	335										RC14: REC 25% RQD 0%
																		Tricone drilling from 14.2 m to 14.9 m, then rock coring with NQ core barrel.
334.0								334										



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+ 3 × 3 Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No RW9

2 OF 2

W.P. 466-93-00 LOCATION N 5041349 E 319708 18+724 O/S 22.1 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 2 March 2002 - 2 March 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

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									
									20	40	60	80	100					
									○ UNCONFINED + FIELD VANE					WATER CONTENT (%)				
									● QUICK TRIAXIAL × LAB VANE					10 20 30				
									20	40	60	80	100					
14.9	GRANITIC GNEISS BEDROCK		15	RC	-		15	333										RC15: REC 75% RQD 69%
			16	RC	-		16	332										RC16: REC 98% RQD 87%
331.1	End of Borehole																	
17.8	Borehole dry prior to coring																	

RECORD OF BOREHOLE No RW9



1 OF 2

W.P. 466-93-00 LOCATION N 5041349 E 319708, 18+724 O/S 22.1 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 4 March 2002 - 4 March 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

ELEV DEPTH (m)	Drilling Record	DESCRIPTION	STRAT PLOT	Run Number	Penetration Rate(m/min)	Colour Flush	Recovery		RQD (%)	Fracture Index (per 1.5 m)	Discontinuity Data		Point Load Index (MPa)	GROUND WATER CONDITIONS	Remarks & Instrumentation & Water Levels	DEPTH m	ELEVATION SCALE m
							TCR (%)	SCR (%)			Dip (°) with respect to core axis	Type & Surface Description					
348.9 0.0		See sheet 1 for detailed overburden description															348
																	347
																	346
																	345
																	344
																	343
																	342
																	341
																	340
																	339
338.5 10.4		COBBLES and BOULDERS with Sand and Gravel															338
				1			67		0								337
				2			25		0								336
																	335
334.0																	334

Continued Next Page

RECORD OF BOREHOLE No RW9



2 OF 2

W.P. 466-93-00 LOCATION N 5041349 E 319708, 18+724 O/S 22.1 Lt N-E/W Ramp CL ORIGINATED BY NNK
 DIST 52 HWY 11 BOREHOLE TYPE Hollow Stem Auger, Rock Coring COMPILED BY NS
 DATUM Geodetic DATE 4 March 2002 - 4 March 2002 CHECKED BY RM
 PROJECT Fern Glen Retaining Wall JOB NO. TT22811

ELEV DEPTH (m)	Drilling Record	DESCRIPTION	STRAT PLOT	Run Number	Penetration Rate(m/min)	Colour Flush %Return	Recovery		RQD (%)	Fracture Index (per 1.5 m)	Discontinuity Data		Point Load Index (MPa)	GROUND WATER CONDITIONS	Remarks & Instrumentation & Water Levels	DEPTH m	ELEVATION SCALE
							TCR (%)	SCR (%)			Dip (°) with respect to core axis	Type & Surface Description					
14.9		Fresh, grey, Medium to coarse grained GRANITIC GNEISS BEDROCK, rusty fracture surfaces, silt and mica present in fractures, very close to moderately close jointing		3	0.1	murky	75	69	69	2	30 70	smooth-undulating, rusty, mica, silt smooth-undulating, rusty, silt				16	333
				4	0.1	murky	98	91	87	5	40 80 50 90	rough-undulating, rusty, mica rough-undulating, rusty, mica smooth-undulating, rusty, mica smooth-undulating, rusty, mica, silt smooth-undulating, rusty, mica, silt				17	332
331.1 17.8		End of Borehole									90	smooth-undulating, rusty, mica, silt					

NOTES TO BOREHOLE LOGS

DRILLING DATA

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

SAMPLES

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

LABORATORY DATA

WP - Plastic Limit (%)
W - Water Content (%)
WL - Liquid Limit (%)
? - Natural Unit Weight (kN m³)
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 millimetre o.d. split barrel sample to penetrate 0.3 metres 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 metres. For penetrations of less than 0.3 metres, N-values are indicated as the number of blows for the penetration achieved (e.g. 50:25: 50 blows for 25 centimetre penetration).

Dynamic Cone Penetration Test: Continuous penetration of a conical steel point (51 millimetre 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 metres advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency or compactness.

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

COMPACTNESS: Cohesionless soils are described on the basis of compactness 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.

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

SOLID CORE RECOVERY (SCR): Total length of recovered solid, full diameter rock core expressed as a percent of the length of the coring run.

FRACTURE INDEX: Number of cracks per 1.5m.

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 millimetres	1.0 - 3.0 millimetres	> 3.0 millimetres
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK