

**FOUNDATION INVESTIGATION REPORT
PROPOSED HIGHWAY 17 (NEW)
FROM ECHO RIVER TO BAR RIVER ROAD
DISTRICT 62, SAULT STE. MARIE, ONTARIO
G.W.P. 354 AND 352-94-00**

(Volume 1)

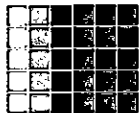
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**Project: SPT1055
August 2003**



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DRAWINGS

DRAWING NO.

BOREHOLE LOCATION PLAN

1 - 4

**FOUNDATION INVESTIGATION REPORT
PROPOSED HIGHWAY 17 (NEW)
FROM ECHO RIVER TO BAR RIVER ROAD
DISTRICT 62, SAULT STE. MARIE, ONTARIO
G.W.P. 354 AND 352-94-00**

1. INTRODUCTION

Shaheen & Peaker Limited (S&P) was retained by Marshall Macklin Monaghan Ltd. to carry out a foundation investigation for a number of cut and fill sections along the proposed realignment of Highway 17 from the Lower Echo River to Bar River Road in Sault Ste. Marie, Ontario.

The sections investigated are designated as Sites 1 through 9 for the purposes of this report, as follows:

- Site 1: Highway 17 (New) Cut Section between Stations 10+210 and 10+410 Eastbound Lanes, and between Stations 10+220 and 10+350 Westbound Lanes
- Site 2: Highway 17 (New) Cut Section between Stations 10+670 and 10+825 Eastbound Lanes, and between Stations 10+700 and 10+780 Westbound Lanes
- Site 3: Highway 17 (New) Fill Section between Stations 10+825 and 11+000 Eastbound Lanes, and between Stations 10+780 and 11+000 Westbound Lanes – Boreholes 10+840CL, 10+860CL, 10+885Lt, 10+900CL, 10+923Rt, 10+940CL and 10+980Rt
- Site 4: Highway 17 (New) Fill Section between Stations 11+375 and 11+690 Eastbound Lanes, and between Stations 11+380 and 11+670 Westbound Lanes – Boreholes 11+441CL, 11+475Lt, 11+505Rt, 11+540Lt, 11+547CL, 11+572Rt, 11+597CL, 11+622Lt, 11+655Rt and 11+657Lt
- Site 5: Highway 17 (New) Swamp Section between Stations 11+800 and 13+400, and Swamp Section along Highway 638
- Site 6: Highway 17 (New) Fill Section between Stations 15+470 and 15+670 Westbound Lanes, and between Stations 15+470 and 15+690 Eastbound Lanes
- Site 7: Highway 17 (New) Cut Section between Stations 15+670 and 15+850 Westbound Lanes, and Fill and Cut Section between Stations 15+690 and 15+850 Eastbound Lanes
- Site 8: Highway 17 (New) Fill Section between Stations 15+850 and 16+600
- Site 9: Government Road
Cut Section between Stations 11+000 and 11+220

The findings of investigation are presented in this report.

2. SITE DESCRIPTION AND GEOLOGY

The realignment of the proposed Highway 17 (New) is located between the Lower Echo River and Bar River Road and east of the existing Highway 17. It involves the construction of new twin bridges at the Huron Central Rail (CPR) crossing, north of Maple Leaf Road, realignment of Government Road and the realignment of Highway 638 in Sault Ste. Marie, Ontario.

The site is undulating with high ground and low-lying areas. Rock outcrops were observed in high grounds at south of Echo River and west of the proposed Highway 17 alignment, east of Pioneer Road between Highway 638 and Findlay Hill Road, and east of Government Road and north of the proposed CPR crossing. Low-lying areas, including a swamp section, are located in the vicinity of Highway 638 and Watson Road area.

According to Map 2108 published by the Ontario Department of Mines, the bedrock at the site consists of Cambrian sandstone of Jacobsville Formation at the interface with Pre-cambrian Lorrain Formation which consists of quartzite, siltstone, greywacke and conglomerate.

Typically, in high ground, bedrock of undifferentiated igneous and metamorphic classifications (Southern Province) are exposed at surface forming shallow hills. These rocks are generally Pre-cambrian formations while some Cambrian unconformities are also noted. The rock generally dips rapidly to below surface and in the relatively higher lying foot-hill areas, the bedrock is covered with some glacial till and/or granular deposits. In the low-lying areas, peat, muck and marl are found, covering glaciolacustrine deposits. The glaciolacustrine deposits typically consist of clay and silt, minor sand deposited in basin and quiet water environments. The depth of clay in areas can exceed 40 m.

The massive bedrock outcrop, which is exposed to the north, northeast of the railway crossing, was identified as sandstone of Cambrian origin. Some Pre-cambrian quartzite is also present in the area.

3. INVESTIGATION PROCEDURES

The fieldwork for the investigation consisted of the following:

Site 1:	9 boreholes and 14 test pits
Site 2:	16 boreholes and 11 test pits
Site 3:	7 boreholes

Site 4:	10 boreholes
Site 5:	107 boreholes
Site 6:	10 boreholes and 6 test pits
Site 7:	4 boreholes and 12 test pits
Site 8:	41 boreholes
Site 9:	26 test pits

The boreholes were advanced using solid and hollow stem continuous flight augers with track-mounted vehicles owned and operated by Colbar Resources of Sudbury, Ontario, under the supervision and direction of Geotechnical Engineers from our office. Sampling in the overburden was effected starting at the ground surface at frequent intervals of depth by the Standard Penetration Test (SPT) method, as specified in ASTM D1586. This consists of freely dropping a 63.5 kg hammer a vertical distance of 0.76 m to drive a 51 mm diameter O.D. split-spoon (split barrel) sampler into the relatively undisturbed ground. The number of blows required to drive the sampler into the ground by a vertical distance of 0.30 m is recorded as the Standard Penetration or the N-value of the soil and this gives an indication of the consistency or the compactness condition of the soil deposit. Where the consistency of the soil permitted in the cohesive deposits, the undrained shear strength of the soil was measured in-situ by means of Field Vane tests using an MTO-Type Field Vane and relatively undisturbed samples were taken by means of thin-walled Shelby tube samplers.

In some cases, difficulty in drilling of the boreholes due to sand back-up (in spite of the fact that drilling mud was used to prevent this from happening) and/or due to cobbles and boulders, was encountered. These necessitated the use of washboring and/or diamond drilling methods. Because of this and due to the prevailing cold weather conditions, the drilling took considerably longer than anticipated.

Because access was not possible with a drill rig in some areas (especially in the swamp section), boreholes at these locations were put down by manual methods, using light portable equipment. Sampling was effected using a standard split-spoon sampler driven by a 22.7 kg hammer (rather than a 63.5 kg hammer, as required by the SPT method). The number of blows of the hammer to drive the sampler was recorded but these values are not reported on the Record of Borehole Sheets, as they do not represent standard N-values.

The bedrock was proven in most cases by BQ and/or NQ rock coring at the borehole locations.

In addition, Dynamic Cone Penetration tests (DCPT) were performed at various borehole locations. This test consists of driving a 51 mm O.D., 60-degree apex cone, screw attached to the tip of an A-size rod, continuously into the undisturbed ground using the same driving energy as the SPT method. By recording the number of blows of the hammer to drive the

cone/rod assembly into the soil every 0.3 m, a qualitative record of soil compactness condition is obtained.

Piezometers were installed in a number of boreholes to enable us to monitor the groundwater level over a prolonged period of time without interference from surface water.

The subsurface stratigraphy encountered in the boreholes, type of samples and sampling depths, N-values and DCPT results, together with the coring data are presented on the Record of Borehole Sheets, in Appendices A1 through A9 of this report.

Upon their completion, the boreholes were backfilled to about 6 to 8 m below the ground surface with soils brought up by augering (i.e. auger cuttings). The upper 6 to 8 m of the open boreholes was then grouted using bentonite or a cement/bentonite mixture.

Test pits were dug using track-mounted backhoes, under the supervision of S&P technical personnel. The test pit results are shown on Test Pit Logs in Appendix A.

The borehole and test pit locations were established in the field by surveyors from Marshall Macklin Monaghan Ltd., who also provided us with ground surface elevations at the borehole and test pit locations along with co-ordinates.

A laboratory testing programme, consisting of natural moisture content measurement, bulk unit weight determination, Atterberg Limits, consolidation tests and grain-size analyses, was performed on selected soil samples. The results of the laboratory tests are presented on the appropriate Record of Borehole Sheets and also in Appendices B1 through B9.

4. SUBSURFACE CONDITIONS

4.1 SITE NO. 1 : HIGHWAY 17 (NEW) CUT SECTION BETWEEN STATIONS 10+210 AND 10+410 EASTBOUND LANES, AND BETWEEN STATIONS 10+220 AND 10+350 WESTBOUND LANES

Site No. 1 is located at the north end of the project, just south of the south approach fill for the future bridge structure over the Lower Echo River. The site is generally wooded, with a bedrock knob to the right (west) of the proposed eastbound lanes of Highway 17(New).

The existing grade in this area varies from about Elevation 185 to 194 m along eastbound lanes (EBL) and 181.5 to 187 m along westbound lanes (WBL). The existing grades are also sloping down towards the left (east) at a rate of about 6 to 12% (i.e., 2.5 to 5 m drop over 40 m horizontal distance).

The location plan of the boreholes and test pits in this section is shown on Drawing No. 1A. The stratigraphic profiles for EBL and WBL are presented in Drawing Nos. 1A and 1B, respectively. The cross-sections through Stations 10+240, 10+250 and 10+310 are also shown on Drawing Nos. 1C and 1D.

Nine boreholes were drilled and fourteen test pits were dug in this area and these show that below about 0.15 to 0.7 m of topsoil or peat, this section is generally underlain by a surficial layer of sand and gravel with some organics and occasional cobbles and boulders extending to depths of 0.6 to 1.8 m. This sand and gravel layer is in turn underlain by an extensive clay deposit to at least 10 m depth below existing grade, along the WBL. Along the EBL, the clay deposit extends to depths of 1.5, 2.9 and 8.5 m below existing grade at the location of Boreholes 10+347 21m Rt, 10+309 19m Rt, and 10+256 18m Rt, respectively. Also along the EBL, the bedrock or probable bedrock (inferred by refusal to augering and test pitting) was encountered immediately below the clay. At the location of Borehole 10+256 18m Rt, the bedrock was proven by diamond drilling. (It should be noted that offset distances, e.g. 18m Rt, indicated in this report were taken from the median centerline of the highway).

Details of the subsurface conditions encountered in the boreholes and test pits are presented on the Record of Borehole Sheets and Test Pit Logs in Appendix A1. The individual strata are briefly described in the following paragraphs.

4.1.1 TOPSOIL AND PEAT

In most of the boreholes and test pits, topsoil and peat were encountered ranging in thickness between about 0.15 and 0.7 m. The peat in Borehole 10+315 21m Lt contains some sand, which extended to a depth of 0.7 m below existing grade.

4.1.2 SURFICIAL SAND AND GRAVEL

Below the topsoil and peat or from the ground surface, the boreholes and test pits contacted a surficial layer of sand and gravel extending to depths of 0.6 to 1.8 m below existing grade. This sand and gravel layer generally contains some organics and occasional cobbles and boulders.

A grain-size distribution analysis was performed on one of the samples from this layer and the results are presented in Figure B1-1, Appendix B1. The results indicate the following particle-size distribution:

Gravel	=	19%
Sand	=	74%
Silt	=	6%
Clay	=	1%

Measured N-values in this layer widely ranged from 5 to greater than 50 blows/0.3 m indicating loose to very dense relative density.

4.1.3 CLAYEY SILT

In Borehole 10+350 CL, a 1.4 m thick clayey silt layer was contacted below the sand and gravel layer at a depth of 0.7 m below existing grade.

A grain-size distribution analysis was performed on a sample from this layer and the results are presented in Figure B1-2, Appendix B1. They indicate the following particle-size distribution:

Gravel	=	0%
Sand	=	0%
Silt	=	70%
Clay	=	30%

Measured N-values in this layer were 38 and 43 blows/0.3 m indicating hard consistency.

4.1.4 CLAY

Underneath the surficial sand and gravel and clayey silt, the boreholes encountered a clay deposit extending to a depth of at least 10 m below existing grade under the proposed WBL and to depths of 1.5 to 8.5 m under the EBL centreline. The clay contains occasional seams/layers or pockets of silts.

The results of the grain-size distribution analysis performed on two of the selected clay samples are presented in Figure B1-3, Appendix B1. They indicate the following particle-size distribution:

Gravel	=	0%
Sand	=	0%
Silt	=	17 to 21%
Clay	=	79 to 83%

Atterberg Limits tests carried out in the laboratory on samples from the clay deposit gave the following index values:

Liquid Limit:	49 to 77%
Plastic Limit:	23 to 26%
Plasticity Index:	26 to 53%

As presented in Figure B1-4 in Appendix B1, these values are characteristics of clay soils of medium to high plasticity, but generally high plasticity. The measured natural moisture contents generally range from 19 to 91%.

The measured bulk unit weights of the clay range from 14.7 to 19.4 kN/m³.

Standard Penetration tests performed in this deposit gave N-values varying between 1 and 6 blows/0.3 m, except in the upper 1 to 3 m of the deposit in majority of the boreholes where N-values of 4 to 17 blows/0.3 m were recorded. Field vane tests yielded undrained in-situ shear strength values ranging from about 60 to in excess of 100 kPa within the top 1 to 3 m of the deposit, and ranging from about 20 to 55 kPa below this depth. Variation of measured undrained shear strengths with elevations is plotted and this plot is presented in Figures C1-1 in Appendix C1. Figure C1-2 shows typical plot of undrained shear strength versus elevation at the location of Borehole 10+315 21 Lt. These values indicate that the consistency of the material can be described as generally very stiff in the upper 1 to 3 m of the clay deposit and generally soft to stiff below.

4.1.5 CLAYEY SILT to SILTY CLAY TILL

Below the clay in Borehole 10+309 19m Rt and Borehole 10+359 14m Lt, a 0.3 to 1.0 m thick layer of clayey silt to silty clay till was encountered. This deposit is a heterogeneous mixture of clay, silt, sand and gravel. A measured N-value of in excess of 50 blows/0.3 m at Borehole 10+309 indicate a hard consistency. A low N-value of 2 blows/0.3 m was recorded in Borehole 10+359 which indicates a very soft to soft consistency. This low N-value could however be caused by disturbance of the soil due to hydrostatic uplift at the bottom of the hole during sampling.

4.1.6 BEDROCK

Boreholes and test pits from this investigation indicate bedrock and possible bedrock encountered along the EBL from about Stations 10+250 to 10+360. Beyond or south of Station 10+360 to Station 10+410 (south limit of this section), borehole logs by DST Consulting Engineers Inc. were utilized to be able to plot the probable rock line and this is shown in Drawing 1A.

The bedrock was proven in Borehole 10+256 18m Rt, where the surface of the bedrock was encountered at a depth of 8.5 m below existing grade. The bedrock in this area is classified as quartzite. From the measured total core recovery (TCR) of 88 to 100% and the Rock Quality Designation (RQD) of 80 to 94%, this rock is considered sound and of good to excellent quality.

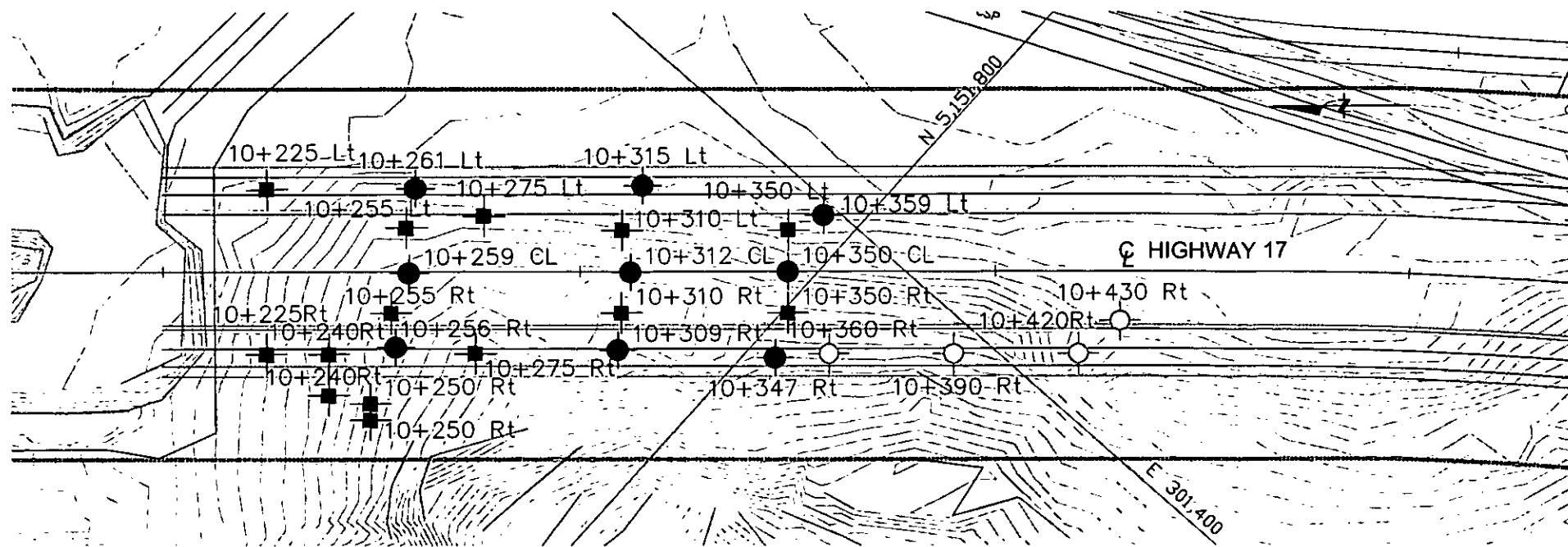
4.1.7 GROUNDWATER CONDITIONS

Water level observations in the boreholes were made during drilling and at completion of each borehole. The boreholes were dry at completion except in Boreholes 10+256 18m Rt, 10+350 CL, and 10+359 14m Lt, where the recorded water levels at completion ranged between the ground surface and 3.9 m below existing grade, but these are unlikely to represent the stabilized water levels.

To enable us to monitor the groundwater level in Borehole 10+359 14m Lt, where artesian condition was suspected, a piezometer was installed in this borehole. Water level in the piezometer was measured the next day at a depth of 0.3 m below existing ground surface. In October 19, 2002 or about six months after completion of the borehole, the water level was again measured and recorded level was at 0.9 m above the existing ground surface or at Elevation 183.8 m (i.e., artesian condition was observed).

Based on the above observations and the greyish colour of the clay, the groundwater table is believed to be at a depth of about 1 m below existing grade along the EBL, and at approximate Elevation of 184 m (at or near ground surface to about 1 m above ground surface) along the WBL. Due to the pervious nature of the surficial sand and gravel layer over the impervious clay deposit, perched water condition could also be expected. The groundwater table can be expected to fluctuate seasonally and in response to weather events.

Drawings

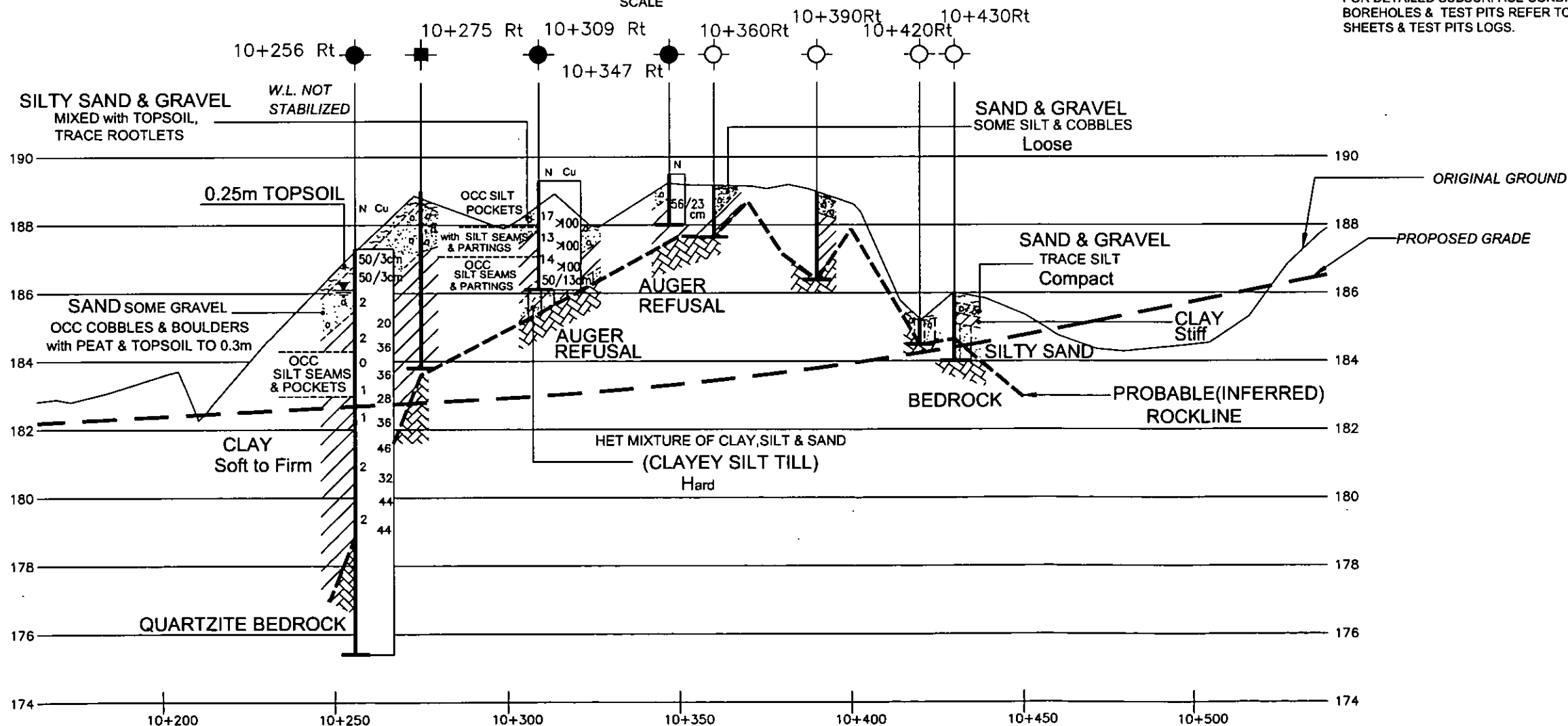


PLAN
10m 0 10 20m
SCALE

METRIC

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

NOTE:
FOR DETAILED SUBSURFACE CONDITIONS OF ALL
BOREHOLES & TEST PITS REFER TO RECORD OF BOREHOLE
SHEETS & TEST PITS LOGS.



PROFILE EASTBOUND LANES

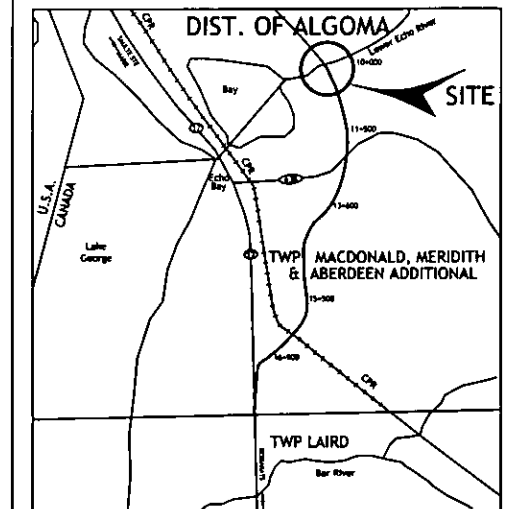
10m 0 10 20m
1m 0 1 2m
SCALES
HORIZ
VERT

CONT No.

GWP: 354-94-00

HIGHWAY 17 (NEW) EBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 1
BORE HOLE LOCATIONS & SOIL STRATA

SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND

- Bore Hole
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation Apr. 2002
- Water Level in Piezometer
- Piezometer
- Test Pit
- Bore Hole Done by DST Consulting Engineers Inc

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+256 Rt	187.3	5 151 863.4	301 304.9
10+275 Rt	189.0	5 151 848.1	301 316.3
10+309 Rt	189.3	5 151 823.4	301 339.7
10+347 Rt	189.5	5 151 793.9	301 363.5

NOTE

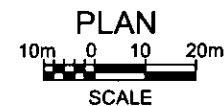
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REV.	DATE	BY	DESCRIPTION

Geocres No.

HWY No. 17 (New)			DIST 62
SUBMD ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 1A



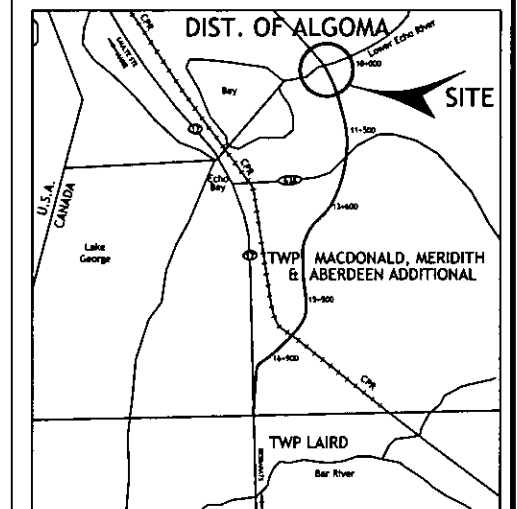
METRIC

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

CONT No.







GWP: 354-94-00

HIGHWAY 17 (NEW) WBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 1
BORE HOLE LOCATIONS & SOIL STRATA

**SHAHEEN & PEAKER LIMITED**

KEY PLAN
N.T.S

LEGEND

- | | |
|---|--|
|  | Bore Hole |
| N | Blows/0.3m (Std. Pen. Test, 475 J/blow) |
| Cu | Un drained Shear Strength measured by
Field Vane Test |
|  | Water Level at Time of Investigation |
|  | Water Level in Piezometer |
|  | Piezometer |
|  | Test Pit |
|  | Bore Hole Done by DST Consulting Engineers Inc |

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+261Lt	183.8	5 151 885.7	301 336.7
10+315Lt	183.1	5 151 845.6	301 373.4
10+359Lt	182.9	5 151 808.2	301 397.1

NOTE

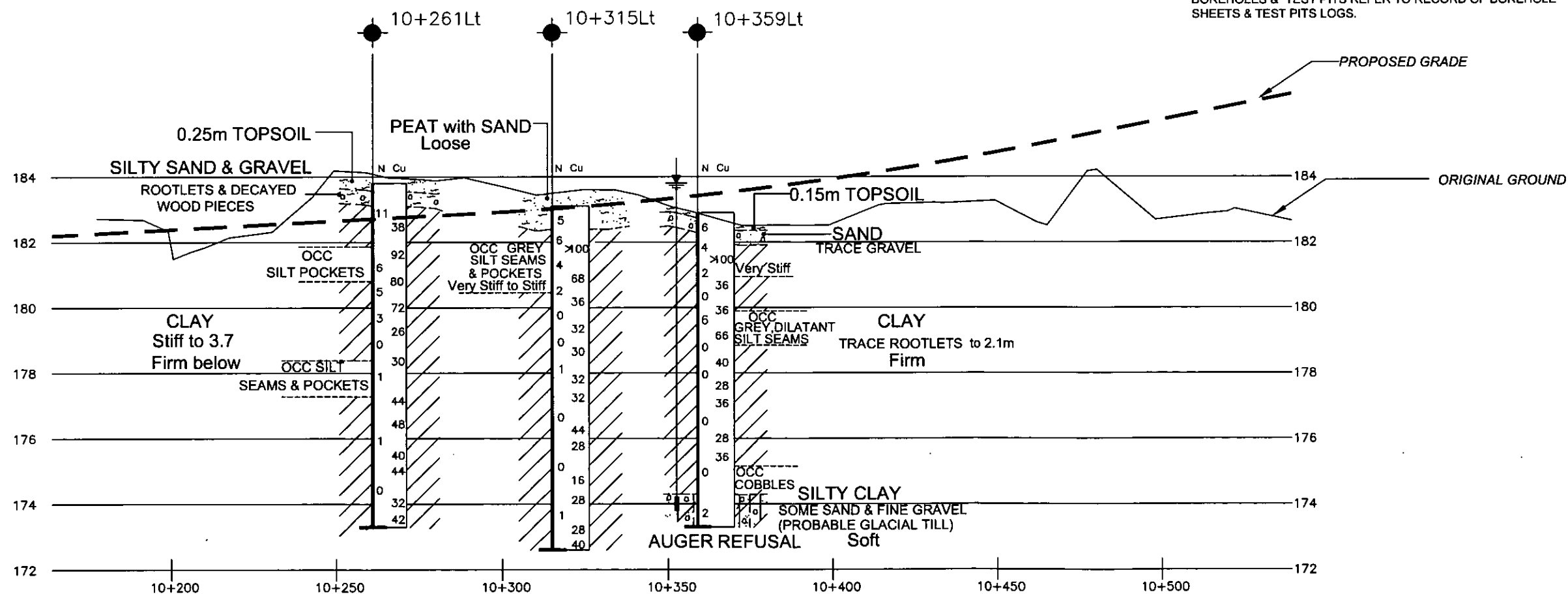
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REV.			
DATE	BY	DESCRIPTION	

Geocres No.

HWY No. 17 (New)			DIST 62
SUBM'D ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 1B

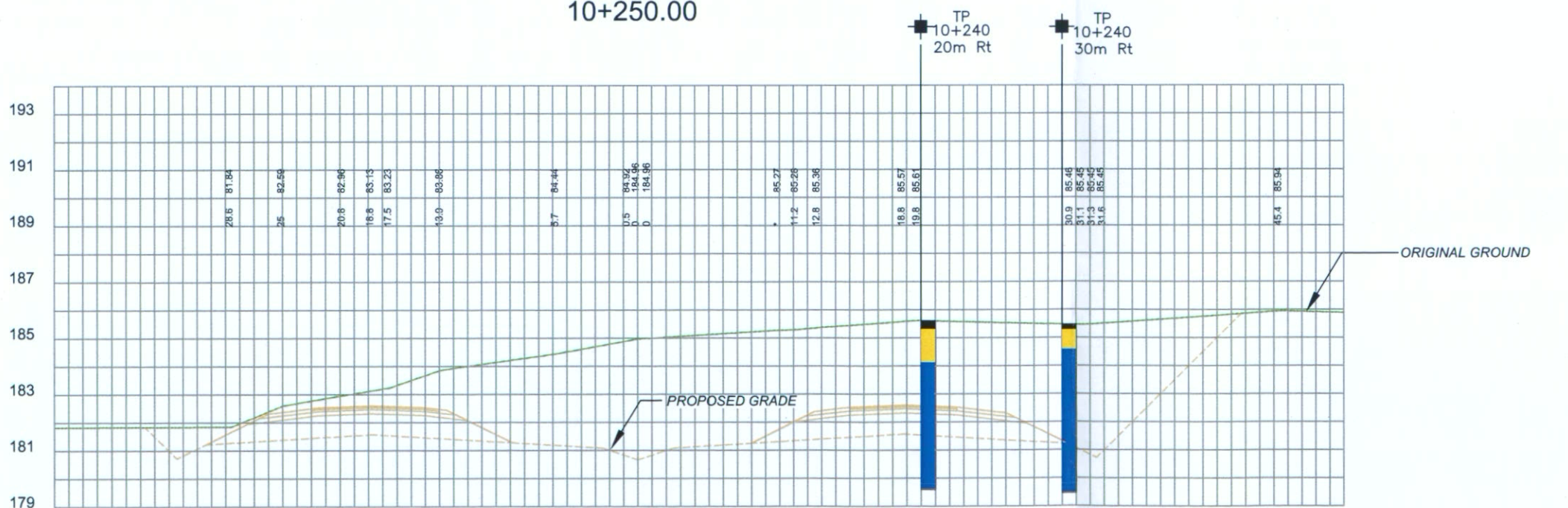
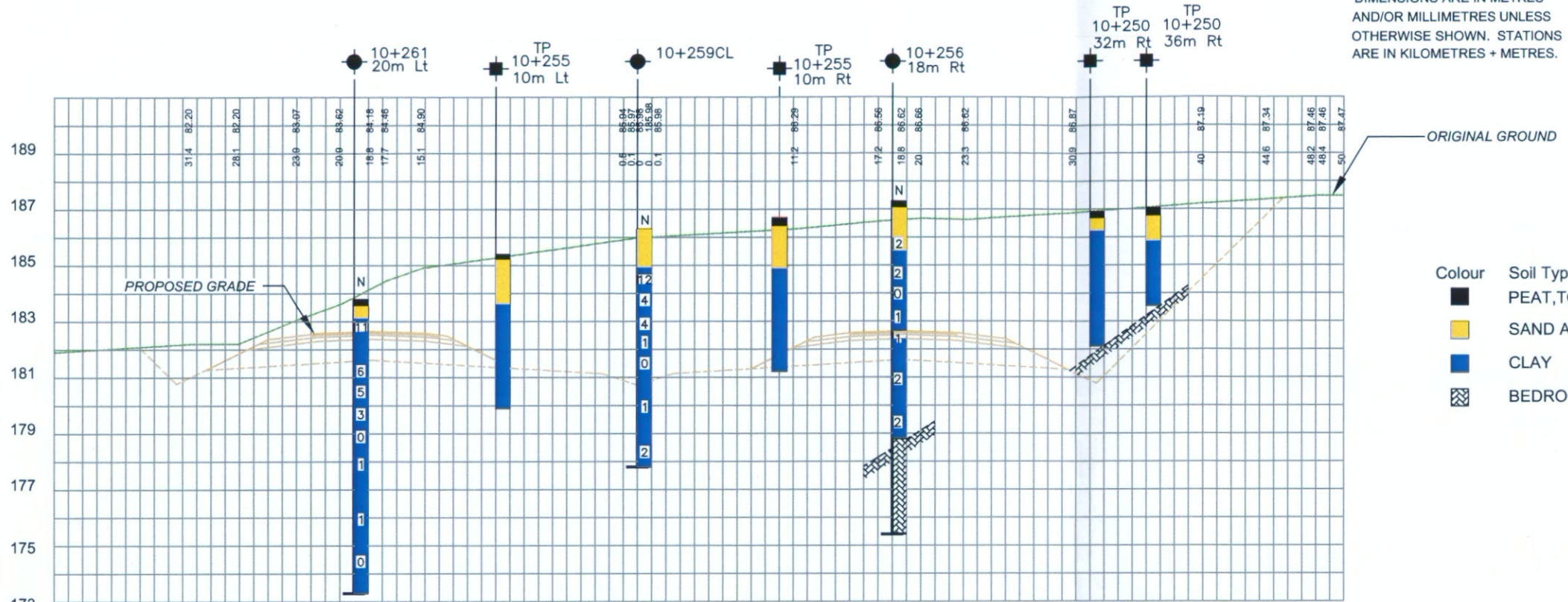


C PROFILE WESTBOUND LANES

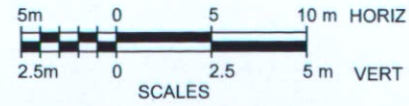


METRIC

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

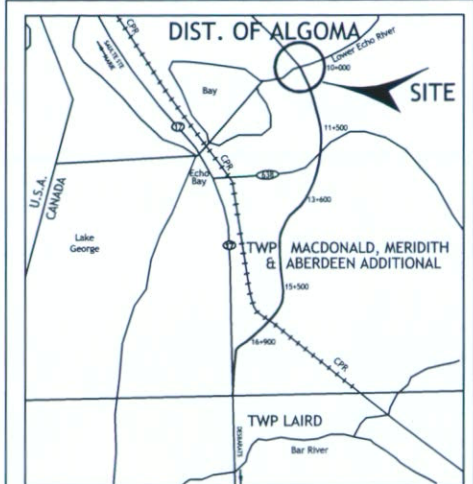


CROSS SECTION (SITE 1)



CONT No.
GWP: 354-94-00
HIGHWAY 17 (NEW)
ECHO RIVER TO BAR RIVER ROAD
SITE No. 1
CROSS SECTION

SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND				
	Bore Hole			
	Test Pit			
N	Blows/0.3m (Std. Pen. Test, 475 J/blow)			
No.	ELEV.	CO-ORDINATES		
		NORTH	EAST	
10+255 Rt	186.7	5 151 869.7	301	310.4
10+255 Lt	185.4	5 151 883.0	301	325.3
10+256 Rt	187.3	5 151 863.4	301	304.9
10+259 CL	186.3	5 151 873.1	301	320.4
10+261 Lt	183.8	5 151 885.7	301	336.7
10+250 32mRt	186.9	5 151 858.8	301	290.7
10+250 36mRt	187.0	5 151 856.1	301	287.7
10+240 20mRt	185.6	5 151 874.2	301	293.0
10+240 30mRt	185.5	5 151 867.6	301	285.5

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 Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV.	DATE	BY	DESCRIPTION

Geocres No.

HWY No. 17 (New)	DIST 62		
SUBMD ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 1C

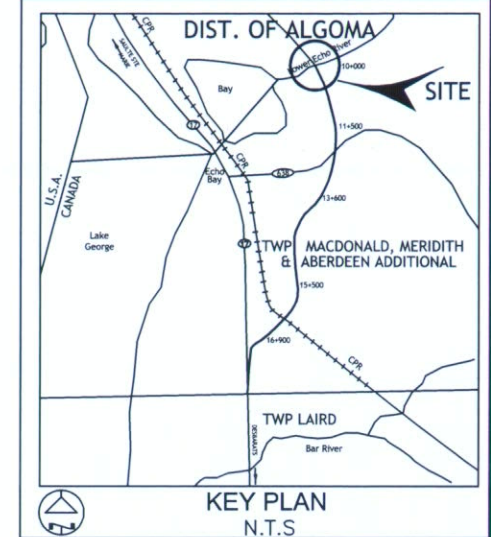
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOMETRES + METRES.

CONT No.



GWP: 354-94-00

HIGHWAY 17 (NEW)
ECHO RIVER TO BAR RIVER ROAD
SITE No. 1
CROSS SECTION

SHAHEEN & PEAKER LIMITED



LEGEND

-  Bore Hole
 Test Pit
 N Blows/0.3m (Std. Pen. Test, 475 J/blow)

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+309 19mRt	189.3	5 151 823.4	301 339.7
10+310 10mLt	185.1	5 151 842.0	301 362.0
10+310 10mRt	188.3	5 151 828.7	301 347.0
10+312 CL	187.0	5 151 833.7	301 355.8

NOTE

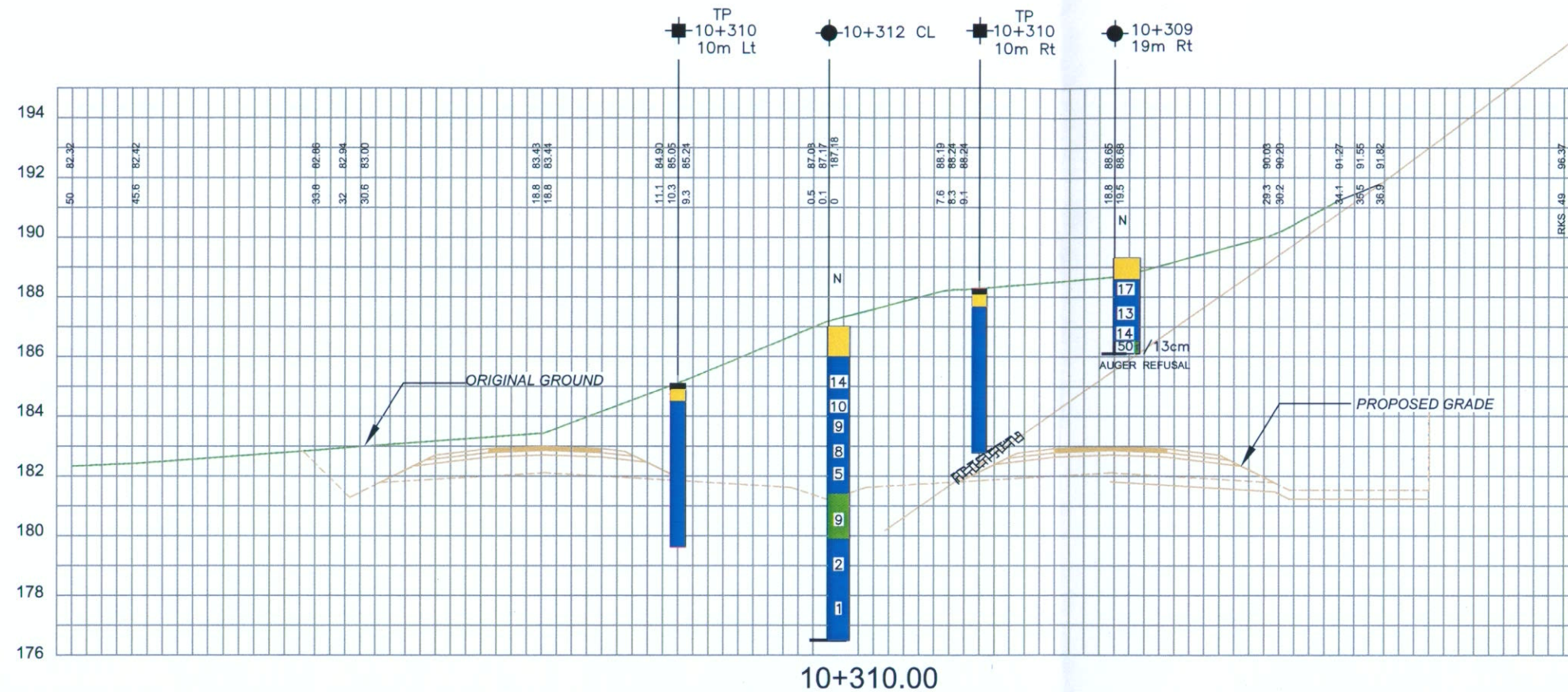
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

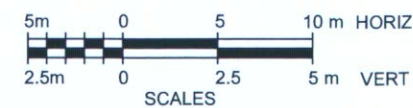
REV.			
DATE	BY	DESCRIPTION	

Geocres No.

HWY No. 17 (New)			DIST 62
SUBM'D ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 1D



CROSS SECTION (SITE 1)



Colour	Soil Type
	PEAT,TOPSOIL,ORGANIC SOIL
	SAND AND GRAVEL
	SAND
	CLAY
	SILT
	CLAYEY SILT TILL
	BEDROCK

Appendix A1-1

Record of Boreholes and Test Pit Logs

SPT 1055

RECORD OF BOREHOLE No 10+256; 18m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 863.4; E 301 304.9 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers, Casing & Washboring & BQ Rock Coring COMPILED BY Y.L.
 DATUM Geodetic DATE 4/17/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
187.3 0.0	Ground Surface												
	0.25 m Topsoil		1	SS	50/3								
	SAND, some Gravel occasional cobbles and boulders with peat and topsoil to 0.3 m dark brown moist to wet		2	SS	60/3								19 74 6 1
185.5 1.8			3	SS	2							17.5	
			4	SS	2								
	occasional silt seams and pockets		5	SS	0								
			6	SS	1								
	CLAY reddish grey soft to firm		7	SS	1								
			8	SS	2								
			9	SS	2								
178.8 8.5			10	BQ RC	Rec. 100%								RQD = 94%
	QUARTZITE BEDROCK		11	BQ RC	Rec. 88%								RQD = 82%
175.4 11.9			12	BQ RC	Rec. 97%								RQD = 80%
	End of borehole												
	* Water level at 1.2 m (not stabilized) and hole open to full depth on completion.												
	** No recovery with split spoon. Auger sample collected.												
	*** Spoon sinking under weight of hammer and/or rods.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+259 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 873.1; E 301 320.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 4/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE										

186.3 0.0	Ground Surface		1	AS	-	**	186									
184.9 1.4	SILTY SAND and GRAVEL mixed with topsoil dark brown, damp to moist		2	AS	-	**	185									
	CLAY reddish grey firm to stiff occasional silt seams partings and pockets	very stiff ----- ----- occasional silt seams partings and pockets	3	SS	12		184							18.1		
			4	SS	4		183								16.7	
			5	SS	4		182								17.1	
			6	SS	1		181									
			7	SS	0	***	180									
			8	SS	1		179									
			9	SS	2		178									
177.6 8.5			End of borehole. Vane and Auger refusal at 8.5 m, probably on a boulder or bedrock. * Borehole dry (not stabilized) and hole open to full depth on completion ** No recovery with split spoon. Auger sample collected. *** Spoon sinking under weight of hammer and/or rods. Borehole advanced 0.2 m right of median centre line													

+ 3, × 3: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+261; 20m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 885.7; E 301 336.7 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
 DATUM Geodetic DATE 4/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE		WATER CONTENT (%) W _P W W _L				
183.8	Ground Surface					*								
0.0	0.25 m Topsoil		1	AS	-									
183.1	SILTY SAND and GRAVEL rootlets and decayed wood pieces with topsoil and peat inclusions dark brown to black moist		2	SS	11								17.7	
0.7			3	TW	PH								17.3	0 0 17 83
	occasional silt pockets		4	SS	6								16.0	
			5	SS	5								16.5	
	CLAY trace rootlets to 2.1 m reddish grey stiff to 3.7 m, firm below		6	SS	3								15.4	
			7	SS	0									
	occasional silt seams and pockets		8	SS	1									
			9	SS	1								14.7	
			10	SS	0	**						15.8		
173.3	End of borehole													
10.5	* Borehole dry (not stabilized) and hole open to full depth on completion. ** Spoon sinking under weight of hammer and/or rods.													

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+309; 19m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 823.4; E 301 339.7 ORIGINATED BY S.O.
DIST 82 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 4/23/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								○ UNCONFINED ● POCKET PENETR.	+ FIELD VANE × LAB VANE			
189.3	Ground Surface						20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L		
0.0	SILTY SAND and GRAVEL mixed with topsoil, trace rootlets dark brown, moist		1	AS	-	*	189					
188.6												
0.7	CLAY reddish gray, very stiff occasional silt pockets with grey silt seams and partings occasional silt seams and partings		2	SS	17		188				19.4	
			3	SS	13						18.4	
			4	SS	14		187				17.7	
186.4												
2.9	Heterogeneous Mixture of Clay, Silt and Sand		5	SS	50/13							
186.1	(CLAYEY SILT TILL) reddish gray, hard											
3.2	End of borehole. Sampler and Auger refusal probably on boulder or bedrock. * Borehole dry (not stabilized) and hole open to full depth on completion											

RECORD OF BOREHOLE No 10+312 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 833.7; E 301 355.8 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
 DATUM Geodetic DATE 4/23/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
187.0	Ground Surface						20 40 60 80 100	W P W W L				GR SA SI CL
0.0	SAND and GRAVEL with rootlets and organics, occasional cobbles frequent topsoil inclusions to 0.3 m silty clay inclusions below 0.7 m brown to dark brown moist to wet		1	AS	-	*	187	○ UNCONFINED + FIELD VANE				
188.0			2	AS	-		186	● POCKET PENETR. x LAB VANE				
1.0			3	SS	14		185	WATER CONTENT (%)			18.1	
			4	SS	10		184	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			17.2	
			5	SS	9		183	W P W W L			17.1	
			6	SS	8		182				16.4	
			7	SS	5		181					
181.4	CLAY trace rootlets to 2.1 m occasional silt seams and pockets very stiff to stiff						180					
5.6			8	SS	9		179					
179.9	SILT trace clay grey, wet stiff						178					
7.1			9	SS	2		177					
			10	SS	1							
176.5	CLAY grey soft to firm											
10.5												
	End of borehole											
	* Borehole dry (not stabilized) and hole open to full depth on completion. Borehole advanced 0.1 m right of median centre line.											

SPT 1055

RECORD OF BOREHOLE No 10+315; 21m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 845.6; E 301 373.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 4/2/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE							
183.1 0.0	Ground Surface							20 40 60 80 100							
182.4 0.7	Peat with sand, wet, loose		1	SS	5	*	183								
			2	SS	6		182						18.1		
	occasional gray silt seams and pockets very stiff to stiff		3	SS	4		181								
			4	SS	2		180								
			5	SS	0	**	179								
			6	SS	0	**	178								
	CLAY reddish grey soft to firm		7	SS	1		177								
			8	SS	0	**	176								
			9	SS	0	*	175								
			10	SS	1		174								
172.6 10.5	End of borehole						173								
	* Borehole dry (not stabilized) and hole open to full depth on completion.														

+³, X³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+347; 21m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 793.9; E 301 363.5 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 4/22/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE										
189.5	Ground Surface						20	40	60	80	100							
0.0	SAND and GRAVEL some silt, mixed with topsoil to 0.2 m, with occasional cobbles		1	AS	-	•	189						○		18.6			
188.8																		
0.7	CLAY occasional silt pockets reddish grey, hard		2	SS	56/23								○					
188.0							188											
1.5	End of borehole. Auger refusal probably on a boulder or bed rock. Borehole moved to N 5151795.8, E 3013636.5, refusal again at 1.5 m. * Borehole dry (not stabilized) and hole open to full depth on completion																	

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+350 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 805.5; E 301 381.1 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 4/23/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
185.9	Ground Surface							20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
0.0	SAND and GRAVEL some silt, mixed with topsoil and rootlets, dark brown, moist		1	AS	-				○ UNCONFINED	+ FIELD VANE			
185.2									● POCKET PENETR.	× LAB VANE			
0.7	CLAYEY SILT grey, moist hard		2	SS	43		185					16.6	
			3	SS	38		184						0 0 70 30
183.8			4	SS	9		183					16.2	0 0 21 79
2.1	CLAY reddish grey firm to stiff		5	TW	PH		182					15.8	
	frequent grey dilatant silt seams and silt pockets		6	SS	15		181						
			7	SS	6								
180.4													
5.5	End of borehole. Auger refusal at 5.5 m probably on a boulder or bedrock. * Water level at 3.9 m (not stabilized) and hole open to full depth on completion. Borehole advanced 0.1 m right of median centre line												

SPT 1055

RECORD OF BOREHOLE No 10+359; 14 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 808.2; E 301 397.1 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 4/22/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.9	Ground Surface							20 40 60 80 100	20 40 60					
0.0	0.15 m Topsoil, over SAND trace gravel		1	SS	6									
182.3			2	SS	4		182						17.5	
0.6			3	SS	2		181							
	very stiff		4	SS	0**		180							
			5	SS	6		179							
	occasional grey, dilatant silt seams		6	SS	0**		178							
	CLAY trace rootlets to 2.1 m reddish grey firm		7	SS	0**		177							
			8	SS	0**		176							
			9	SS	0**		175							
174.3							174							
8.6	SILTY CLAY some sand and fine gravel (probable Glacial Till) reddish grey, soft		10	SS	2									
173.3														
9.6	End of borehole Piezometer installed to 9.1 m. Water level on April 22, 2002 - at surface; (Elev. 182.9) April 23, 2002 - 0.3 m; (Elev. 182.6) Oct. 19, 2002 - 0.9 m above ground (Elev. 183.8) ** Vane attempted at 8.0 m, refusal probably on a boulder or cobble.													

+³, x³: Numbers refer to Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

TEST PIT LOGS

CUT AREA #1 HIGHWAY 17 (New), Sault Ste. Marie (Offset distances are from median centreline)

10+225 20m Rt C/L (El. 184.0m)

0	-	200	Tps
200	-	1.8	Sa and Gr Occ Cob and Blds
1.8	-	5.5	Cl Tr Si layers, Soft to firm

10+225 20m Lt C/L (El. 182.2m)

0	-	300	Tps
300	-	800	Sa and Gr Occ Cob
800	-	5.5	Cl Tr Si Seam, Varved, Firm, Moist

10+240 20m Rt C/L

0	-	300	Tps
300	-	1.5	Sa and Gr Occ Cob and Blds
1.5	-	6.0	Cl Tr Si layers, Stiff to firm, Moist

10+240 30m Rt C/L

0	-	200	Tps
200	-	900	Sa and Gr Occ Cob and Blds
900	-	6.0	Cl Tr Si layers, Stiff to firm, Moist

10+250 32m Rt C/L

0	-	250	Tps
250	-	700	Sa and Gr Occ Cob and Blds
700	-	4.8	Cl Tr Si layers, Stiff to firm, Moist
		4.8	NFP (Poss BR)

10+250 36m Rt C/L

0	-	300	Tps
300	-	1.2	Sa and Gr Occ Cob and Blds
1.2	-	3.5	Cl Tr Si layers, Moist
		3.5	NFP (Poss BR)

10+255 10m Rt C/L (El. 186.7m)

0	-	300	Tps
300	-	1.8	Sa and Gr Occ Cob and Blds, Damp
1.8	-	5.5	Cl Tr Si layers, Stiff to firm, Moist

10+255 10m Lt C/L (El. 185.3m)

0	-	200	Tps
200	-	1.8	Sa and Gr Occ Cob and Blds
1.8	-	5.5	Cl Tr Si layers, Firm, Moist

10+275 20m Rt C/L (El. 189.0m)

0	-	200	Tps
200	-	1.4	Sa and Gr Occ Cob and Blds
1.4	-	5.2	Cl Tr Si layers, Firm, Moist
		5.2	NFP BR

10+275 20m Lt C/L (El. 185.1m)

0	-	200	Tps
200	-	1.8	Sa and Gr
1.8	-	5.2	Cl Tr Si layers, Firm, Moist

10+310 10m Rt C/L (El. 188.3m)

0	-	200	Tps
200	-	600	Sa and Gr Occ Cob and Blds
600	-	5.5	Cl Tr Si layers, Firm, Moist
		5.5	NFP BR

10+310 10m Lt C/L (El. 185.1m)

0	-	200	Tps
200	-	600	Sa and Gr
600	-	5.5	Cl Tr Si layers, Soft to firm, Moist

10+350 10m Rt C/L (El. 188.2m)

0	-	200	Tps
200	-	1.4	Sa and Gr
1.4	-	3.0	Cl Tr Si layers, Soft to firm, Moist
		3.0	NFP BR

10+350 10m Lt C/L

0	-	200	Tps
200	-	3.7	Cl Tr Si layers, Soft to firm, Moist
3.7	-	5.5	Si Tr Cl, Comp, Moist

Appendix A1-2

Photograph

SPT 1055
GWP 354-94-00

Highway 17 (New)
Sault Ste. Marie, Ontario



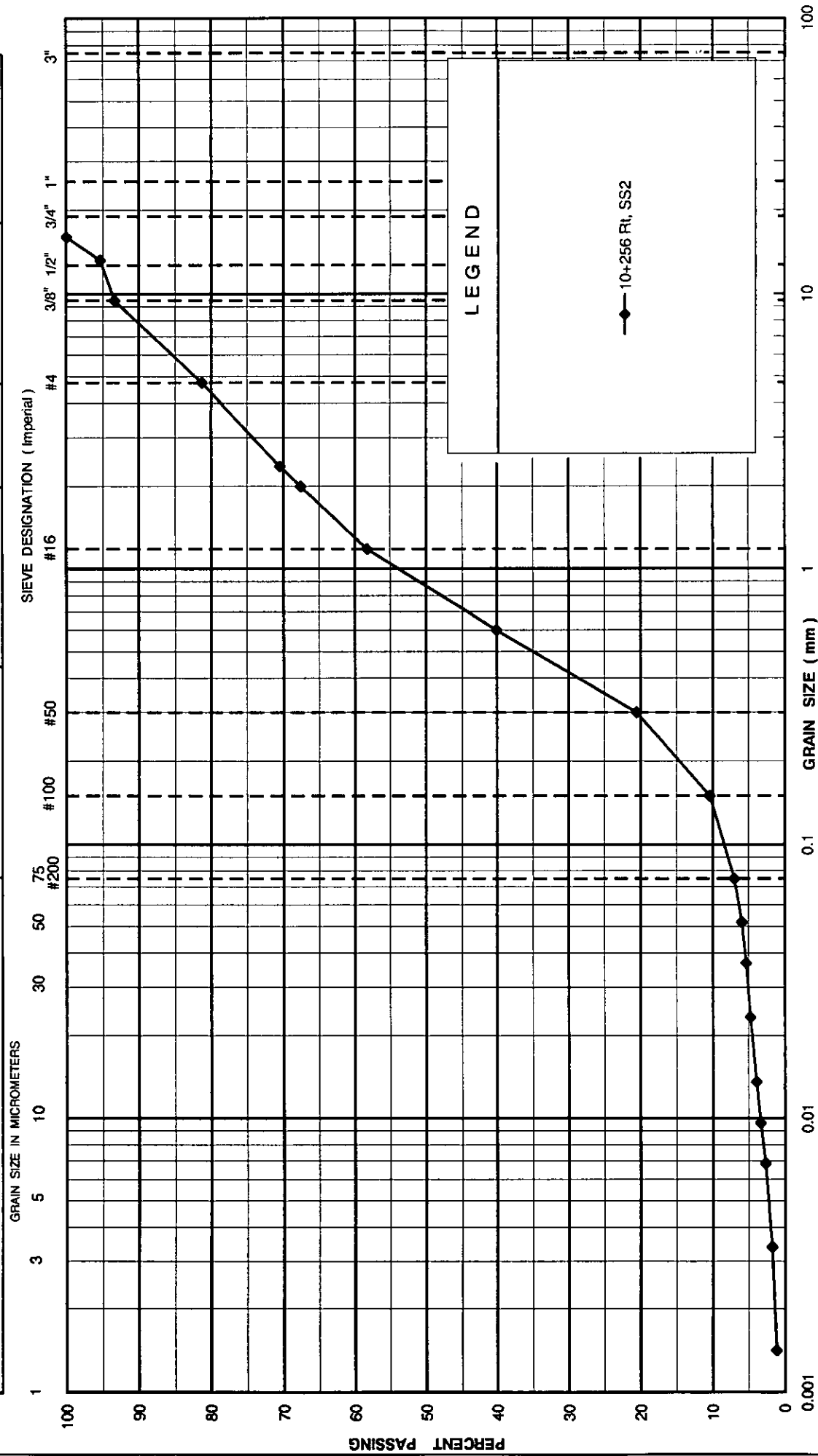
PHOTOGRAPH OF BEDROCK CORE
Borehole 10+256, 18m Rt, Quartzite Bedrock

Appendix B1

Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION
SAND, some gravel

SHAHEEN & PEAKER LIMITED

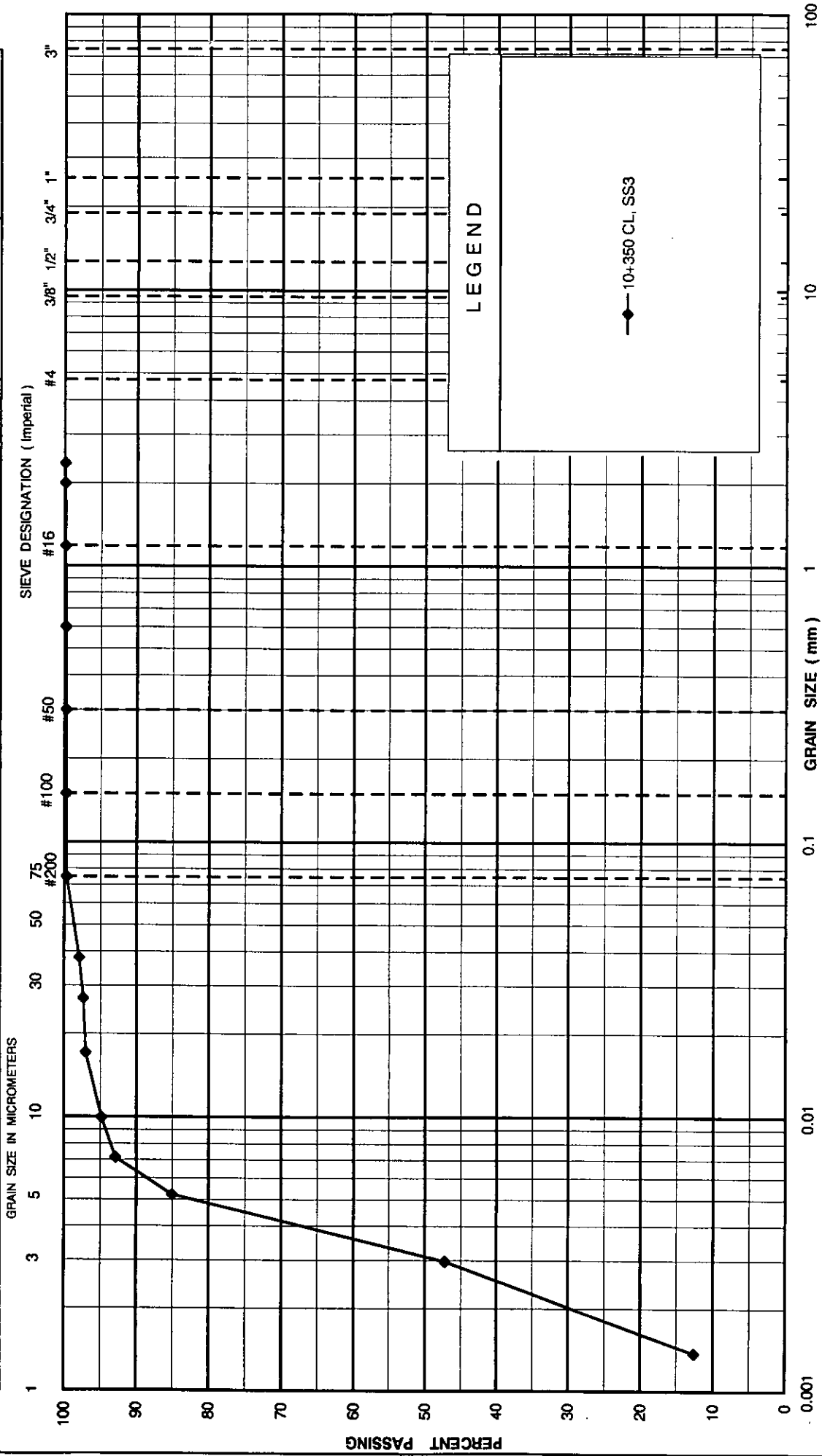
FIG. No. B1-1

REF. No. SPT 1055

G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION CLAYEY SILT

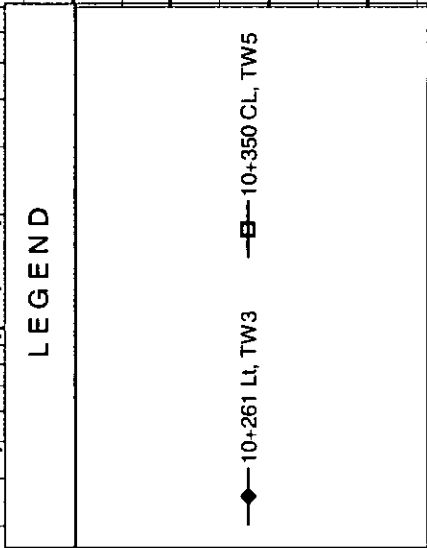
SHAHEEN & PEAKER LIMITED

FIG. No. B1-2

REF. No. SPT 1055

G.W.P. 354-94-00

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



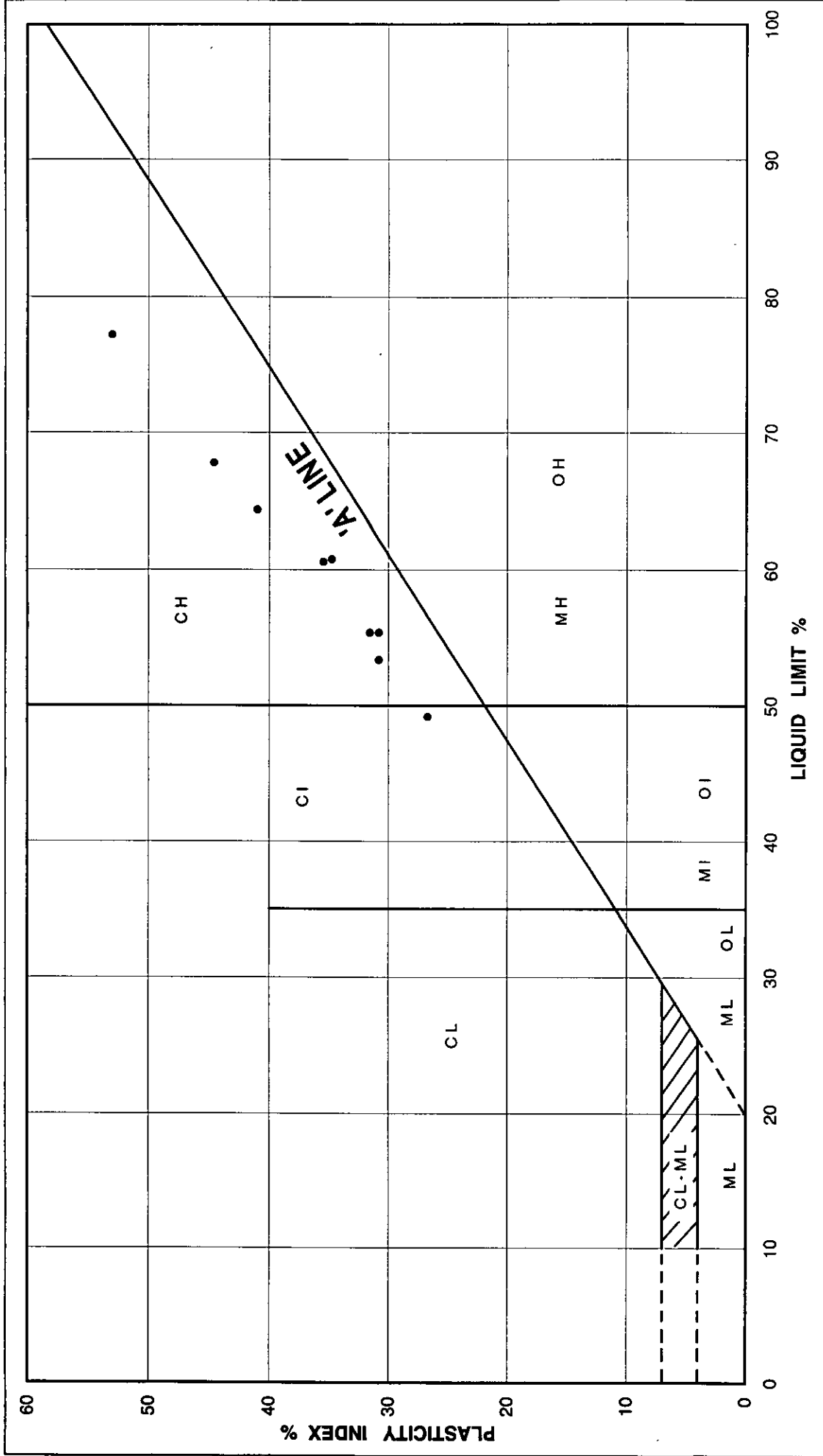
SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION CLAY

FIG. No. B1-3

REF. No. SPT 1055

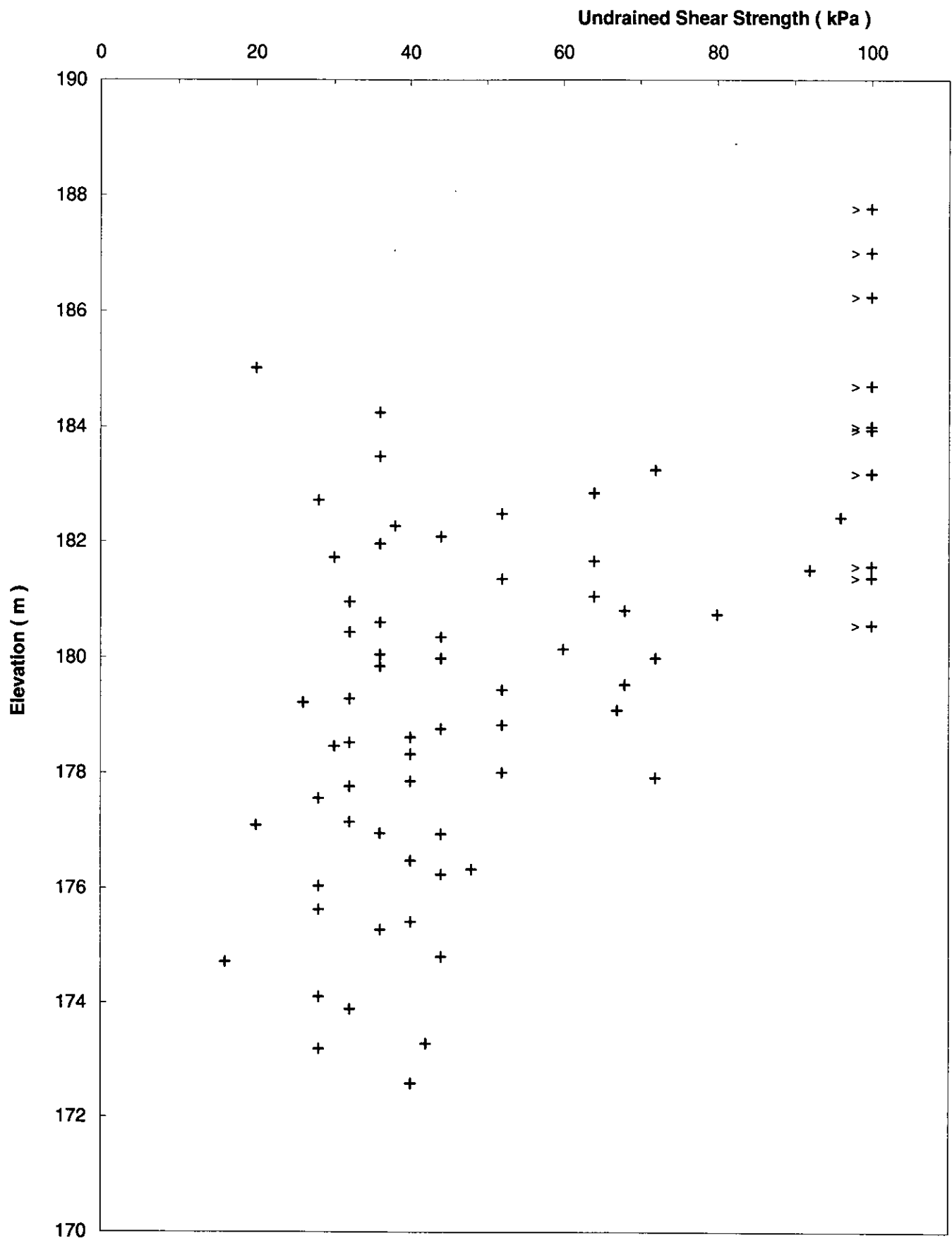
G.W.P. 354-94-00



SHAHEEN & PEAKER LIMITED	PLASTICITY CHART		FIG No B1-4
	CLAY		G.W.P. 354-94-00
			SPT 1055

Appendix C1

Measured Undrained Shear Strength Results



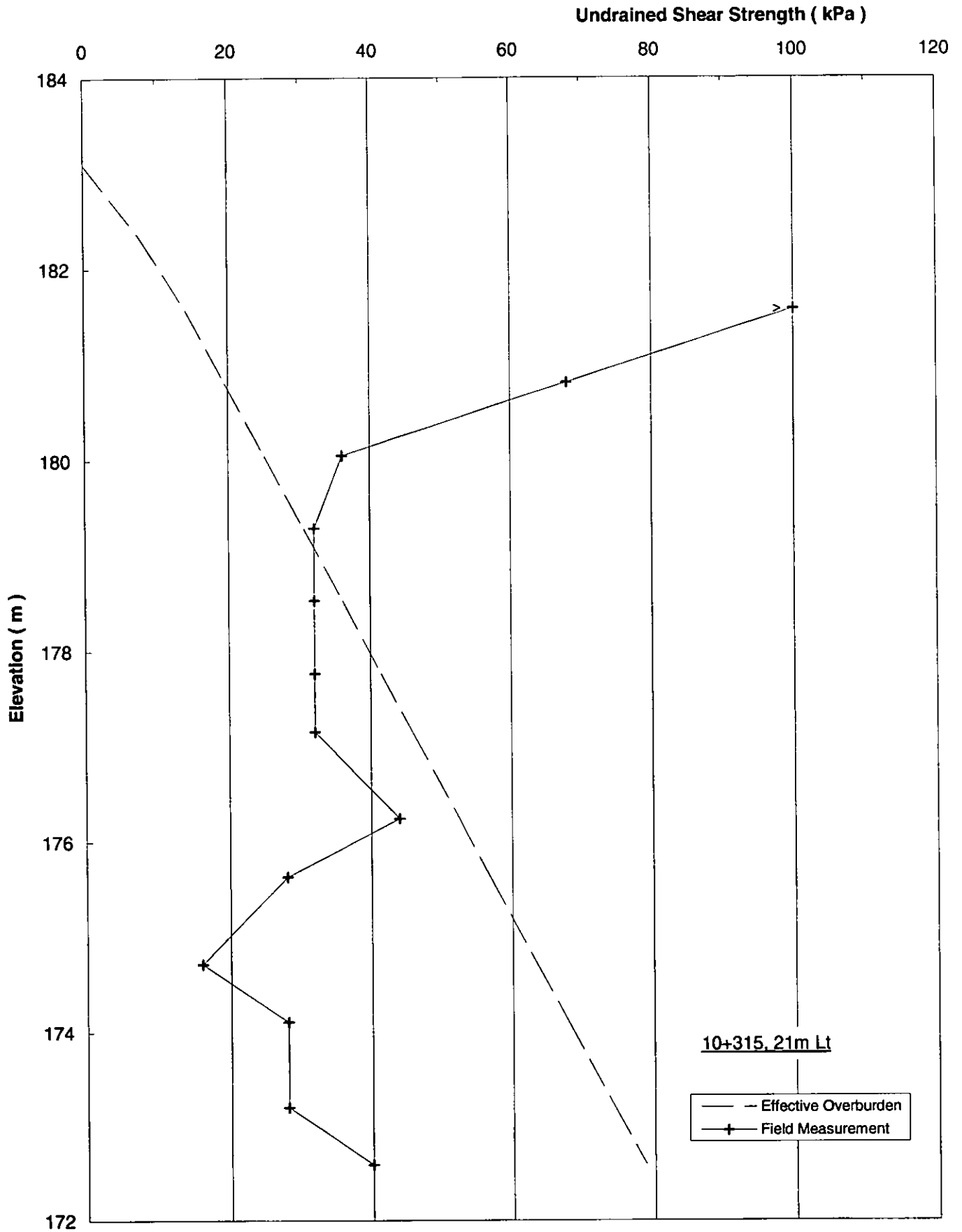


Fig. C1-2: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation
(Borehole 10+315, 21m Lt)

4.2 SITE NO. 2 : HIGHWAY 17 (NEW) CUT SECTION BETWEEN STATIONS 10+670 AND 10+825 EASTBOUND LANES, AND BETWEEN STATIONS 10+700 AND 10+780 WESTBOUND LANES

Site No. 2 is the next section south of Site No. 1, and just north of the low-lying section of Site No. 3. The site is located in a hilly location with sparse trees and with numerous cobbles and boulders at the ground surface. The ground slopes down from the right (west) to left (east) and it forms a knob at about Station 10+690. To the east (or left) of the proposed WBL is the existing Echo Lake Road. From the contour plan, the ground appears to continue to rise towards the west (or right) at about Station 10+750.

The existing grade in this area varies from about Elevation 198 to 196.5 m along eastbound lanes (EBL) and 194 to about 190 m along westbound lanes (WBL). The existing grades are also sloping down towards the left (east) at a rate of about 10% (i.e., about 4 m drop over a horizontal distance of 40 m).

The location plan of the boreholes and test pits in this section and the stratigraphic profiles for EBL and WBL are presented in Drawing Nos. 2A and 2B. The cross-sections through Stations 10+730, 10+750 and 10+790 are also shown in Drawing Nos. 2C and 2D.

Sixteen boreholes were drilled and eleven test pits were dug in this area and these show that below about 0.1 to 0.3 m of topsoil and topsoil with sand and gravel, this section is generally underlain by a predominant deposit of sand and gravel and/or silty sand till with cobbles and boulders. Along the proposed WBL, based on the data collected, the surficial materials consist mainly of topsoil with sand and gravel underlain by sand and gravel with cobbles and boulders. Along the EBL, the sand and gravel with cobbles and boulders is underlain by bedrock along the north end of this section (e.g., at Station 10+738), and is interbedded with clay deposit along the south end of this section (e.g., at Station 10+800). The interbedded clay deposit extends from about Station 10+795 southerly towards the low lying area (of Site No. 3). At the locations of Borehole 10+738 18m Rt and Borehole 10+733 15m Lt, the bedrock was proven by diamond drilling. In Boreholes 10+789 39m Rt and 10+750 38m Rt, the boulders within the sand and gravel or silty sand till layer were cored to be able to extend the hole.

Details of the subsurface conditions encountered in the boreholes and test pits are presented on the Record of Borehole Sheets and Test Pit Logs in Appendix A2. The individual strata are briefly described in the following paragraphs.

4.2.1 TOPSOIL

The majority of the boreholes and the test pits encountered 0.1 to 0.3 m of topsoil or topsoil with sand and gravel.

4.2.2. SAND AND GRAVEL

Below the topsoil or from the ground surface, the boreholes and test pits contacted a major deposit of silty sand to sand and gravel extending to depths of 0.7 to at least 5 m below existing grade. This sand and gravel layer contains frequent cobbles and boulders and traces of silt.

Measured N-values in this deposit range from 8 to 18 blows/0.3m in the top 0.6 m indicating loose to compact relative density. Below this surficial layer, N-values are generally in excess of 50 blows/0.3 m indicating very dense relative density.

4.2.3 SILTY SAND TILL

Below or interbedded in the sand and gravel, a silty sand till was also contacted in most of the boreholes. This glacial till is a heterogeneous mixture of silt, sand and gravel-size particles and contains frequent cobbles and boulders.

Grain-size distribution analyses were performed on two of the samples from this layer and the results are presented in Figure B2-1, Appendix B2. They indicate the following particle-size distribution:

Gravel	=	14 - 31%
Sand	=	52 - 58%
Silt	=	15 - 26%
Clay	=	2%

Standard Penetration tests (SPT) conducted in this deposit gave N-values greater than 50 blows/0.3 m with little penetration. These values are unlikely to be reliable due to the presence of oversize particles, however, the silty sand till is considered to have a dense to very dense relative density.

4.2.4 SILTY CLAY TO CLAY

Along the EBL, Borehole 10+800 35m Rt, below the silty sand at a depth of 0.8 m, contacted a 1.3 m thick clay layer extending to a depth of 2.1 m. In Test Pits 10+795 20m Rt,

10+800 20m Rt, and 10+810 20m Rt, the clay layer was also encountered interbedded in the sand and gravel deposit. These test pits and borehole indicate clay layer within the section along the EBL from about Station 10+795 and southerly. The thickness of the silty clay to clay varies from about 0.5 to 4.6 m at the locations of the boreholes and test pits. From the test pits and borehole, the clay appears to thin out towards the right (west). The clay contains occasional seams of sand.

Along the WBL, in Borehole 10+790 21m Lt, a 1.7 m thick silty clay to clay layer was contacted below the topsoil and extends to a depth of 1.8 m below existing grade. In Test Pit 10+800 20m Lt, the clay deposit was also encountered below the topsoil and sand and gravel layer at a depth of about 0.8 m and this extends to at least 5.5 m below existing grade. From these borehole and test pit, the silty clay to clay is present in the low-lying area from about 10+780 and southerly.

Atterberg Limits tests carried out in the laboratory on samples from the clay deposit gave the following index values:

Liquid Limit :	40 to 46%
Plastic Limit :	20 to 22%
Plasticity Index :	20 to 24%

As presented in Figure B2-2 in Appendix B2, these values are characteristics of clayey soils of medium plasticity. The measured natural moisture contents generally range from 30 to 38%.

Standard Penetration tests performed in this deposit gave N-values varying between 6 and 36 blows/0.3 m. Field Vane tests yielded undrained in-situ shear strength values in excess of 100 kPa. These values indicate that the consistency of the material can be described as generally very stiff to hard.

4.2.5 COBBLES AND BOULDERS

In Boreholes 10+789 39m Rt and 10+750 38m Rt along the EBL in the high ground area, cobbles and boulders were encountered below the silty sand till at a depth of about 1.7 m. Wash boring and diamond drilling had to be utilized to penetrate this deposit. Several SPTs were conducted in this deposit and they all gave N-values greater than 50 blows/0.3m. Due to the presence of oversize particles, these results are unreliable. However, based on the above and the observed hard drilling, the deposit is considered generally very dense. As mentioned before, cobbles and boulders were also encountered within the sand and gravel and silty sand till deposits. It should be noted that no boulder greater than 1 m³ was encountered in the test pits.

4.2.6 BEDROCK

Boreholes and test pits from this investigation indicate that bedrock was encountered along the EBL at Station 10+738 18m Rt and at 10+750 38m Rt. To the north of these stations, borehole logs by DST Consulting Engineers Inc. were utilized to be able to plot the rock line and this is shown in Drawing 2A. The bedrock was also encountered along the WBL at Station 10+733 15m Lt at a depth of 8.2 m below existing grade. Bedrock outcrop was also observed at Station 10+725 10m Rt.

The bedrock was proven in three boreholes (Boreholes 10+738 18m Rt, 10+750 38m Rt, and 10+733 15m Lt) and is classified as quartzite. With the measured total core recovery (TCR) of 94 to 100% and the Rock Quality Designation (RQD) of 60 to 100%, this rock is described as fair to excellent quality.

4.2.7 GROUNDWATER CONDITIONS

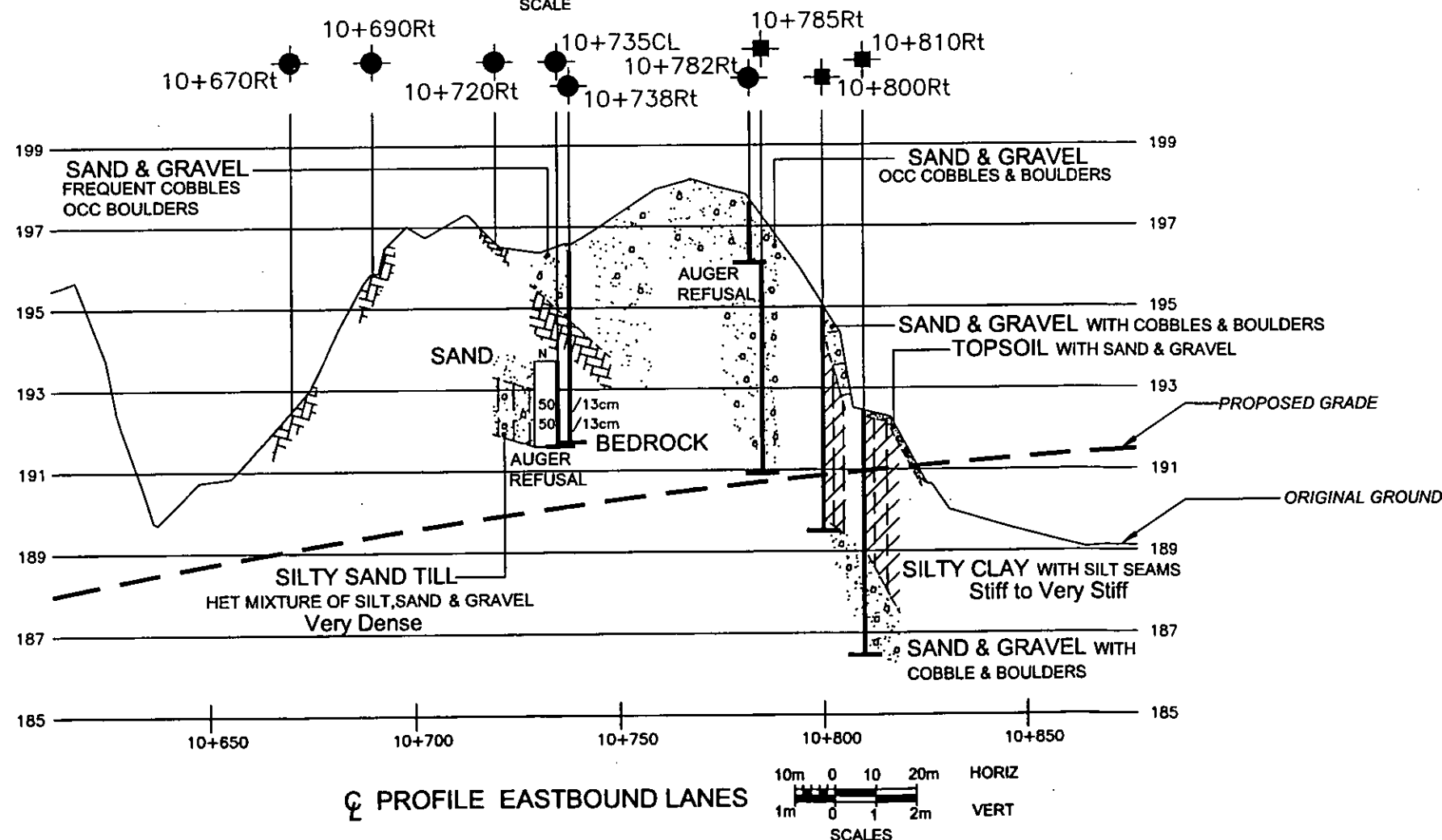
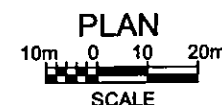
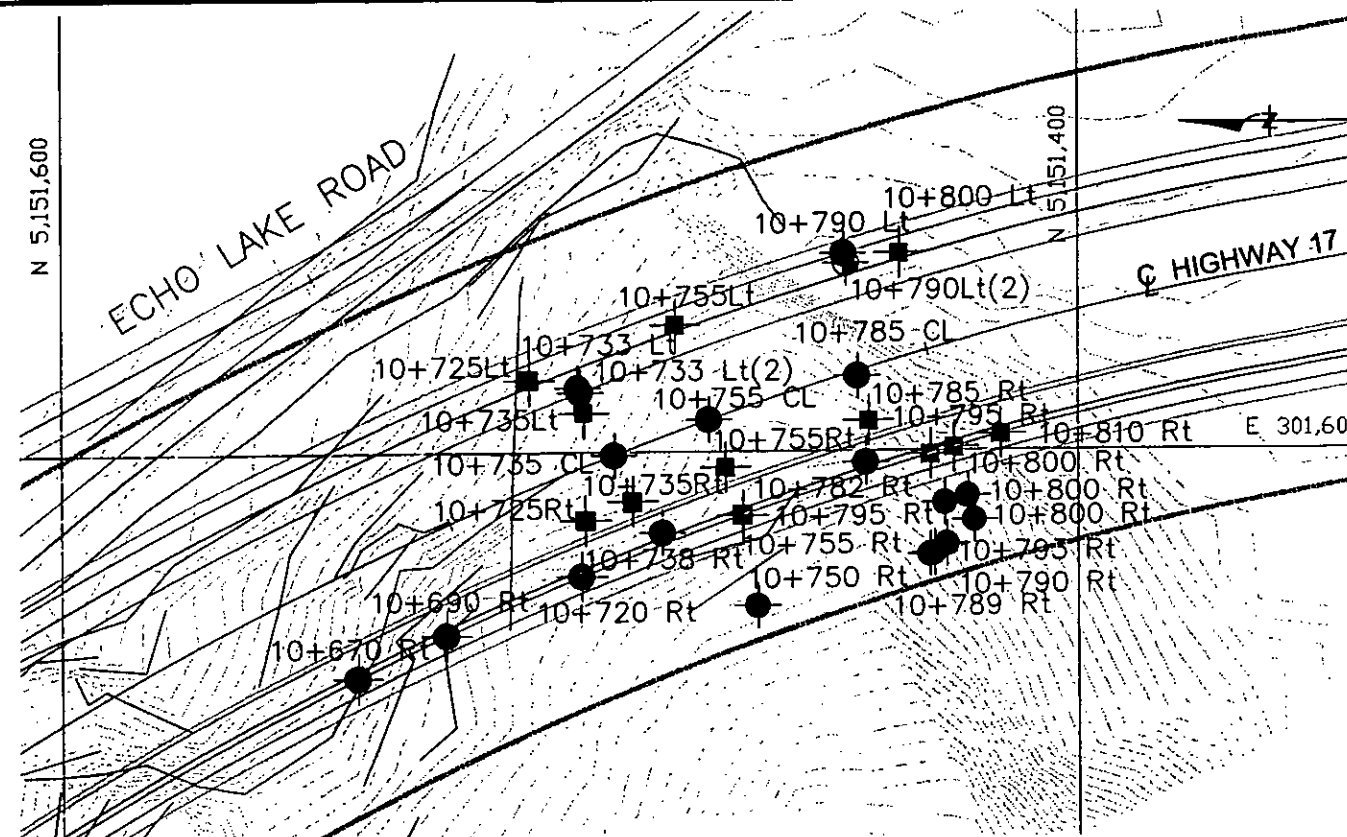
Water level observations in the boreholes were made during drilling and at completion of each borehole. The boreholes were dry at completion except in Borehole 10+790 21m Lt, where the recorded water level at completion was recorded at a depth of 1.2 m below existing grade, but these are unlikely to represent the stabilized water levels.

To enable us to monitor the groundwater level in Borehole 10+733 15m Lt, a piezometer was installed in this borehole. Water level in the piezometer was measured eight days after completion of the borehole and no water was observed. In October 19, 2002 or about six months after completion of the borehole, the water level was again measured and recorded level was at 0.6 m below the existing ground surface or at Elevation 191.1m.

In addition, piezometers were also installed at Boreholes 10+750 38m Rt and 10+789 39m Rt, along the right side of the EBL, and these observations will be reported once they are available.

The groundwater table can be expected to fluctuate seasonally and in response to weather events.

Drawings



METRIC

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

NOTE:
FOR DETAILED SUBSURFACE CONDITIONS OF ALL
BOREHOLES & TEST PITS REFER TO RECORD OF BOREHOLE
SHEETS & TEST PITS LOGS.

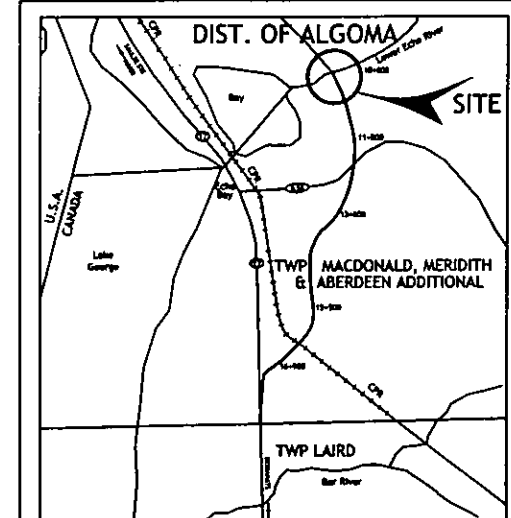
CONT No.

GWP: 354-94-00

HIGHWAY 17 (NEW) EBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 2
BORE HOLE LOCATIONS & SOIL STRATA



SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND

- Bore Hole
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation
- Water Level in Piezometer
- Piezometer
- Test Pit
- Bore Hole Done by DST Consulting Engineers Inc

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+735 CL	193.7	5 151 491.7	301 599.4
10+738 Rt	196.4	5 151 482.2	301 584.0
10+782 Rt	197.6	5 151 442.2	301 597.8
10+785 Rt	196.1	5 151 441.5	301 606.1
10+800 Rt	195.0	5 151 424.6	301 600.7
10+810 Rt	192.5	5 151 415.2	301 603.2

NOTE

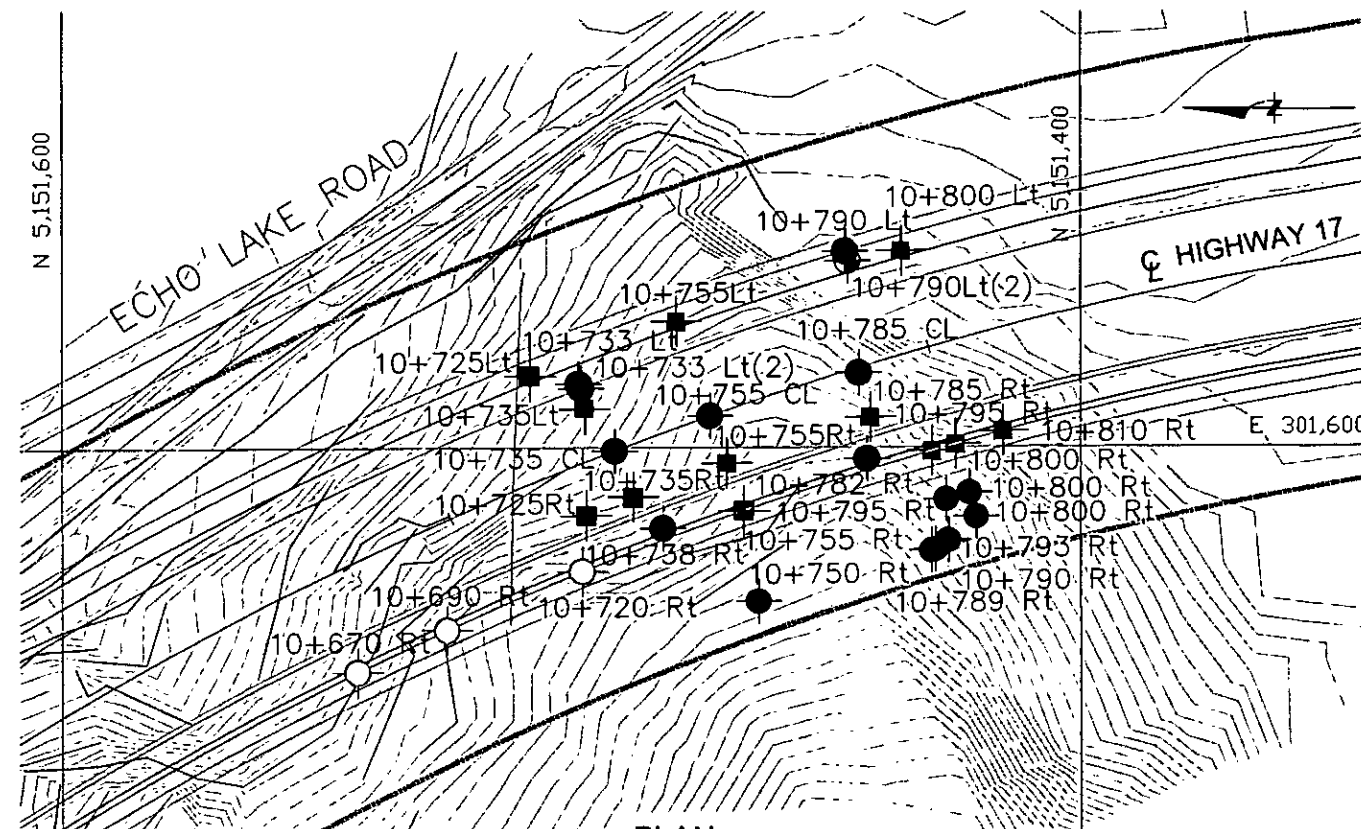
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

REV.	DATE	BY	DESCRIPTION

Geocres No.

HWY No. 17 (New)			DIST 62
SUBM'D ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 2A

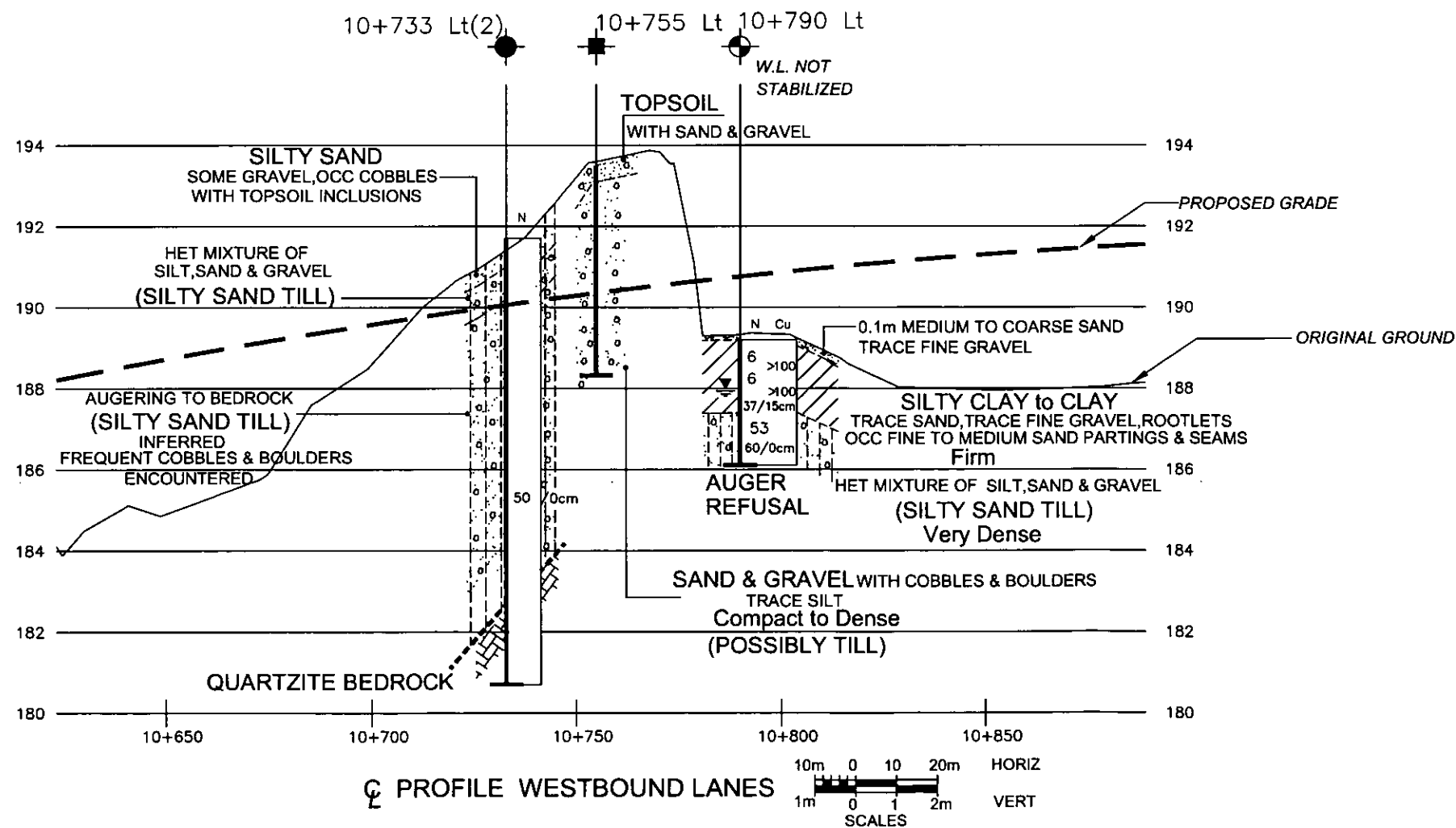


METRIC

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

NOTE:
FOR DETAILED SUBSURFACE CONDITIONS OF ALL
BOREHOLES & TEST PITS REFER TO RECORD OF BOREHOLE
SHEETS & TEST PITS LOGS.

PLAN
10m 0 10 20m
SCALE



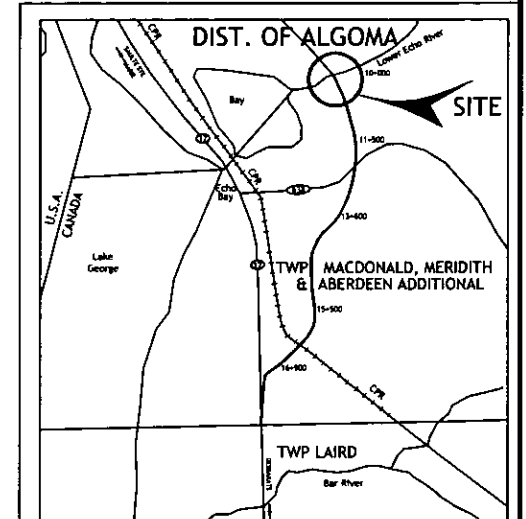
CONT No.

GWP: 354-94-00

HIGHWAY 17 (NEW) WBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 2
BORE HOLE LOCATIONS & SOIL STRATA



SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND

- Bore Hole
- ⊙ Bore Hole & Cone
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation Apr. 2002
- Test Pit
- Bore Hole Done by DST Consulting Engineers Inc

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+733Lt(2)	191.7	5 151 498.3	301 611.9
10+755Lt	193.5	5 151 479.5	301 625.2
10+790Lt	189.2	5 151 446.5	301 639.1

NOTE

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

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REV.	DATE	BY	DESCRIPTION

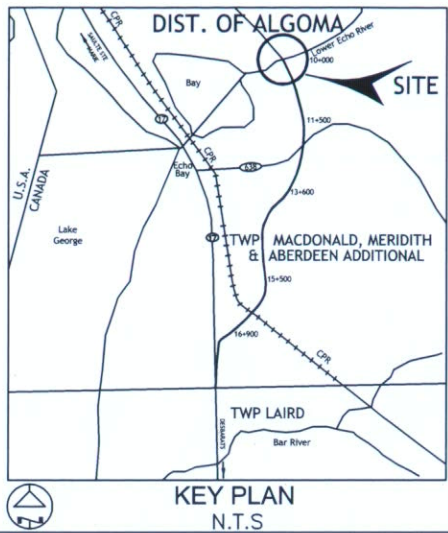
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SUBMD ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 28

METRIC

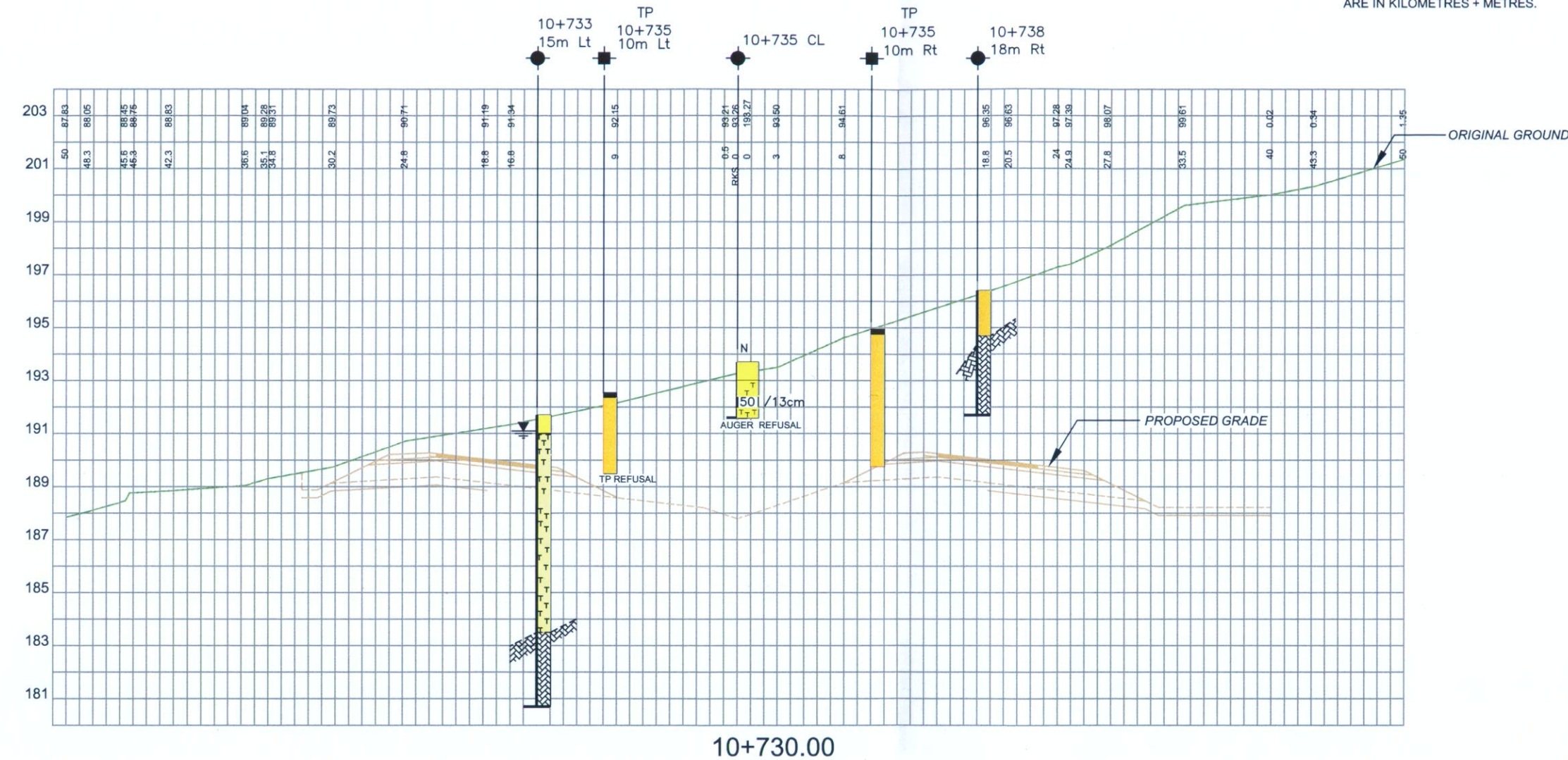
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AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOMETRES + METRES.

CONT No.
GWP: 354-94-00
HIGHWAY 17 (NEW)
ECHO RIVER TO BAR RIVER ROAD
SITE No. 2
CROSS SECTION

SHAHEEN & PEAKER LIMITED



LEGEND			
	Bore Hole		
	Test Pit		
N	Blows/0.3m (Std. Pen. Test, 475 J/blow)		
	Water Level at Time of Investigation Oct., 2002		
No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+733 15mLt	191.7	5 151 498.7	301 612.8
10+735 10mRt	194.9	5 151 488.1	301 590.1
10+735 CL	193.7	5 151 491.7	301 599.4
10+735 10mLt	192.5	5 151 495.3	301 608.8
10+738 18mRt	196.4	5 151 482.2	301 584.0



CROSS SECTION (SITE 2)

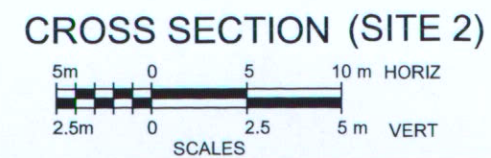
Colour	Soil Type
	PEAT, TOPSOIL, ORGANIC SOIL
	SAND AND GRAVEL
	SAND
	SILTY SANDY TILL
	BEDROCK



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 Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV.	DATE	BY	DESCRIPTION
Geocres No.			
HWY No. 17 (New)			DIST 62
SUBM'D ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 2C

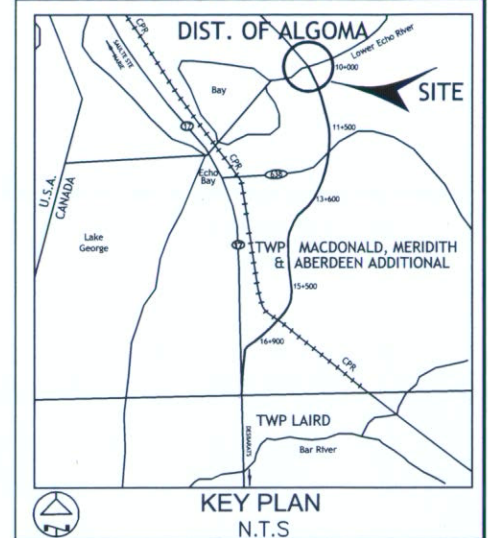




METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOMETRES + METRES.

CONT No.
GWP: 354-94-00

HIGHWAY 17 (NEW)
ECHO RIVER TO BAR RIVER RO
SITE No. 2
CROSS SECTION

SHAHEEN & PEAKER LIMITED



LEGEND					
		Bore Hole			
		Test Pit			
N		Blows/0.3m (Std. Pen. Test, 475 J/blow)			
No.	ELEV.	CO-ORDINATES			
		NORTH		EAST	
10+750 38mRt	200.2	5 151	463.3	301	569.5
10+755 20mLt	193.5	5 151	479.5	301	625.2
10+755 CL	195.6	5 151	472.9	301	608.4
10+755 20mRt	197.8	5 151	466.3	301	587.5
10+755 10mRt	196.7	5 151	469.6	301	596.9
10+785 CL	195.0	5 151	443.8	301	614.9
10+785 10mRt	196.1	5 151	441.5	301	606.1
10+790 21mLt	189.2	5 151	446.0	301	637.2
10+790 39mRt	198.6	5 151	428.5	301	579.8
10+795 20mRt	195.5	5 151	429.3	301	599.3
10+800 20mLt	189.3	5 151	435.4	301	639.2
10+800 20mRt	195.0	5 151	424.6	301	600.7
10+800 30mRt	196.3	5 151	421.9	301	591.0
10+800 35mRt	196.7	5 151	420.5	301	586.2

=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 Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV.				
	DATE	BY	DESCRIPTION	
Geocres No.				
HWY No. 17 (New)				DIST 62
SUBM'D ZO	CHECKED ZO	DATE Mar, 2003	SITE	
DRAWN JZ	CHECKED	APPROVED	DWG 2D	

Appendix A2-1

Record of Boreholes and Test Pit Logs

SPT 1055

RECORD OF BOREHOLE No 10+733; 15m Lt (1) 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 498.7; E 301 612.8 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 4/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
FLEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
191.7	Ground Surface							20	40	60	80	100					
0.0	SILTY SAND some gravel, occasional cobbles with topsoil inclusions, brown, moist		1	AS	-												
191.0							191										
0.7	Heterogeneous mixture of silt, sand and gravel (SILTY SAND TILL) rootlets, brown, moist		2	AS	-												14 58 26 2
190.2																	
1.5	End of borehole. Auger refusal probably on a boulder or bedrock. Borehole moved to N 5151498.3, E 301611.9 refusal again at 1.5 m. Piezometer installed to 1.4 m. Water level on: May 03, 2002 - Dry Oct. 19, 2002 - 0.6 m (Elev. 191.1 m)																

+ 3. x 3. Numbers refer to
Sensitivity





20
15 10 5
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+733; 15m Lt (2) 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 498.3; E 301 611.9 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers, Casing & Washboring & BQ Rock Coring COMPILED BY M.L.
DATUM Geodetic DATE 5/2/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
191.7 0.0	Ground Surface					*						GR SA SI CL
190.2 1.5	Augering to bedrock Refer to Record of Borehole 10+733 Lt (1) for inferred soil stratigraphy						191					
	boulder		1	RC	-	**	190					
	Augering to bedrock (SILTY SAND TILL) INFERRED frequent cobbles and boulders encountered						189					** commence casing and wash boring
	boulder		2	RC	-		188					
							187					
			3	RC	-		186					05/02/2002
			4	SSC/B	-	***	185					05/03/2002
	boulder		5	RC	-		184					
183.5 8.2	QUARTZITE BEDROCK unweathered		6	BQ RC	Rec 100%		183					RQD=100%
			7	BQ RC	Rec 100%		182					RQD=60%
180.7 11.0	End of borehole * Wet cave at 0.3 m on completion. *** Spoon and rods bouncing probably on a cobble						181					

SPT 1055

RECORD OF BOREHOLE No 10+735 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 491.7; E 301 599.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 4/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
193.7 0.0	Ground Surface													
193.0 0.7	SAND some silt, trace clay with topsoil inclusions and rootlets brown, moist		1	AS	-									
			2	SS	50/13									31 52 15 2
	Heterogeneous mixture of silt, sand and gravel (SILTY SAND TILL) brown, moist, very dense		3	SS	50/13									
191.6 2.1	End of borehole. Auger refusal probably on a boulder or bedrock. Borehole moved to N 5151491.8, E 301598.5 refusal again at 2.4 m. * Borehole dry (not stabilized) and open to full depth on completion.													

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+738; 18m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 482.2; E 301 584.0 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers, Casing & Washboring & BQ Rock Coring COMPILED BY M.L.
DATUM Geodetic DATE 5/1/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
196.4 0.0	Ground Surface												
	SAND and GRAVEL frequent cobbles, occasional boulders gray brown, moist		1	AS	-								
			2	AS	-								
194.7 1.7	QUARTZITE BEDROCK unweathered		3	BQ RC	Rec 94%								RQD=73%
			4	BQ RC	Rec 100%								RQD=60%
			5	BQ RC	Rec 100%								RQD=90%
191.7 4.7	End of borehole * Wet cave at 0.8 m on completion.												

SPT 1055

RECORD OF BOREHOLE No 10+750; 38 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 464.7; E 301 568.9 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers, casing & washboring & NQ rock coring COMPILED BY R.A.
DATUM Geodetic DATE 1/8/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
200.2 0.0	Ground Surface											
	0.1 m Topsoil		1	SS	7		200					
	SILTY SAND some gravel, trace rootlets (probable till) brown, moist, loose to very dense		2	SS	50/15		199					
198.5 1.7			3	SS	50/10		198					
	COBBLES and BOULDERS some sand, trace gravel, brown very dense (inferred)		4	RC	-		197					
			5	SS	50/5		196					
			6	RC	-		195					
			7	SS	50/3							
			8	RC	-							
			9	SS	50/3							
			10	RC	-							
195.2 5.0			11	SS	50/3							
			12	RC	-							
	QUARTZITE BEDROCK		13	SS	50/0							
194.1 6.1			14	NQ RC	Rec 100%							
	End of borehole. * Auger refusal at 1.7 m. ** No recovery Piezometer installed to 6 m. Water level on: January 10, 2003: 4.0 m											

SPT 1055

RECORD OF BOREHOLE No 10+755 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 472.9, E 301 606.4 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 5/1/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			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		
195.6 0.0	Ground Surface		1	AS	-		195							
194.1 1.5	SAND and GRAVEL occasional cobbles brown, moist													
193.3 2.3	Heterogenous mixture of silt, sand and gravel (SILTY SAND TILL) occasional cobbles and boulders grey brown, moist		2	AS	-		194							
	End of borehole. Auger refusal probably on a boulder or bedrock. Borehole moved to N 5151471.8, E 301603.5 auger refusal at 1.5 m. Borehole moved to N 5151473.4, E 301608.2 auger refusal at 2.3 m. * Borehole dry (not stabilized) and open to 0.9 m on completion.													

+³ × 10³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+782; 18m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 442.2; E 301 597.8 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 5/1/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								20 40 60 80 100										
197.6 0.0	Ground Surface																	
	SAND and GRAVEL occasional cobbles and boulders brown, moist		1	AS	-		197											
196.1 1.5			2	AS	-													
	End of borehole. Auger refusal probably on a boulder or bedrock. Borehole moved to N 5151444.0, E 301597.2 auger refusal at 0.9 m. Borehole moved to N 5151440.2, E 301598.4 auger refusal at 2.3 m. * Borehole dry (not stabilized) and hole open to 0.6 m on completion.																	

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+785 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 443.8; E 301 614.9 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 5/3/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE										
195.0	Ground Surface						20	40	60	80	100							
0.0	SAND and GRAVEL frequent cobbles, occasional boulders brown, moist		1	AS	-													
193.6			2	AS	-													
1.4	End of borehole. Auger refusal at 1.4 m probably on a boulder or bedrock. Borehole moved to N 5151441.9, E 301609.1 auger refusal at 1.2 m. Borehole moved to N 5151442.9, E 301612.5 auger refusal at 1.4 m. * Caved at surface. Borehole advanced 0.9 m right of median centre line.																	

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+789; 39 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 429.4; E 301 579.5 ORIGINATED BY G.I
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers, casing and washboring COMPILED BY R.A
DATUM Geodetic DATE 1/3/2003 to 1/3/2003 CHECKED BY R.A

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE		● POCKET PENETR. × LAB VANE											
							20	40	60	80	100	20	40	60	GR	SA	SI	CL			
198.7	Ground Surface																				
0.0	0.15 m Topsoil		1	SS	14													24	68	6	2
	SILTY SAND with gravel, occasional cobbles and boulders (probable till) brown, moist very dense (inferred)		2	SS	50/8		198														
197.0			3	SS	50/8		197														
1.7			4	RC	-																
			5	SS	88																
			6	RC	-		196														
			7	SS	50/10																
	COBBLES AND BOULDERS some gravel and sand brown, moist very dense (inferred)		8	RC	-																
			9	SS	60/8		195														
			10	RC	-																
			11	SS	50/8		194														
			12	RC	-																
			13	SS	50/10																
			14	RC	-		193														
192.4			15	SS	50/8																
6.3	End of Borehole *water used to facilitate casing and washboring. Piezometer installed to 5.2 m. Water level on: January 10, 2003: Dry																				

SPT 1055

RECORD OF BOREHOLE No 10+790; 21m Lt (1) 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 446.0; E 301 637.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 4/4/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
189.2	Ground Surface							20 40 60 80 100						
0.0	0.1 m medium to coarse sand, trace fine gravel		1	SS	6		189							
	SILTY CLAY to CLAY trace sand, trace fine gravel, rootlets occasional fine to medium sand partings and seams reddish grey, firm		2	SS	6		188							
187.4			3	TW	PH									
1.8			4	SS	37/15									
187.1	Heterogeneous mixture of silt, sand and gravel (SILTY SAND TILL) brown, wet, very dense													
2.1	End of borehole. Auger refusal at 2.1 m probably on a boulder or bedrock. Borehole moved to N 5151445.4, E 301635.3 auger refusal at 0.8 m. Borehole moved again, refer to Record of Borehole Log 10+790 Lt (2).													

+³ ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+790; 39 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 428.5, E 301 579.8 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY R.A.
DATUM Geodetic DATE 1/3/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE					WATER CONTENT (%) 20 40 60				
198.6 0.0	Ground Surface 0.15 m Topsoil SILTY SAND some gravel, occasional cobbles brown, damp, loose to compact		1	SS	10	*	198										
			2	SS	50/15												
197.0 1.6	End of borehole. Auger refusal probably on a boulder or bedrock. * Borehole dry (not stabilized) and open to full depth on completion.		3	SS	50/8												

SPT 1055

RECORD OF BOREHOLE No 10+790; 21 m Lt (2) 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 446.5; E 301 639.1 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
DATUM Geodetic DATE 4/4/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80					
189.2 0.0	Ground Surface															
	Refer to Record of Borehole Sheet 10+790 21m Lt (1) for soil stratigraphy															
187.1 2.1	Heterogeneous mixture of silt, sand and gravel (SILTY SAND TILL)		1	SS	53											
186.5 2.7	brown, damp, very dense		2	SS	60/0											
186.1 3.1	End of borehole. ** End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test performed from 2.7 m to 3.1 m. ** Auger refusal at 2.7 m probably on a cobble or boulder. * Water level at 1.2 m (not stabilized) and hole open to 1.8 m on completion.															

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+793; 38 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 426.1; E 301 581.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY R.A.
DATUM Geodetic DATE 1/5/2003 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
198.0	Ground Surface												
0.0	0.2 m Topsoil		1	SS	15								24 68 6 2
197.1	SILTY SAND some gravel, occasional cobbles brown, damp, compact		2	SS	50/15								
0.9	End of borehole. Auger refusal at 0.9 m probably on a boulder or bedrock. * Borehole dry (not stabilized) and open to full depth on completion.												

+ 3, X 3: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+795; 30 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 426.5; E 301 589.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY R.A.
DATUM Geodetic DATE 1/5/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
197.0	Ground																
0.0	0.3 m Topsoil		1	SS	9		197										
196.1	SILTY SAND some gravel, occasional cobbles brown, moist, loose		2	SS	50/10												
0.9	End of borehole. Auger refusal probably on a boulder or bedrock. * Borehole dry (not stabilized) and open to full depth on completion.																

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+800; 30 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste Marie - Coords: N 5 151 421.9; E 301 591.0 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers, Casing & Washboring COMPILED BY R.A.
DATUM Geodetic DATE 1/5/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE									
							20	40	60	80	100						
196.3	Ground Surface																
0.0	0.15 m Topsoil		1	SS	18	*	196										
195.4	SILTY SAND some gravel, occasional cobbles brown, damp, compact		2	SS	50/13												
0.9	End of Borehole. Auger refusal probably on a boulder or bedrock. * Borehole dry (not stabilized) and open to full depth on completion.																

+³, ×³: Numbers refer to
Sensitivity


20
15
10
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+800; 35 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 420.5; E 301 586.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers, Casing & Washboring COMPILED BY R.A.
DATUM Geodetic DATE 1/5/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE									WATER CONTENT (%) W P W W L
196.7 0.0	Ground Surface		1	SS	8	•	196									35 57 6 2	
195.9 0.8	0.25 m Topsoil SILTY SAND some gravel, brown, damp, trace rootlets loose		2	SS	36			195									
	CLAY reddish brown very stiff		3	SS	28												
194.6 2.1			SILTY SAND: some gravel, occasional cobbles, brown, wet, very dense (inferred)	4	SS				50.00								
194.3 2.4	End of borehole. Auger refusal probably on a boulder or bedrock. * Borehole dry (not stabilized) and open to 2.0 m on completion.																

+³, x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

TEST PIT LOGS

CUT AREA #2 HIGHWAY 17 (New), Sault Ste. Marie (Offset distances are from median centreline)

Highway 17 (New)

10+725 10m Rt C/L

0 BR

10+725 20m Lt C/L (El. 190.8m)

0	-	200	Tps with Sa and Gr
200	-	5.2	Sa and Gr with Cob and Blds (Poss Till)
			Tr Si, Comp to Dense, Moist
			Grey at 1.2m, wet at 1.8 m

10+735 10m Rt C/L (El. 194.9m)

0	-	200	Tps with Sa and Gr
200	-	5.2	Sa and Gr with Cob and Blds (Poss Till)
			Tr Si, Comp to Dense

10+735 10m Lt C/L (El. 194.9m)

0	-	200	Tps with Sa and Gr
200	-	3.0	Sa and Gr with Cob and Blds (Poss Till)
			Tr Si, Comp to Dense, Moist
		3.0	NFP Poss Bld

10+755 10m Rt C/L

0	-	200	Tps with Sa and Gr
200	-	600	Sa and Gr with Cob and Blds
600	-	5.6	Sa and Gr, some Si with Cob and Blds (Poss Till)

10+755 20m Rt C/L (El. 197.8m)

0	-	100	Tps
100	-	5.5	Sa and Gr with Cob and Blds (Poss Till)
			Tr Si, Comp to Dense, Moist

10+755 20m Lt C/L (El. 193.5m)

0	-	300	Tps with Sa and Gr
300	-	5.2	Sa and Gr with Cob and Blds (Poss Till)
			Tr Si, Comp to Dense, Moist
			Grey at 4.9m

10+785 10m Rt C/L (El. 196.1m)

0	-	200
200	-	5.2

Tps with Sa and Gr, with Blds at surface
Sa and Gr with Cob and Blds (Poss Till)
Tr Si, Comp to Dense, Moist

10+795 20m Rt C/L

0	-	150
150	-	2.0
2.0	-	2.5
2.5	-	6.0

Tps with Sa and Gr
Sa and Gr with Cob and Blds, Moist
Si Cl with Si seams, reddish-brown, Moist
Sa and Gr with Cob and Blds, Damp

10+800 20m Rt C/L (El. 195.3m)

0	-	600
600	-	5.2
5.2	-	5.5

Sa and Gr with Cob and Blds, Moist
Si Cl with Si seams, reddish-brown, Firm, Moist
Sa and Gr with Cob and Blds, Wet

10+800 20m Lt C/L (El. 189.3m)

0	-	100
100	-	750
750	-	3.4
3.4	-	5.5

Tps with Sa and Gr
Sa and Gr with Cob and Blds, Moist
Si Cl with Si layers, reddish-brown, Firm, Moist
Si Cl, grey, soft to firm

10+810 20m Rt C/L

0	-	150
150	-	3.4
3.4	-	6.0

Tps with Sa and Gr
Si Cl with Si seams, reddish-grey, Moist
Stiff to very stiff
Sa and Gr with Cob and Blds, Damp to moist

Appendix A2-2

Photograph

SPT 1055
GWP 354-94-00

Highway 17 (New)
Sault Ste. Marie, Ontario

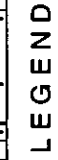


PHOTOGRAPH OF BEDROCK CORE
Borehole 10+750, 38m Rt, Quartzite Bedrock

Appendix B2

Laboratory Test Results

CLAY AND SILT	SAND		GRAVEL	
	Fine	Medium	Coarse	Coarse



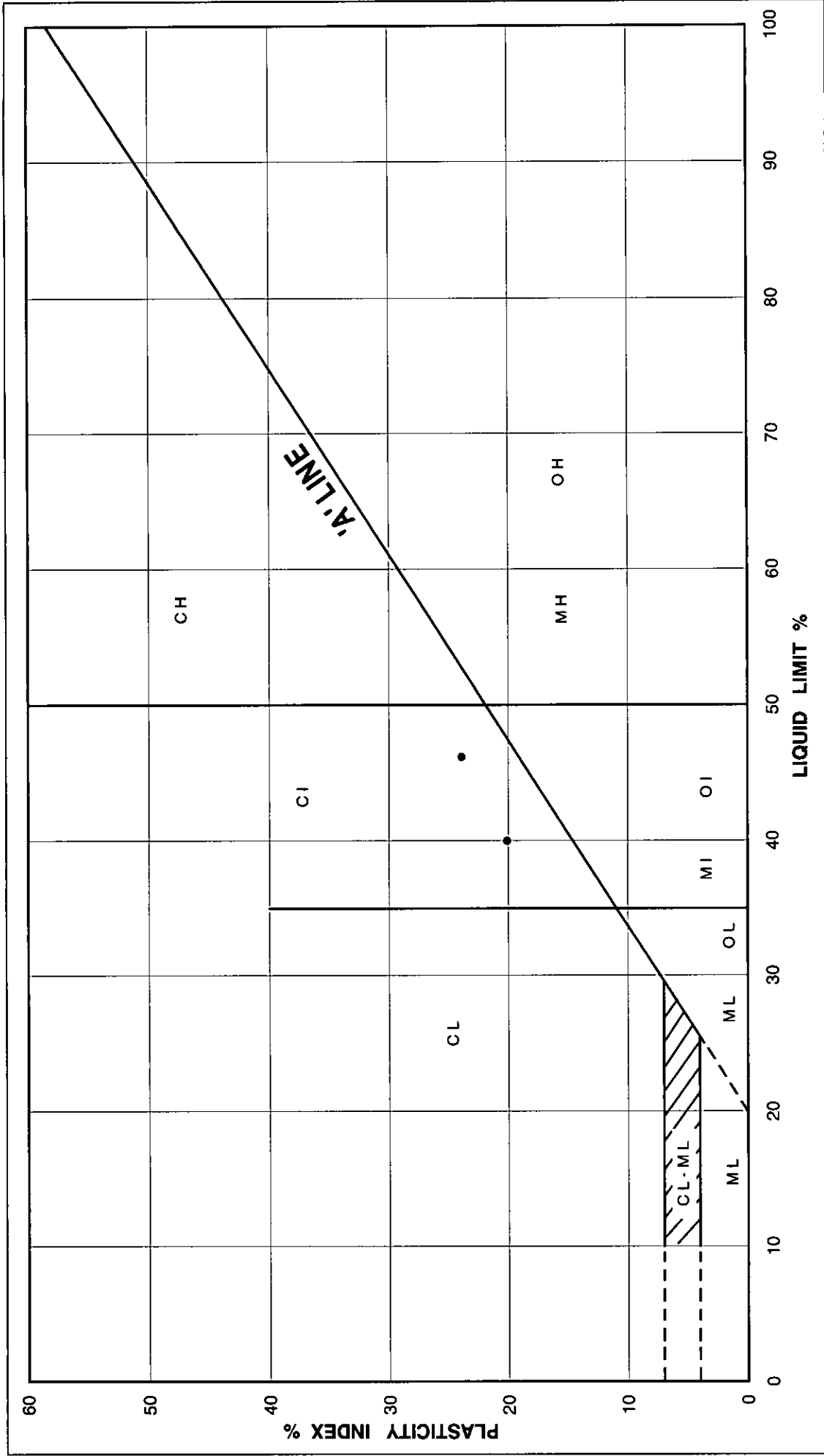
GRAIN SIZE DISTRIBUTION

SILTY SAND TILL

FIG. No. B2-1

REF. No. SPT 1055

G.W.P.	354-94-00
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SHAHEEN & PEAKER LIMITED	PLASTICITY CHART		FIG No B2-2
	SILTY CLAY to CLAY		G.W.P. 354-94-00
			SPT 1055

4.3 SITE NO. 3 : HIGHWAY 17 (NEW) FILL SECTION BETWEEN STATIONS 10+825 AND 11+000 EASTBOUND LANES, AND BETWEEN STATIONS 10+780 AND 11+000 WESTBOUND LANES (BOREHOLES 10+840 Lt, 10+860 CL, 10+885 Lt, 10+900 CL, 10+923 Rt, 10+940 CL and 10+980 Rt)

Site No. 3 is a low-lying area adjacent to and south of a high ground area (Site No. 2). The existing grade from this high ground area falls southerly from a high elevation of 198 m at about Station 10+770 to about Elevation 189 to 190 m at Station 10+810 to 10+830. In this section, between about Station 10+780 to 10+830 and 10+960, the lowest point along the alignment centerline is at Elevation 188 m. Towards the south, the grade rises slightly to about Elevation 189.5 m at Station 10+960.

The location plan of the boreholes in this section and the stratigraphic profiles along the EBL and WBL are presented in Drawing Nos. 3A and 3B.

Seven boreholes (10+840 Lt, 10+860 CL, 10+885 Lt, 10+900 CL, 10+923 Rt, 10+940 CL and 10+980 Rt) were drilled in this area and these show that below about 0.15 to 0.3 m of topsoil, this section is underlain by an extensive clay deposit to at least 10 m depth below existing grade, at the borehole locations. At the location of Borehole 10+900 CL, the borehole was extended by a Dynamic Cone Penetration test (DCPT) to a refusal depth of about 29 m (Elevation 159.7 m). The groundwater level at the site was found to be close to the existing ground surface.

Details of the subsurface conditions encountered in the boreholes are presented on the Record of Borehole Sheets in Appendix A3. The individual strata are briefly described in the following paragraphs.

4.3.1 TOPSOIL

The boreholes encountered 0.15 to 0.5 m of topsoil.

4.3.2 SURFICIAL SAND

In Borehole 10+923 Rt, a 0.2 m thick silty sand layer was contacted below the topsoil and this extends to a depth of 0.4 m below existing grade. Measured N-value in this layer was 4 blows/0.3 m indicating very loose to loose relative density.

4.3.3 CLAY

Below the topsoil and surficial silty sand, all the boreholes encountered a deep clay deposit extending to a depth of at least 10 m below existing grade. Boreholes 10+840Lt, 10+860 CL, 10+885 Lt, 10+923 Rt, 10+940 CL and 10+980 Rt were terminated in this deposit at a depth of 10.2 m below existing grade. In Borehole 10+900 CL, which was terminated in the clay at a depth of 13.3 m, the presence of a somewhat 'stiffer' and a competent strata were inferred from a DCPT at depths of about 24 and 28 m, respectively.

The clay in this area has a reddish grey colour and is considered relatively homogeneous, at least within the 10 m depth explored.

The results of the grain-size distribution analyses performed on three of the selected clay samples are presented in Figure B3-1, Appendix B3. They indicate the following particle size distribution:

Gravel	=	0%
Sand	=	0%
Silt	=	13 to 15%
Clay	=	85 to 87%

Atterberg Limits tests carried out in the laboratory on samples from the clay deposit gave the following index values:

Liquid Limit :	61 to 85%
Plastic Limit :	24 to 27%
Plasticity Index :	34 to 59%

As presented in Figure B3-2 in Appendix B3, these values are characteristics of clay soils of high plasticity. The measured natural moisture contents generally range from 36 to 88%, that is, generally at or in excess of the liquid limit values (except in the upper desiccated zone near the ground surface). The Liquidity Index values range between 0.2 and 1.4, but generally 1.0 to 1.4. These results are generally indication of weak and compressible (generally normally consolidated) clays.

Two consolidation tests were performed on samples from this deposit (from Boreholes 10+860 CL and 10+900 CL) and the results are shown in Figures B3-3 and B3-4 in Appendix B3. These tests indicate a probable preconsolidation pressure (P_c) of about 80 to 100 kPa, which is about 65 to 80 kPa in excess of the existing overburden pressure (P_o). The test results also indicate very high C_c -values (e.g., in the range of 1.8) indicating an extremely compressible clay structure, especially beyond the preconsolidation pressure

range. Specific gravity of these two samples was also measured and this ranged from 2.72 to 2.75.

The measured bulk unit weights range from 16.4 to 17.6 kN/m³ within the upper desiccated zone, and are between 14.3 and 15.0 kN/m³ within the weaker clay below.

Standard Penetration tests performed in this deposit gave N-values varying between 1 and 4 blows/0.3 m, except in the upper 1.5 m of the deposit where N-values of 4 to 11 blows/0.3 m were recorded. Field vane tests yielded undrained in-situ shear strength values ranging from 58 to in excess of 100 kPa within the top 1.5 ± m of the deposit, and ranging from 18 to 49 kPa below this depth. These values indicate that the consistency of the material can be described as very stiff to stiff in the upper 1.5 m of the clay deposit and soft to firm below.

The variation of measured undrained shear strengths with elevation from all the boreholes is presented in Figure C3-1 in Appendix C3. Figure C3-2 shows typical plot of undrained shear strength versus elevation at the location of Borehole 10+900 CL. In general, the undrained shear strength increases with depth which indicates normally consolidated clays.

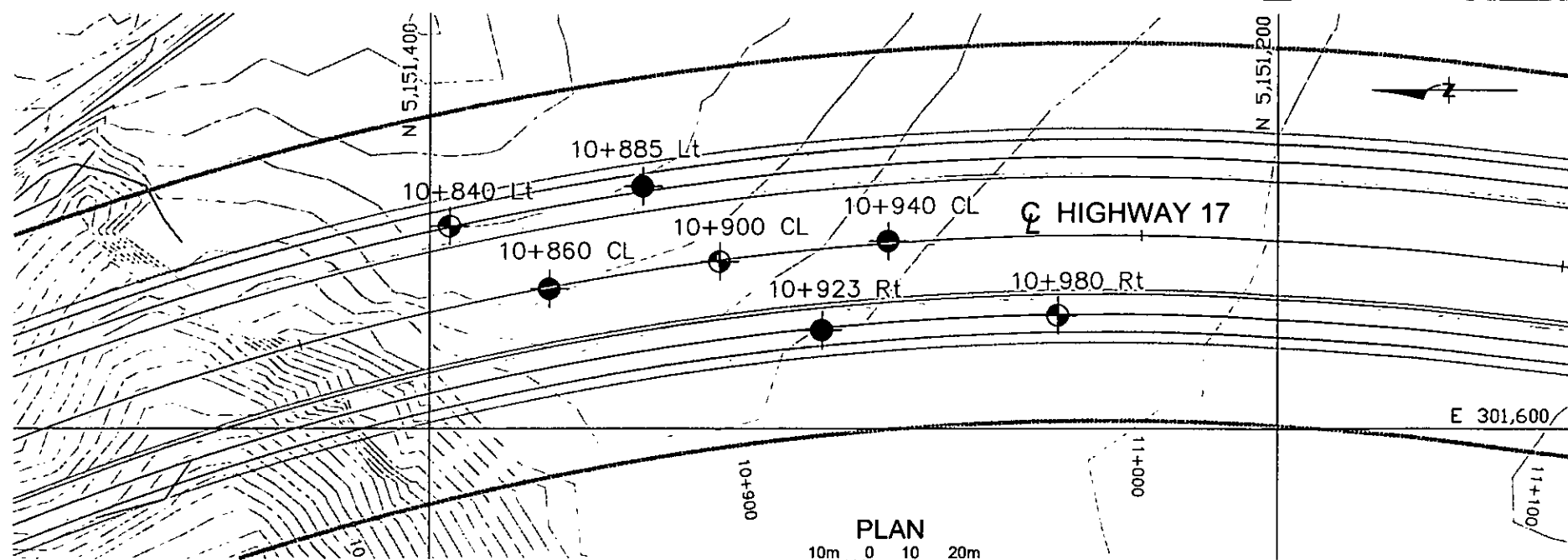
DCPT were conducted in Boreholes 10+840 Lt, 10+900 CL and 10+980 Rt and the results of the test were presented on the corresponding Record of Borehole Sheets.

4.3.4 GROUNDWATER CONDITIONS

Water level observations in the boreholes were made during drilling and at completion of each borehole. The recorded water levels at completion ranges between 6.1 and 8.2 m below existing grades, but these are unlikely to represent the stabilized water levels.

To enable us to monitor the groundwater level over a prolonged period of time without interference from surface water, a piezometer was installed in Borehole 10+860 CL. Water level in the piezometer was measured in October 19, 2002 or about six months after completion of the borehole, and the recorded water level was at a depth of 0.6 m below existing ground surface or at Elevation 188.0 m. Based on the above observations and the colour of the soil, the groundwater level is expected to be at or near the existing ground surface. The groundwater table can be expected to fluctuate seasonally and in response to weather events.

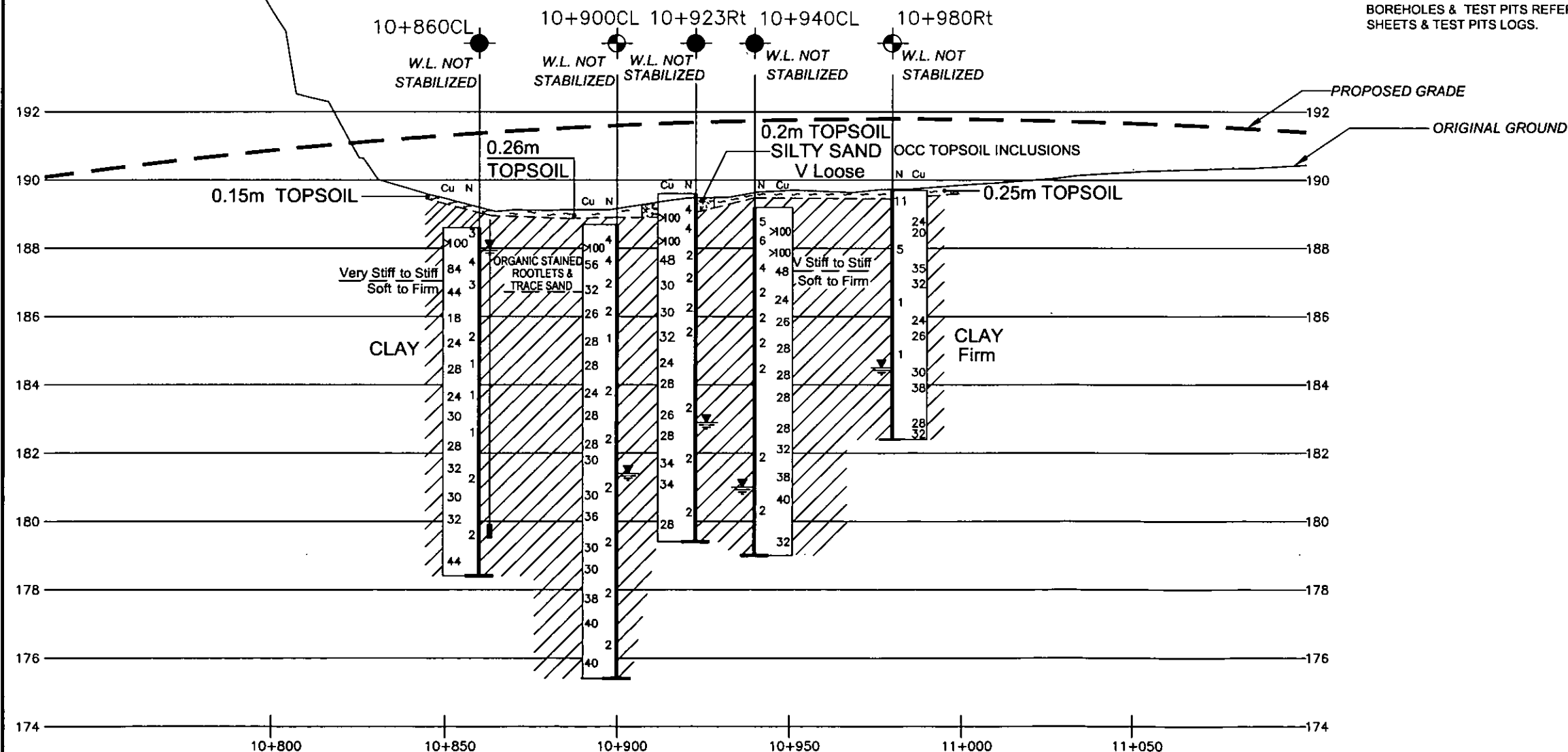
Drawings



METRIC

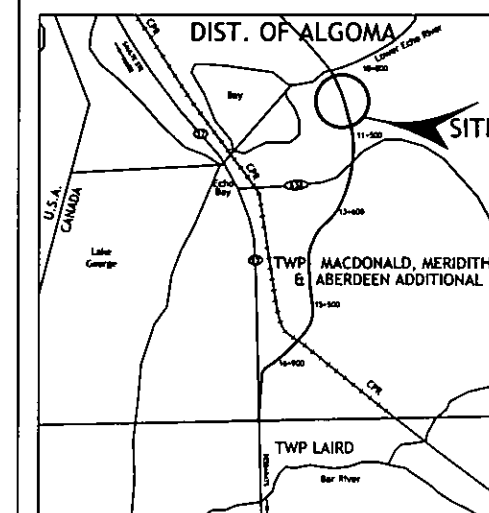
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOMETRES + METRES.

NOTE:
FOR DETAILED SUBSURFACE CONDITIONS OF ALL
BOREHOLES & TEST PITS REFER TO RECORD OF BOREHOLE
SHEETS & TEST PITS LOGS.



CONT No.	
GWP: 354-94-00	
HIGHWAY 17 (NEW) EBL ECHO RIVER TO BAR RIVER ROAD SITE No. 3	
BORE HOLE LOCATIONS & SOIL STRATA	

SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND

- Bore Hole
- Bore Hole & Cone
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation Apr. ,2002 and Jan. ,2003
- Water Level in Piezometer
- Piezometer

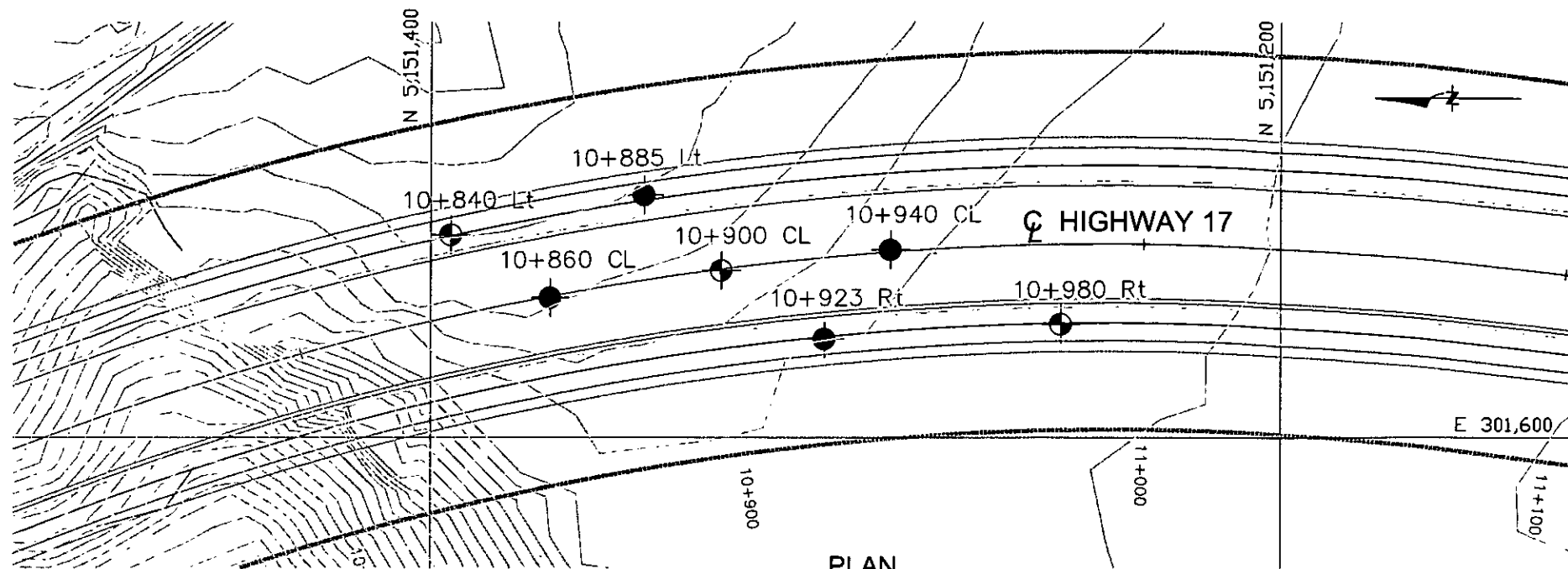
No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+860 CL	188.6	5 151 372.0	301 633.3
10+923 Rt	189.6	5 151 307.6	301 623.5
10+900 CL	188.7	5 151 331.8	301 639.8
10+940 CL	189.2	5 151 292.1	301 664.7
10+980 Rt	189.7	5 151 252.1	301 627.0

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 Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

DATE	BY	DESCRIPTION

Geocres No.		DIST 62	
HWY No. 17 (New)	CHECKED ZO	DATE Jul, 2003	SITE
SUBMD ZO	CHECKED	APPROVED	DWG 3A



METRIC

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

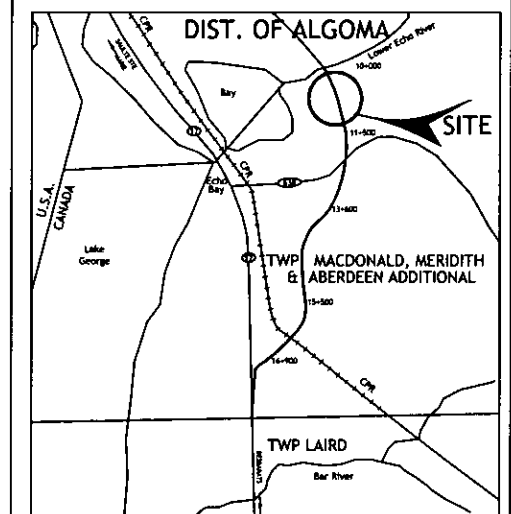
NOTE:
FOR DETAILED SUBSURFACE CONDITIONS OF ALL
BOREHOLES & TEST PITS REFER TO RECORD OF BOREHOLE
SHEETS & TEST PITS LOGS.

CONT No.
GWP: 354-94-00

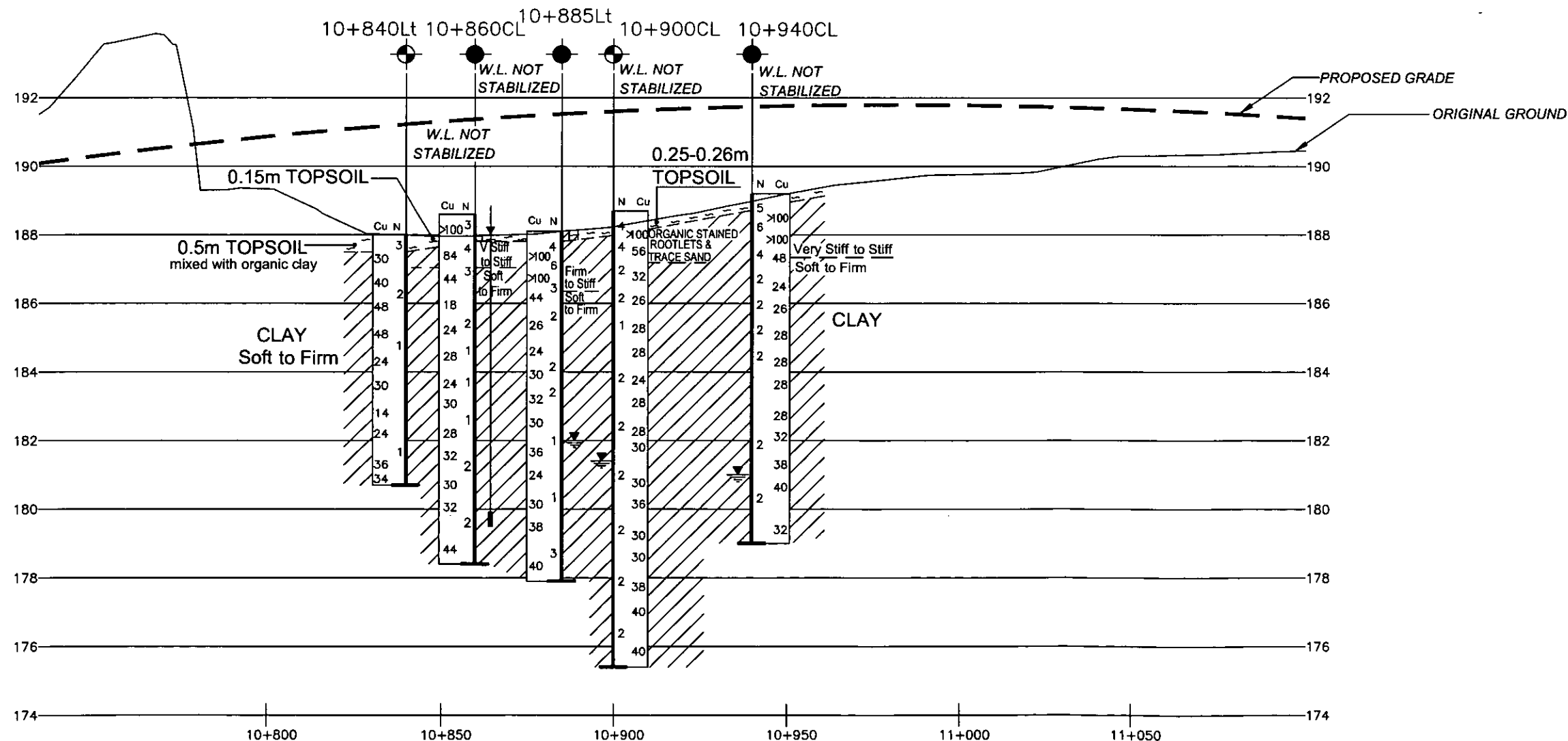
HIGHWAY 17 (NEW) WBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 3
BORE HOLE LOCATIONS & SOIL STRATA



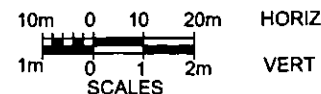
SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.



PROFILE WESTBOUND LANES



LEGEND

- Bore Hole
- Bore Hole & Cone
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation Apr. 2002
- Water Level in Piezometer
- Piezometer

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
10+840 Lt	188.0	5 151 395.4	301 648.2
10+860 CL	188.6	5 151 372.0	301 633.3
10+885 Lt	188.1	5 151 350.0	301 657.7
10+900 CL	188.7	5 151 331.8	301 639.8
10+940 CL	189.2	5 151 292.1	301 664.7

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 Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV.	DATE	BY	DESCRIPTION

Geocres No.			
HWY No. 17 (New)	DIST 62		
SUBM'D ZO	CHECKED ZO	DATE Jul, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 3B

Appendix A3

Record of Boreholes

RECORD OF BOREHOLE No 10+840; 19 m Lt 1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 395.4; E 301 648.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY J.Z.
DATUM Geodetic DATE 1/9/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
188.0 0.0	Ground Surface											
	0.5 m Topsoil mixed with Organic Clay.		1	SS	3		188					
							187					
			2	SS	2		186					
							185					
			3	SS	1		184					
							183					
			4	TW	PH		182					
							181					
			5	SS	1		180					
							179					
							178					
							177					
							176					
							175					
							174					
180.7 7.3	End of Borehole.											

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+840; 19 m Lt 2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 395.4; E 301 648.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY J.Z.
DATUM Geodetic DATE 1/9/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L				
173														
172														
171														
170														
169														
168														
167														
166														
165														
	End of Dynamic Cone Penetration Test. Dynamic Cone Penetration Test (DCPT) performed from 7.3 m to 23.9 m. * Wet cave at 6.1 m.													

SPT 1055

RECORD OF BOREHOLE No 10+860 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 372.0; E 301 633.3 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 4/4/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE					
188.6	Ground Surface						20	40	60	80	100		
0.0	0.15 m Topsoil						20	40	60	80	100		
			1	SS	3								
			2	SS	4								
			3	SS	3								
			4	TW	PH								
			5	SS	2								
			6	SS	1								
			7	SS	1								
			8	SS	1								
			9	SS	2								
			10	SS	2								
178.4	End of borehole												
10.2													

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10


(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+885; 20 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 350.0; E 301 657.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 4/3/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE				
188.1	Ground Surface							20 40 60 80 100				
0.0	TOPSOIL		1	SS	4							
187.8												
0.3												

+³ ×³: Numbers refer to
Sensitivity 20 15 10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+900 CL

1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 331.8; E 301 639.8 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
 DATUM Geodetic DATE 4/3/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		NATURAL MOISTURE CONTENT		LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p		W		W _L			
188.7	Ground Surface							20 40 60 80 100									
0.0	0.26 m Topsoil organic stained, rootlets and trace sand -----	<div>very stiff to stiff</div> <div>-----</div> <div>soft to firm</div>	1	SS	4												
			2	SS	4												
			3	SS	2												
			4	SS	2												
			5	SS	1												
			6	TW	PH												
			7	SS	2												
	CLAY reddish grey to grey		8	SS	2												
			9	SS	2												
			10	SS	2												
			11	SS	2												
			12	SS	2												
175.4	End of borehole																
13.3	* Water level at 7.3 m (not stabilized) and hole open to 9.1 m on completion. Borehole advanced 0.3 m right of median centre line.																

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+900 CL

2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 331.8; E 301 639.8 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
DATUM Geodetic DATE 4/3/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
173													
172													
171													
170													
169													
168													
167													
166													
165													
164													
163													
162													
161													
160													
159.7 29.0	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test performed from 13.3 m to 29.0 m.												

+³, ×³: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+923; 19 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 307.6; E 301 623.5 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY M.L.
 DATUM Geodetic DATE 4/3/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. X LAB VANE				
189.6	Ground Surface											
0.0	0.2 m Topsoil											
189.2	SILTY SAND occasional topsoil inclusions grey, wet, very loose		1	SS	4							
0.4			2	SS	4							
		very stiff		3	SS	2						
		firm		4	SS	2						
				5	SS	2						
				6	SS	2						
				7	TW	PH						
		soft to firm		8	SS	2						
				9	SS	2						
				10	SS	2						
179.4	End of borehole											
10.2	* Water level at 6.7 m (not stabilized) and hole open to 7.6 m on completion.											

SPT 1055

RECORD OF BOREHOLE No 10+940 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 292.1; E 301 844.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 4/2/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
189.2	Ground Surface													
0.0	0.25 m Topsoil		1	SS	5		189							
			2	SS	6		188							
	very stiff to stiff		3	SS	4		187							
	soft to firm		4	SS	2		186							
			5	SS	2		185							
			6	SS	2		184							
	CLAY reddish grey		7	SS	2		183							
			8	TW	PH		182							
			9	SS	2		181							
			10	SS	2		180							
179.0	End of borehole						179							
10.2	* Water level at 8.2 m (not stabilized) and hole open to 8.8 m on completion. Borehole advanced 0.5 m left of median centre line.													

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 10+980; 19 m Rt 1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 252.1; E 301 627.0 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY J.Z.
DATUM Geodetic DATE 1/10/2003 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE	WATER CONTENT (%)					
189.7 0.0	Ground 0.25 m Topsoil		1	SS	11									** frozen to 0.3 m
	CLAY reddish grey firm		2	SS	5									
			3	SS	1									
			4	SS	1									
			5	TW	PH									
182.4 7.3		End of Borehole.												

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity
20
15
10 (%) STRAIN AT FAILURE

SPT 1055

METRIC

GWP	354-94-00	LOCATION	Echo River to Bar River Road, Sault Ste. Marie - Coords: N 5 151 252.1; E 301 627.0	ORIGINATED BY	G.I.
DIST	62	HWY	17 (New)	BOREHOLE TYPE	Hollow Stem Augers & DCPT
DATUM	Geodetic	DATE	1/10/2003	CHECKED BY	R.A.

[illegible]

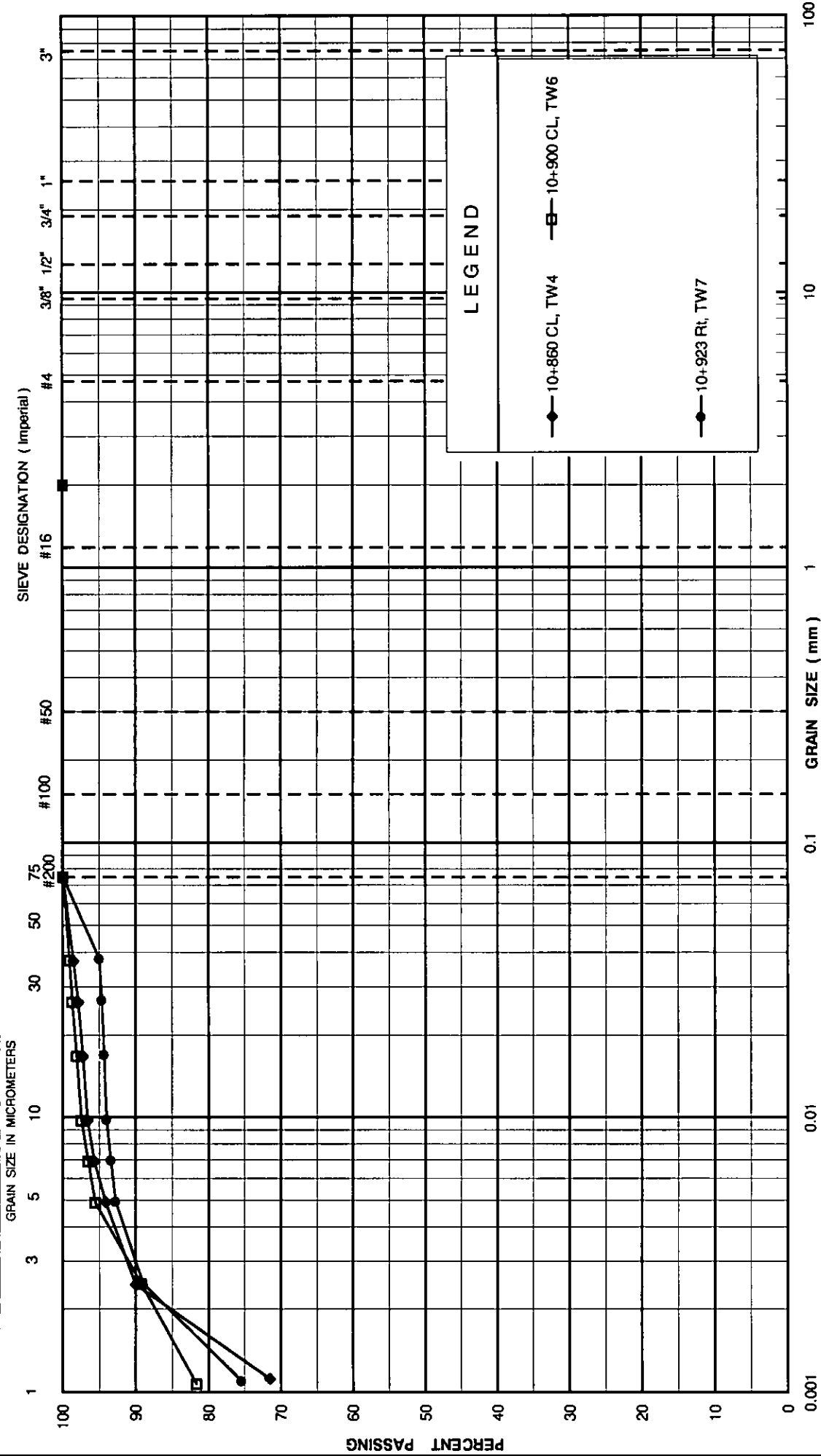
+ 3, x 3; Numbers refer to Sensitivity

Appendix B3

Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



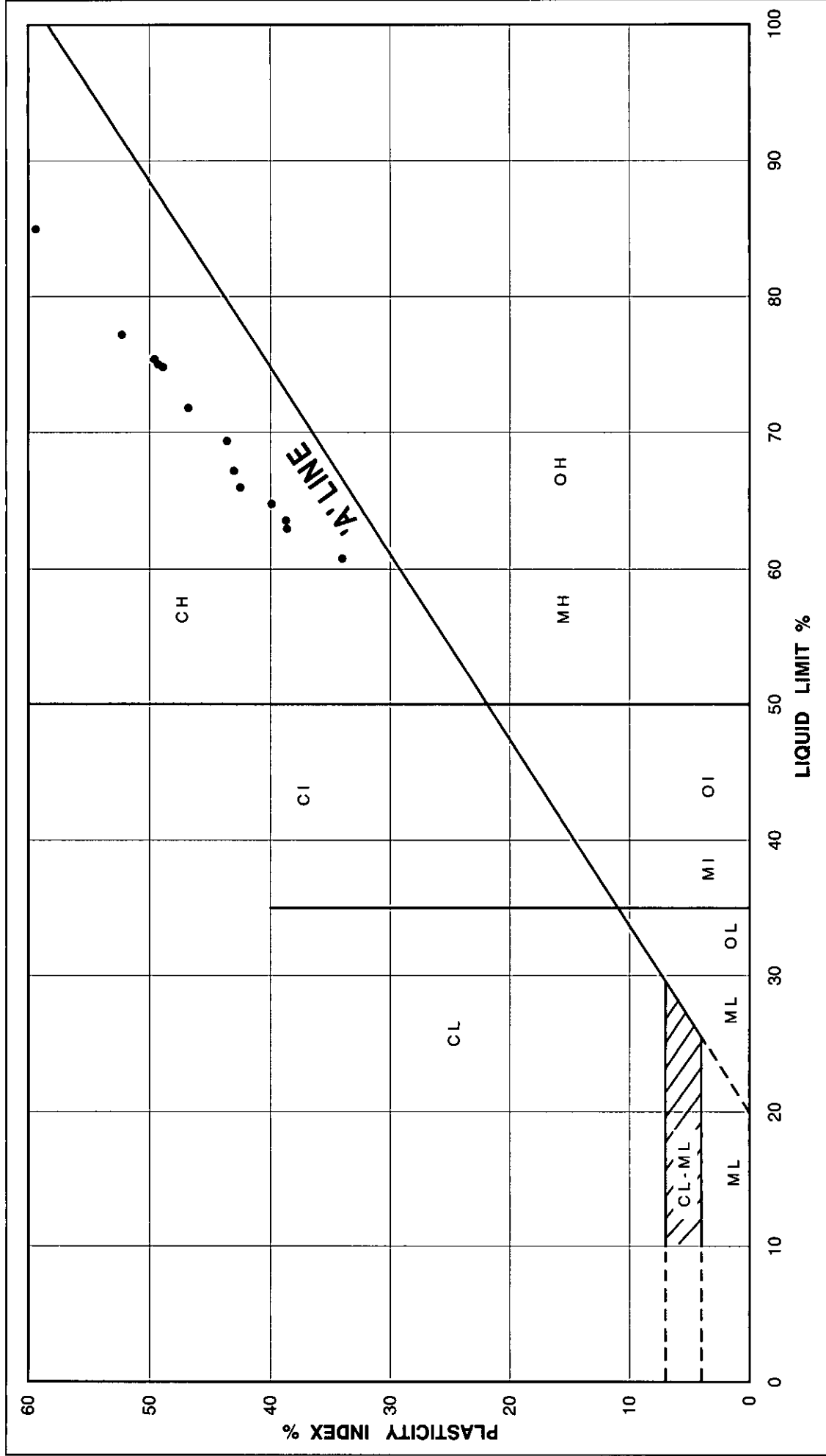
GRAIN SIZE DISTRIBUTION CLAY

SHAHEEN & PEAKER LIMITED

FIG. No. B3-1

REF. No. SPT 1055

G.W.P. 354-94-00



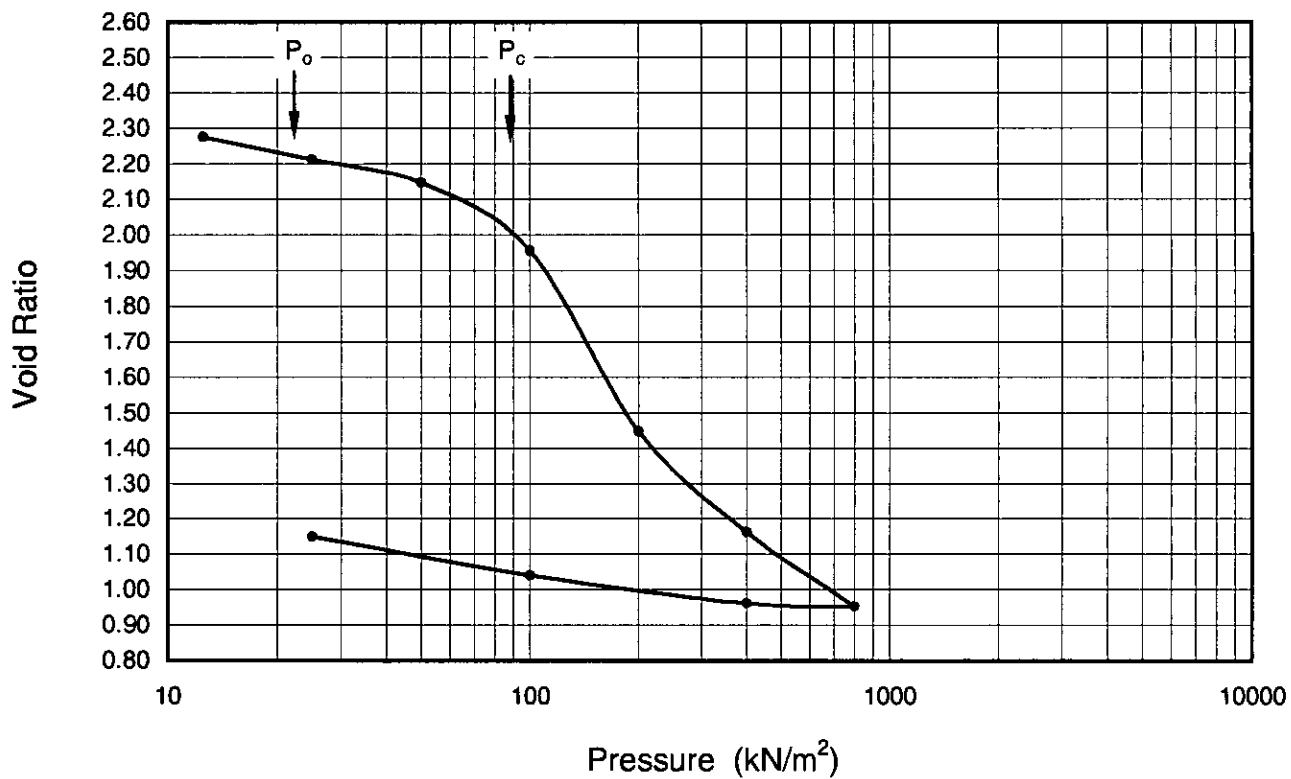
SHAHEEN & PEAKER LIMITED	PLASTICITY CHART		FIG No B3-2
	CLAY		G.W.P. 354-94-00
			SPT 1055

10+860 CL

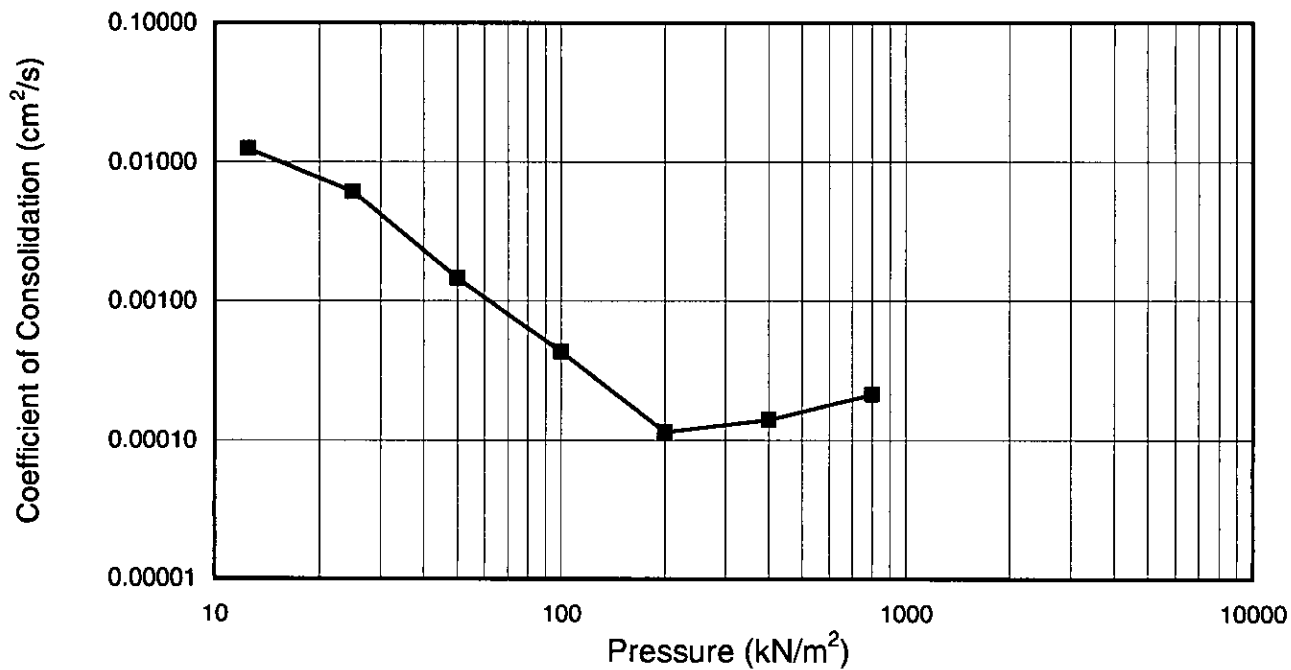
TW 4 Depth 2.50 m

Fig. B3-3

Void Ratio versus Pressure



Coefficient of Consolidation vs Pressure

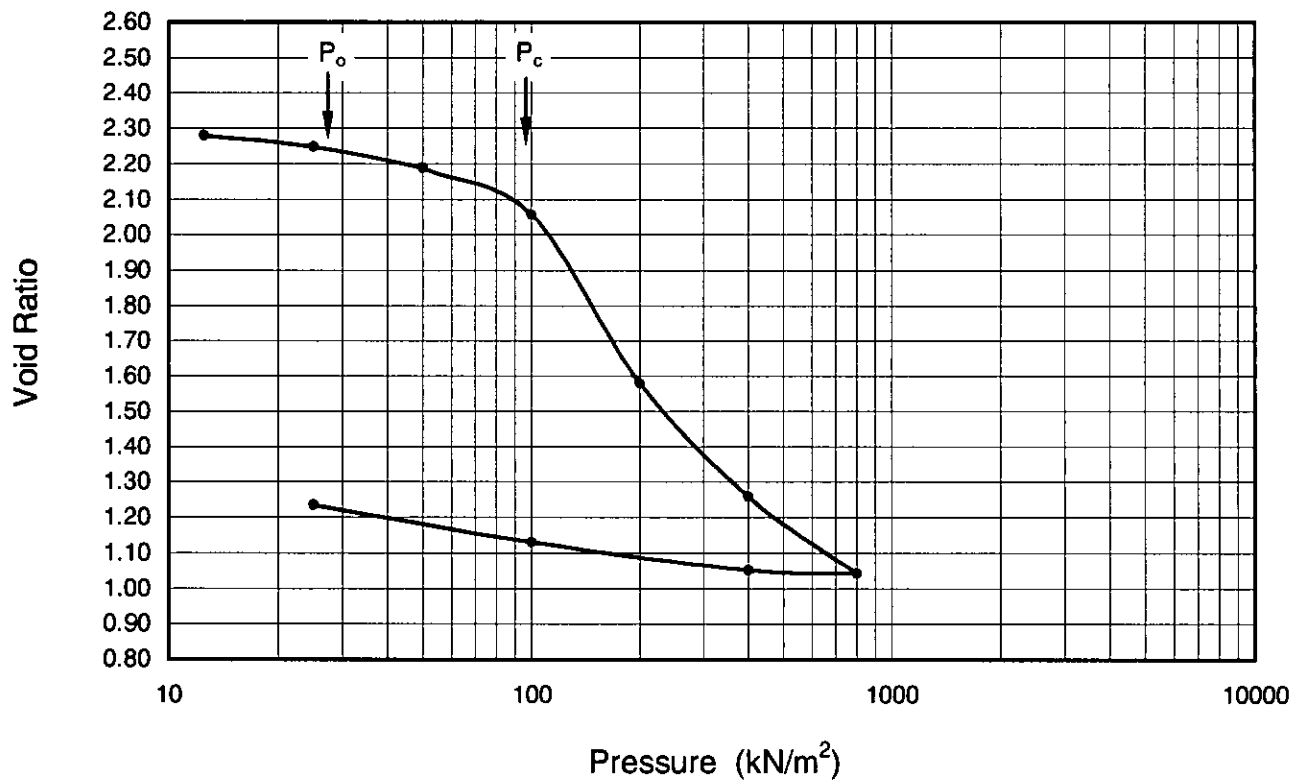


10+900 CL

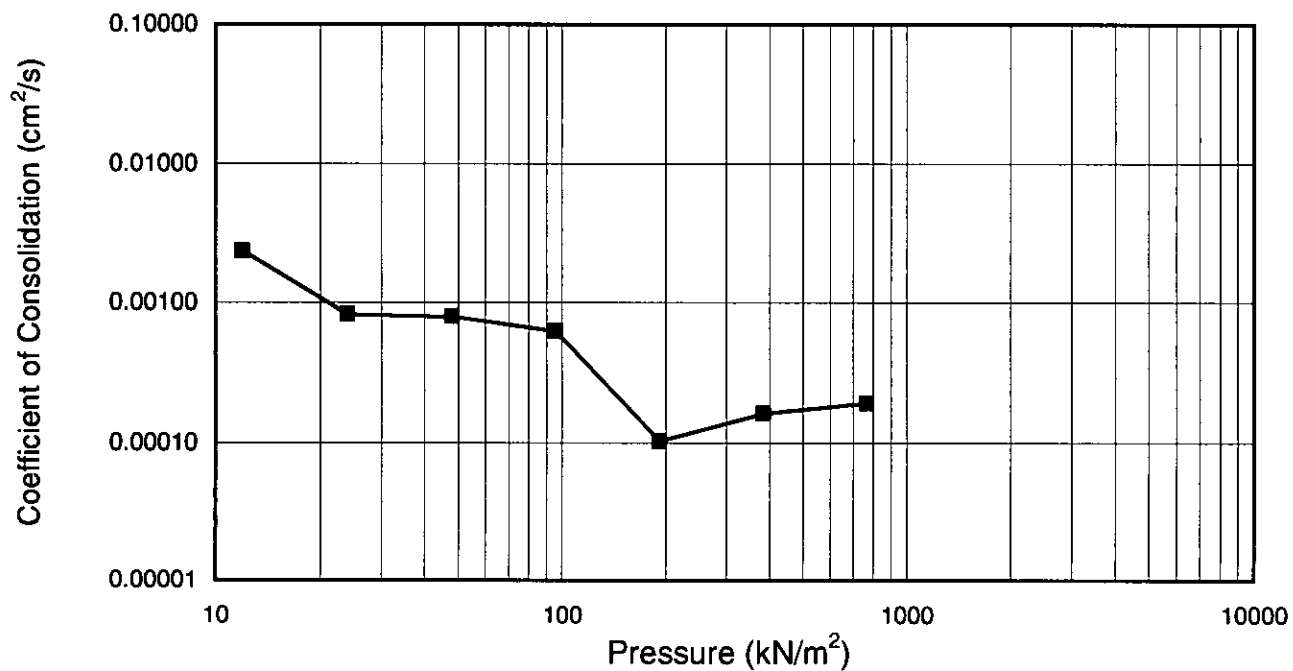
TW 6 Depth 4.00 m

Fig. B3-4

Void Ratio versus Pressure



Coefficient of Consolidation vs Pressure



Appendix C3

Measured Undrained Shear Strength Results

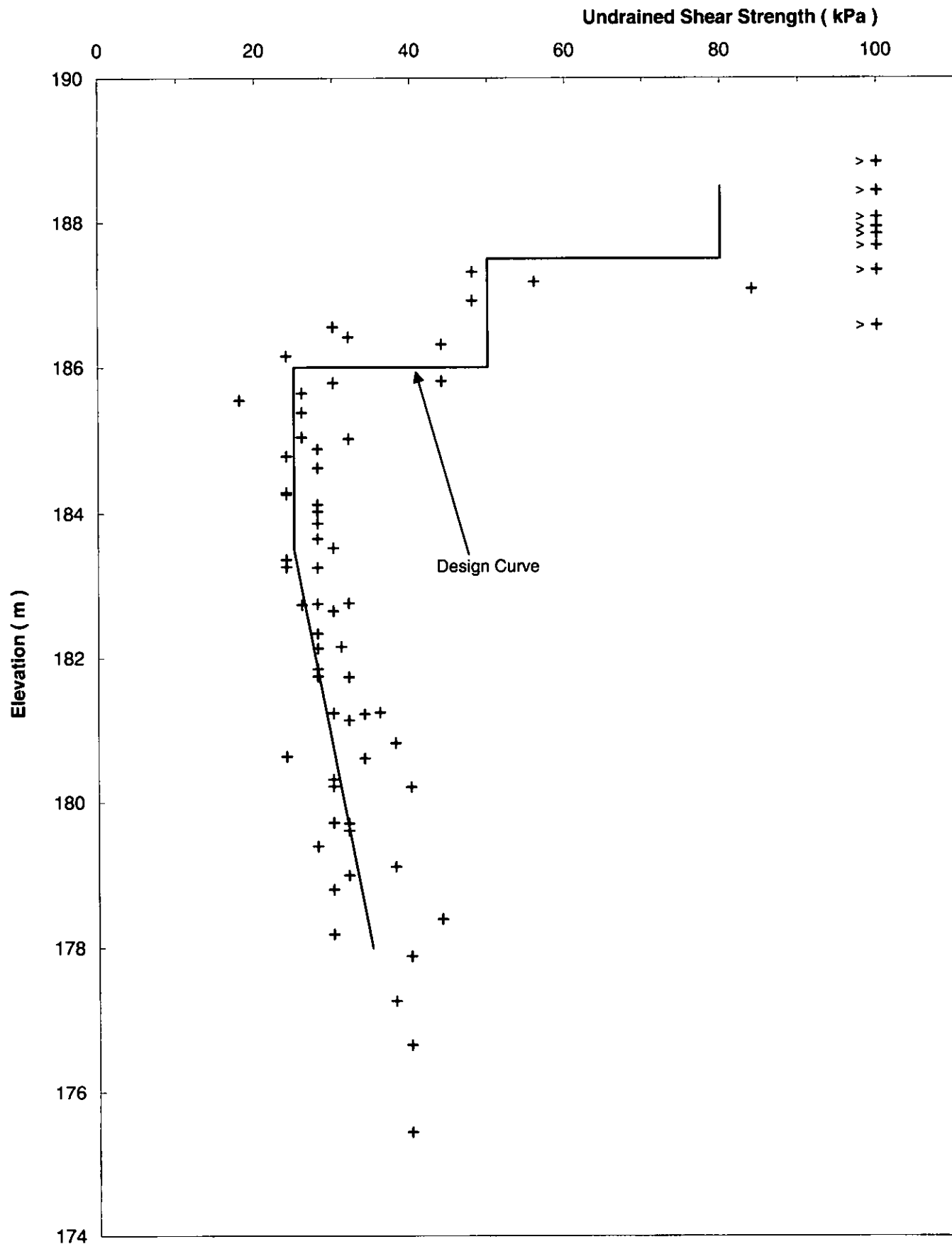


Fig. C3-1: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

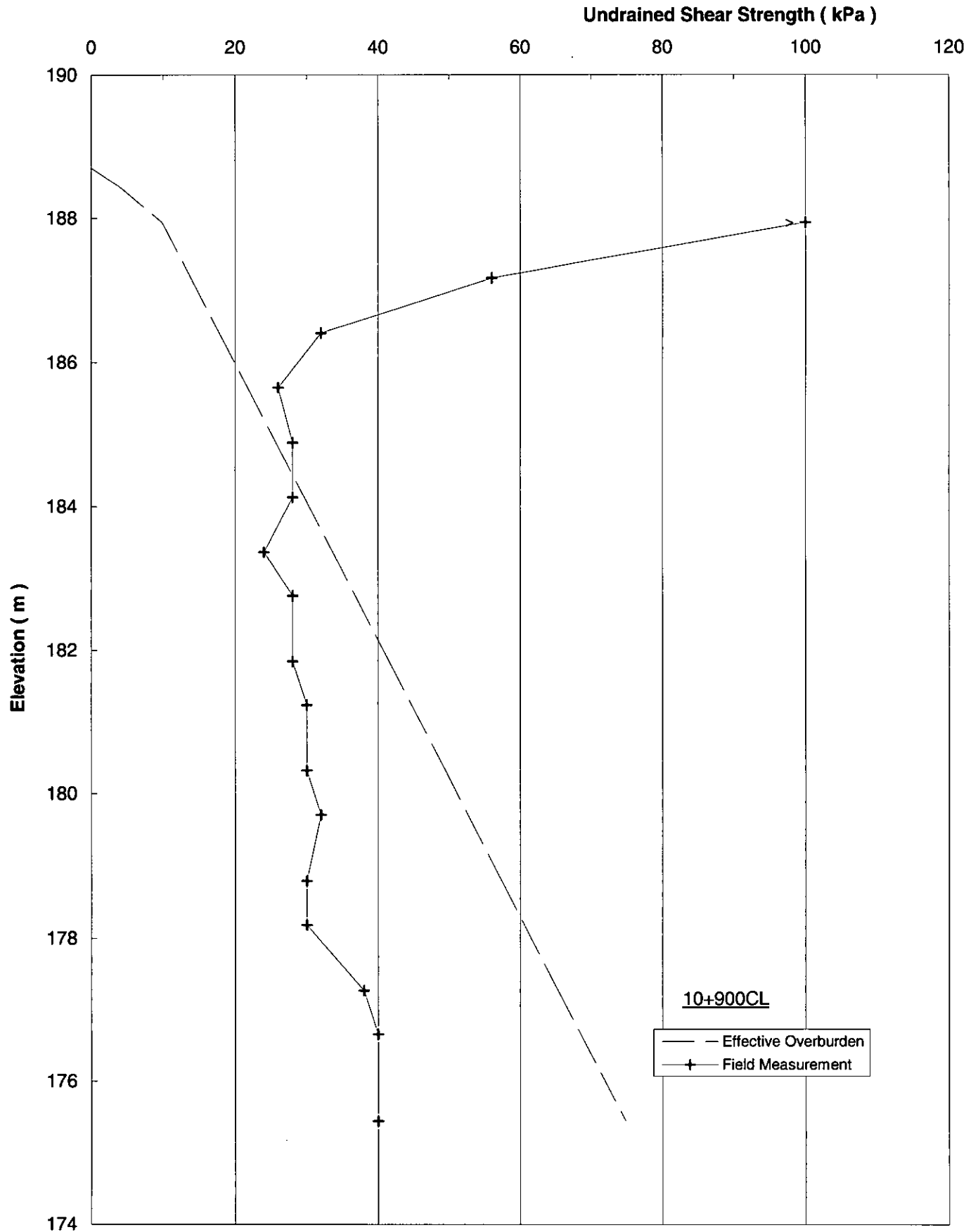


Fig. C3-2: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation
(Borehole 10+900 CL)

4.4 SITE NO. 4 : HIGHWAY 17 (NEW) FILL SECTION BETWEEN STATIONS 11+375 AND 11+690 EASTBOUND LANES AND BETWEEN STATIONS 11+380 AND 11+670 WESTBOUND LANES – BOREHOLES 11+441CL, 11+475Lt, 11+505Rt, 11+540Lt, 11+547CL, 11+572Rt, 11+597CL, 11+622Lt, 11+655Rt, 11+657Lt

The grade to the north of this section of the alignment falls southerly from a high elevation of 191 m at about Station 11+280 to about Elevation 183 m at Station 11+440. From thereon, it drops to a low point about Elevation 180 m near Station 11+650, beyond which ground rises slightly. In this section, from Station 11+400 to 11+665, a total of ten boreholes was drilled, some along the proposed east and westbound lanes, others at or near the median centerline. In general, the grade also falls very gradually from east to west or from westbound towards eastbound lanes.

The location plan of the boreholes in this section and the stratigraphic profiles for eastbound lanes (EBL) and westbound lanes (WBL) are presented in Drawing Nos. 4A and 4B.

The boreholes showed the presence of 0.15 to 0.6 m thick topsoil or peat followed in some of the boreholes by a surficial layer of sand, silty sand or sandy silt to a maximum depth of 1.4 m below the ground surface. These surficial soils are underlain by an extensive clay deposit. In some of the boreholes, the clay is underlain by sand or silty sand till deposits at depths ranging from 7.5 to 9.0 m below the ground surface with others were terminated at depths of up to 13 m within the clay deposit, without encountering these sand or silty sand till deposits.

Details of the subsurface conditions encountered in the boreholes are presented on the Record of Borehole Sheets in Appendix A4. The individual soil strata are briefly described in the following paragraphs.

4.4.1 TOPSOIL AND PEAT

In Boreholes 11+441CL and 11+540Lt, a 0.15 to 0.25 m thick topsoil layer was contacted. The remaining boreholes, drilled in this stretch, encountered a 0.15 to 0.6 m thick layer of peat.

4.4.2 SURFICIAL SAND TO SANDY SILT

Underlying the topsoil and peat, all the boreholes except for Boreholes 11+505Rt and 11+622Lt contacted surficial granular soils ranging in composition from sand to silty sand and sandy silt. These deposits extended to depths ranging from 0.7 to 1.4 m below the ground surface.

The grain-size distribution of two samples from these surficial granular deposits is given in Figure B4-1 in Appendix B4. These results indicate 1-4% gravel, 58-64% sand, 18-22% silt and 14-19% clay size particles.

With the exception of Borehole 11+441CL, in which a value of 16 blows/0.3 m was recorded, the Standard Penetration tests performed in these surficial granular deposits yielded N-values ranging from 2 to 7 blows/0.3 m, indicating a generally very loose to loose condition.

4.4.3 SURFICIAL SILTY CLAY

Borehole 11+441CL, which is located on relatively higher ground near the north end of this section, contacted a surficial silty clay layer at a depth of 0.7 m or Elevation 182.5 m. This layer was 1.4 m thick and extended to a depth of 2.1 m or to Elevation 181.1 m. This is a cohesive material and from the presence of occasional embedded gravel, it was identified as possible glacial till.

The following grain-size distribution was measured on a sample from this material (Figure B4-2, Appendix B).

Gravel	=	8%
Sand	=	24%
Silt	=	32%
Clay	=	36%

The measured natural moisture contents of the two recovered samples from this deposit are 24 and 29%.

In this layer, the recorded N-values are 7 and 10 blows/0.3 m and a Field Vane test yielded an undrained shear strength in excess of 100 kPa. Based on these test results, the consistency of the material is described as stiff to very stiff.

4.4.4 CLAY

Underlying the surficial deposits described in the preceding paragraphs, all the boreholes contacted a major deposit of clay at depths ranging from 0.3 to 2.1 m below the ground surface or below elevations ranging from 181.1 and 179.2 m. Boreholes 11+441CL, 11+540Lt, 11+572Rt, 11+597CL, 11+622Lt and 11+655Rt were terminated in this deposit at depths ranging from 10.2 to 13.3 m below the ground surface while in the remaining four boreholes, the presence of sand or silty sand till was found at depths ranging from 7.5 to 10.9 m or below Elevations 173.7 and 170.1 m. In Boreholes 11+572Rt, 11+597CL and

11+655Rt which were terminated in the clay at depths of 13.3 m, 12.2 m and 11.7 m, respectively, the presence of a competent deposit (probably silty sand till) was inferred at about 18 m, 19 m and 15 m, respectively from Dynamic Cone Penetration tests.

At most locations the clay is a layered material with highly plastic (fat) to medium plasticity clay with some low plasticity (lean) clay seams/lenses. It is generally irregularly layered with occasional thin clayey silt to silt interlayers, some zones being more layered than others. In general, the soil has a reddish to reddish grey colour. The results of grain-size analyses carried out on six samples from the deposit are presented in Figure B4-3 of Appendix B4. These indicate 0-1% sand, 10-36% silt and 64-90% clay-size particles. When analyzing these results, it must be remembered that each sample tested was composed of various interbeds, which may range from silt to fat (highly plastic) clays. From the above results, the deposit can be expected to be highly impermeable and because of the interbedded structure, its mass permeability can be expected to be variable, especially in the horizontal direction.

This deposit is described as a cohesive soil and Atterberg Limits tests performed on seventeen samples from the material gave the following index values (Figure B4-4, Appendix B4):

Liquid Limit :	45-74%
Plastic Limit :	22-27%
Plasticity Index :	21-48%

As shown in Figure B4-4, these values are characteristic of clays of medium to high but generally of high plasticity. Once again, when analyzing these results, the interlayered nature of the soil should be kept in mind.

Natural moisture contents measured on samples from the deposit generally range from about 50 to 93% but are generally in excess of 60%. The measured natural moisture contents are generally near or in excess of the measured liquid limit values, with Liquidity Index values of between 0.6 and 1.4, but generally 1.0 to 1.4. These results are characteristic of weak and compressible (generally normally consolidated) clays. The measured bulk unit weights range from 15.2 to 16.9 kN/m³. The results of a consolidation (oedometer) test are given in Figure B4-5 of Appendix B4. These test results show a probable pre-consolidation pressure of about 70 kPa, which is about 50 kPa in excess of the existing overburden pressure. This is probably attributable to 'aging' rather than erosion of overburden or desiccation.

Standard Penetration tests in this cohesive deposit gave N-values ranging from 1 to 4, but generally 1 to 2 blows/0.3 m. Field Vane tests yielded in-situ undrained shear strengths ranging from 14 to 60 kPa (except for higher values in the desiccated crust in

Borehole 11+441CL). These values indicate that the consistency of the material can be described as very soft to stiff, but generally very soft to firm. A combined plot of all the Field Vane Test results from all the boreholes is presented in Figure C4-1 of Appendix C4. In many of the boreholes, an approximately linear increase of undrained shear strength with depth was observed. This usually indicates normally consolidated clay. Figures C4-2, 3 and 4 show plots of undrained shear strengths vs elevation, for several of the boreholes. On the same figures, plot of effective overburden pressure (p' or σ_v') have been superimposed. These indicate p'/c values generally in excess of 0.5 was observed, which is greater than p'/c values for normally consolidated clays usually observed in Northern Ontario. These results may indicate some pre-consolidation which may have occurred due to aging possibly combined with some temporary lowering of the groundwater table.

Field Vane tests showed sensitivity values (i.e. ratio of intact to remoulded shear strength) ranging from 3 to 14 but generally between 6 and 10. These indicate values medium to extra-sensitive clays but generally sensitive to extra-sensitive.

4.4.5 LOWER SAND

A 1.5 m thick sand layer was contacted in Borehole 11+657L, immediately underlying the clay deposit, at a depth of 8.5 m or Elevation 171.9 m.

The grain-size distribution of a sample recovered from this granular soil is given in Figure B4-6 of Appendix B4. This shows 24% gravel, 67% sand, 8% silt and 1% clay size particles.

From a recorded N-value of 29 blows/0.3 m, the relative density of the material is described as compact.

4.4.6 SILTY SAND TILL

Underlying the clay in Boreholes 11+475Lt, 11+505Rt, 11+547CL and the lower sand layer in Borehole 11+657Lt, a glacial till deposit was contacted at depths/elevations ranging from 7.5 m/Elevation 173.7 m to 10.9 m/Elevation 170.1 m. The till was penetrated for a vertical distance of 0.4 to 1.5 m where the boreholes were terminated.

The grain-size distribution of a sample from the deposit is given in Figure B4-7 of Appendix B4. Based on this and visual and tactile examination of the soil samples, the deposit is described as silty sand till, which consists of a heterogeneous, unsorted mixture of sand and silt with some gravel and clay. It is described as a granular material.

Standard Penetration tests performed in this deposit yielded N-values ranging from 18 to in excess of 60 blows/0.3 m, indicating a compact to very dense condition.

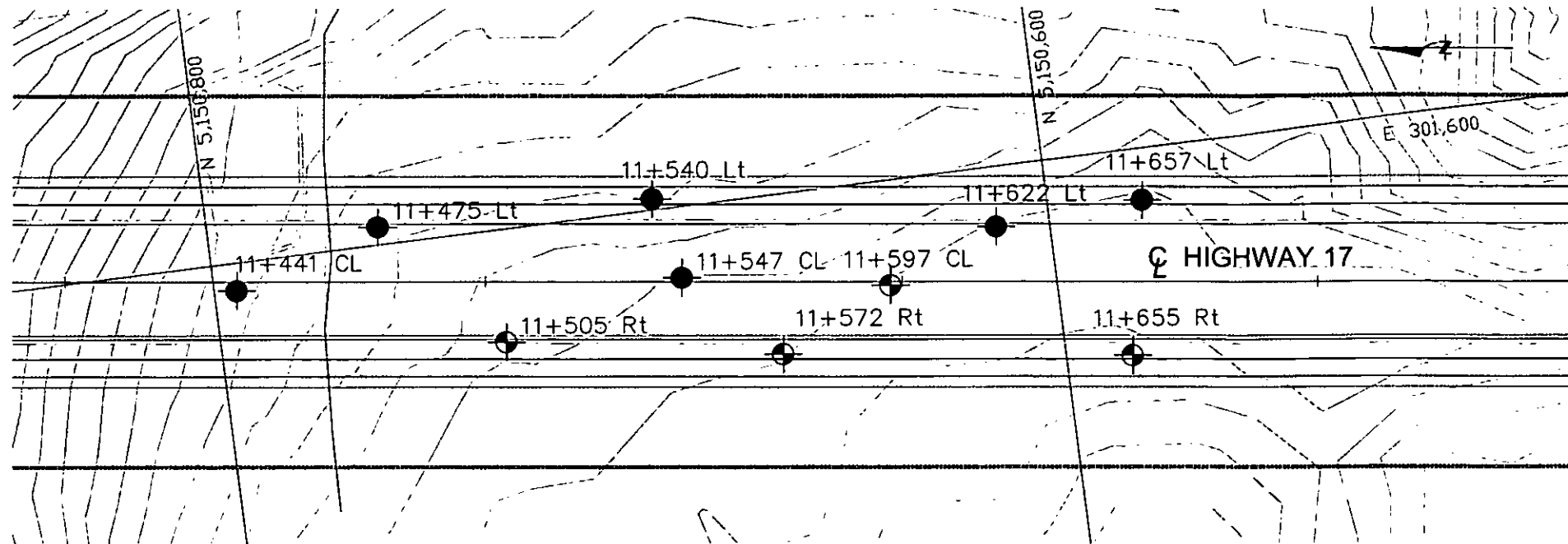
4.4.7 GROUNDWATER CONDITIONS

Upon their completion, water levels in the open boreholes were measured at depths ranging from 3.0 to 9.1 m below the ground surface. These levels are, however, not considered to be stabilized. Judging from the site conditions, the colour and the wetness of the soils encountered in the boreholes, it is our opinion that the water level at the site was at or very close to the ground surface. Borehole 11+441CL is located in a relatively high ground and in this borehole the groundwater level can be expected to be about 1 m below the ground surface. In this borehole too, however, a perched water table can occur due to the accumulation of surface water in the surficial silty sand layer overlying the clay.

A piezometer was installed in Borehole 11+655Rt within the clay deposit at a depth of 10.7 m below the ground surface and the water level in this piezometer was measured at 0.5 m above the ground surface or at Elevation 180.4 m, about eight months after its installation, indicating an artesian condition.

It should be pointed out that the groundwater table would be subject to seasonal fluctuations and a perched water condition can occur in the more pervious surficial deposits overlying the practically impervious clay deposit.

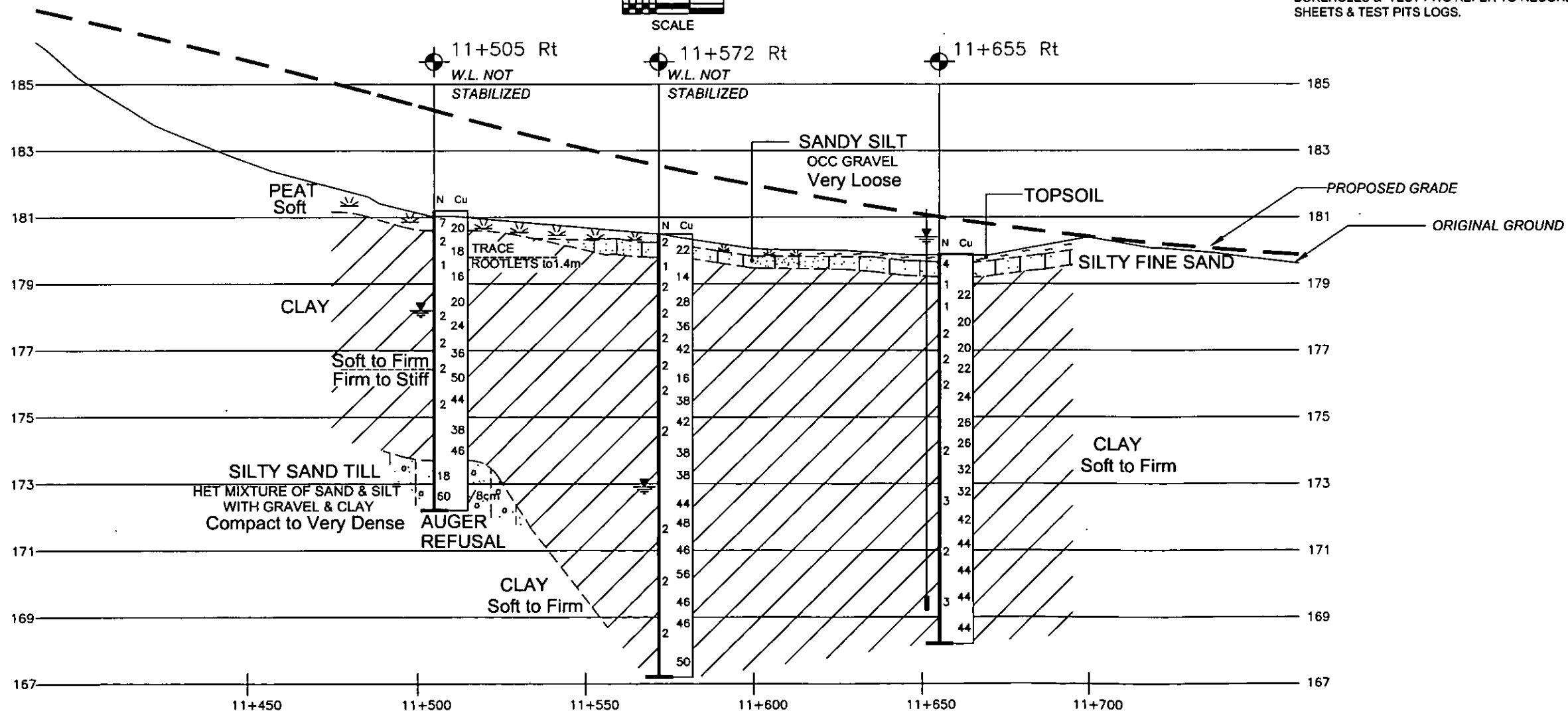
Drawings



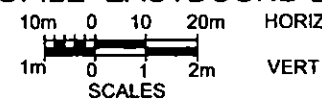
METRIC

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

NOTE:
FOR DETAILED SUBSURFACE CONDITIONS OF ALL
BOREHOLES & TEST PITS REFER TO RECORD OF BOREHOLE
SHEETS & TEST PITS LOGS.



PROFILE EASTBOUND LANES

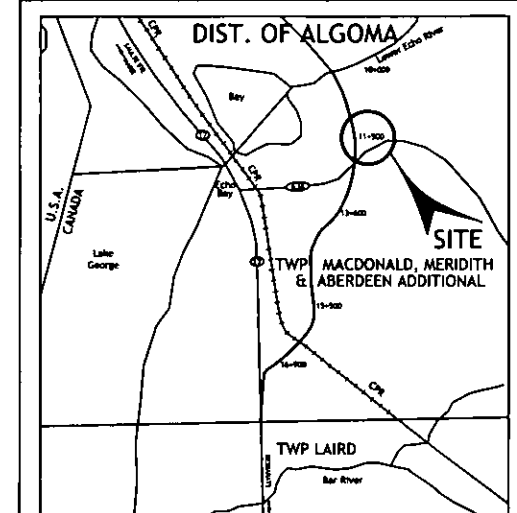


CONT No.

GWP: 354-94-00

HIGHWAY 17 (NEW) EBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 4
BORE HOLE LOCATIONS & SOIL STRATA

SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND

- Bore Hole
- Bore Hole & Cone
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation Mar., 2002
- Water Level in Piezometer
- Piezometer

No.	ELEV.	CO-ORDINATES NORTH	EAST
11+505 Rt	181.2	5 150 732.7	301 572.8
11+572 Rt	180.5	5 150 667.1	301 561.4
11+655 Rt	179.9	5 150 584.2	301 550.4

NOTE

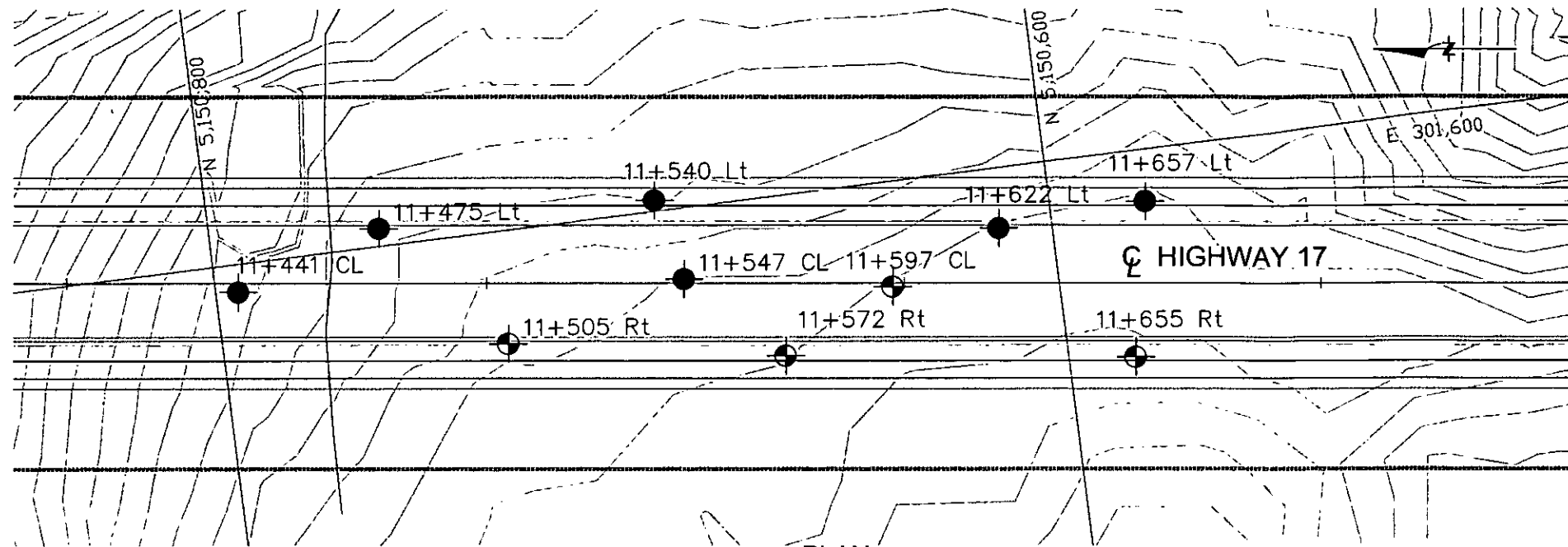
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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

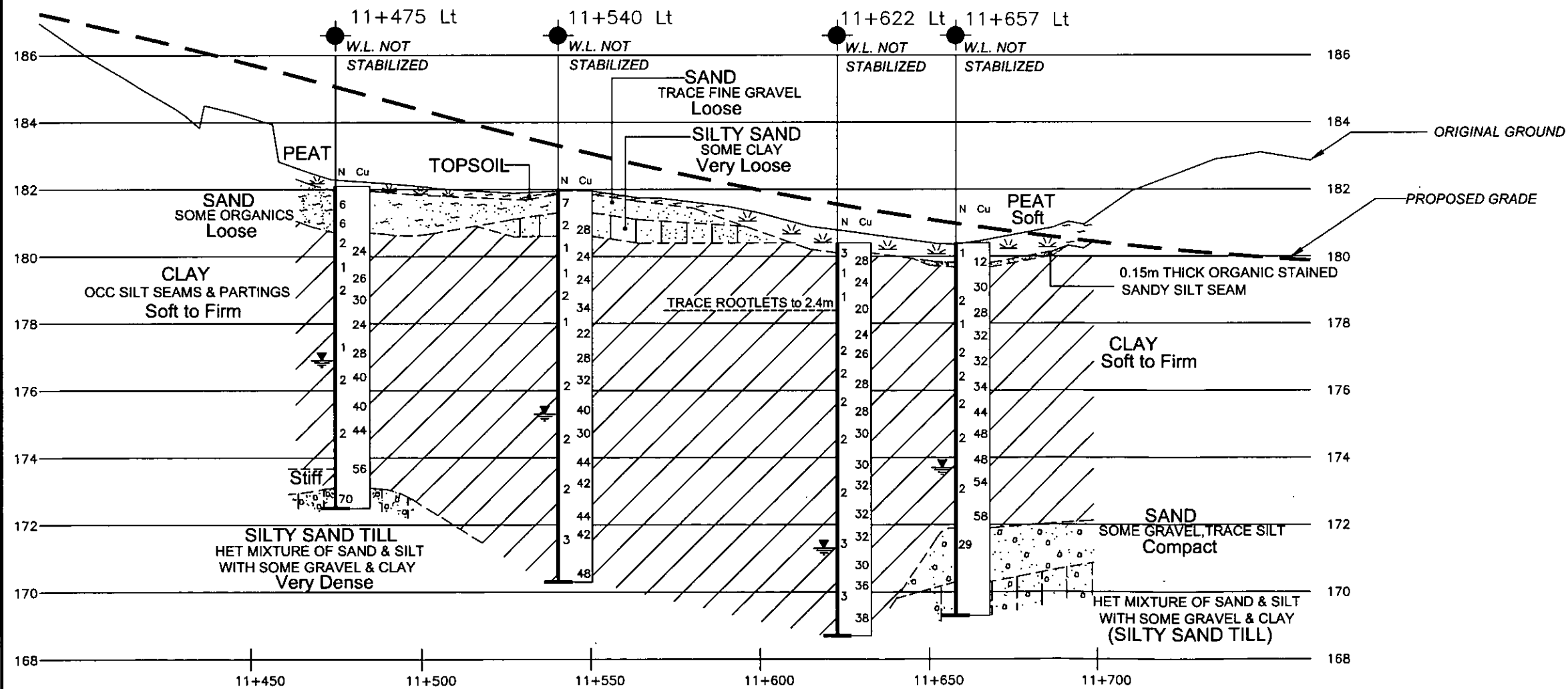
REV.	DATE	BY	DESCRIPTION

Geocres No.

HWY No. 17 (New)			DIST 62
SUBMD ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 4A



PLAN
10m 0 10 20m
SCALE



PROFILE WESTBOUND LANES

10m 0 10 20m HORIZ
1m 0 1 2m VERT
SCALES

METRIC

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

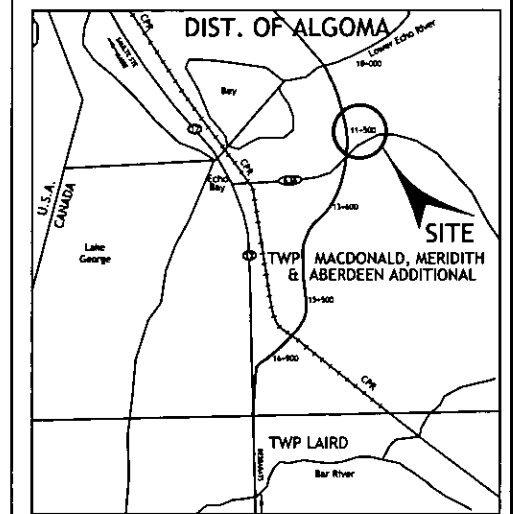
CONT No.

GWP: 354-94-00

HIGHWAY 17 (NEW) WBL
ECHO RIVER TO BAR RIVER ROAD
SITE No. 4
BORE HOLE LOCATIONS & SOIL STRATA



SHAHEEN & PEAKER LIMITED



KEY PLAN
N.T.S.

LEGEND

- Bore Hole
- Bore Hole & Cone
- N Blows/0.3m (Std. Pen. Test, 475 J/blow)
- Cu Undrained Shear Strength measured by Field Vane Test
- Water Level at Time of Investigation Mar. ,2002
- Water Level in Piezometer
- Piezometer

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
11+475Lt	182.1	5 150 759.5	301 604.3
11+540Lt	182.0	5 150 693.7	301 602.7
11+622Lt	180.4	5 150 612.8	301 585.5
11+657Lt	180.4	5 150 577.3	301 587.5

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 Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV	DATE	BY	DESCRIPTION

Geocres No.			
HWY No. 17 (New)	DIST 62		
SUBM'D ZO	CHECKED ZO	DATE Mar, 2003	SITE
DRAWN JZ	CHECKED	APPROVED	DWG 48

Appendix A4

Record of Boreholes

SPT1055

RECORD OF BOREHOLE No 11+441 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 794.7; E 301 593.3 ORIGINATED BY G.I
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
183.2	Ground Surface													
0.0	0.25m Topsoil													
182.5	SILTY SAND trace to some clay, occasional fine gravel, greyish brown, moist, compact		1	SS	16		183							
0.7	SILTY CLAY some sand, occasional fine gravel reddish grey, stiff to very stiff		2	SS	10		182							8 24 32 36
			3	SS	7									
181.1							181							
2.1			4	SS	4									
			5	TW	PH		180						15.9	0 0 35 65
			6	SS	2		179							
			7	SS	1		178							
			8	SS	2		177							
			9	SS	2		176							
			10	SS	2		175							
173.0							174							
10.2	End of borehole						173							
	* Water level at 6.1 m (not stabilized) and hole open to 6.7 m on completion. Borehole advanced 2.2 m right of median centre line													

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+475; 13 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 759.5; E 301 604.3 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR. × LAB VANE						
182.1 0.0	Ground Surface						20 40 60 80 100	20 40 60 80 100	20 40 60							
	0.15m Peat		1	SS	6		182									
	SAND brown, some organics, wet, loose		2	SS	6		181									
180.7 1.4			3	SS	2		180									
	CLAY reddish grey occasional silt seams and partings, soft to firm		4	SS	1		179									
			5	SS	2		178									
			6	TW	PH		177									
			7	SS	1		176									
			8	SS	2		175									
			9	SS	2		174									
173.1 9.0			10	SS	70		173									
172.5 9.6	Heterogeneous mixture of sand and silt with some gravel and clay, grey, wet, very dense (SILTY SAND TILL)															
	End of borehole															
	* Water level at 5.2 m (not stabilized) and hole open to 6.1 m on completion															

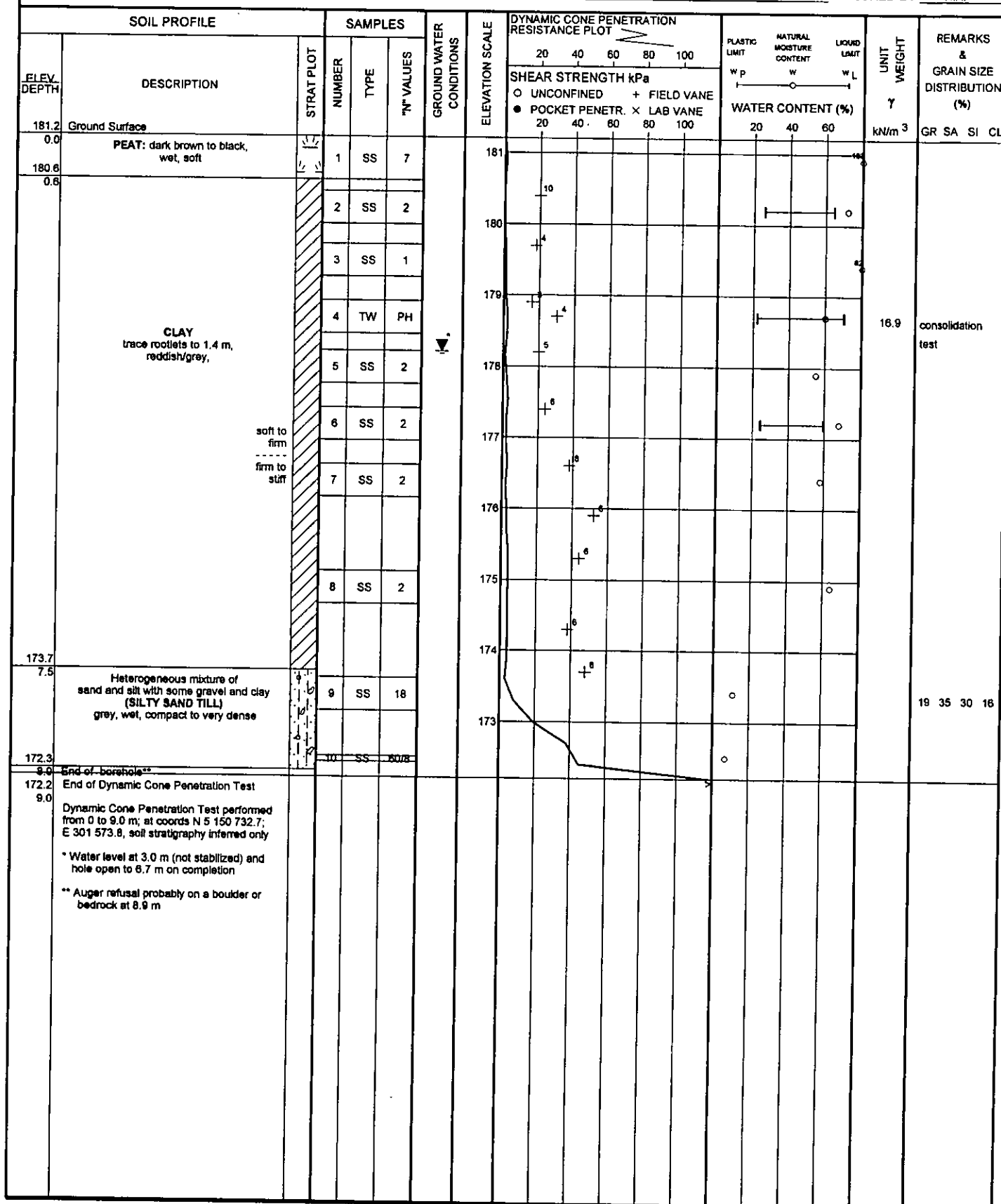
+ 3, x 3: Numbers refer to
Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+505; 14 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 732.7; E 301 572.8 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/26/2002 CHECKED BY R.A.



+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+540 Lt; 20 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 693.7, E 301 602.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/26/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100	20 40 60 80 100					
182.0	Ground Surface					182							
0.0	0.15 m Topsoil SAND		1	SS	7								** frozen to 0.5 m
181.3	trace fine gravel, wet, brown, loose												
0.7	SILTY SAND		2	SS	2	181							1 58 22 19
180.6	some clay, gray very loose												
1.4			3	SS	1								
			4	SS	1	180							
			5	SS	2	179							
			6	SS	1	178							
	CLAY reddish, gray soft to firm		7	TW	PH	177						15.3	0 1 11 88
			8	SS	2	176							
			9	SS	2	175							
			10	SS	2	174							
			11	SS	3	173							
170.3	End of borehole					172							
11.7	* Water level at 6.7 m (not stabilized) and hole open to 7.6 m on completion					171							

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+547 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 689.0, E 301 582.9 ORIGINATED BY G.I.
DIST 82 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 4/5/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
181.0	Ground Surface						181						
0.0	PEAT:		1	SS	1		180						
180.5	dark brown to black, wet, soft		2	SS	2		179						
0.5	0.15 m thick, grey, wet silty fine sand seam		3	SS	1		178						
			4	SS	2		177						
			5	SS	2		176						
			6	SS	2		175						
			7	SS	2		174						
			8	SS	3		173						
			9	SS	3		172						
			10	SS	2		171						
			11	SS	23		170						
170.1	(SILTY SAND TILL)												
10.9	grey, saturated, compact												
169.7													
11.3	End of borehole												
	* Water level at 7.6 m (not stabilized) and hole open to 9.1 m on completion. Borehole advanced 1.0 m left of median centre line.												

+³ × 3: Numbers refer to
Sensitivity

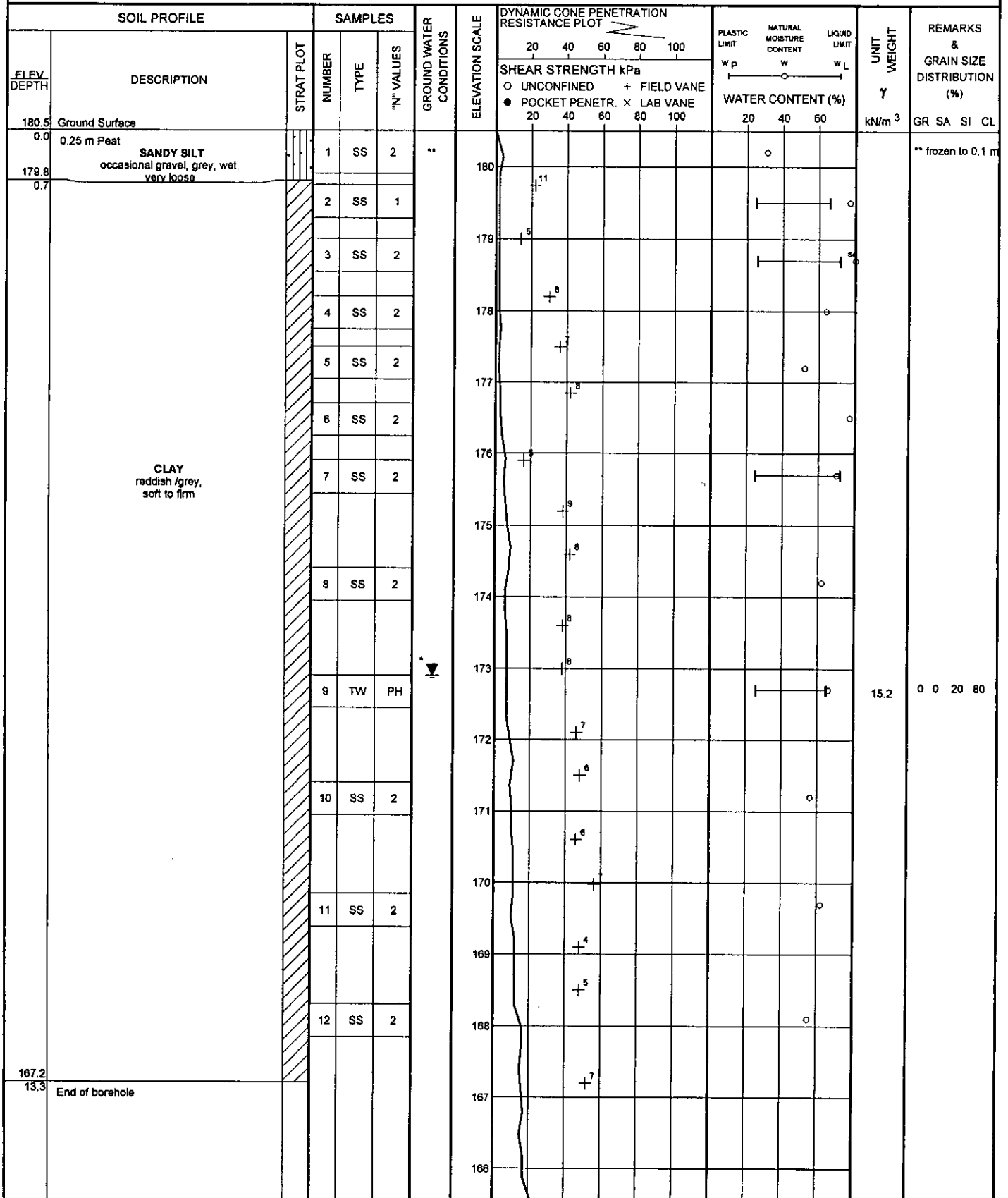
20
15
10

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+572; 17 m Rt 1 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 667.1; E 301 561.4 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/27/2002 CHECKED BY R.A.



Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+572; 17 m Rt 2 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 667.1; E 301 561.4 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/27/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
FLEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						
						20	40	60	80	100	20	40	60	
161.3														
19.2	End of Dynamic Cone Penetration Test * Water level at 7.6 m (not stabilized) and hole open to 8.5 m on completion. Dynamic Cone Penetration Test performed from 0 m to 19.2 m at coords N 5 150 667.0; E 301 561.9.													

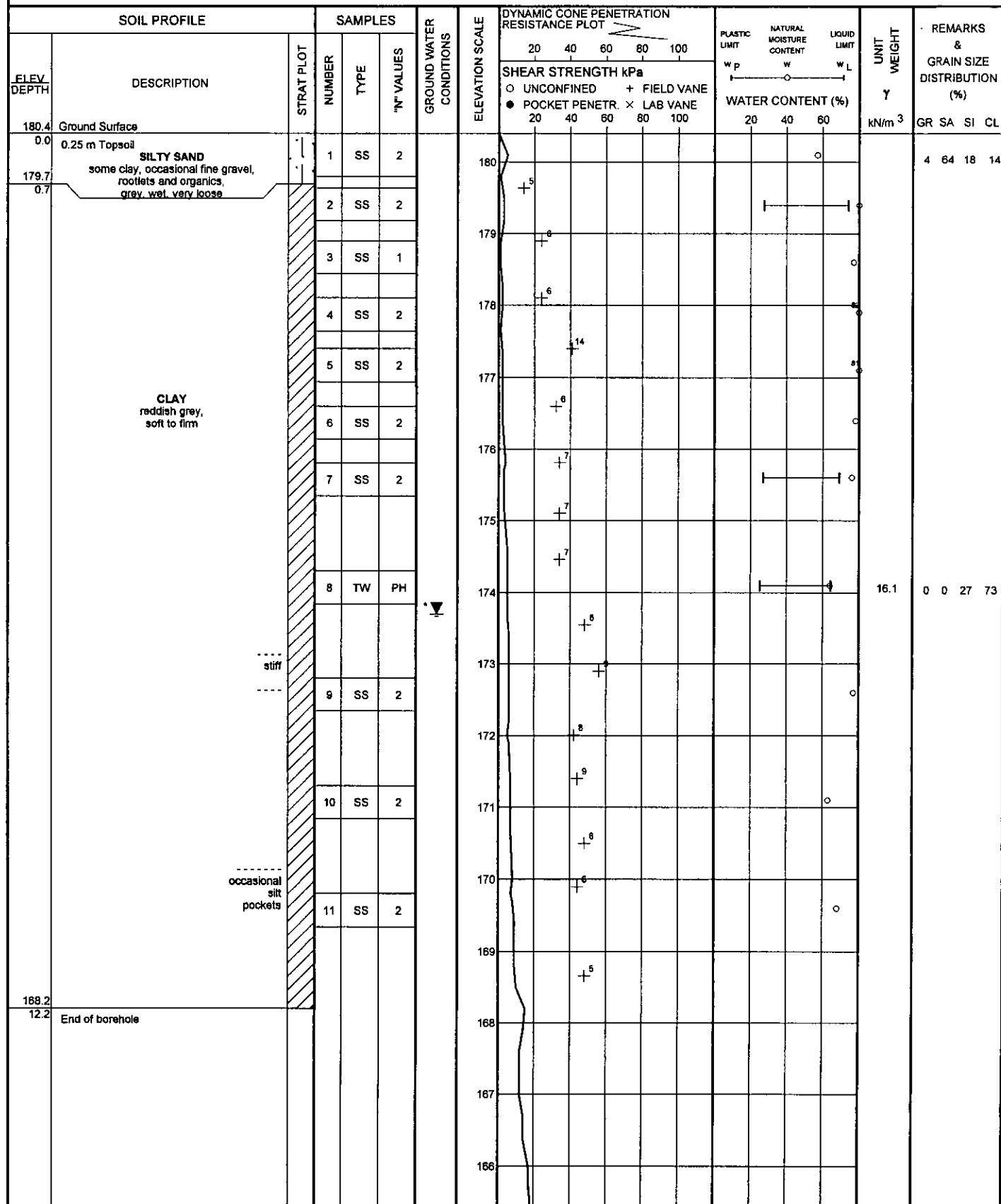
SPT1055

RECORD OF BOREHOLE No 11+597 CL

1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 839.7, E 301 574.7 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
 DATUM Geodetic DATE 3/27/2002 CHECKED BY R.A.



Continued Next Page

+ 3, x 3; Numbers refer to Sensitivity
 20
 15 10 5
 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+597 CL

2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 639.7; E 301 574.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/27/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
165														
164														
163														
162														
161														
160.6														
19.8	<p>End of Dynamic Cone Penetration Test</p> <p>* Water level at 6.7 m (not stabilized) and hole open to 8.5 m on completion</p> <p>Dynamic Cone Penetration Test performed from 0 to 19.8 m; at coords N 5 150 639.1; E 301 574.6.</p> <p>Borehole advanced 0.9 m right of median centre line</p>													

SPT1055

RECORD OF BOREHOLE No 11+622; 13 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 612.8; E 301 585.5 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/28/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
FLYV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L			
180.4	Ground Surface												
180.0	PEAT: dark brown to black		1	SS	3								**ground frozen to 0.3 m
0.3	CLAY reddish grey trace rootlets to 2.4 m, soft to firm		2	SS	1								
			3	SS	1								
			4	TW	PH								
			5	SS	2								
			6	SS	2								
			7	SS	2								
			8	SS	2								
			9	SS	2								
			10	SS	3								
			11	SS	3								
168.7		End of borehole											
11.7	* Water level at 9.1 m (not stabilized) and hole open to 9.8 m on completion.												

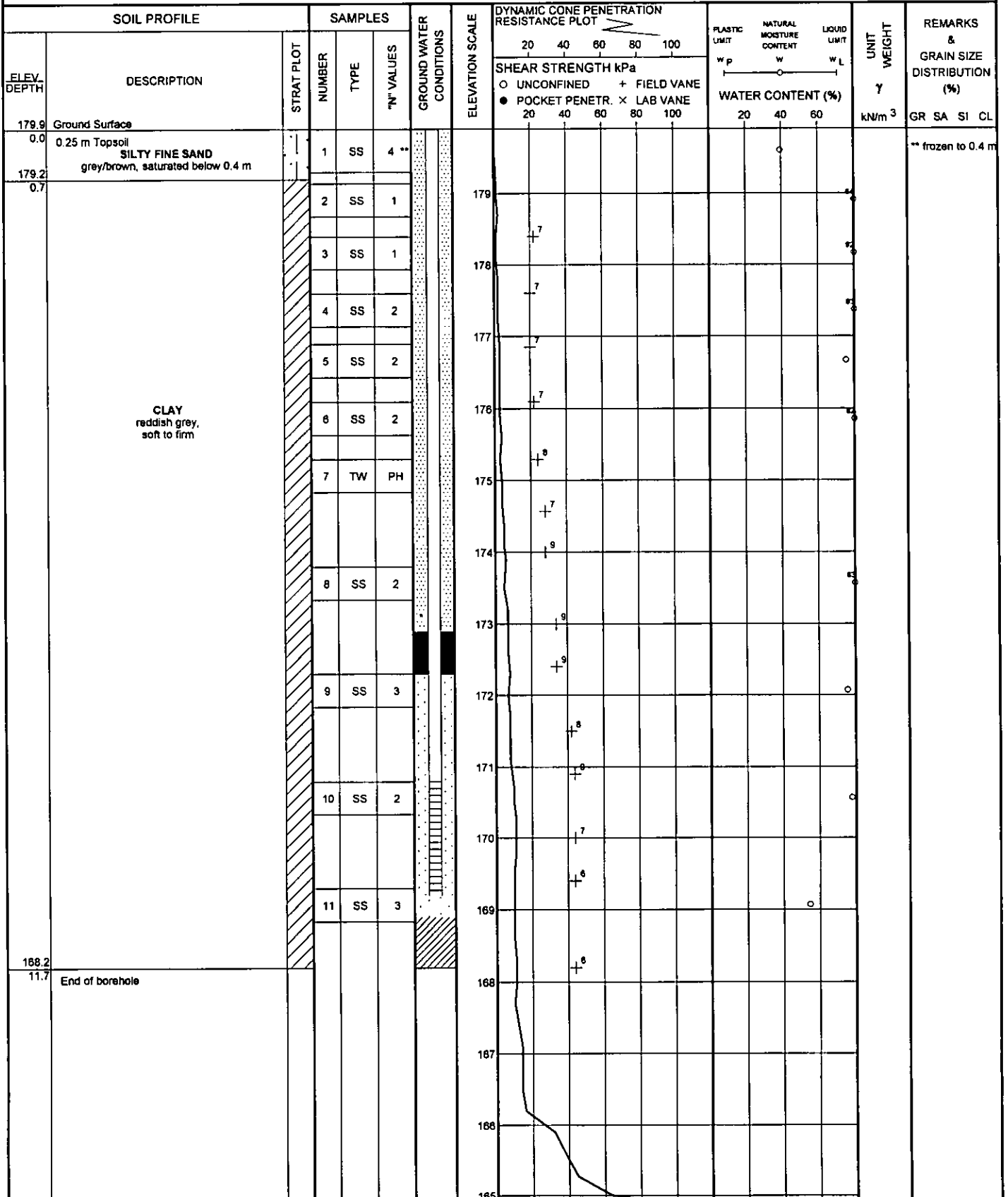
SPT1055

RECORD OF BOREHOLE No 11+655; 18 m Rt

1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 584.2; E 301 550.4 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers & D.C.P.T. COMPILED BY G.T.
DATUM Geodetic DATE 3/28/2002 CHECKED BY Z.O.



Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+655; 18 m Rt 2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 584.2; E 301 550.4 ORIGINATED BY G.I.
DIST 82 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers & D.C.P.T. COMPILED BY G.T.
DATUM Geodetic DATE 3/28/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE							
184.7 15.2	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test (D.C.P.T.) performed from 0 to 15.2 m at N 5 150 584.1; E 301 550.9. Water level at 6.7 m (not stabilized) and hole open to 8.5 m on completion. Piezometer installed to 10.7 m. Water level on 19/10/2002 0.5 m above ground surface. * Hole grouted above bentonite seal.						184								

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+657; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 577.3; E 301 587.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 4/5/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● POCKET PENETR. × LAB VANE									
							20	40	60	80	100	WATER CONTENT (%)					
							20	40	60	80	100	20	40	60			
180.4	Ground Surface																
0.0	PEAT		1	SS	1												
179.8	dark brown to black, wet, soft																
0.6	0.15 m thick organic stained sandy silt seam		2	SS	2												
			3	SS	2												
			4	SS	1												
			5	SS	2												
	CLAY		6	SS	2												
	reddish grey		7	SS	2												
	soft to firm		8	SS	2												
			9	SS	2												
			10	SS	29												
171.9			11	AS	-												
8.5	SAND																
	some gravel, trace silt																
	compact, grey, wet																
170.3	Heterogeneous mixture of sand and silt																
10.1	with some gravel and clay, wet																
	(SILTY SAND TILL)																
169.3																	
11.1	End of borehole																
	* Water level at 6.7 m (not stabilized) and hole open to 8.5 m on completion.																
	*** Unable to sample with Spilt Spoon Sampler at 10.7 m due to sand back up in Hollow Stem Augers , auger sample collected.																

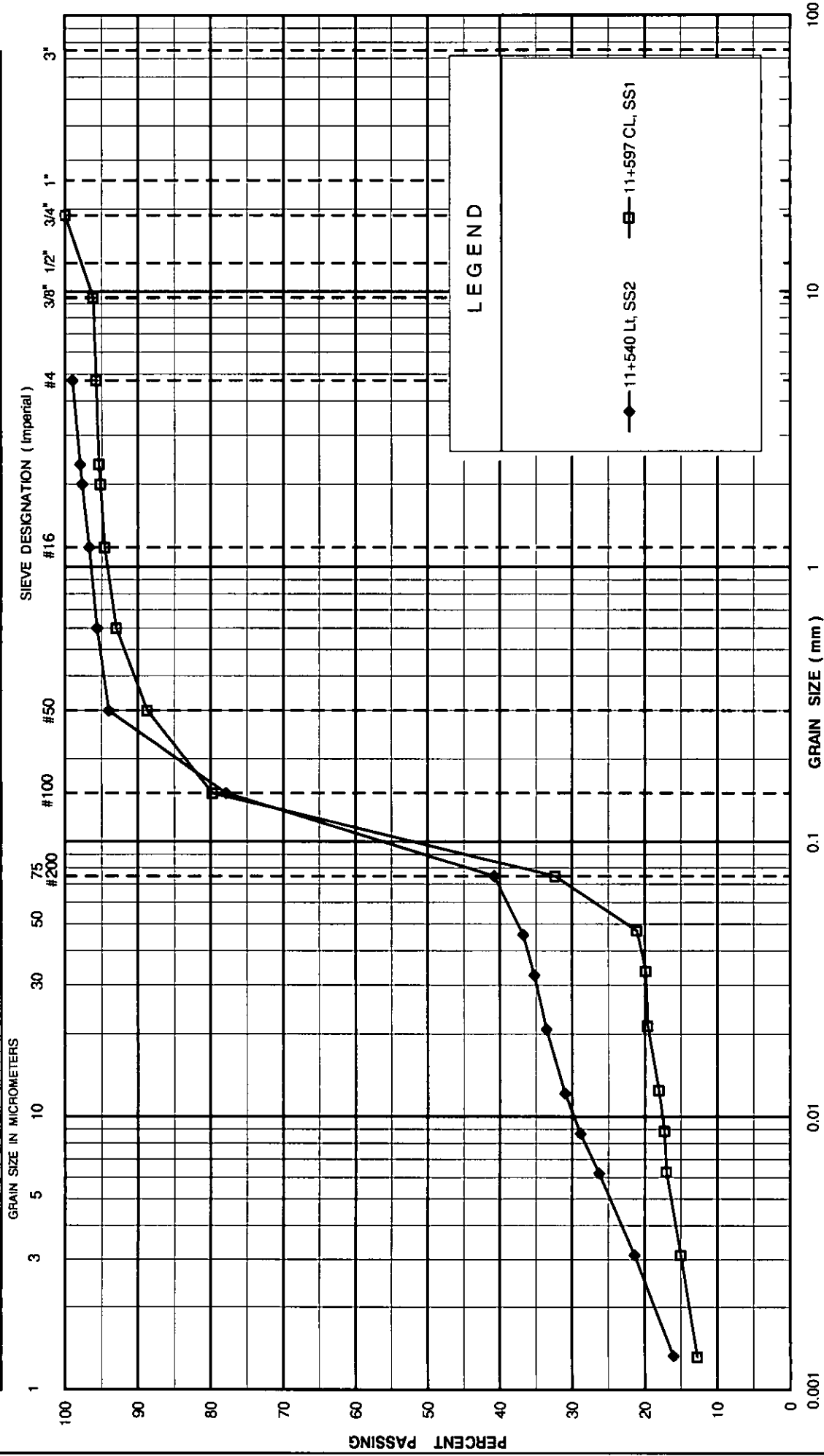
+ 3. x 3. Numbers refer to Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

Appendix B4

Laboratory Test Results

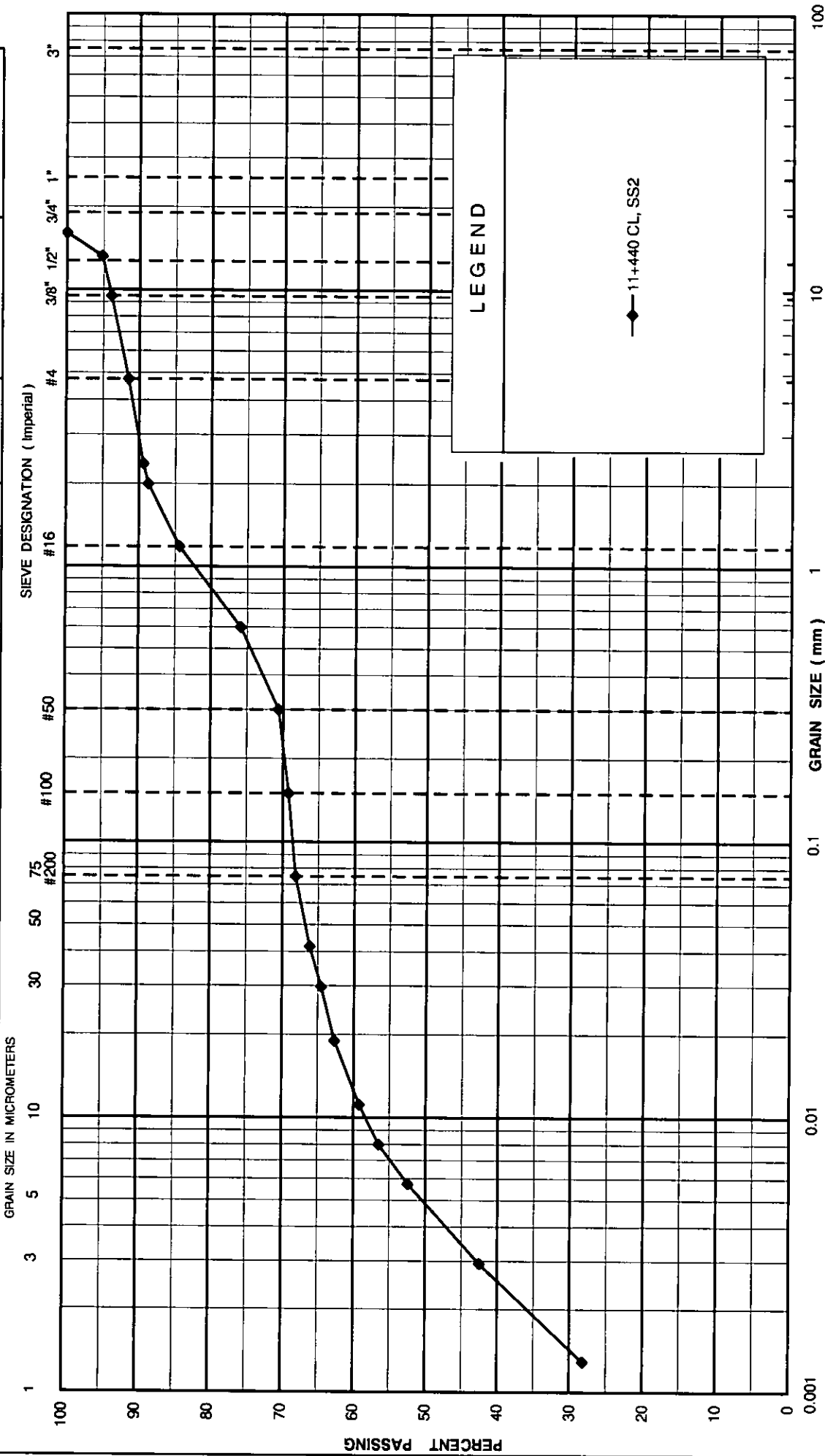
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
GRAIN SIZE IN MICROMETERS			Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION
SILTY CLAY, some sand, trace gravel

SHAHEEN & PEAKER LIMITED

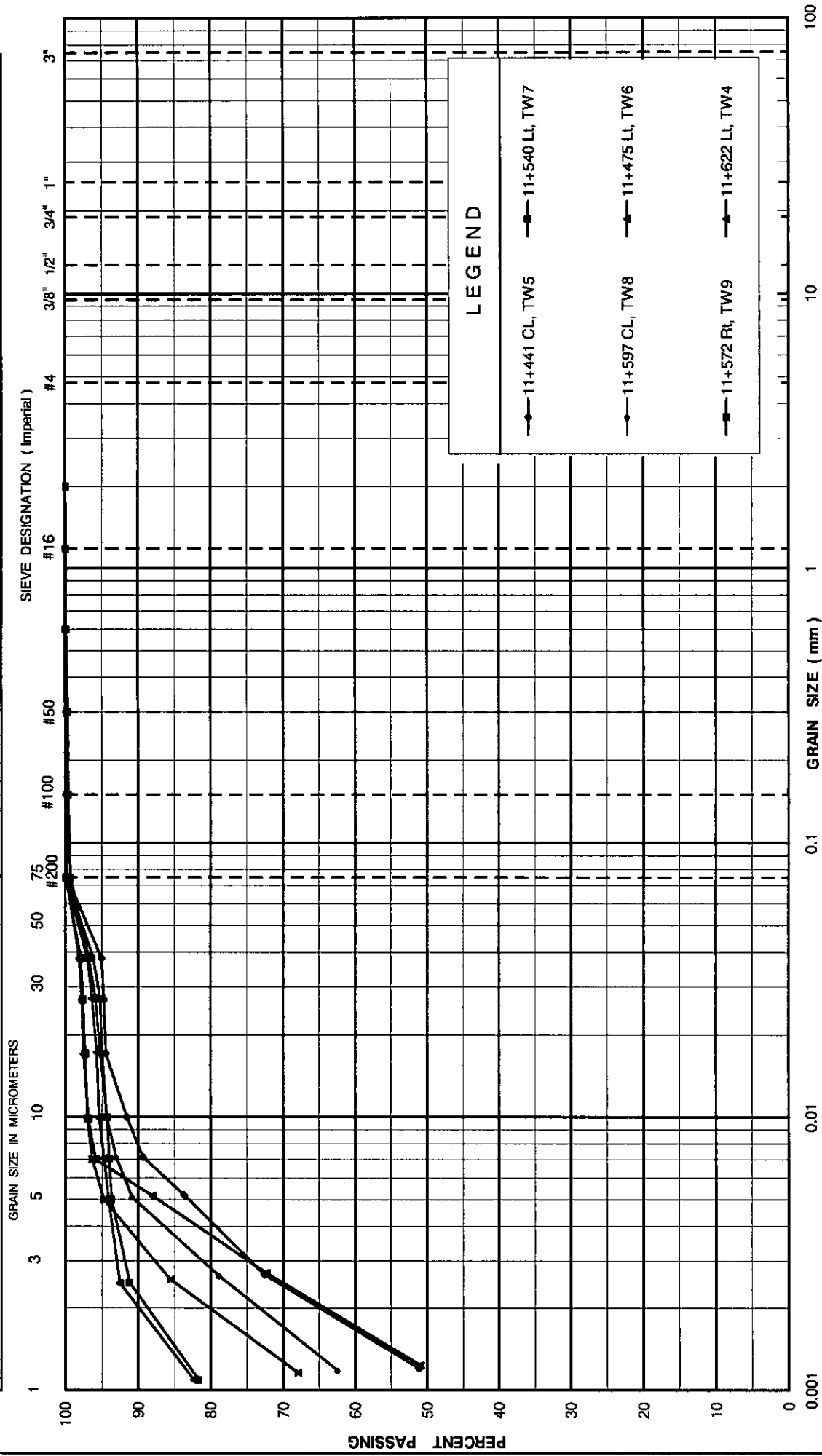
FIG. No. B4-2

REF. No. SPT 1055

G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION

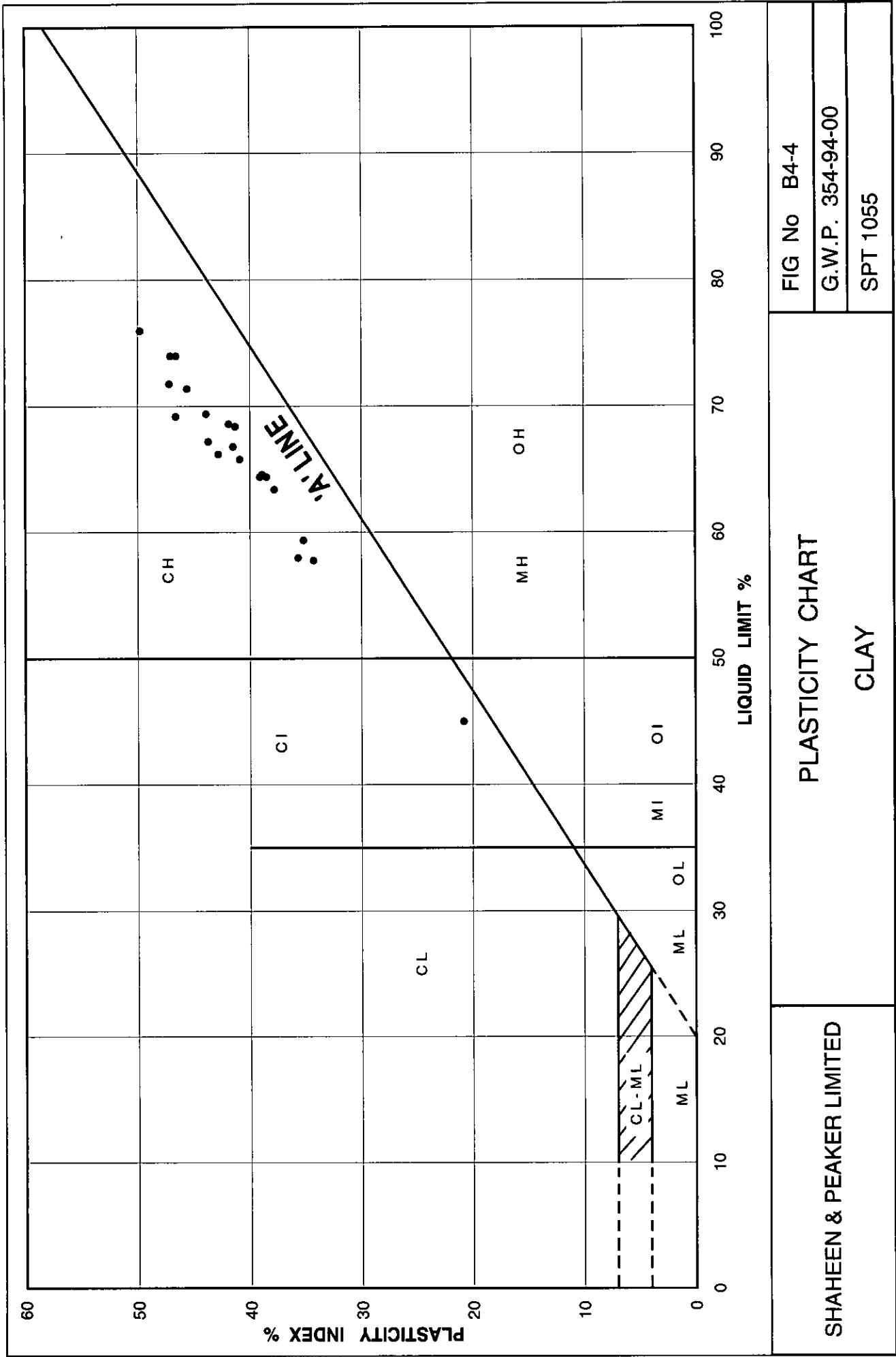
CLAY

SHAHEEN & PEAKER LIMITED

FIG. No. B4-3

REF. No. SPT 1055

G.W.P. 354-94-00



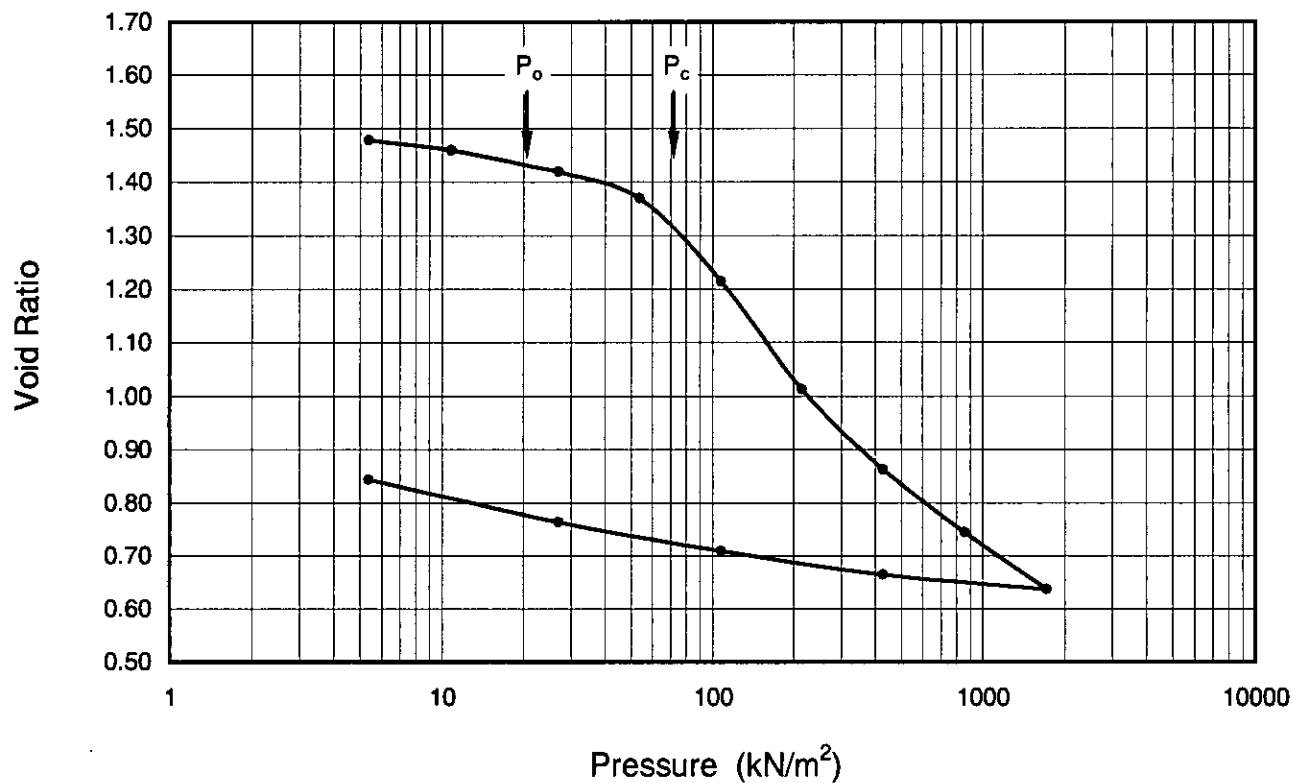
SHAHEEN & PEAKER LIMITED	PLASTICITY CHART		FIG No B4-4
	CLAY		G.W.P. 354-94-00
			SPT 1055

11+505 Rt

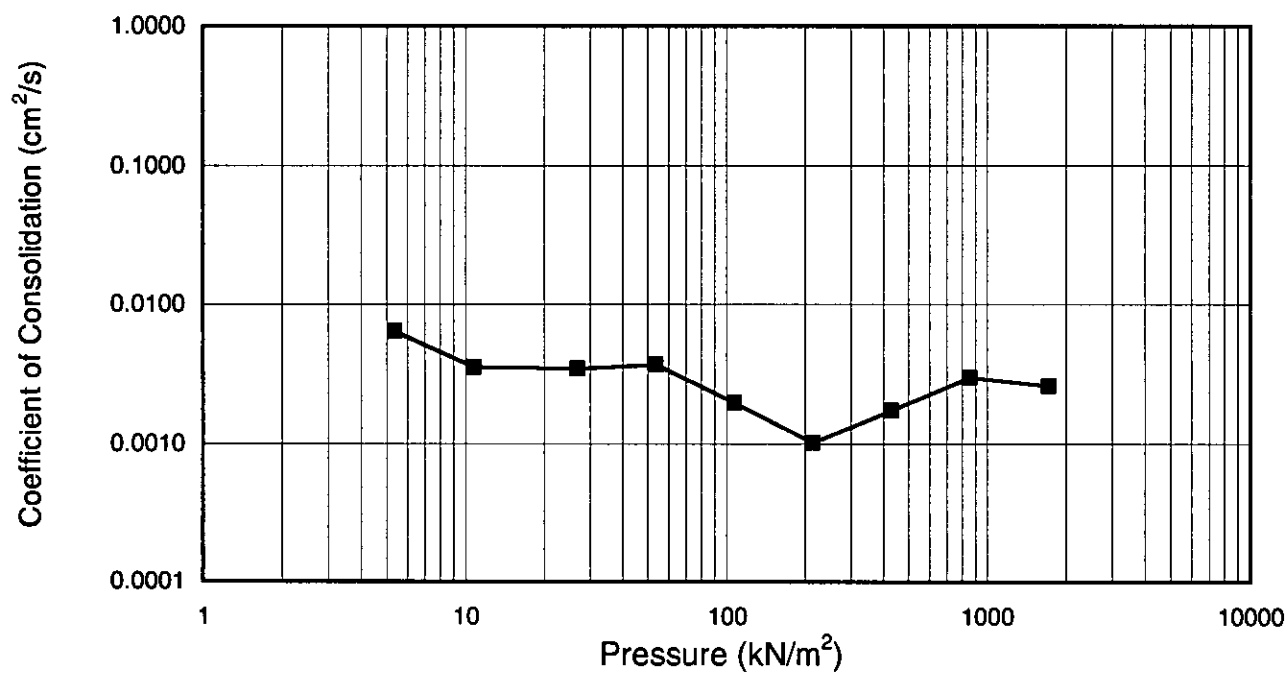
TW 4 Depth 2.50 m

Fig. B4-5

Void Ratio versus Pressure

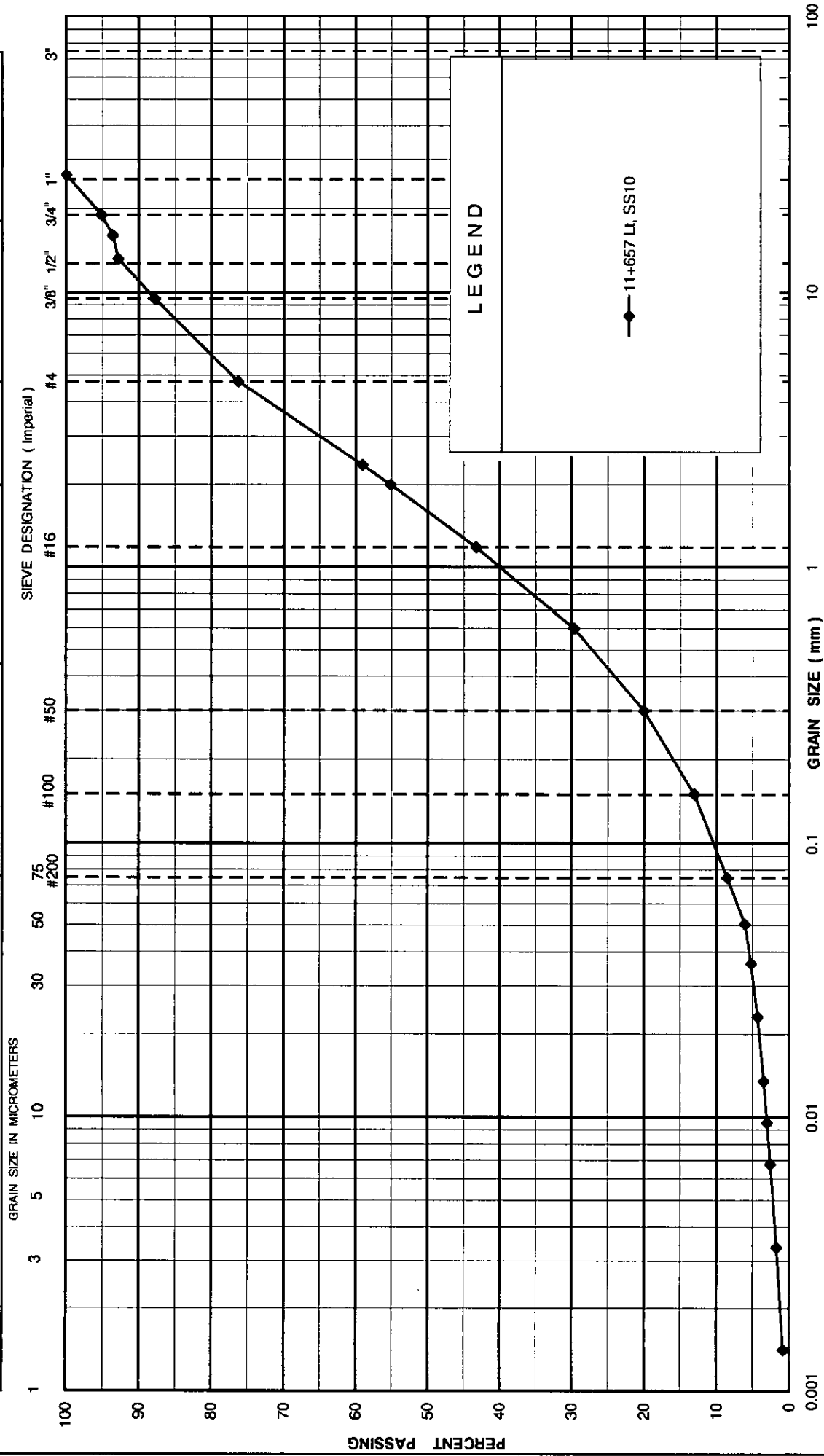


Coefficient of Consolidation vs Pressure



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION
LOWER SAND

FIG. No. B4-6

REF. No. SPT 1055

G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

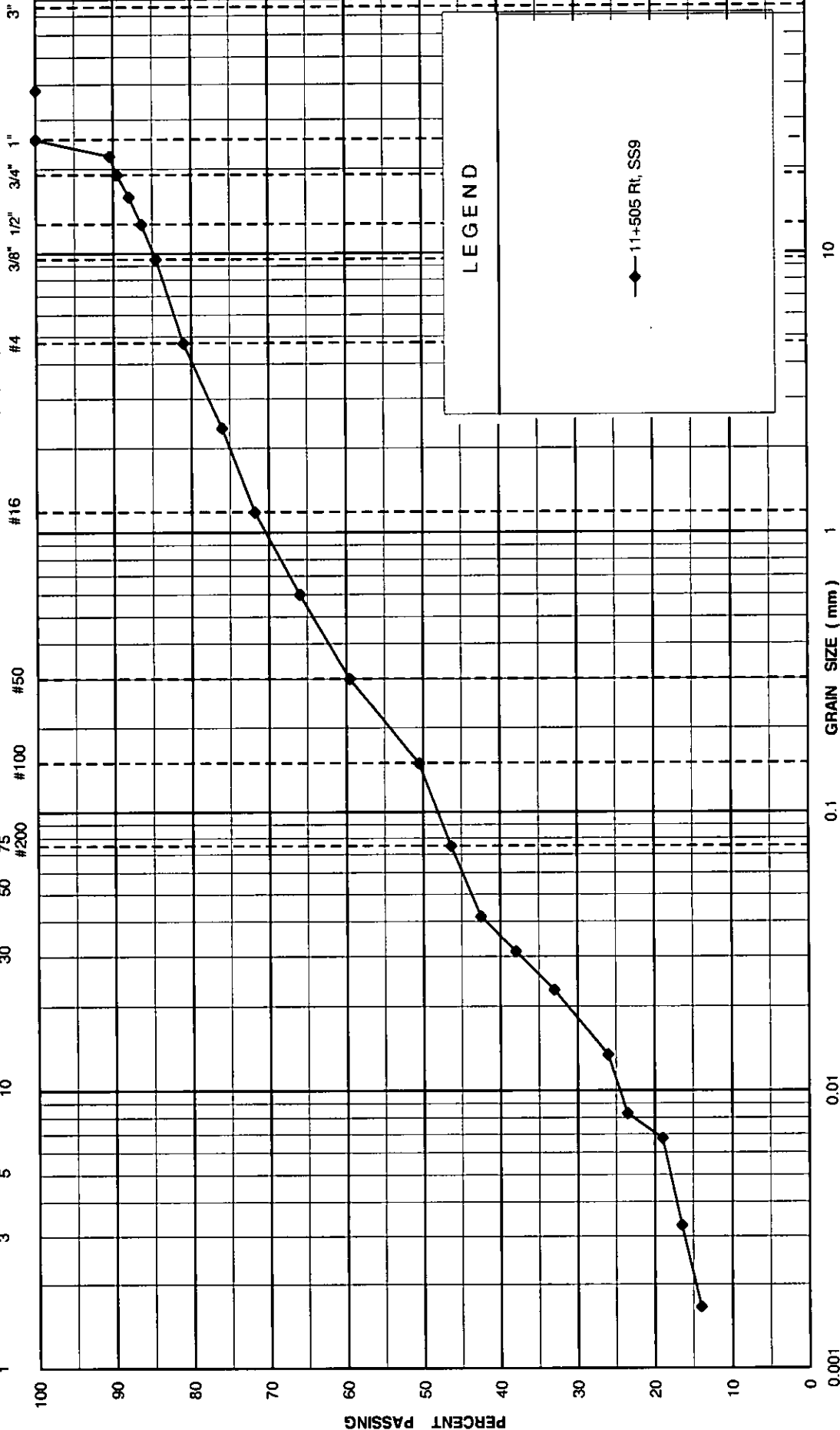
CLAY AND SILT

SAND

GRAVEL

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (Imperial)



LEGEND

11-505 Rt, SS9

GRAIN SIZE DISTRIBUTION
SILTY SAND TILL

SHAHEEN & PEAKER LIMITED

FIG. No. B4-7

REF. No. SPT 1055

G.W.P. 354-94-00

Appendix C4

Measured Undrained Shear Strength Results

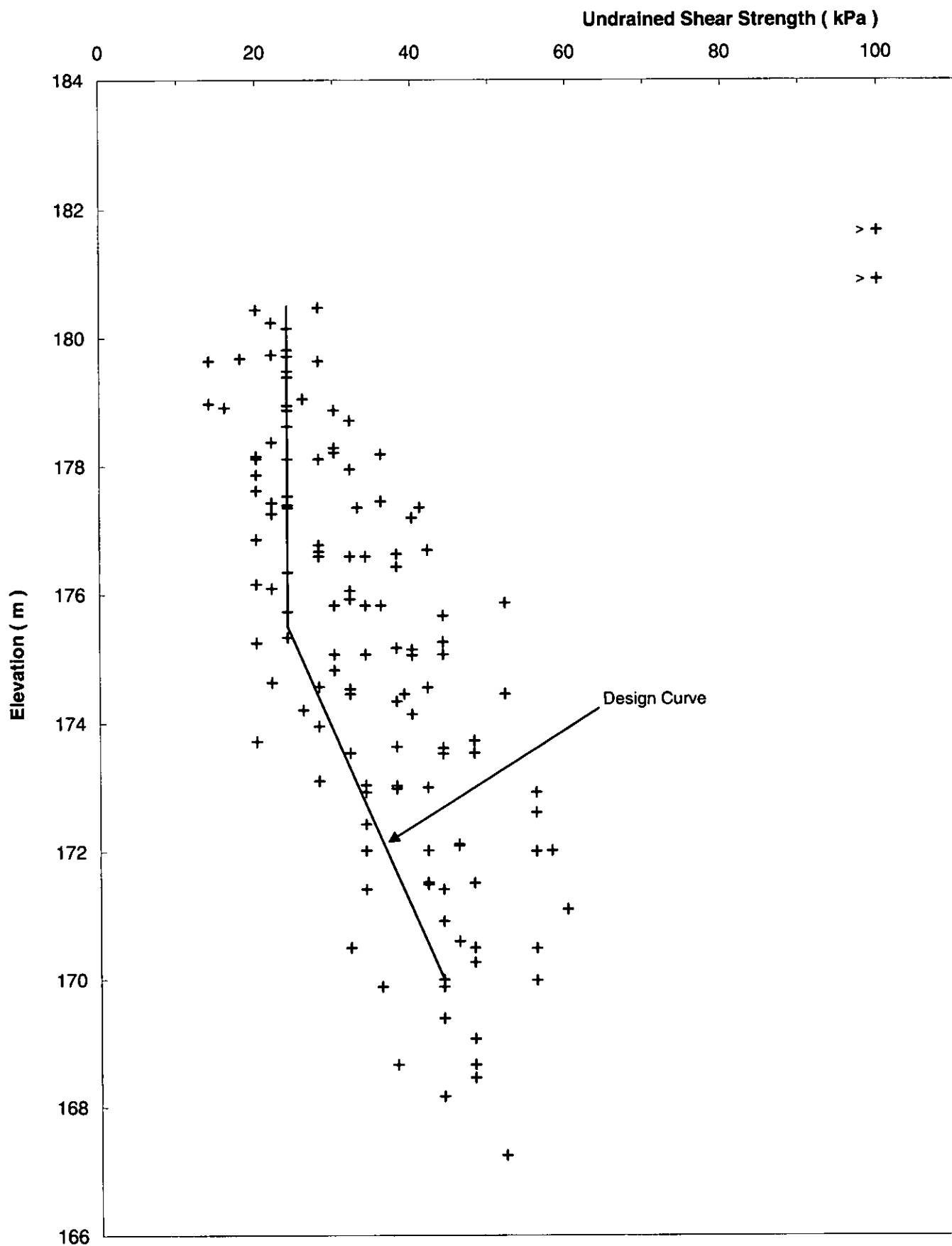


Fig. C4-1: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

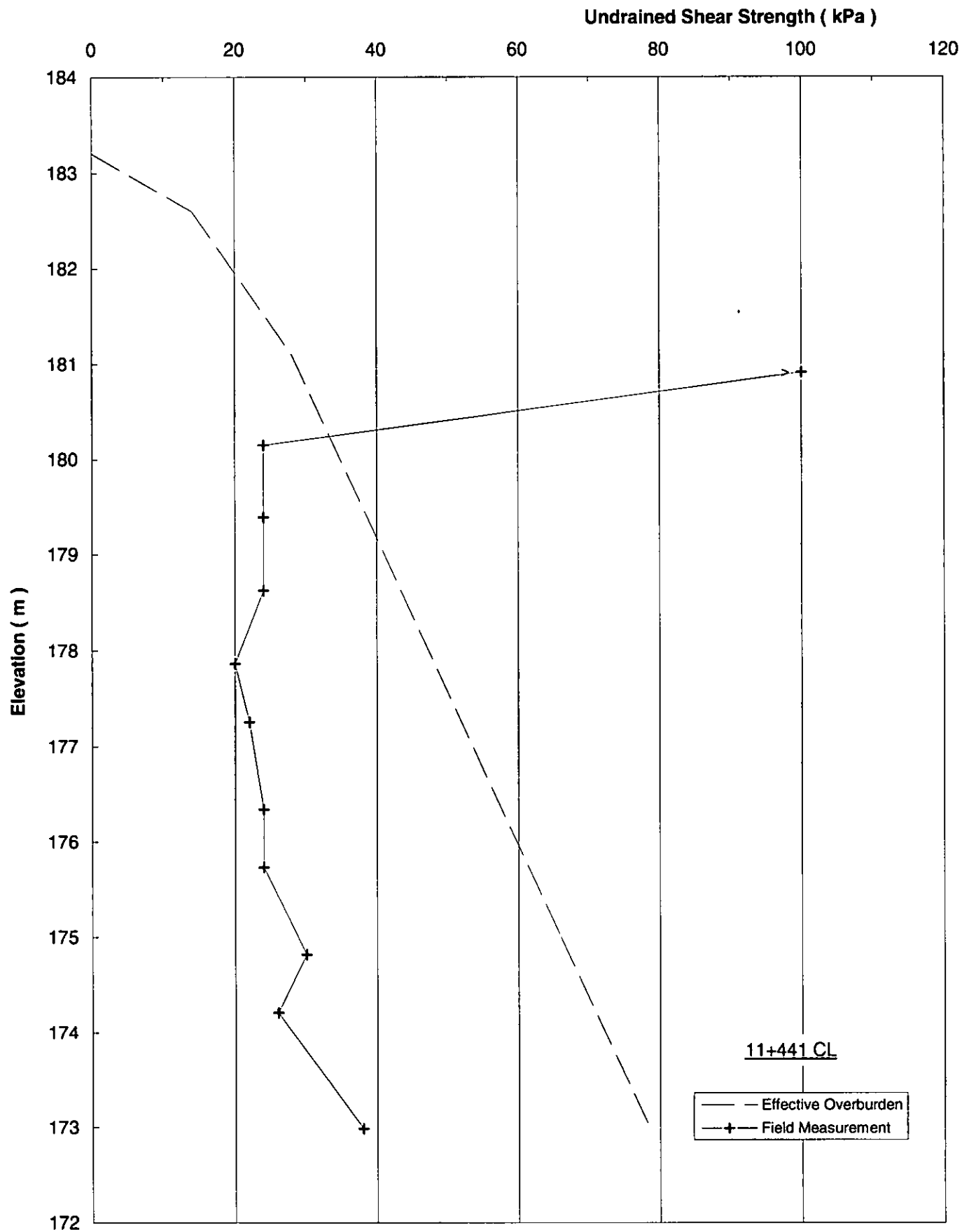


Fig. C4-2: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation
(Borehole 11+441 CL)

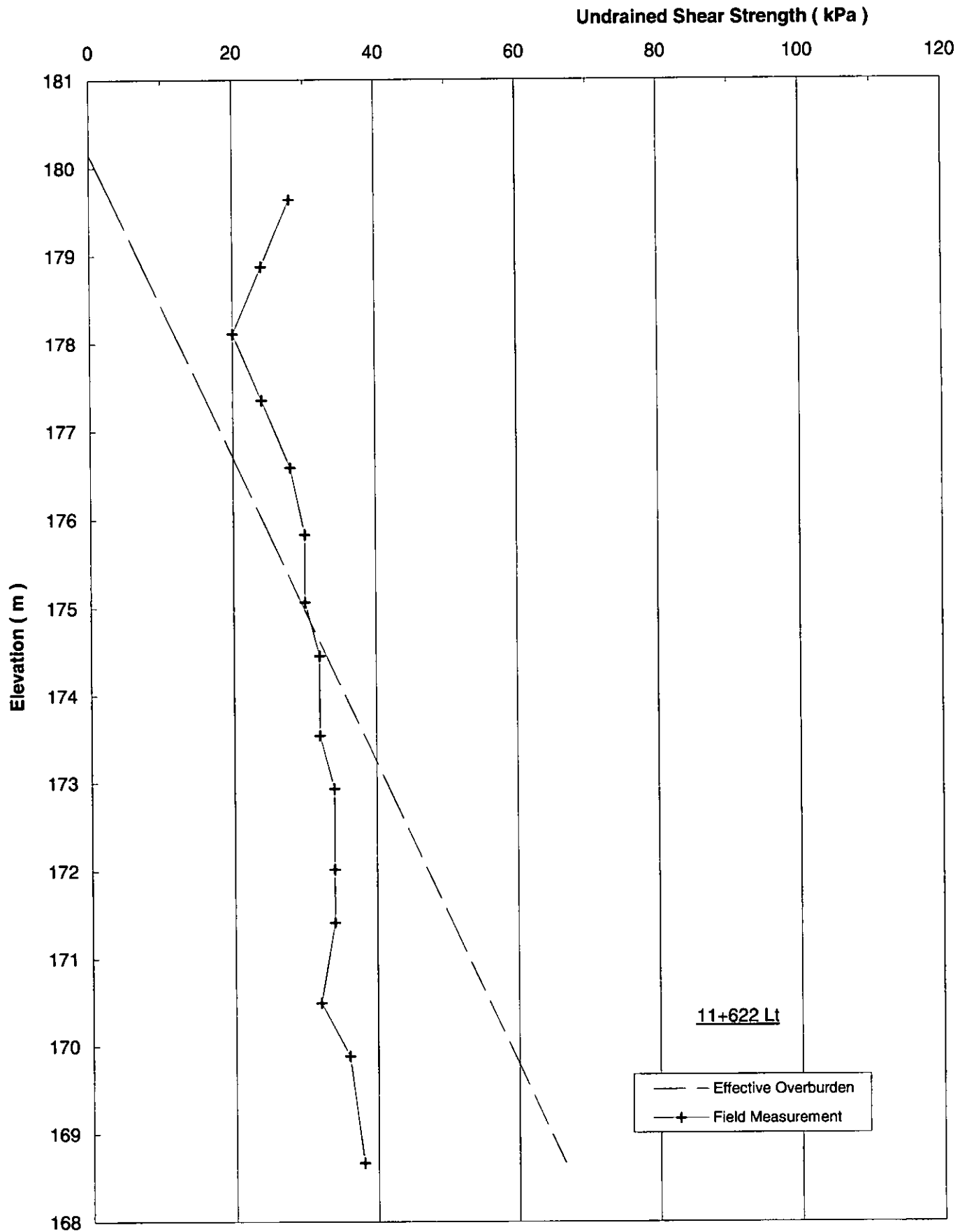


Fig. C4-3: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation
(Borehole 11+622 Lt)

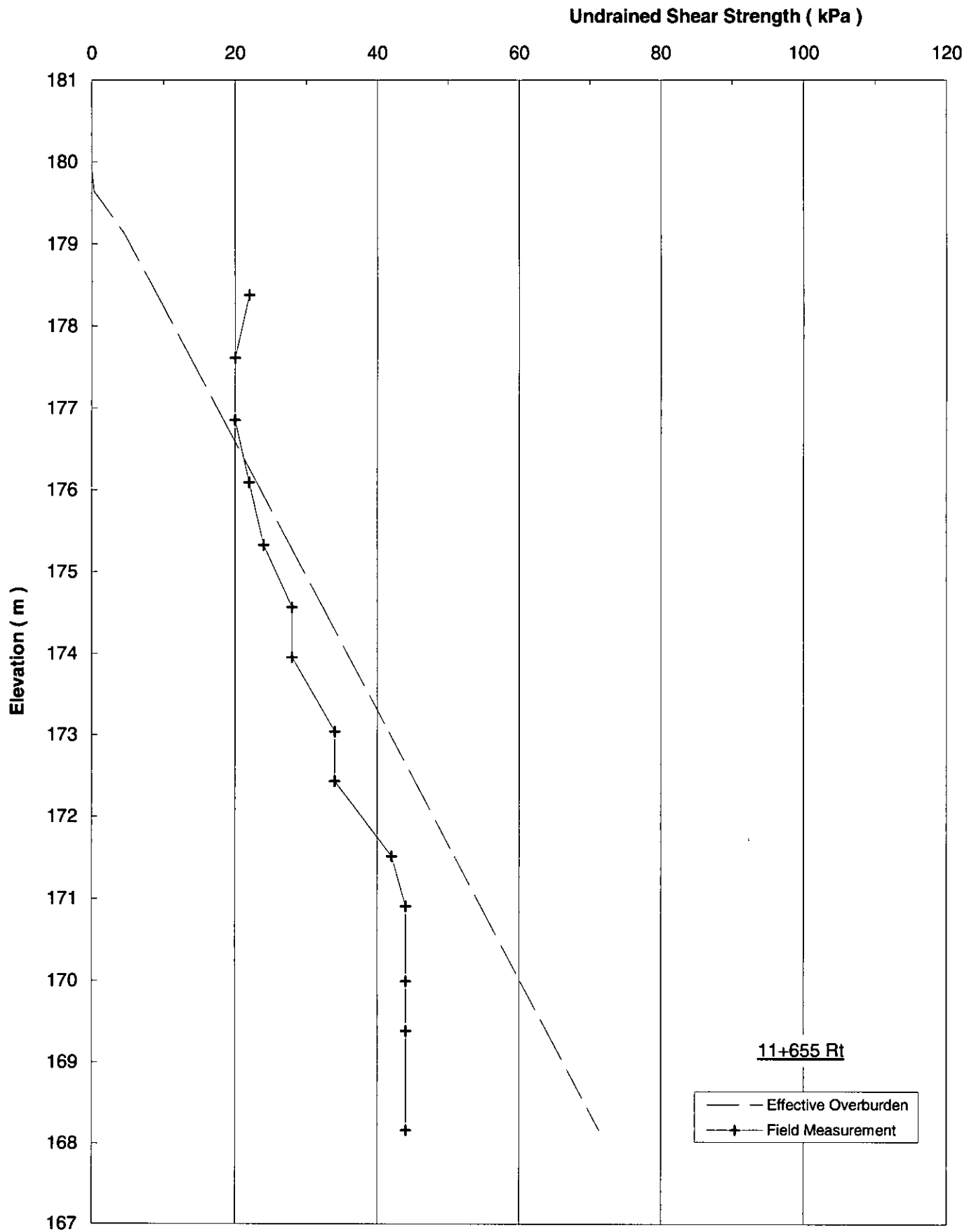


Fig. C4-4: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation
(Borehole 11+655 Rt)

4.5 SITE NO. 5 : HIGHWAY 17(NEW) SWAMP SECTION BETWEEN STATIONS 11+800 AND 13+400* AND SWAMP SECTION ALONG HIGHWAY 638

Site No. 5 is a low-lying area adjacent to and south of Site No. 4. The grade to the north of this section falls southerly from an elevation of 183 m at about Station 11+750 to about Elevation 178 m at Station 11+900 along the westbound lane (WBL) alignment. Further south, the grade is relatively level and drops to an elevation of about 177 m near Highway 638 at about Station 12+600. Further to the south, the grade gradually rises to about Elevation 180 m at about Station 13+250. Along the eastbound lane (EBL) alignment, the grade follows the similar pattern, except the grade to the north of this section falls southerly from an elevation of 180 m at about Station 11+730.

On Highway 17(New), a total of 89 boreholes was put down. The locations of the boreholes are shown in Drawing No. 3 while stratigraphic profiles along the EBL and WBL are presented in Drawings Nos. 5A, 5B, 5C and 5D.

Also part of this project is the realignment of existing Highway 638, in the vicinity of Station 12+950 (Highway 17). As shown in Drawing No. 3, the existing Highway 638 will be re-aligned to cross the new Highway 17 at Station 12+945. This assignment includes the geotechnical investigation for the proposed Highway 638 re-alignment up to the existing Pioneer Road. In this section, in addition to boreholes drilled on Highway 17(New), 21 boreholes were drilled, specifically for the proposed realignment. The locations of the boreholes (Boreholes PR1 to PR17, C1, C1-A, C1-B, 12+000 CL, 12+142 CL and 12+260 CL) along proposed Highway 638 are shown in Drawing No. 3, and the stratigraphic profiles along this section are presented in Drawing No. 5E and 5F.

In general, the boreholes drilled on Highway 17 show the presence of 0.1 to 1.7 m but generally 0.5 to 0.6 m thick peat layer. In some of the boreholes, the peat is followed by surficial sand and gravel, sand, silty sand, sandy silt or silt layers to a maximum depth of 4.4 m below the ground surface. These granular soils or peat are underlain by an extensive clay deposit which is considered very weak and sensitive. In some boreholes, the clay is underlain by sand and gravel, silty sand till, sand, silty sand, sandy silt, silt or clayey silt deposits at depths generally ranging from 1.7 to 14.4 m below the ground surface while others were terminated at depths of up to 16.2 m within the clay deposit, without encountering these lower granular soils. Towards the northern limits of the site, the granular deposits were generally found to be relatively coarser, while in the majority of the boreholes to the south of Station 12+690 these consist of a combination of mixture of sand and silt.

On Highway 638, Boreholes PR1, PR3 and PR4 encountered embankment fill consisting mainly of gravelly sand to silty sand extending to depths of 2.1 to 2.9 m, followed by

* For a list of boreholes put down in-between these stations, reference can be made to Appendix A5.

extensive clay deposit, with silt interbedding in Borehole PR3. Boreholes C1, C1-A, C1-B, PR5 to PR17, 12+000 CL, 12+142 CL and 12+260 CL, in general, contacted a 0.1 to 0.7 m thick peat or topsoil layer, underlain by surficial deposits of sandy silt to silty sand (except at Boreholes C1, C1-B, PR9 and PR10) extending to depths of 0.6 to 2.1 m below existing grades. Below the surficial deposits, these boreholes are also underlain by an extensive clay deposit. In some of the boreholes, the clay is interbedded with silt to sandy silt and silt and sand layers.

Details of the subsurface conditions encountered in the boreholes are given on the Record of Borehole Sheets in Appendix A5. The individual strata are briefly described in the following paragraphs.

The Records of Boreholes, previously drilled at the site by MTO and Golder Associates Ltd. in 1975 and 1995 respectively, are also included in Appendix A5.

4.5.1 SWAMP SECTION BETWEEN STATIONS 11+800 AND 13+400

4.5.1.1 PEAT

All the boreholes, except for Boreholes 12+747 Lt and 12+772 CL (which were drilled from the embankment of Highway 638) contacted peat or a peaty topsoil extending to depths ranging from 0.1 to 1.7 m, but generally 0.5 to 0.6 m.

It should however be pointed out that many of the boreholes were drilled when the ground was frozen and/or inundated, which rendered an accurate description of the soils within the upper 0.6 ± m rather difficult.

4.5.1.2 FILL

Boreholes 12+747 Lt and 12+772 CL were drilled from the existing Highway 638 embankment and therefore, contacted embankment fill. The fill at the borehole locations was found to consist of granular materials (i.e. sand and gravel) mixed with some organics. The depth of the fill at borehole locations was 2.1 m and extended to Elevations 176.6 and 176.3 m, respectively. Standard Penetration tests performed within the granular embankment fill yielded N-values ranging from 8 to 28 blows/0.3 m, indicating that the fill materials have received some systematic compaction when first placed.

4.5.1.3 SAND AND GRAVEL

Sand and gravel was encountered in the two most northerly boreholes (Boreholes 11+793 CL and 11+817 Lt) which were drilled from the relatively high ground surface immediately beyond the northern edge of the swampy area.

In both boreholes, the deposit was encountered immediately below a 0.5 to 0.7 m thick peat layer and extended to a depth of 3.6 to 3.7 m where auger refusal was encountered. Dynamic Cone Penetration tests performed from below the boreholes, however, the deposit appeared to extend to somewhat greater depths. In addition, in Borehole 11+793 CL, the deposit is interbedded with a 0.3 m thick soft to firm clay layer at 1.4 m below the ground surface.

The grain-size distribution of a sample from this granular deposit is given in Figure B5-1, in Appendix B5. These results indicate 38% gravel, 58% sand and 4% silt and clay-size particles.

Standard Penetration tests performed in the deposit gave N-values range from 43 to in excess of 60 blows/0.3 m, except for one low value of 4 blows/0.3 m immediately below the peat layer in Borehole 11+817 Lt. From this, the relative density of the deposit is considered generally dense to very dense with a very loose zone.

4.5.1.4 SURFICIAL SILTY SAND

Surficial silty sand to sandy silt layers were encountered immediately below the peat or peaty topsoil at one borehole near the north end of the site, in Borehole 11+817 Rt and in the boreholes drilled between Stations 12+985 and 13+187 towards the south end of the site.

In Borehole 11+817 Rt, drilled near the north end, the thickness of the deposit was found to be 0.6 m. While towards the south side, its thickness was found between 0.1 m and 1.3 m at boreholes drilled between Stations 12+985 and 13+114, increasing to between 1.7 m and 3.6 m between Stations 13+140 and 13+187 (further south).

The grain-size distribution of four samples from this fine-grained granular deposit is given in Figure B5-2, in Appendix B5.

These indicate:

Sand	=	42 – 69 %
Silt	=	29 – 56 %

Clay = 2 – 6 %

N-values recorded in this material ranged from zero (i.e. hammer sank under its own weight plus the weight of the rods) to 6 blows/0.3 m. Based on these values and recorded penetration values with a 22.7 kg (50-lb) hammer freely dropping 0.61 m, the relative density of the soil is described as very loose to compact.

4.5.1.5 FINE SAND

The surficial silty sand to sandy silt deposit described in the preceding Section 4.5.1.4, attains a somewhat coarser texture (i.e. becomes fine sand) beyond (south) of Station 13+190. The fine sand was contacted in all the boreholes drilled between Stations 13+191 and 13+307 and extended immediately below the 0.15 to 0.3 m thick peaty topsoil or peat to depths ranging from 2.9 and 4.4 m below the ground surface.

The grain-size distribution of eight samples from the deposit is given in an envelope form in Figure B5-3, in Appendix B5. The results indicate the following particle size distribution:

Fine Sand	=	76 – 95 %	
Silt	=	4 – 21 %	(generally 5-10 %)
Clay	=	1 – 3 %	(generally 1 %)

Standard Penetration tests recorded in this basically granular soil in Borehole 13+279 Lt yielded N-values ranging from 1 to 6 blows/0.3 m. From these results together with modified penetration tests carried out using a 22.7 kg hammer freely dropping 0.61 m (instead of 63.6 kg hammer freely dropping 0.76 m), the relative density of the deposit is considered to be generally very loose to loose with some compact zones.

4.5.1.6 CLAY

Underlying the surficial peat layer or peaty topsoil and the upper (surficial) silty sand and fine sand deposits, all the boreholes, except for Boreholes 11+793 CL and 11+817 Lt (drilled at the north end of the site), encountered a major deposit of clay at depths ranging from 0.15 to 4.4 m below the ground surface.

To the north of Station 12+680, most of the boreholes, where clay was encountered, extend to the full depth of exploration (i.e. about 6 to 16 m below the ground surface) while Dynamic Cone Penetration tests (DCPT) show probable greater depths. In this stretch

(i.e. between Stations 11+840 and 12+680), in Boreholes 11+863 Lt and 11+917 Lt, the clay was found to extend to 4.6 m (El. 174.1 m) and 4.9 m (El. 173.5 m), respectively, where it is underlain by a coarse glacial till-like deposit. These depths are likely to represent the full depth of the clay at these two locations. In Borehole 12+220 CL, the clay is underlain by sand deposit at 14.4 m (El. 163.4 m). It is, however, unlikely that this represents the full depth of clay at this location rather it is likely that there are sand layers within a deeper clay. It should be pointed out that at both locations artesian conditions were recorded emanating from the sand layers.

Further south from about Station 12+680, the clay is interbedded with frequent silt layers, as shown on the profiles presented on Drawings 5A and 5B, and in the area where Borehole C2 (at Station 13+069) was extended to 31.0 m (El. 147.3 m). A DCPT put down below the bottom of the borehole indicates that the clay probably extends to about 44 m (El. 134 m). A DCPT carried out nearby at Station 13+068 also show a very similar trend.

In general, the clay is a highly plastic (fat) material with some medium and occasional low plasticity (lean) clay structure zones/layers. The presence of occasional clayey silt and silt seams was also noted, especially in the areas south of Highway 638. The grain-size distribution of 25 samples from across the site is given in an envelope form in Figure B5-4, in Appendix B5. This shows the percentage of clay-size particles is extremely high (i.e. generally 60 to 90 %).

From the grain-size distribution curves, the clay can be expected to be practically impervious material. The deposit is classified as a cohesive soil. Figure B5-5, in Appendix B5, shows the grain-size distribution of samples from less plastic zones with silty clay and clayey silt zones. These show lower clay-size particle content, ranging from 19 to 48 %. It is of interest to note that all, except for one of these samples, are from the southern part of the site.

Index properties of 53 samples from the northern half of the site (i.e. from Station 11+840 to 12+680) were determined in the laboratory and these indicate the following results,

Liquid Limit :	33 – 93 %
Plastic Limit :	18 – 31 %
Plasticity Index :	14 – 62 %

As shown in Figure B5-6, Appendix B5, these results are characteristic of clays of high to medium plasticity. The index values of samples from boreholes drilled along the southern part of the site are as follow:

Liquid Limit :	29 – 92 %
Plastic Limit :	15 – 31 %

Plasticity Index : 12 – 62 %

These results, summarized in Figure B5-7 (Appendix B5), indicate an overall somewhat less plastic clays in the southern zones, overall, in comparison with the northern zone.

The results of 8 consolidation (oedometer) tests performed on samples from the deposit are presented in Figure B5-8 to B5-15, Appendix B5. The test results show the probable pre-consolidation pressure (P_c) ranged from 18 to 210 kPa, which are about 7 to 102 kPa, in excess of the existing effective overburden pressure.

N-values generally ranging from 0 to 10 blows/0.3 m were recorded in this deposit. In most cases, however, the recorded values were 0 to 2 blows/0.3 m. Undrained in-situ shear strengths as measured by Field Vane tests ranged from 4 to 84 kPa. These values indicate that the consistency of the material can be described as very soft to stiff, but generally very soft to firm. Sensitivity values generally between 4 and 8 were measured in the clay indicating sensitive material with extra-sensitive pockets. A combined plot of all the in-situ vane test results from all the boreholes is presented in Figure C5-1, in Appendix C5.

For analysis purposes, the measured undrained shear strength values have been combined in these zones and replotted as Figures C5-2, 3 and 4. Figure C5-2 shows the undrained shear strength values measured in boreholes drilled between Stations 11+840 and 12+540 while Figure C5-3 shows values collected from boreholes drilled between Stations 12+540 and 13+000. Figure C5-4 presents values south of Station 13+000. It is of interest to note that relatively lower undrained shear strengths were obtained in the 'middle' zone between Stations 12+540 and 13+000. Also in Figure C5-3, it should be pointed out that the measured undrained shear strength of the clay under the existing Highway 638 embankment is relatively higher than the undrained shear strength measured outside of the embankment, in the same area.

4.5.1.7 SILT

To the south of Station 12+700, the boreholes encountered where silt to sandy silt layers, which are interbedded within the clay deposit at depths between 1.7 and 7.5 m below existing grades. These deposits extend to the full depth of exploration (i.e. between 5.8 and 6.6 m below the ground surface) between Stations 12+855 and 13+191, except in Boreholes 12+855 Lt, 12+887 CL, 12+900 Lt, 13+069 CL, 13+072 Rt, 13+072 Lt and 13+165 Lt. In Boreholes 12+391 Rt, 12+440 Lt, 12+543 Rt and 12+583 Rt, the silt to sandy silt layers were encountered below the peat and these extend to depths of 0.7 to 2.1 m below ground surface. The thickness of this deposit ranged from 0.4 to about 10.4 m. In Borehole 13+279 Lt, a lower silt to sandy silt deposit was encountered at a depth 10.1 m

below the ground surface (El. 169.9 m) and extends to the full depth of exploration, i.e. 16.0 m below the ground surface (El. 164.0 m).

Measured N-values recorded in this material ranged from zero (i.e. hammer sank under its own weight plus the weight of the rods) to 28 blows/0.3 m. Based on these values and recorded penetration values with a 22.7 kg (50-lb) hammer freely dropping 0.61 m, the relative density of the soil is described as very loose to compact.

The grain-size distribution of 22 samples from this granular deposit is given in Figure B5-16, in Appendix B5.

These indicate:

Sand	=	3 – 32 %
Silt	=	51 – 85 %
Clay	=	1 – 17 %

The silt to sandy silt are generally cohesionless deposits but in some of the boreholes, these contain traces to some clay which make the deposit cohesive.

Cohesive silt deposits were found in Boreholes 13+072 Rt and Lt, 13+165 CL and 13+279 Lt. Undrained in-situ shear strengths as measured by Field Vane tests ranged from 22 to 46 kPa. Standard Penetration tests performed in the deposit yielded N-values of 1 to 12 blows/0.3 m. Based on these values together with the measured undrained shear strengths, the consistency of the material is described as soft to stiff.

4.5.1.8 SILTY SAND some gravel (Probable Till)

Underlying the clay, a deposit of silty sand with some gravel was contacted in Boreholes 11+863 Lt and 11+917 Lt at depths of 4.6 and 4.9 m, respectively, below the ground surface, and this extends to the remaining depth of the boreholes.

The deposit consists of a heterogeneous mixture of sand and silt with traces to some gravel and trace of clay. The grain-size distribution of a sample from the deposit is given in Figure B5-17, in Appendix B5.

These indicate:

Gravel	=	16 %
Sand	=	50 – 53 %
Silt	=	26 – 28 %
Clay	=	5 – 6 %

Based on the grain-size curves (well-graded) and texture of the soil, this material can be described as probable till.

The recorded N-values in the deposit ranged from 15 to in excess of 60 blows/0.3 m, indicating a compact to very dense material.

4.5.1.9 GROUNDWATER CONDITIONS

The area is generally low lying and poorly drained, consequently, the groundwater can generally be expected at the ground surface level. Groundwater levels in four piezometers, installed across the site, were measured at depths ranging from 0.0 to 0.3 m below the ground surface or between Elevations 177.6 and 176.9 m.

Based on these values, observations made in the boreholes while drilling, water contents of the samples and the site conditions during our field work, it is our opinion that the groundwater level at the site was at or very close to the ground surface.

In addition to this, artesian conditions were recorded in Boreholes 11+920 Rt, 12+064 Rt and 12+220 CL. The artesian water level was recorded at 1.2 to 1.7 m above the ground level (Elevations 179.0 to 179.8 m).

It should be pointed out that both surface and groundwater levels can be expected to fluctuate seasonally and in response to major weather events.

4.5.2 SWAMP SECTION ALONG HIGHWAY 638

4.5.2.1 PEAT

All the boreholes, except for Boreholes PR1, PR3 and PR4 (which were drilled from the existing embankment of Highway 638) contacted peat or a peaty topsoil extending to depths ranging from 0.1 to 0.7 m, but generally 0.3 to 0.6 m.

It should however be pointed out that many of the boreholes were drilled when the ground was frozen and/or inundated, which rendered an accurate description of the soils within the upper 0.6 ± m rather difficult.

4.5.2.2 EMBANKMENT FILL

Boreholes PR1, PR3 and PR4 were drilled from the existing Highway 638 embankment and therefore, contacted embankment fill. The fill at the borehole locations was found to consist of granular materials (i.e. silty sand to gravely sand). The depth of the fill at the borehole locations ranged between 2.1 and 2.9 m and extended to between Elevations 175.4 and 175.5 m.

Grain-size distribution tests were performed on samples recovered from these granular deposits and the results are presented in Figure B5-18, Appendix B5. These results indicate 6 to 27% gravel, 54 to 64% sand, 17 to 27% silt and 2 to 3% clay-size particles.

Standard Penetration tests performed within the granular embankment fill yielded N-values ranging from 18 to 38 blows/0.3 m, indicating that the fill materials have received some systematic compaction when first placed.

4.5.2.3 SURFICIAL SILTY SAND TO SANDY SILT

Surficial silty sand layers were encountered immediately below the peat or peaty topsoil in Boreholes PR11, PR12, PR13, PR14, PR17, 12+142 CL and 12+260 CL drilled on the east side of proposed Highway 17 (New) and these layers were found to extend to depths of 0.7 to 2.1 m below existing grade. Boreholes PR5, PR6, PR7, C1-A and 12+000 CL contacted 0.3 to 1.4 m thick surficial sandy silt below the peat and peaty topsoil; this sandy silt extended to depths of 0.6 to 2.1 m below existing grade.

The grain-size distribution of 3 samples from the sandy silt is given in Figure B5-19, in Appendix B5. The results indicate the following particle size distribution:

Gravel	=	3 %
Sand	=	25 – 45 %
Silt	=	51 – 66 %
Clay	=	4 – 12 %

N-values recorded in the surficial silty sand to sandy silt layers ranged from 3 to 21 blows/0.3 m, indicating very loose to compact relative density.

4.5.2.4 CLAY

Underlying the embankment fill, peat/peaty topsoil layer and/or the surficial granular deposits, all boreholes encountered a major clay deposit which was contacted at depths ranging from 0.4 to 2.9 m below the ground surface.

At most locations, the clay is a material with medium to high plasticity (fat) clay. In general, it has a reddish grey to grey colour. The grain-size distribution of 5 samples from various boreholes drilled along this stretch is given in an envelope format in Figure B5-20 of Appendix B5. The following grain-size distribution is indicated.

Sand	=	0 – 7 %
Silt	=	58 – 80 %
Clay	=	20 – 37 %

From the grain-size distribution curves, the deposit can be expected to be practically impervious. The deposit is classified as a cohesive soil. Index properties of 15 samples were determined in the laboratory and the tests performed gave the following results (as shown in Figure B5-21, Appendix B5).

Liquid Limit :	43 – 93 %
Plastic Limit :	18 – 30 %
Plasticity Index :	22 – 64 %

These results are characteristic of medium to high plasticity clay. The measured natural moisture contents of samples from the deposit ranges from 12 to 119 %. The Liquidity Indices range from 1.1 to 3.5. Generally such results are characteristic of normally consolidated, highly compressible weak clays, while other criteria indicate some pre-consolidation, as discussed below.

The results of 2 consolidation (oedometer) tests performed on samples from the deposit are presented in Figure B5-22 to B5-23, Appendix B5. The test results show the probable pre-consolidation pressure (P_c) ranged from 28 to 35 kPa, which is about 4 to 23 kPa, in excess of the existing effective overburden pressure.

N-values generally ranging from 0 (i.e., sampler sunk under the static weight of the sampler and the drill rods) to 21 blows/0.3 m were recorded in this deposit. In most cases, however, the recorded values were 0 to 2 blows/0.3 m. Undrained in-situ shear strengths as measured by Field Vane tests ranged from 5 to 86 kPa. These values indicate that the consistency of the material can be described as very soft to stiff, but generally very soft to firm. A combined plot of all the in-situ vane test results from all the boreholes is presented in

Figure C5-5 of Appendix C5. Figure C5-6 in Appendix C5 shows the results of a typical borehole with regards to undrained shear strength versus depth (Borehole PR9).

4.5.2.5 SILT

In Boreholes PR3, C1, C1-A, C1-B, PR9 and PR10, a layer of silt to sandy silt was contacted interbedded within the clay deposit at depths ranging from 4.9 to 10.9 m, and extending to depths of 13.1 to 15.4 m, below the ground surface.

Measured N-values recorded in this material ranged from zero (i.e. sampler sank under its own weight plus the weight of the rods) to 30 blows/0.3 m. Based on these values, the relative density of the soil is described as very loose to compact.

The grain-size distribution of 10 samples from this granular deposit is given in Figure B5-24, in Appendix B5.

These indicate:

Sand	=	1 – 40 %
Silt	=	57 – 88 %
Clay	=	0 – 22 %

The silt to sandy silts are generally cohesionless deposits but in some of the boreholes, these contain traces to some clay which make the deposit cohesive (see Figure B5-25).

Cohesive silt deposits were found in Boreholes PR3, C1, C1-A and C1-B. Undrained in-situ shear strengths as measured by Field Vane tests ranged from 15 to 25 kPa. Standard Penetration tests performed in the deposit yielded N-values of 0 to 5 blows/0.3 m. Based on these values together with the measured undrained shear strengths, the consistency of the material is described as soft.

4.5.2.6 SILT AND SAND

In Boreholes PR11, PR12 and C1-B, a layer of silt and sand was also encountered interbedded within the clay deposit at depths ranging from 2.9 to 4.4 m in Boreholes PR11 and PR12, and at a depth of 14.0 m in Boreholes C1-B. The thickness of this layer is about 0.8 m in Borehole PR11, at least 1.4 m in Borehole PR12, and 1.5 m in Borehole C1-B.

Grain-size distribution of two samples from this granular deposit is given in Figure B5-26, in Appendix B5.

These show:

Sand	=	41 to 48 %
Silt	=	50 to 54 %
Clay	=	2 to 5 %

Measured N-values recorded in this material ranged from 2 to 12 blows/0.3 m. Based on these values, the relative density of the soil is described as very loose to compact.

4.5.2.7 SILTY SAND TILL

Underlying the clay in Borehole 12+260 CL, a glacial till deposit was contacted at a depth of 9.4 m or Elevation 169.7 m. The till was penetrated for a vertical distance of 0.5 m where the boreholes were terminated.

Based on this and visual and tactile examination of the soil samples, the deposit is described as silty sand till, which consists of a heterogeneous, unsorted mixture of sand and silt with some gravel and clay. It is described as a granular material.

Standard Penetration tests performed in this deposit yielded N-values ranging from 51 to in excess of 60 blows/0.3 m, indicating a very dense condition.

4.5.2.8 GROUNDWATER CONDITIONS

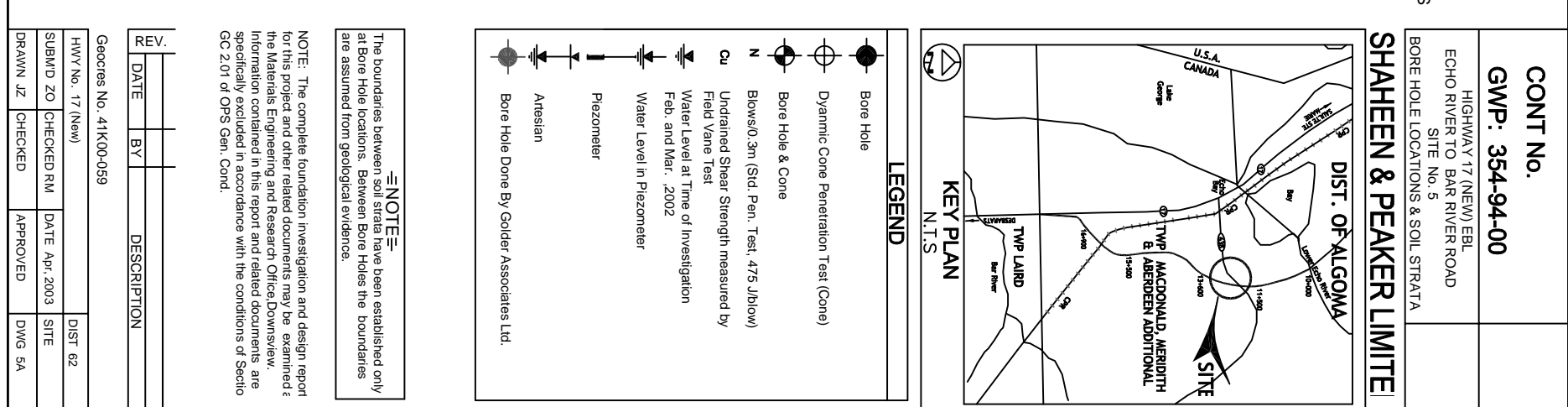
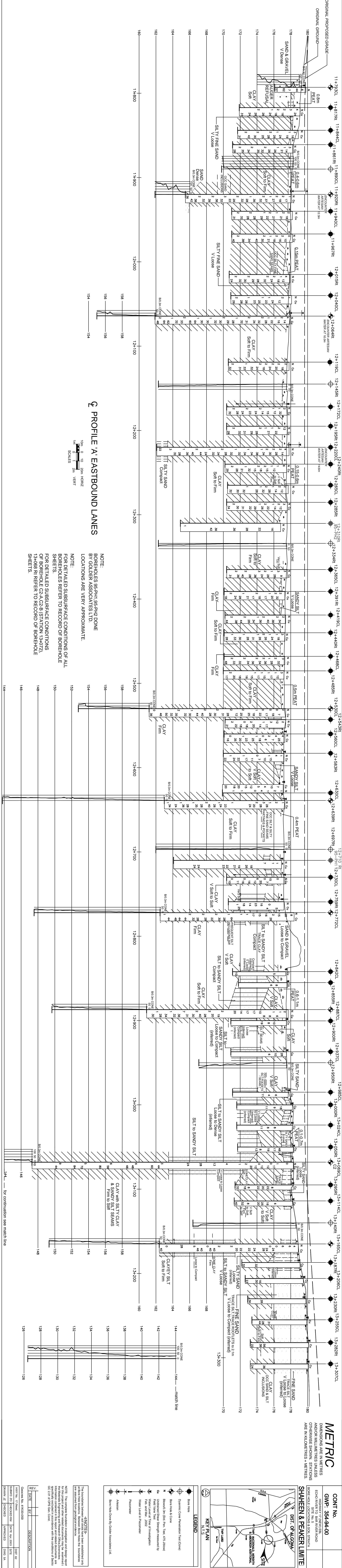
Similar to Highway 17, the area is generally low lying and poorly drained, consequently, the groundwater can generally be expected at the ground surface level.

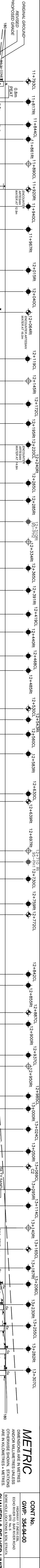
Based on observations made in the boreholes while drilling, water contents of the samples and the site conditions during our field work, at the time of the investigation, the groundwater level at the site was at or very close to the ground surface.

In addition to this, artesian conditions could be present as was encountered in at least three of the boreholes in this swamp area in boreholes drilled along Highway 17 (New) alignment.

It should be pointed out that both surface and groundwater levels can be expected to fluctuate seasonally and in response to major weather events.

Drawings

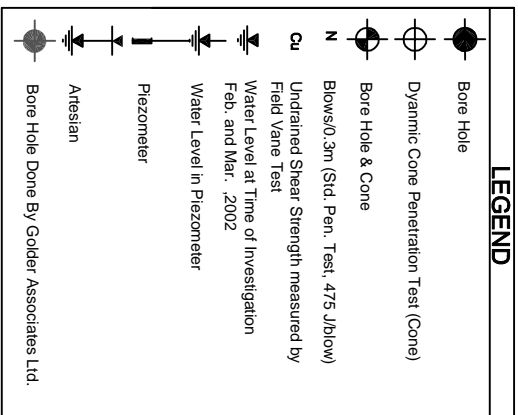
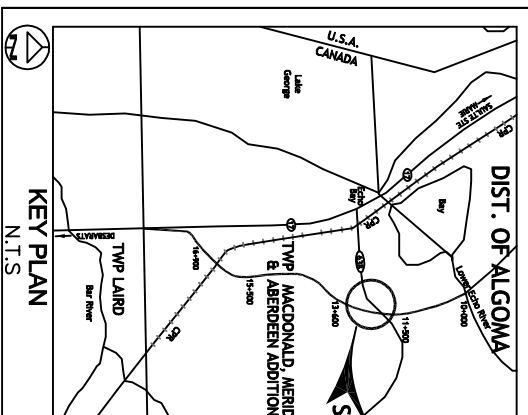




METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOWETRES + METRES

CONT NO. _____
GWP: 354-94-00
HIGHWAY 17 (NEW) RR
ECHO RIVER TO BAR RIVER ROAD
SITE NO. 5
BORE HOLE LOCATIONS & SOIL STRATA

SHAHEEN & PEAKER LIMITE



NOTE: The borehole locations shown on this plan are established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete duration investigation and design report for this project and other related documents may be examined by the public at the project file. The information contained in this report and related documents are the property of SHAHEEN & PEAKER LIMITE and are not to be used for any other purpose without the written consent of SHAHEEN & PEAKER LIMITE.

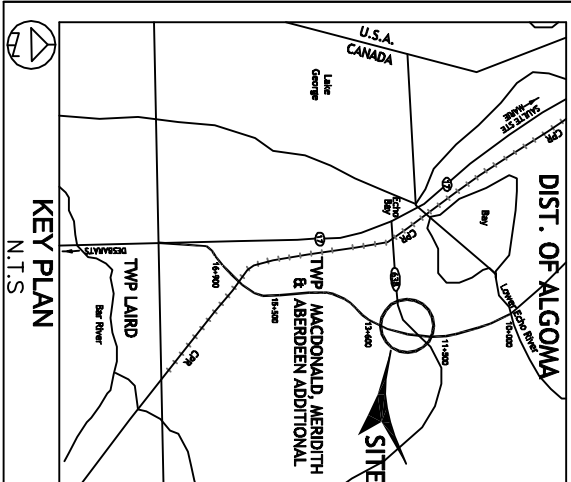
REV	DATE	BY	DESCRIPTION
1	2003	MM	DATE: APR 2003 SITE
2	2003	MM	DATE: APR 2003 SITE
3	2003	MM	DATE: APR 2003 SITE









Geotecs No. 41000-059
Hwy No. 17 (New)
SIBARD 20 CHECKED MM
DATE: APR 2003 SITE
DRAWN: JZ
CHECKED: APPROVED: DMS SC

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

HIGHWAY 638
ECHO RIVER TO BAR RIVER ROAD
BORE HOLE LOCATIONS & SOIL STRATA

SHAHEEN & PEAKER LIMITED



LEGEND	
	Bore Hole
	Dynamic Cone Penetration Test (Cone)
	Bore Hole & Cone
	Blows/0.3m (Std. Pen. Test, 475 J/blow)
	Undrained Shear Strength measured by Field Vane Test
	Water Level at Time of Investigation
	Water Level in Piezometer
	Piezometer

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 Materials Engineering and Research Office/Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

Geocres No.					
HWY No. 638					DIST 02
SUBRD NO	CHECKED RM	DATE May, 2003	SITE		
DRAWN JZ	CHECKED	APPROVED	DWG SE		

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

**HIGHWAY 638
ECHO RIVER TO BAR RIVER ROAD
BORE HOLE LOCATIONS & SOIL STRATA**

SHAHEEN & PEAKERL



LEGEND

○ Cone	Penetration Test (Cone)
△ Cone	Penetration Test (Cone)
□ (Std. Pen. Test, 475 J/blow)	Penetration Test (Cone)
■ Shear Strength measured by	Penetration Test (Cone)
○ at Time of Investigation	Penetration Test (Cone)
△ and Jul. 2002	Penetration Test (Cone)
□ in Piezometer	Penetration Test (Cone)

soil strata have been established only between Bore Holes the boundaries are not clear. Geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section 2C.2.01 of OPS Gen. Cond.

REV.					
DATE	BY	DESCRIPTION			
Geocries No.					
HWY No. 638				DIST 62	
SUBMID ZO	CHECKED RM	DATE May, 2003		SITE	
BRAWN JZ	CHECKED	APPROVED		DWG 5F	

Appendix A5

Record of Boreholes

List of boreholes put down in-between Stations 11+800 and 13+400

11+793 CL	12+630 CL
11+817 (15m) Lt	12+637 (20m) Lt
11+817 (15m) Rt	12+639 (19m) Rt
11+844 CL	12+697 (25m) Rt
11+861 (15m) Rt	12+699 (20m) Lt
11+863 (16m) Lt	12+730 CL
11+890 CL	12+747 (20m) Lt
11+917 (17m) Lt	12+759 (20m) Rt
11+920 (11m) Rt	12+772 CL
11+940 CL	12+794 (12m) Lt
11+965 (16m) Lt	12+842 CL
11+967 (14m) Rt	12+855 (20m) Lt
12+015 (18m) Rt	12+855 (20m) Rt
12+016 (17m) Lt	12+887 CL
12+040 CL	12+900 (20m) Lt
12+064 (18m) Lt	12+900 (20m) Rt
12+064 (20m) Rt	12+937 CL
12+119 CL	12+950 (20m) Lt
12+145 (20m) Rt	12+950 (20m) Rt
12+146 (32m) Lt	12+985 CL
12+172 CL	13+000 (20m) Rt
12+195 (20m) Lt	13+018 (15m) Lt
12+195 (20m) Rt	13+024 CL
12+220 CL	13+050 (20m) Lt
12+240 (20m) Rt	13+050 (20m) Rt
12+244 (17m) Lt	13+068 (2m) Rt
12+265 CL	C2
12+285 (20m) Rt	C2-A
12+287 (19m) Lt	C2-B
12+334 (18m) Rt	13+085 (22m) Lt
12+340 (20m) Lt	13+095 (20m) Rt
12+365 CL	13+114 CL
12+391 (20m) Rt	13+140 (20m) Lt
12+393 (20m) Lt	13+140 (20m) Rt
12+419 CL	13+165 CL
12+440 (23m) Lt	13+187 (16m) Rt
12+440 (20m) Rt	13+191 (22m) Lt
12+468 CL	13+206 CL
12+485 (20m) Lt	13+227 (22m) Lt
12+485 (20m) Rt	13+230 (20m) Rt
12+530 CL	13+255 CL
12+543 (19m) Rt	13+279 (19m) Lt
12+560 CL	13+282 (19m) Rt
12+583 (20m) Rt	13+307 CL
12+585 (20m) Lt	

SPT1055

RECORD OF BOREHOLE No 11+793 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 445.8; E 301 550.2 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
 DATUM Geodetic DATE 3/24/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
179.8 0.0	Ground Surface											
179.3 0.5	PEAT some decayed wood pieces dark brown to black, soft to firm		1	SS	6 **							**frozen to 0.3 m.
178.4 1.4	SAND and GRAVEL (possible till), dense, grey, wet		2	SS	44							
178.1 1.7	CLAY trace sand, occasional black sand pockets, reddish grey, soft to firm		3	SS	7							
	SAND and GRAVEL (possible till), very dense, grey, wet		4	SS	62							38 58 (4)
178.1 3.7	End of borehole. Auger refusal, probably on a boulder or bedrock. Borehole moved to N 5 150 444.7; E 301 550.1. Auger refusal again at 1.4 m		5	SS	57							
End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test performed from 1.4 m to 6.1 m at N 5 150 444.7; E 301 550.1. Soil Stratigraphy inferred Borehole advanced 0.4 m right of median centre line. * Water level at 0.3 m (not stabilized) and hole open to 1.2 m on completion												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+817; 15 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 420.0; E 301 562.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T. COMPILED BY G.T.
DATUM Geodetic DATE 3/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100					
180.2	Ground Surface														
0.0	PEAT some decayed wood pieces, dark brown to black, wet, very soft		1	SS	1		180							517	
179.6															
0.6	very loose dense to very dense		2	SS	4		179								
	SAND and GRAVEL trace of clay to 2.1 m, (possible till) grey, wet		3	SS	43		178								
			4	SS	80/8		177								
			5	SS	82		176								
176.8	End of borehole. Auger refusal probably on a boulder or bedrock. Borehole moved to N 5 150 419.7; E 301 563.5. Auger refusal again at 2.6 m						175								
3.8	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test (D.C.P.T.) performed from 3.0 m to 5.5 m at N 5 150 419.7; E 301 563.5 after encountering auger refusal at 2.6 m. * Water level at 0.3 m (not stabilized) and hole open to 0.9 m on completion														

SPT1055

RECORD OF BOREHOLE No 11+817; 15 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 423.4; E 301 532.2 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
179.1	Ground Surface						179					
0.0	PEAT some decayed wood pieces dark brown to black, very soft to soft		1	SS	4	**	179					**frozen to 0.3 m.
178.3												
0.8	SILTY FINE SAND decayed wood pieces, very loose, reddish/grey, wet		2	SS	3		178					
177.7												
1.4			3	SS	2		177					
	CLAY reddish/grey, soft		4	SS	2		177					
			5	SS	1		176					
			6	SS	2		175					
							174					
			7	TW	PH		173					
171.9	End of borehole						172					
7.2	* Water level at 5.9 m (not stabilized) and hole open to 6.1 m on completion											

SPT1055

RECORD OF BOREHOLE No 11+844 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 394.6; E 301 544.6 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/22/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20 40 60 80 100				
178.9	Ground Surface											
0.0	PEAT some decayed wood pieces dark brown to black, very soft to soft		1	SS	3						483	**frozen to 0.3 m
178.2												
0.7			2	SS	1		178					
			3	TW	PH		177				482	0 0 16 84
	silt and silty clay pockets and seams		4	SS	1		176					
			5	SS	2		175					***non-plastic silt seam
	CLAY reddish / grey, rootlets to 2.1 m, soft to firm						174					
			6	SS	2		173					
			7	SS	2		172				482	
171.7												
7.2	End of borehole Borehole advanced 0.5 m left of median centre line. * Wet cave at 5.8 m on completion.											

+ 3, × 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+861; 15 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 379.4; E 301 527.0 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/21/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE	WATER CONTENT (%)					
178.3	Ground Surface													
0.0	PEAT some decayed wood pieces, dark brown to black, wet, very soft		1	SS	3									
177.7	0.1 m thick wet silty fine sand seam		2	SS	1									
0.6	CLAY trace rootlets, trace organics to 4.0 m, reddish /grey, soft to firm		3	SS	1									
			4	TW	PH									
			5	SS	2									
			6	SS	2									
			7	SS	2									
171.1	End of borehole													
7.2	* Wet cave at 5.8 m on completion.													

SPT1055

RECORD OF BOREHOLE No 11+863; 16 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 373.7; E 301 557.6 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/22/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p — w — w _L		
							20 40 60 80 100				20 40 60	GR SA SI CL			
178.7	Ground Surface														
0.0	PEAT		1	SS	4	**	178					87	**frozen to 0.4 m.		
178.1	some decayed wood pieces dark brown to black, soft		2	SS	1		178					101			
0.6	0.1 m thick grey wet sandy silt seam		3	SS	2		177								
	CLAY reddish /grey, soft to firm		4	SS	3		176								
		5	SS	2	175										
174.1		SILTY SAND some GRAVEL trace clay (probable till) dense to compact, grey, wet		6	SS	37	174					16 50 28 6			
4.6	7		SS	15	173										
172.1	8		SS	18											
6.6	End of borehole														
	* Water level at 3.0 m (not stabilized) and hole open to 3.7 m on completion														

+ 3, x 3; Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+890 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 349.1; E 301 538.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/21/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
178.3 0.0	Ground Surface													
							178							
							177							
							176							
							175							
							174							
							173							
							172							
							171							
169.8 8.5	End of Dynamic Cone Penetration Test. Dynamic Cone Penetration Test (D.C.P.T.) performed from 0 to 8.5 m						170							

RECORD OF BOREHOLE No 11+917; 17 m Lt 1 OF 1 METRIC

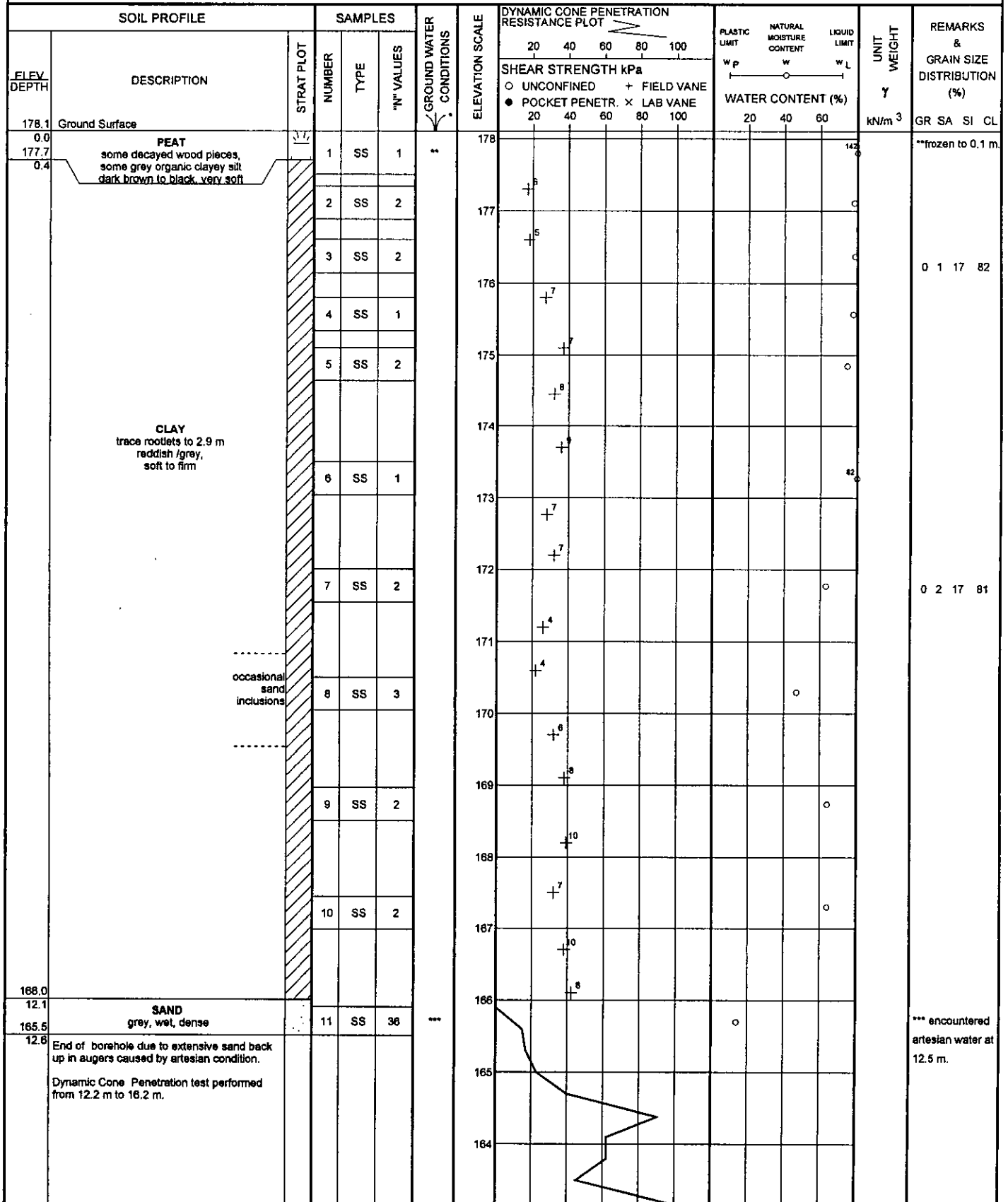
GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 320.0; E 301 551.8 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR.						× LAB VANE	W _p	W
178.4	Ground Surface						20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL		
0.0	PEAT		1	SS	2													
177.9	some decayed wood pieces		2	SS	2													
0.5	dark brown to black, wet, soft																	
	very soft		3	SS	1													
	soft to firm		4	SS	2													
	CLAY		5	SS	1													
	trace rootlets to 4.0 m, reddish / grey,																	
	frequent silty sand inclusions and pockets		6	SS	2													
173.5	SILTY SAND some GRAVEL																	
4.9	(probable till) some clayey silt																	
	very dense																	
	moist to wet																	
	grey																	
172.2	frequent cobbles.																	
6.2	End of borehole.																	
	* Water level at 5.5 m (not stabilized) and hole open to 6.1 m on completion.																	

SPT1055

RECORD OF BOREHOLE No 11+920; 11 m Rt 1 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 321.0 E 301 523.4 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/29/2002 CHECKED BY R.A.



Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+920; 11 m Rt 2 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 321.0 E 301 523.4 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/29/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
163.1 15.0							20 40 60 80 100						
161.9 16.2	End of Dynamic Cone Penetration Test * Water level at 1.7 m above ground surface (under artesian pressure) and hole open to 10.7 m on completion.						20 40 60 80 100						

SPT1055

RECORD OF BOREHOLE No 11+940 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 299.5; E 301 531.9 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)					
								○ UNCONFINED	+ FIELD VANE											
								● POCKET PENETR.	× LAB VANE											
							20	40	60	80	100	20	40	60		GR	SA	SI	CL	
178.2	Ground Surface																			
0.0	PEAT						178													
177.8	dark brown to black, wet, very soft		1	SS	2															
0.4	0.2 m thick, grey, wet sandy silt seam																			
	CLAY																			
	rootlets to 2.9 m, soft to firm		2	SS	2		177													
			3	SS	1															
			4	SS	2		176													
			5	SS	1		175													
	occasional silty fine sand pockets																			
			6	SS	2		174													
							173													
			7	SS	2		172													
171.0	End of borehole.						171													
7.2	* Water level at 5.9 m (not stabilized) and hole open to 6.1 m on completion																			

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+965; 16 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N N 5 150 273.0; E 301 545.0 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
178.4	Ground Surface											
0.0	PEAT		1	SS	2		178				181	
177.8	some decayed wood pieces, dark brown to black, wet, very soft		2	SS	2		177				83	
0.6	0.1 m thick, gray, wet sandy silt seam		3	SS	1		176				81	
	CLAY		4	SS	2		175				147	
	reddish/ gray trace rootlets to 2.1 m, soft to firm		5	SS	2		174					
			6	SS	2		173					
			7	TW	PH		172					
171.2	End of borehole.											
7.2	* Wet cave at 3.0 m on completion.											

Continued Next Page

+ 3 . x 3 : Numbers refer to
Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 11+967; 14 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 274.6; E 301 514.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/20/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	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	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE		WATER CONTENT (%) w _p w w _L			
178.2	Ground Surface						20 40 60 80 100	20 40 60					
0.0	PEAT some decayed wood pieces, dark brown to black, wet, very soft		1	SS	0								
177.6	0.1 m thick, grey, wet sandy silt seam		2	SS	2								
0.6	CLAY trace rootlets to 2.9 m, reddish/grey, soft to firm		3	SS	2								
			4	SS	1								
			5	SS	2								
			6	TW	PH								
			7	SS	2								
171.0	End of borehole.												
7.2	Piezometer installed at 6.1 m Water level on : March 20/2002 5.5 m (El. 172.7)												

+ 3. x 3. Numbers refer to
Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+015; 18 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 227.5; E 301 504.8 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/21/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.9	Ground Surface												
0.0	0.2 m PEAT SILTY FINE SAND: some rootlets and organics, wet, grey, very loose		1	SS	4								**frozen to 0.5 m.
177.2			2	SS	1		177	+					
0.7	occasional silty fine sand seams		3	SS	2		176	+					
			4	SS	2		175	+					
	CLAY trace rootlets and trace organics to 2.9 m reddish /gray, soft to firm		5	TW	PH		174	+				14.4	
			6	SS	2		173	+					
			7	SS	2		172	+					
170.7							171	+					
7.2	End of borehole * Water level at 5.2 m (not stabilized) and hole open to 5.8 m on completion												

SPT1055

RECORD OF BOREHOLE No 12+016; 17 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 221.9; E 301 539.1 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/21/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
178.6	Ground Surface											
0.0	PEAT some decayed wood pieces dark brown to black, very soft to soft		1	SS	4	*	178	+	7		445	**frozen to 0.4 m
178.0	0.1 m thick grey, wet sandy silt seam		2	SS	1		177	+	5		95	
0.6	trace organics		3	SS	2		176	+	9		91	
	CLAY trace rootlets to 2.1 m, reddish/grey soft to firm		4	SS	2		175	+	7			
			5	SS	2		174	+	9			
			6	SS	1		173	+	7			
			7	SS	2		172	+	5			
171.4	End of borehole											
7.2	* Water level at 4.6 m (not stabilized) and hole open to 5.2 m on completion											

SPT1055

RECORD OF BOREHOLE No 12+040 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 200.6; E 301 519.0 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR.	× LAB VANE						
178.1	Ground Surface						20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL	
0.0	PEAT		1	SS	1	178									180	Consolidation test	
177.6	some decayed wood pieces dark brown to black, wet, very soft		2	SS	2		177										125
0.5	0.1 m thick, grey, wet sandy silt seam		3	TW	PH			176	+ ³								87
	CLAY trace rootlets to 2.9 m, reddish/grey, soft to firm		4	SS	1		175		+ ⁵								80
			5	SS	1			174	+ ⁶								80
							173		+ ¹⁰								
			6	SS	1			172	+ ⁷								84
					171	+ ⁶											
170.8	End of borehole																
7.2	* Water level at 4.6 m (not stabilized) and hole open to 5.5 m on completion Borehole advanced 0.1 m right of median centre line																

+³ x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+064; 18 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 174.5; E 301 534.1 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/14/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
178.3	Ground Surface											
0.0	PEAT		1	SS	2		178				579	
177.8	some decayed wood pieces, dark brown to black, wet, very soft		2	SS	1		177					
0.5	CLAY		3	SS	2		176					
	trace rootlets to 2.1 m, reddish/grey, soft to firm		4	TW	PH		175				15.2	0 0 10 90
			5	SS	2		174					
			6	SS	1		173					
			7	SS	2		172					
171.1	End of borehole											
7.2	* Water level at 5.9 m (not stabilized) and hole open to 6.1 m on completion											

+ 3, x 3: Numbers refer to
Sensitivity

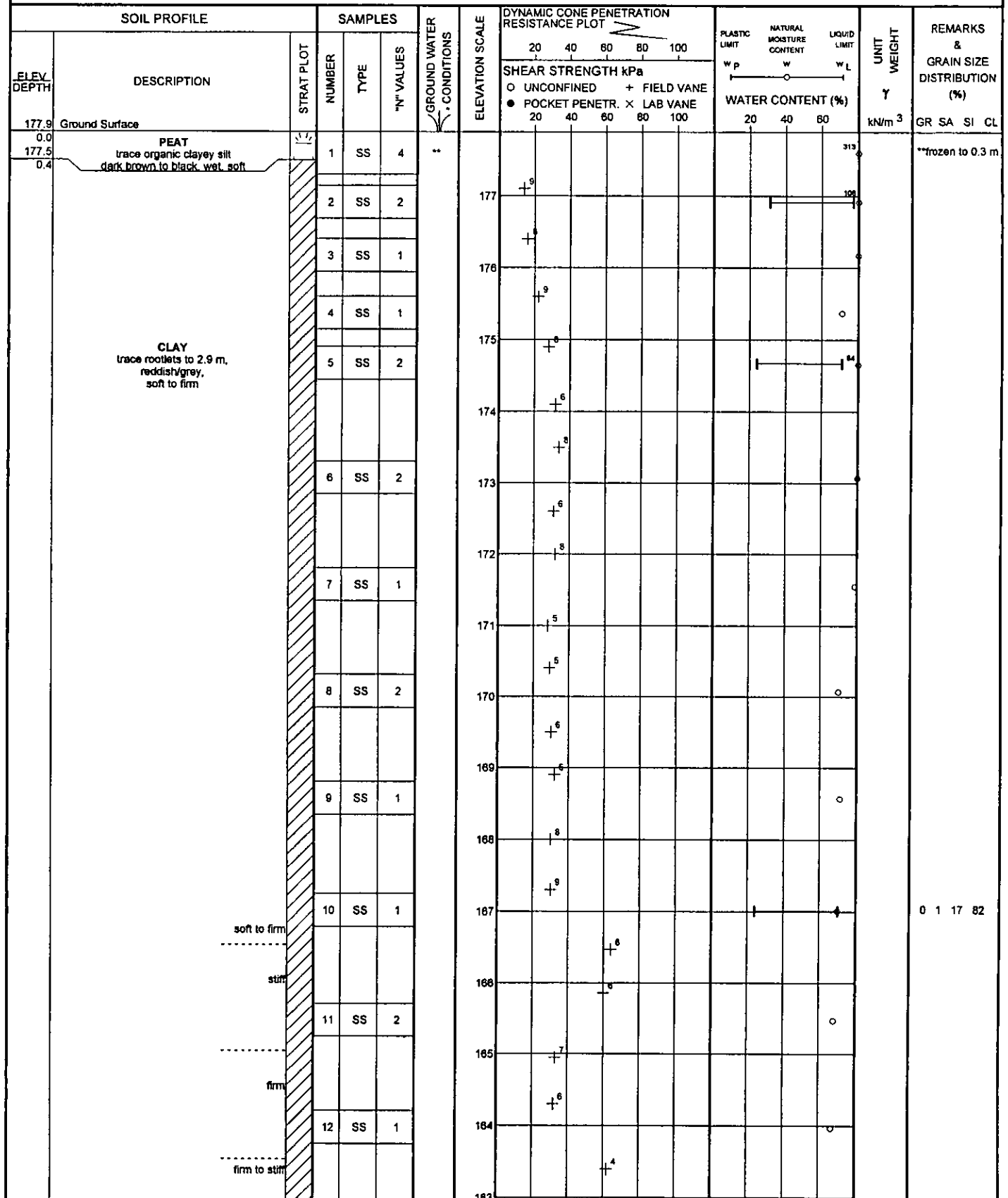
20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+064; 20 m Rt 1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 179.2; E 301 496.6 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/13/2002 CHECKED BY R.A.



Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity
20
15
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+064; 20 m Rt 2 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 179.2; E 301 496.6 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T. COMPILED BY G.T.
 DATUM Geodetic DATE 3/13/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	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	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)		
162.9 15.0	CLAY reddish/grey, firm to stiff		13	SS	2								
161.9 16.0													
160.0	End of borehole					***	162						*** artesian condition encountered at 16.0 m
155.0 22.9	End of Dynamic Cone Penetration Test						161						
	* Water level at 1.4 m above ground surface (under artesian pressure) and hole open to 10.1 m on completion						160						
	Dynamic Cone Penetration Test performed from 16.2 m to 22.9 m						159						
							158						
							157						
							156						
							155						

SPT1055

RECORD OF BOREHOLE No 12+119 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 121.7; E 301 509.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/14/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE					WATER CONTENT (%) W _P W W _L					
177.8 0.0	Ground Surface							20	40	60	80	100						
177.3 0.5	PEAT some decayed wood pieces dark brown to black, wet, very soft		1	SS	2		177	9									120	
			2	SS	2			4									85	
			3	SS	2		176		4								84	
	CLAY trace rootlets to 2.9 m, reddish/grey, soft to firm		4	SS	2		175		4									
			5	SS	2													
							174	8										
								11										
			6	SS	1		173		7								70	
							172		6									
			7	SS	2													
170.6 7.2	End of borehole						171	6										
	* Water level at 4.6 m (not stabilized) and hole open to 4.9 m on completion																	
	Borehole advanced 0.2 m left of median centre line																	

SPT1055

RECORD OF BOREHOLE No 12+145; 20 m Rt 1 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 098.8; E 301 485.9 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
 DATUM Geodetic DATE 3/12/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		WATER CONTENT (%)			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _P W W _L				
177.5	Ground Surface													
0.0	0.5 m Peat at this location													
177														
176														
175														
174														
173														
172														
171														
170														
169														
168														
167														
166														
165														
164														
163														

Continued Next Page

+ ³, × ³: Numbers refer to
Sensitivity

20
15 ϕ 5
10 (%) STRAIN AT FAILURE

SPT1055

METRIC

GWP	354-94-00	LOCATION	Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 098.8; E 301 485.9	ORIGINATED BY	G.I.
DIST	62	HWY	17 (New)	BOREHOLE TYPE	D.C.P.T
DATUM	Geodetic	DATE	3/12/2002	COMPILED BY	G.T.
				CHECKED BY	R.A.

SOIL PROFILE						DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER TYPE "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE		WATER CONTENT (%) w p w w L				
162.3 15.2	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test performed from ground surface to 15.2 m				162							

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+146; 32 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 091.1; E 301 537.6 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/12/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR. × LAB VANE		
178.0	Ground Surface						20 40 60 80 100					
0.0	PEAT											
177.8	some decayed wood pieces		1	SS	3							**frozen to 0.3 m
0.4	dark brown to black, very soft											
	0.3 m thick grey, wet sandy silt seam		2	SS	2							
			3	SS	1							
	CLAY											
	trace rootlets to 2.1 m,		4	SS	2							
	reddish/grey,											
	soft to firm		5	TW	PH						15.6	0 0 22 78
			6	SS	1							
			7	SS	1							
170.8	End of borehole											
7.2	* Water level at 6.1 m (not stabilized) and hole open to full depth on completion											

SPT1055

RECORD OF BOREHOLE No 12+172 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 069.8; E 301 502.8 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/13/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa		W _P W W _L			
177.6	Ground Surface						○ UNCONFINED + FIELD VANE						
0.0	PEAT						● POCKET PENETR × LAB VANE						
177.0	dark brown to black, wet, very soft		1	SS	2 *		20 40 60 80 100	20 40 60		267			* frozen to 0.3 m
0.6	CLAY trace rootlets to 1.4 m, reddish/grey soft to firm		2	SS	1		177	+16		90			
			3	SS	1		176	+2					
			4	TW	PH		175	+3		61		15.5	0 2 13 85
			5	SS	2		174	+7					
							173	+5					
							172	+4					
							171	+3					
				6	SS	2			+5				
170.4	End of borehole												
7.2	Borehole advanced 0.5 m left of median centre line Piezometer installed at 6.1 m Water level on: Oct. 19, 2002 - 0.3 m above ground surface												

+3, x3: Numbers refer to 20
15 5 10 (%) STRAIN AT FAILURE
Sensitivity

SPT1055

RECORD OF BOREHOLE No 12+195; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 105 043.9; E 301 519.1 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/12/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
177.9	Ground Surface													
0.0	PEAT		1	SS	2	++							252	**frozen to 0.4 m
177.3	dark brown to black, wet, very soft													
0.6	0.1 m thick grey, wet sandy silt seam		2	SS	2		177						92	
	CLAY trace rootlets to 1.4 m, reddish/grey, soft to firm		3	SS	0		176	5					83	
			4	SS	1		175	6					81	
			5	SS	1		174	8						
			6	SS	2		173	6						
			7	SS	1		172	6						
							171	11						
170.7	End of borehole													
7.2	* Wet cave at 3.7 m on completion													

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+195; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 105 049.4; E 301 479.4 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/12/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _P W W _L	20 40 60			
177.6 0.0	Ground Surface													
177.0 0.6	PEAT dark brown to black		1	SS	12	**								**frozen to 0.5 m
	CLAY trace rootlets to 2.1 m, reddish/grey, soft to firm		2	SS	2		177							
			3	SS	1		176	6						
			4	SS	1		175	6						
			5	SS	2		174							
			6	TW	PH		173	7 5						
			7	SS	2		172	6 6						
170.4 7.2		End of borehole						171	8					
	* Water level at 5.5 m (not stabilized) and hole open to full depth on completion													

SPT1055

RECORD OF BOREHOLE No 12+220 CL

1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 105 022.0; E 301 496.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/6/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE					WATER CONTENT (%) w _p w w _L	
177.8	Ground Surface					**							***frozen to 0.5 m	
177.5	PEAT some decayed wood pieces dark brown to black		1	SS	4		177	5						
0.3	CLAY trace rootlets to 2.1 m, reddish/grey, soft to firm		2	SS	2		176	6						
			3	SS	2		175	8						
			4	SS	2		174	6						
			5	SS	1		173	8						
			6	SS	1		172	8						
			7	SS	1		171	5						
			8	SS	2		170	9						
			9	SS	1		169	4						
			10	SS	2		168	6						
			11	SS	1		167	5						
163.4	SILTY SAND grey, wet, compact		12	SS	3	***	166	7					*** artesian condition encountered at 14.6 m	
14.4							165	5						

Continued Next Page

+³, x³: Numbers refer to Sensitivity
20
15 10 5
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+220 CL

2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 105 022.0; E 301 496.5 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/6/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
182.8																	
15.0																	
162.1	SILTY SAND grey, wet, compact		13	SS	22												
15.7	End of borehole Borehole advanced 0.8 m left of median centre line * Water level at 1.2 m above ground surface (artesian condition) and hole open to full depth on completion																

SPT1055

RECORD OF BOREHOLE No 12+240; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 150 005.5; E 301 472.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/11/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
								20 40 60 80 100		WATER CONTENT (%)			
177.5	Ground Surface												
0.0	PEAT		1	SS	6		177						
177.0	dark brown to black, wet, soft		2	SS	1								
0.5	0.3 m thick, brown wet silty sand seam						176	12					
			3	SS	1			6					
	occasional thin sand seams/lenses		4	SS	2		175	4					
			5	SS	2			4					
	CLAY						174	4					
	reddish grey to grey, soft to firm		6	SS	1		173	6					
							172	5					
			7	SS	2			5					
							171						
170.3	End of borehole							7					
7.2	* Water level at 4.6 m (not stabilized) and hole open to 5.5 m on completion												

SPT1055

RECORD OF BOREHOLE No 12+244; 17 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 995.7; E 301 508.5 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/11/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
178.1	Ground Surface											
0.0												
177.7	PEAT dark brown to black, wet, very soft to soft		1	SS	2		178					
0.4	0.3 m thick grey, wet, silty sand seam, trace organics		2	SS	1		177					
			3	SS	0		176					
	CLAY trace rootlets to 1.1 m, reddish grey, soft to firm		4	SS	2		175					
			5	SS	2		174					
			6	SS	1		173					
			7	TW	PH		172					
170.9	End of borehole						171					
7.2	* Water level at 5.2 m (not stabilized) and hole open to full depth on completion ** Spoon sinking under weight of hammer and/or rods.											

SPT1055

RECORD OF BOREHOLE No 12+265 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 977.3; E 301 487.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/28/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.7	Ground Surface												
0.0	PEAT		1	SS	2	**	177	+				93	**frozen to 0.3 m
177.2	dark brown to black, wet, very soft to soft		2	SS	2		177	+					
0.5			3	SS	1		176	+					
			4	SS	2		175	+					
			5	SS	1		174	+					
			6	SS	1		173	+					
			7	TW	PH		172	+					
							171						
170.5													
7.2	End of borehole												
	Borehole advanced 0.7 m right of median centre line.												
	* Water level at 5.5 m (not stabilized) and hole open to 5.8 m on completion.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+285; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 962.2; E 301 464.0 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/27/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L		
177.8 0.0	Ground Surface											
	0.2 m PEAT		1	SS	3		177	+				
			2	SS	2		176	+				
			3	SS	1		175	+				
			4	SS	2		174	+				
			5	SS	1		173	+				
			6	TW	PH		172	+				
			7	SS	2		171	+				
170.4 7.2	End of borehole											
	* Wet cave at 3.0 m on completion.											

RECORD OF BOREHOLE No 12+287; 19 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 952.0; E 301 502.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/27/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
178.2	Ground Surface											
177.9	PEAT		1	SS	2		178					
0.3	dark brown to black, wet, very soft to soft		2	SS	1		177					
			3	SS	1		176					
			4	SS	2		175					
			5	SS	2		174					
			6	SS	2		173					
			7	SS	1		172					
171.0	CLAY						171					
7.2	trace rootlets to 1.2 m, grey to 1.4 m, reddish grey below											
	very soft to soft firm											
	End of borehole											
	* Water level at 3.4 m (not stabilized) and hole open to 4.6 m on completion.											

+³ ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+334; 18 m Rt 1 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 914.8, E 301 454.9 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T. COMPILED BY G.T.
 DATUM Geodetic DATE 2/28/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa	W _p	W	W _L		
177.5 0.0	Ground Surface						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PENETR. X LAB VANE 20 40 60 80 100						
177													
176													
175													
174													
173													
172													
171													
170													
169													
168													
167													
166													
165													
164													
163													

Continued Next Page

+³, X³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

SPT1055

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
FLY ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE						
								WATER CONTENT (%) 20 40 60 80 100						

[illegible]

SPT1055

RECORD OF BOREHOLE No 12+340; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 899.8; E 301 490.8 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.I.
 DATUM Geodetic DATE 2/27/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
178.0	Ground Surface													
0.0	PEAT													
177.8	some decayed wood pieces		1	SS	3									**frozen to 0.4 m
0.4	dark brown to black, soft		2	SS	2									
	CLAY		3	SS	2									
	trace rootlets to 2.1 m,		4	SS	1									
	reddish/grey,		5	SS	1									
	soft to firm													
			6	SS	2									
			7	SS	2									
170.8	End of borehole													
7.2	* Water level at 1.2 m (not stabilized) and hole open to full depth on completion.													

SPT1055

RECORD OF BOREHOLE No 12+365 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 880.5; E 301 464.1 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/26/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	T _N VALUES			20 40 60 80 100	20 40 60 80 100					
177.6	Ground Surface													
0.0	PEAT													
177.1	dark brown to black, soft		1	SS	3								523	**frozen to 0.4 m
0.5														
	very soft		2	SS	3									
	soft to firm		3	SS	1									
			4	SS	2									
	CLAY		5	SS	3									
	trace rootlets to 2.1 m, reddish/grey,													
			6	SS	2									
			7	SS	2									
170.4	End of borehole													
7.2	* Wet cave at 1.5 m on completion.													

SPT1055

RECORD OF BOREHOLE No 12+391; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 861.6; E 301 436.9 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 2/26/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
177.3	Ground Surface												
0.0 177.0 0.3 176.6 0.7	PEAT dark brown to black SANDY SILT very loose, gray, wet		1	SS	2	..	177						**frozen to 0.3 m
			2	SS	2		176						
			3	SS	1		175						
	CLAY trace rootlets to 2.1 m, reddish/grey, soft to firm		4	TW	PH	***	174						*** Consolidation Test
			5	SS	2		173						
			6	SS	1		172						
			7	SS	2		171						
170.1 7.2	End of borehole * Wet cave at 4.6 m on completion												

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+393; 20 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 647.8; E 301 474.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/26/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
177.8	Ground Surface							20 40 60 80 100					
0.0	PEAT							20 40 60 80 100					
177.3	some decayed wood pieces, wet soft		1	SS	2	.	177	+ ⁶					
0.5	CLAY trace rootlets to 2.1 m, reddish/grey, soft to firm		2	SS	2		176	+ ⁶					
			3	SS	2		175	+ ⁷					
			4	SS	1		174	+ ⁶					
			5	TW	PH		173	+ ⁵					
							172	+ ⁴					
				6	SS		1	171	+ ⁵				
				7	SS		2						
170.6	End of borehole												
7.2	* Wet cave at 5.5 m on completion.												

SPT1055

RECORD OF BOREHOLE No 12+419 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 828.8; E 301 447.2 ORIGINATED BY G.J.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
177.4	Ground Surface												
0.0	PEAT												
176.9	dark brown to black, very soft to soft		1	SS	2	**	177						**frozen to 0.3 m
0.5													
	CLAY												
	reddish/grey, firm		2	SS	2		176						
			3	TW	PH	***							
			4	SS	2		175						
			5	SS	1		174						
			6	SS	2		173						
							172						
			7	SS	2		171						
170.2	End of borehole												
7.2	Borehole advanced 0.2 m left of median centre line												
	* Water level at 4.8 m (not stabilized) and hole open to 5.5 m on completion												

+ 3 . x 3 : Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+440; 23m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 801.5; E 301 481.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.5	Ground Surface												
0.0	PEAT		1	SS	2		177						**frozen to 0.3 m
177.1	some decayed wood pieces, very soft to soft												
0.4	SANDY SILT		2	SS	2		176					14.5	
176.7	grey, wet, very loose		3	SS	1		175						
0.8	CLAY		4	SS	2		174					14.5	
	trace rootlets to 2.1 m, reddish/grey, soft to firm		5	SS	1		173						
			6	SS	2		172						
			7	TW	PH		171					15.1	0 0 24 76
170.4	End of borehole												
7.1	* Wet cave at 3.0 m on completion												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+440; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 817.3 E 301 420.9 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 2/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.3	Ground Surface											
0.0	PEAT		1	SS	3	**	177					** frozen to 0.3 m
176.8	some decayed wood pieces, dark brown to black, soft		2	SS	1		178				14.7	
0.5	CLAY		3	SS	1		175					
	trace rootlets to 2.1 m, occasional fine sand seams/lenses from 2.1 m to 2.9 m, reddish/grey, soft to firm		4	SS	2		174					
			5	SS	1		173				14.6	
			6	SS	1		172					
			7	SS	1		171					
170.1	End of borehole											
7.2	* Water level at 1.5 m (not stabilized) and hole open to full depth on completion											

SPT1055

RECORD OF BOREHOLE No 12+468 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 783.4; E 301 424.6 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
177.3	Ground Surface													
0.0	PEAT													
178.9	dark brown to black		1	SS	3		177							**frozen to 0.3 m
0.4			2	SS	2		176							
	CLAY		3	SS	1		175							
	reddish/grey, firm		4	SS	2		174							
			5	SS	2		173							
			6	SS	2		172							
			7	SS	2		171							
170.1	End of borehole													
7.2	Borehole advanced 0.3 m left of median centre line * Water level at 3.7 m (not stabilized) and hole open to 4.3 m on completion													

SPT1055

RECORD OF BOREHOLE No 12+485; 20 m Lt 1 of 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 759.9; E 301 441.1 ORIGINATED BY G.J.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
177.4	Ground Surface							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE	WATER CONTENT (%) 20 40 60			GR SA SI CL
0.0	0.15 m PEAT (frozen)		1	SS	1		177	+				
			2	SS	2		176	+				0 1 24 75
	CLAY frozen to 0.3 m, trace rootlets to 2.1 m, reddish/grey, soft to firm		3	SS	1		175	+				
			4	SS	1		174	+				
			5	SS	1		173	+				
			6	SS	2		172	+				0 0 14 86
			7	SS	2		171	+				
170.2	End of borehole							3				
7.2	* Water level at surface (not stabilized) and hole open to 3.7 m on completion											

SPT1055

RECORD OF BOREHOLE No 12+485; 20 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 775.9; E 301 404.4 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE	WATER CONTENT (%) 20 40 60					
177.2 0.0	Ground Surface													
176.7 0.5	PEAT some decayed wood pieces dark brown to black, soft		1	SS	3		177							**frozen to 0.3 m
			2	SS	1		176							
			3	SS	1		175							
			4	SS	1		174							
			5	SS	1		173							
			6	TW	PH		172						14.2	
			7	SS	2		171							
170.0 7.2	End of borehole						170							
	* Water level at 0.6 m (not stabilized) and hole open to full depth on completion													

SPT1055

RECORD OF BOREHOLE No 12+530 CL

1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 727.1; E 301 404.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
177.4	Ground Surface													
0.0	PEAT		1	SS	2	**	177							**frozen to 0.3
176.9	some decayed wood pieces		2	SS	0		176							0 1 43 56
0.5	dark brown to black, soft		3	SS	0		175							
			4	SS	0		174							
	CLAY		5	SS	1		173							
	trace rootlets to 2.9 m,						172							
	reddish/grey,		7	SS	2		171							
	soft to firm						170							
			8	SS	2		169							
							168							
			9	SS	2		167							
							166							
			10	SS	1		165							0 1 12 87
							164							
			11	SS	2		163							

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+530 CL

2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 727.1; E 301 404.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
162.4 15.0	CLAY reddish/grey, firm		12	SS	0									
161.2 16.2														
162.4 16.2	End of borehole													
152.8 24.8	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test (D.C.P.T) performed from 16.2 m to 24.8 m * Water level at 0.8 m (not stabilized) and hole open to 4.6 m on completion Borehole advanced 0.8 m left of median centre line.													

SPT1055

RECORD OF BOREHOLE No 12+543; 19 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 723.9; E 301 381.3 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/23/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE					PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L WATER CONTENT (%)
177.4	Ground Surface							20 40 60 80 100					
0.0	PEAT												
176.9	dark brown to black		1	SS	2 **		177						** frozen to 0.3 m
0.5			2	SS	12								
	SANDY SILT												
	grey, saturated, compact		3	SS	3 ***		176						
	trace rootlets												
	very loose												
175.3													
2.1			4	SS	1		175						*** no recovery auger sample collected
	CLAY												
	reddish grey,		5	TW	PH		174					14.6	
	soft												
			6	SS	2		173						
			7	SS	0		172						
			8	SS	2		171						
170.2	End of borehole												
7.2													
	* Water level at 1.5 m (not stabilized) and hole open to full depth on completion												
	Piezometer installed to 6.0 m.												
	Water level on: Oct. 19, 2002 - 0.3 m (Elev 177.1)												

+ 3, x 3: Numbers refer to
Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+560 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 701.4; E 301 389.1 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/22/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE					WATER CONTENT (%) w _p w w _L
177.3	Ground Surface												
0.0	PEAT		1	SS	4	**	177						**frozen to 0.3 m
176.9	some decayed wood pieces dark brown to black		2	SS	4								
0.4			3	SS	2		176						
	occasional silty sand pockets and seams		4	SS	0		175						
	CLAY		5	SS	1		174						
	trace rootlets to 4.0 m, reddish/grey, very soft to soft		6	SS	1		173						
			7	SS	0		172						
170.1	End of borehole						171						
7.2	* Water level at ground surface (not stabilized) and hole open to full depth on completion Borehole advanced 1.4 m right of median centre line												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+583; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 690.2; E 301 361.4 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 2/22/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.2	Ground Surface												
176.9	PEAT dark brown to black, wet, very soft		1	SS	1		177						
175.8	SANDY SILT gray, wet very loose		2	SS	4		176						
174.4	CLAY trace rootlets to 2.1 m, reddish gray, very soft to soft		3	SS	1		175						
			4	TW	PH		174						
			5	SS	0		173						
			6	SS	1		172						
			7	SS	1		171						
170.0	End of borehole						170						
7.2	* Water level at ground surface (not stabilized) and hole open to full depth on completion. ** Spoon sinking under weight of hammer and/or rods.												

SPT1055

RECORD OF BOREHOLE No 12+585; 20 m Lt 1 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 668.6; E 301 395.7 ORIGINATED BY G.I.
DIST 82 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40
177.3 0.0	Ground Surface													
177														
176														
175														
174														
173														
172														
171														
170														
169														
168														
167														
166														
165														
164														
163														
162.4														

METRIC

GWP	<u>354-94-00</u>	LOCATION	<u>Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 668.6; E 301 395.7</u>	ORIGINATED BY	<u>G.I.</u>
DIST	<u>62</u> HWY <u>17 (New)</u>	BOREHOLE TYPE	<u>D.C.P.T</u>	COMPILED BY	<u>G.T.</u>
DATUM	<u>Geodetic</u>	DATE	<u>2/24/2002</u>	CHECKED BY	<u>R.A.</u>

[illegible]

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+630 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 639.5; E 301 355.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/22/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
177.1	Ground Surface											
0.0	PEAT											
176.6	dark brown to black, very soft		1	SS	1	*	177					** frozen to 0.3 m
0.5												
	CLAY											
	trace rootlets to 2.1 m, occasional silt pockets reddish/grey, very soft to soft		2	SS	2		176					0 7 42 51
			3	SS	1							
			4	SS	4		175					
			5	SS	0	***	174					
			6	SS	1		173					
							172					
							171					
			7	SS	1							
169.9							170					
7.2	End of borehole											
	Borehole advanced 0.2 m left of median centre line.											
	* Water level at ground surface (not stabilized) and hole open to 5.2 m on completion											
	***Spoon sinking under weight of hammer and/or rods.											

RECORD OF BOREHOLE No 12+637; 20 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 623.3; E 301 368.8 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20 40 60 80 100				
177.4 0.0	Ground Surface											
176.8 0.6	PEAT black, wet, very soft to soft		1	SS	2		177					
	CLAY occasional silt partings/seams brown, wet, very soft to soft		2	SS	2		176	+				0 0 40 60
			3	SS	1		175	+				
			4	SS	0		174	+				
			5	SS	0		173	+				
							172	+				
				6	SS	0		171				
170.8 6.6	End of borehole		7	SS	0							
	* Water level at 0.1 m (not stabilized) and hole open to full depth on completion											

SPT1055

RECORD OF BOREHOLE No 12+639; 19 m Rt 1 OF 3 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 641.8; E 301 334.7 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
 DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER ▼, CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.3	Ground Surface											
0.0	PEAT		1	SS	1	**	177					** no sample recovery
176.9	dark brown to black wet, very soft		2	SS	2		176					
0.4			3	SS	1		175					
	occasional silt and silty fine sand seams, partings and pockets		4	SS	3		174					
			5	SS	2		173					
			6	TW	PH		172					
	CLAY reddish/grey, soft to firm		7	SS	1		171					
			8	SS	1		170					
			9	SS	2		169					
			10	SS	1		168					
			11	SS	1		167					
			12	SS	1		166					
163.0	End of borehole						165					
14.3							164					
							163					

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+³, ×³: Numbers refer to Sensitivity 20 15 10 (5) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+639; 19 m Rt 2 OF 3 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 641.8; E 301 334.7 ORIGINATED BY G.I.
 DIST 82 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T. COMPILED BY G.T.
 DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE	WATER CONTENT (%)					
162.3 15.0														
162														
161														
160														
159														
158														
157														
156														
155														
154														
153														
152														
151														
150														
149														
148														

Continued Next Page

+ 3 . × 3 : Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+639; 19 m Rt 3 of 3 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 641.8; E 301 334.7 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY G.T.
 DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
147.3 30.0							147							
143.8 33.5	End of Dynamic Cone Penetration Test * Water level at ground surface (not stabilized) and hole open to 6.7 m on completion Dynamic Cone Penetration Test (D.C.P.T) performed from 14.3 m to 33.5 m						144							

SPT1055

RECORD OF BOREHOLE No 12+697; 25 m Rt 1 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 596.8; E 301 298.8 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
177.2 0.0	Ground Surface													
177														
176														
175														
174														
173														
172														
171														
170														
169														
168														
167														
166														
165														
164														
163														

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity 20 15 10 (% STRAIN AT FAILURE)

SPT1055

RECORD OF BOREHOLE No 12+697; 25 m Rt 2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 596.8; E 301 298.8 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
162.0							162										
15.2	End of Dynamic Cone Penetration Test. * Water observed at ground surface (not stabilized)																

SPT1055

RECORD OF BOREHOLE No 12+699; 20 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 571.0: E 301 335.2 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
177.3	Ground Surface												
0.0 176.9	PEAT black, wet		1	AS	-		177						
0.4													
	SANDY SILT with peat and clay seams, trace rootlets, brown to black, wet, loose		2	SS	1		176						
175.8													
1.5			3	SS	2		175						
	CLAY occasional silt seams, partings and lenses reddish gray very soft to soft		4	SS	0		174						
			5	SS	1		173						
			6	TW	PH		172						
			7	SS	0		171						
170.4													
6.9	End of borehole.												
	* Water level at 3m (not stabilized) and hole open to full depth on completion.												
	** No recovery.												

SPT1055

RECORD OF BOREHOLE No 12+730 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 555.2: E 301 301.5 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE						
177.3	Ground Surface							20 40 60 80 100						
0.0	PEAT													
176.9	black, wet		1	AS	-		177						325	
0.4														
	CLAY		2	SS	1									
	grey/brown, very soft						176							
175.8														
1.5	SANDY SILT		3	SS	15									
175.2	occasional silty sand seams, trace clay													
	brownish grey, compact, wet						175							
2.1														
			4	SS	0									
							174							
	clayey silt interbeds		5	SS	6									
							173							
	CLAY													
	reddish grey		6	SS	0		172							
	very soft to soft													
			7	SS	0		171							
170.4														
6.9	End of borehole.													
	Piezometer installed to 6.1 m. Water level on: Oct. 19, 2002 - 0.1 m (Elev 177.2)													

SPT1055

RECORD OF BOREHOLE No 12+747; 20m Lt

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 551.9 ; E 301 275.7 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
 DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED		+ FIELD VANE			● POCKET PENETR. × LAB VANE				
							20	40	60	80	100	20	40	60			
178.7 0.0	Ground Surface		1	SS	68/20	1	178										
	FILL SAND and GRAVEL some organics, trace rootlets moist, compact		2	SS	25												
			3	SS	18												
176.6 2.1			4	SS	2												
	CLAY trace organics and rootlets to 2.9 m reddish grey to grey soft to firm		5	SS	1												
			6	SS	2												
172.1 6.6	End of borehole.		7	TW	PH		173										
	* Wet-cave at 4.8 m on completion. ** High blow count probably due to a cobble.																

SPT1055

RECORD OF BOREHOLE No 12+759; 20 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 542.0; E 301 269.6 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
177.2	Ground Surface													
0.0														
176.5	PEAT		1	AS	-		177							
0.7			2	AS	-		176							
	CLAY reddish grey very soft		3	SS	0		175							
174.8			4	SS	16		174							
2.4	SILT to SANDY SILT trace clay reddish grey, wet, compact		5	SS	23		173							0. 15. 79. 6
			6	SS	14		172							0. 32. 63. 5
	occasional clay lenses and silty sand layers		7	SS	18		171							
	very loose		8	SS	0*									
171.3			9	TW	PH**									
5.9	CLAY reddish grey, very soft													
170.6														
6.6	End of borehole. Piezometer installed to 5.8 m. Water level on: Oct. 19, 2002 - 0.3 m (Elev. 176.9) * Low N-value possibly due to hydrostatic uplift. ** No recovery													

SPT1055

RECORD OF BOREHOLE No 12+772 CL

1 OF 3

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 519.9; E 301 279.2 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY Y.L.
 DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
178.4 0.0	Ground Surface		1	SS	8		178						21.9	
	EMBANKMENT FILL SAND and GRAVEL some organics to 0.7 m grey, moist loose to compact		2	SS	28									
176.3 2.1	CLAY grey, soft to firm		3	SS	15		177							
175.5 2.9	SILT to SANDY SILT reddish grey to grey, wet compact		4	SS	2		176							
			5	SS	16		175						20.8	
			6	SS	15		174							
173.2 5.2	CLAY grey, soft		7	SS	17		173							
172.5 5.9	SILT to SANDY SILT reddish grey, wet very loose		8	SS	1		172							
			9	SS	1		171							
171.2 7.2	CLAY reddish grey firm		10	SS	1		170							
	frequent silt inclusions, stiff		11	SS	2		169							
			12	SS	2		168							
			13	SS	2		167							
							166							
							165							
							164							

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+772 CL

2 OF 3

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 519.9: E 301 279.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY Y.L.
DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
163.4 15.0	CLAY reddish gray, wet firm		14	SS	1		20 40 60 80 100	20 40 60 80 100	20 40 60					
162.5 15.9							End of borehole. Borehole advanced 0.3 m left of median centre line. * Water level at 10.2 m (not stabilized) and hole open to full depth on completion.							

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+772 CL

3 OF 3

METRIC

GWP 354-84-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 519.9: E 301 279.2 ORIGINATED BY G.I.
 DIST 82 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY Y.L.
 DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
148.4																	
30.0																	
147.6																	
30.8	End of Dynamic Cone Penetration Test. Dynamic Cone Penetration Test (D.C.P.T.) performed from 15.9 m to 30.8 m.																

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+794; 12 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 494.8; E 301 277.5 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/20/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
178.0 0.0	Ground Surface													
	PEAT dark brown to black, wet, soft		1	AS	-									
176.8 1.2	0.1 m thick sandy silt seam, trace clay		2	SS	3									
	CLAY grey, very soft, trace rootlets		3	TW	PH									
175.7 2.3	SILT to SANDY SILT trace clay, reddish grey wet		4	SS	24									
	compact very loose		5	SS	18									
			6	SS	0									
173.4 4.6	CLAY reddish grey very soft to soft		7	SS	0									
	silt lenses/pockets		8	SS	0									
171.1 6.9	End of borehole													
	* Spoon sinking under weight of hammer and/or rods.													

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+842 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 460.5; E 301 241.3 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/23/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR.			
177.4	Ground Surface						20 40 60 80 100						
0.0	PEAT some decayed wood pieces dark brown to black, wet		1	SS	- **							0.6 m water and snow above ground surface	
176.5	CLAY trace rootlets reddish grey, very soft, sandy silt and silt zones		2	SS	- **								
0.9			3	SS	- **								
174.8	SILT to SANDY SILT trace clay reddish grey, wet compact (inferred) very loose (inferred)		4	SS	- **								
2.6			5	SS	- **							0. 20. 73. 7	
			6	SS	- **							0. 20. 74. 6	
			7	SS	- **								
			8	SS	- **								
172.1	CLAY reddish grey very soft												
5.3													
171.1	End of borehole.												
6.3	Borehole advanced 0.6 m left of median centre line. * Water level at ground surface (not stabilized) and hole open to full depth on completion. ** No N-value, 22.7 kg hammer used.												

+³, x³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+855; 20 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 481.1; E 301 217.1 ORIGINATED BY S.O.
DIST 82 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20	40	60	80	100						
177.8 0.0	Ground Surface		1	AS	- **												
176.5 1.1	PEAT some decayed wood pieces dark brown to black, wet		2	SS	- **												
175.5 2.1	CLAY grey, very soft		3	SS	- **												
			4	SS	- **												
			5	SS	- **												
			6	SS	- **												
			7	SS	- **												
			8	SS	- **												
171.8 5.6	End of borehole. * Water level at ground surface (not stabilized) and hole open to 4.9 m on completion. ** No N-value, 22.7 kg hammer used.																

SPT1055

1 OF 2

METRIC

ORIGINATED BY G.I.

COMPILED BY Y.L.

CHECKED BY R.A.

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+887 CL

2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 422.9; E 301 216.6 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & D.C.P.T COMPILED BY Y.L.
DATUM Geodetic DATE 3/5/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
182.7 15.0	CLAY reddish gray soft to firm		15	SS	1		20 40 60 80 100	20 40 60						
160.9 16.8														
149.7 28.0	End of borehole. Borehole advanced 0.3 m left of median centre line. * Water level at 5.2 m (not stabilized) and hole open to 9.8 m on completion.													
	End of Dynamic Cone Penetration Test. Dynamic Cone Penetration Test (D.C.P.T.) performed from 16.8 m to 28 m.													

SPT1055

RECORD OF BOREHOLE No 12+900; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 401.6: E 301 226.4 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
 DATUM Geodetic DATE 3/6/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.4 0.0	Ground Surface												
176.6 0.8	PEAT dark brown to black wet		1	AS	-		177						
175.3 2.1	CLAY grey, very soft		2	SS	- **		178					104	
175.3 2.1	SILT to SANDY SILT trace clay grey, wet loose to compact (inferred)		3	SS	- **		175						0 20 73 7
173.0 4.4	CLAY occasional silt seams and partings reddish grey soft to firm		4	SS	- **		174						0 26 69 5
173.0 4.4			5	SS	- **		173						
173.0 4.4			6	SS	- **		172						0 2 53 45
173.0 4.4			7	SS	- **		171						
170.5 6.9	End of borehole. * Water level at 0.1 m (not stabilized) and hole open to 4.6 m on completion. ** No N-value, 22.7 kg hammer used.		9	SS	- **								

SPT1055

RECORD OF BOREHOLE No 12+900; 20 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 423.3; E 301 192.7 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 2/28/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _P W W _L	20 40 60			
177.5	Ground Surface													
0.0	PEAT		1	AS	-									
177.0	some decayed wood pieces													
0.5	dark brown to black, wet		2	SS	- **									
	CLAY		3	SS	- **									
	trace rootlets to 1.4 m													
	grey, soft		4	TW	PH									
	silt seams		5	SS	- **									
173.8														
3.7	SILT to SANDY SILT		6	SS	- **									
	trace clay, grey, wet													
	loose (inferred)		7	SS	- **									
	compact (inferred)		8	SS	- **									
170.9			9	SS	- **									
6.6	End of borehole.													
	* Water level at ground surface (not stabilized) and hole open to 4.6 m on completion.													
	** No N-value, 22.7 kg hammer used.													

RECORD OF BOREHOLE No 12+937 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 381.4: E 301 189.5 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/25/2002 CHECKED BY R.A.





SOIL PROFILE			SAMPLES			GROUND WATER ↓ CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.5	Ground Surface											
177.2	PEAT dark brown to black, wet		1	AS	-		177				201	
177.0			2	TW	PH			+			105	13.8
176.8	CLAY grey very soft to soft		3	SS	- ***	**	176	+			110	
			4	SS	- ***	**	175	+			107	
174.5			5	SS	- ***		174					
174.0	SILT to SANDY SILT grey, wet and dilatant loose to compact (inferred)		6	SS	- ***		173					
			7	SS	- ***		172					
	with silty fine sand seams		8	SS	- ***		171					
170.9			9	SS	- ***							
170.8	End of borehole											
	Borehole advanced 0.1 m right of median centre line.											
	* Water level at ground surface (not stabilized) and hole open to 4.9 m on completion.											
	** Spoon sinking under weight of hammer and/or rods.											
	*** No N-value, 22.7 kg hammer used.											

+³ × 3: Numbers refer to
Sensitivity 20
15 10 5 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+950; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 359.6; E 301 199.3 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 2/25/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL							
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE					WATER CONTENT (%) W _p W W _L PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
177.6	Ground Surface							20	40	60	80	100							
0.0	0.1 m Peat over 0.1 m grey silty sand seam		1	AS	-		177												
	CLAY grey, very soft to soft		2	SS	- *														
			3	SS	- *														
			4	SS	- *														
174.7			5	SS	- *		175												
2.9			6	SS	- *		174												
	SILT to SANDY SILT grey/brown wet and dilatant compact to dense (inferred)		7	SS	- *														
			8	SS	- *														
			9	SS	- *														
171.0	End of borehole						174												
6.6	Piezometer installed to 4.9 m. Water level on: 02/28/02 - 0.2 m (El. 177.4 m) 10/19/02 - 0.0 m (El. 177.6 m) * No N-value, 22.7 kg hammer used.																		

SPT1055

RECORD OF BOREHOLE No 12+950; 20 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 381.2; E 301 185.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T. COMPILED BY G.T.
DATUM Geodetic DATE 3/6/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
177.5 0.0	Ground Surface						20 40 60 80 100	20 40 60					GR SA SI CL
167.1 10.4	End of Dynamic Cone Penetration Test. Dynamic Cone Penetration Test performed from 0 to 10.4 m.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+985 CL

1 OF 1

METRIC

GWP 354-84-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5149 341.0; E 301163.5 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/26/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER ↓ CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
177.7	Ground Surface												
0.0	PEAT												
177.3	dark brown to black wet		1	AS	-								
0.4	SILTY SAND												
177.0	some clay, some organics												
0.7	and wood pieces, gray wet		2	SS	- **		177						
	CLAY												
	trace rootlets to 1.4 m						176						
	reddish grey, very soft		3	SS	- **								
	occasional												
	sandy silt		4	TW	PH	***	175					14.5	0 25 49 26
	pockets/seams												
			5	SS	- **								
173.9							174						
3.8			6	SS	- **								
	SILT to SANDY SILT												
	reddish grey to gray, wet						173						
	loose to dense (inferred)		7	SS	- **								
			8	SS	- **		172						
171.1													
6.6	End of borehole		9	SS	- **								
	* Water level at ground surface (not stabilized) and hole open to 5.2 m on completion.												
	** No N-value, 22.7 kg hammer used.												
	*** Consolidation Test.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 13+000; 20 m Rt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 339.2; E 301 138.6 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 2/27/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
178.2	Ground Surface											
0.0	0.15 m Peat over SILTY SAND brown, wet		1	AS	-		178					
177.5			2	SS	- **		177					
0.7	CLAY gray, very soft to soft		3	TW	PH		176					
			4	SS	- **		175					
175.3			5	SS	- **		174					
2.9	SILT to SANDY SILT gray, wet		6	SS	- **		173					
	very loose to loose (inferred)		7	SS	- **		172					
	compact (inferred)		8	SS	- **							
171.6			9	SS	- **							
6.6	End of borehole											
	* Water level at 0.1 m (not stabilized) and hole open to 5.2 m on completion.											
	** No N-value, 22.7 kg hammer used.											

SPT1055

RECORD OF BOREHOLE No 13+018; 15 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 305.6; E 301 158.3 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 2/26/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
178.3	Ground Surface												
0.0 178.0 0.3	0.2 m Peat over SILTY SAND brown, wet		1	AS	-		178						
			2	SS	- **		177						
	CLAY gray, very soft		3	SS	- **		176						
			4	SS	- **		175						
174.9 3.4			5	SS	- **		174						
	SILT to SANDY SILT gray, wet and dilatant compact (inferred)		6	SS	- **		173						
			7	SS	- **		172						
			8	SS	- **								
			9	SS	- **								
171.7 6.6	End of borehole												
	* Water level at 0.2 m (not stabilized) and hole open to 4.9 m on completion. ** No N-value, 22.7 kg hammer used.												

SPT1055

RECORD OF BOREHOLE No 13+024 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 308.8; E 301 141.8 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/5/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			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		
178.2	Ground Surface													
0.0	PEAT and ORGANIC SILT trace sand and rootlets grey wet		1	AS	-		178							
177.5														
0.7	SILTY SAND trace clay, grey/brown, wet very loose (inferred)		2	SS	- **		177							
176.8														
1.4			3	SS	- **									
	CLAY trace rootlets to 2.1 m grey very soft		4	SS	- **		176							0 1 80 19
			5	SS	- **		175							
			6	SS	- **		174							
173.8														
4.4	SILT to SANDY SILT trace clay, grey, wet very loose (inferred)		7	SS	- **		173							0 13 79 8
	loose (inferred)		8	SS	- **									
	compact to dense (inferred)		9	SS	- **		172							
171.6														
6.6	End of Borehole Borehole advanced 0.8 m right of median centre line. * Water level at 0.1 m (not stabilized) and hole open to 5.8 m on completion. ** No N-value, 22.7 kg hammer used.													

SPT1055

RECORD OF BOREHOLE No 13+050; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 275.5; E 301 145.1 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/8/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
FLEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
178.8	Ground Surface												
178.3	PEAT and Topsoil		1	AS	-		178						
177.2	SILTY SAND brown, wet very loose (inferred)		2	SS	- **		177						
174.9	CLAY gray very soft to soft		3	SS	- **		176						
174.9			4	SS	- **		175						
174.9			5	TW	PH		174						
172.0	SILT to SANDY SILT gray, wet very loose to compact (inferred)		6	SS	- **		173						
172.0			7	SS	- **		172						
172.0			8	SS	- **								
172.0			9	SS	- **								
6.6	End of Borehole												
* Water level at 0.9 m (not stabilized) and hole open to 3.4 m on completion. ** No N-value, 22.7 kg hammer used.													

SPT1055

RECORD OF BOREHOLE No 13+050; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 3/5/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR.			× LAB VANE	W _p	W
178.3	Ground Surface						20	40	60	80	100				
0.0	0.1 m Peat		1	AS	-										
	some organics		2	SS	- **								0 51 43 6		
176.9	SILTY SAND trace clay, trace organics, wet loose (inferred)														
1.4			3	SS	- **										
	CLAY grey soft to firm		4	SS	- **										
			5	SS	- **										
174.0															
4.3	SILT to SANDY SILT trace clay, grey, wet very loose (inferred)		6	SS	- **								0 9 83 8		
			7	SS	- **										
171.7			8	SS	- **										
6.6	End of Borehole														
	*Water level at ground surface (not stabilized) and hole open to 3.4 m on completion.														
	** No N-value, 22.7 kg hammer used.														

SPT1055

RECORD OF BOREHOLE No 13+068; 2 m Rt 1 OF 3

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 272.3; E 301 116.9 ORIGINATED BY S.O.
 DIST 82 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
 DATUM Geodetic DATE 3/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
178.3 0.0	Ground Surface													
178														
177														
176														
175														
174														
173														
172														
171														
170														
169														
168														
167														
166														
165														
164														

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity
 20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 13+068; 2 m Rt 2 OF 3

METRIC

GWP 354-84-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 272.3; E 301 116.9 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T COMPILED BY G.T.
DATUM Geodetic DATE 3/24/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
							163						
							162						
							161						
							160						
							159						
							158						
							157						
							156						
							155						
							154						
							153						
							152						
							151						
							150						
							149						

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

SPT1056

3 OF 3

METRIC

LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 272.3; E 301 116.9

ORIGINATED BY S.O.

BOREHOLE TYPE D.C.P.T

COMPILED BY G.T.

DATUM Geodetic

DATE 3/24/2002

CHECKED BY R.A.

+ 3, x 3: Numbers refer to Sensitivity

SPT1055

RECORD OF BOREHOLE No C2

1 OF 4

METRIC

GWP 354-94-00 LOCATION Station: 13+069 CL - Coords: N: 5 149 270.6; E 301 118.2 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T COMPILED BY Y.L.
 DATUM Geodetic DATE 3/26/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
FLEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
178.3	Ground Surface													
178.1	0.2 m Peat		1	AS	-									
0.2	SILTY SAND trace organics brown, wet, very loose		2	SS	0									
177.2			3	SS	1									
1.1	CLAY grey, wet very soft to soft		4	SS	0									
			5	TW	PH									
			6	SS	0									
			7	TW	PH									
173.1			8	SS	2									
5.2			9	SS	1									
	SILT to SANDY SILT grey, wet		10	SS	4									
			11	SS	13									
			12	SS	28									
			13	SS	24									
163.5														
14.8														

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

SPT1055

2 OF 4

METRIC

LOCATION Station: 13+069 CL - Coords: N : 5 149 270.6; E 301 118.2

ORIGINATED BY S.O.

BOREHOLE TYPE Hollow Stem Augers and D.C.P.T

COMPILED BY Y.L.

DATE 3/26/2002

CHECKED BY Z.O.

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

3 OF 4

METRIC

GWP	<u>354-94-00</u>	LOCATION	<u>Station: 13+069 CL - Coords: N ; 5 149 270.6; E 301 118.2</u>	ORIGINATED BY	<u>S.O.</u>
DIST	<u>62</u>	HWY	<u>17 (New)</u>	BOREHOLE TYPE	<u>Hollow Stem Augers and D.C.P.T</u>
DATUM	<u>Geodetic</u>	DATE	<u>3/26/2002</u>	COMPILED BY	<u>Y.L.</u>
				CHECKED BY	<u>Z.O.</u>

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Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity

SPT1055

RECORD OF BOREHOLE No C2

4 OF 4

METRIC

GWP 354-94-00 LOCATION Station: 13+069 CL - Coords: N: 5 149 270.6; E 301 118.2 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T COMPILED BY Y.L.
 DATUM Geodetic DATE 3/26/2002 CHECKED BY Z.O.

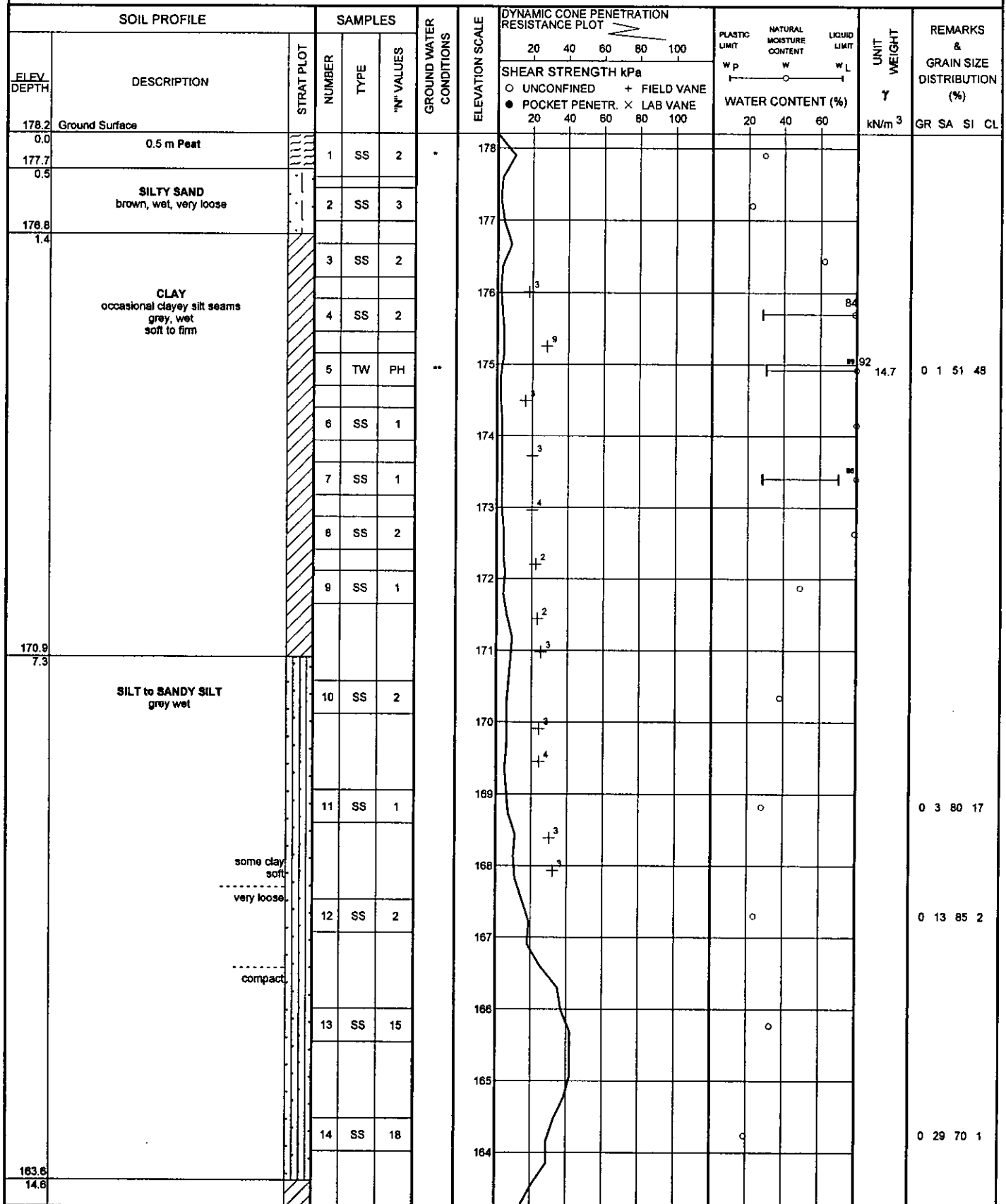
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
FLEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%) 20 40 60			
126.5							133							
							132							
							131							
							130							
							129							
							128							
							127							
51.9	End of Dynamic Cone Penetration Test. Dynamic Cone Penetration Test performed from 31 m to 51.8 m. Move to N: 5 149 212.3; E: 301 118.9 and performed another D.C.P.T. Refer to 13+068; 2 m Rt for results * Wet cave at 0.3 m below ground surface.													

RECORD OF BOREHOLE No C2-A

1 OF 2

METRIC

GWP 354-94-00 LOCATION Station: 13+072; 36 m Rt. - Coords: N 5 149 287.3; E 301 086.1 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T COMPILED BY Y.L.
 DATUM Geodetic DATE 12/14/2002 CHECKED BY Z.O.



SPT1055

RECORD OF BOREHOLE No C2-A

2 OF 2

METRIC

GWP 354-94-00 LOCATION Station: 13+072, 36 m Rt. - Coords: N 5 149 287.3; E 301 086.1 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T COMPILED BY Y.L.
DATUM Geodetic DATE 12/14/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N ^o VALUES								
157.2 21.1	CLAY with silty clay layers reddish grey, wet soft to firm		15	SS	3		163						
							162						
			16	SS	4		161						
							160						
			17	SS	4		159						
							158						
			18	SS	2								
	End of borehole. * Water level at 3.1 m (not stabilized) and hole open to 5.5 m on completion. ** Consolidation Test performed using sample TW 5												

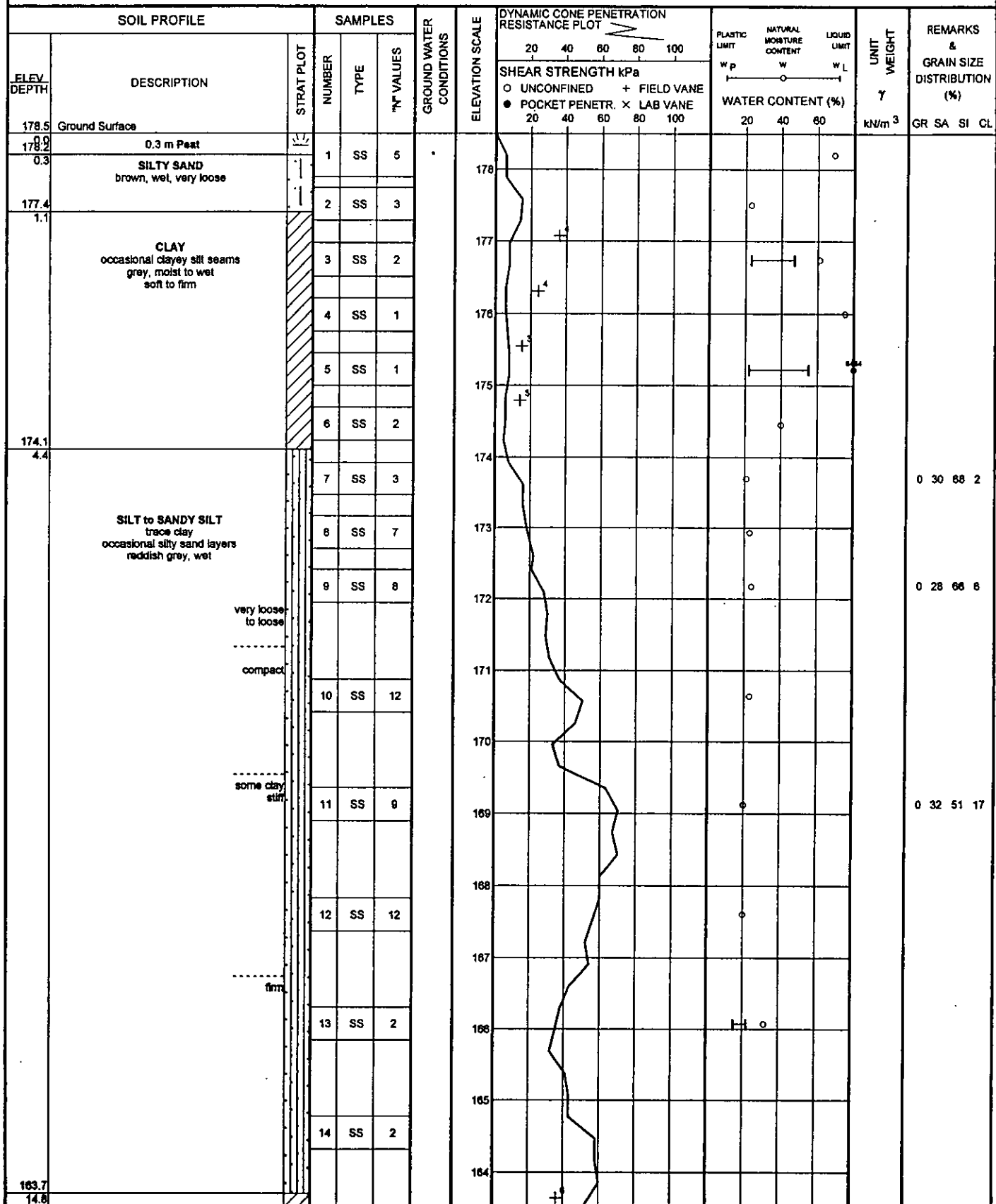
SPT1055

RECORD OF BOREHOLE No C2-B

1 OF 2

METRIC

GWP 354-94-00 LOCATION Station: 13+072; 38 m Lt. - Coords: N 5 149 247.3; E 301 148.3 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T COMPILED BY Y.L.
 DATUM Geodetic DATE 12/15/2002 CHECKED BY Z.O.



Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No C2-B

2 OF 2

METRIC

GWP 354-94-00 LOCATION Station: 13+072; 38 m Lt. - Coords: N 5 149 247.3; E 301 148.3 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T COMPILED BY Y.L.
DATUM Geodetic DATE 12/15/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES		20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
							SHEAR STRENGTH kPa				
							○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE				
							WATER CONTENT (%)				
							20 40 60 80 100				
							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
							W _p W W _L				
157.5			15	TW	PH					15.6	0 0 18 82
			16	SS	2						
			17	SS	3						
			18	SS	2						
21.1											

End of borehole.
* Water level at 7.6 m (not stabilized) and hole open to 8.5 m on completion.
** Consolidation Test performed using sample TW 15

SPT1055

RECORD OF BOREHOLE No 13+085; 22 m Lt 1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 245.2; E 301 128.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/14/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE					WATER CONTENT (%) W _p W W _L
178.7	Ground Surface												
0.0 178.4 0.3	PEAT dark brown to black, wet		1	AS	-								
177.3	SILTY SAND brown, wet and dilatant compact (inferred)		2	SS	- **		178						
1.4	CLAY gray, very soft to soft		3	SS	- **		177						
			4	SS	- **		176						
			5	SS	- **		175						
			6	SS	- **		174						
			7	SS	- **		173						
174.8 3.9	loose (inferred) SANDY SILT gray, wet compact (inferred)		8	SS	- **								
			9	SS	- **								
172.1 6.6	End of borehole * Water level at 0.1 m (not stabilized) and hole open to 4.9 m on completion. ** No N-value, 22.7 kg hammer used.												

SPT1055

RECORD OF BOREHOLE No 13+095; 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 259.1; E 301 087.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/14/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
178.3	Ground Surface							20 40 60 80 100				
0.0	0.2 m Peat over SILTY SAND trace rootlets grey, wet, loose (inferred)		1	AS	-		178					
			2	SS	- **		177					0 58 40 2
178.9			3	SS	- **		176					
1.4	CLAY grey very soft to soft	trace sand	4	TW	PH		175				16.6	
			5	SS	- **		174					
			6	SS	- **		173					
			7	SS	- **		172					
171.4	End of borehole											
8.9	* Water level at 0.1 m (not stabilized) and hole open to 4.9 m on completion. ** No N-value, 22.7 kg hammer used.											

SPT1055

RECORD OF BOREHOLE No 13+114 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 232.8; E 301 093.7 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 3/19/2002 CHECKED BY R.A.

SOIL PROFILE			SAMPLES			GROUND WATER ▼ CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE					WATER CONTENT (%) W _P W W _L		
178.2 0.0	Ground Surface		1	AS	-	▼	178								
177.3 0.9	0.2 m PEAT over SILTY SAND brown, wet compact to loose (inferred)		2	SS	- **		177								
	CLAY grey/brown		3	TW	PH		176	+							
			4	SS	- **		175	+							
			5	SS	- **		174	+							
			6	SS	- **		173	+							
			7	SS	- **		172								
171.3 6.9	End of borehole Borehole advanced 0.1 m right of median centre line * Water level at ground surface (not stabilized) and hole open to 5.5 m on completion. ** No N-value, 22.7 kg hammer used.														

+ 3, × 3: Numbers refer to
Sensitivity 20
15 10 (%) STRAIN AT FAILURE

SPT 1055

METRIC[illegible]

(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 13+140; 20 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 199.9; E 301 096.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/19/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER ▼ CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE						WATER CONTENT (%) w _p w w _L
179.0	Ground Surface						179							
0.0 178.6 0.4	PEAT and Topsoil wet		1	AS	-									
	SILTY SAND with silt layers trace rootlets and organics to 0.7 m. brown, wet very loose to compact (inferred)		2	SS	- **		178							0 42 56 2
			3	SS	- **		177							
176.9 2.1			CLAY grey soft to firm		4	SS	- **		176					
	5	SS			- **		175							
	6	SS			- **		174							
	7	SS			- **		173							
172.1 6.9	End of borehole.													
	* Water level at ground surface (not stabilized) and hole open to 5.2 m on completion. **No N-value, 22.7 kg hammer used.													

SPT 1055

RECORD OF BOREHOLE No 13+165 CL

1 OF 3

METRIC

GWP 354-04-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 190.0; E 301 066.4 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
 DATUM Geodetic DATE 3/24/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)			
178.9	Ground Surface							○ UNCONFINED + FIELD VANE					
178.9 0.3	PEAT wet, soft		1	SS	4			● POCKET PENETR. × LAB VANE		20 40 60 80 100	20 40 60		
			2	SS	6		178						
	SILTY SAND brown, wet and dilatant loose		3	SS	6		177						
176.8			4	SS	0		176						
2.1			5	SS	0		175						
	CLAY grey soft to firm		6	SS	0		174						
			7	TW	PH		173						
171.4			8	SS	2		172						
7.5			9	SS	2		171						
	SILT trace to some sand trace clay below 8.7 m grey, wet and dilatant very loose		10	SS	0		170						
169.1							169						
9.8							168						
	CLAYEY SILT trace sand occasional silt seams/pockets grey, firm						167						
166.6			11	SS	5		166						
12.1							165						
	SANDY SILT grey, wet loose to compact		12	SS	28		164						
164.2													
14.7													

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15
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(%) STRAIN AT FAILURE

SPT 1055

2 OF 3

METRIC

GWP	354-94-00	LOCATION	Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 190.0; E 301 066.4	ORIGINATED BY	S.O.
DIST	62	HWY	17 (New)	BOREHOLE TYPE	Hollow Stem Augers & DCPT
DATUM	Geodetic	DATE	3/24/2002	COMPILED BY	M.L.
				CHECKED BY	Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
163.9 15.0	CLAYEY SILT occasional silt seams/pockets gray, soft to firm		13	SS	0	*								
162.4 16.5			End of borehole											
End of Dynamic Cone Penetration Test														

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

SPT 1055

RECORD OF BOREHOLE No 13+165 CL

3 OF 3

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 190.0; E 301 066.4 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
 DATUM Geodetic DATE 3/24/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
FLEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W _p	W	W _L			
						○ UNCONFINED	+	FIELD VANE								
						● POCKET PENETR.	×	LAB VANE								
						20	40	60	80	100	20	40	60			
	Dynamic Cone Penetration Test (D.C.P.T) performed from 16.4 m to 29.6 m) * Water level at 1.2 m (not stabilized) and hole open to full depth on completion. **Spoon sinking under weight of rods.															

RECORD OF BOREHOLE No 13+187; 16 m Rt 1 OF 1

METRIC

GWP 354-84-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 180.0; E 301 041.0 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/21/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
								20	40	60			
179.1 0.0	Ground Surface												
	0.2 m PEAT over		1	AS	-								
	SILTY SAND organic stained, with organics to 0.7 m brown to 1.4 m, grey/brown below wet loose (inferred)		2	SS	- **								
			3	SS	- **								
			4	SS	- **								
			5	SS	- **								
	very loose (inferred)												
175.3 3.8	CLAY some silt reddish grey firm		6	TW	-	***							
			7	TW	-	****							
				8	SS	- **							
172.2 6.8	End of borehole												
	* Water level at 0.2 m (not stabilized) and hole open to 1.2 m on completion. **No N-value, 22.7 kg hammer used. ***Shelby tube sampling attempted. No recovery. ****Shelby tube sampling attempted. No recovery, sugar sample collected.												

+ ³ . x ³ : Numbers refer to
Sensitivity

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10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 13+191; 22 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 156.1; E 301 070.3 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/20/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
179.5	Ground Surface													
179.2	PEAT		1	AS	-		179							
0.3			2	SS	- **		178							0 87 11 2
	FINE SAND trace silt, rootlets and trace organics to 0.7 m brown to 2.1 m grey/brown below wet, loose to compact (inferred)		3	SS	- **		177							
			4	SS	- **		176							
176.6			5	SS	- **		175							
2.9	CLAY trace silty sand gray soft to firm						174							
175.2			6	SS	- **		173							0 32 61 7
4.3	SILT and SANDY SILT trace clay grey/brown very loose (inferred)		7	SS	- **									
172.9														
6.6	End of borehole													
	* Water level at 0.1 m (not stabilized) and hole open to 1.5 m on completion. **No N-value, 22.7 kg hammer used.													

SPT 1055

RECORD OF BOREHOLE No 13+206 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 155.5; E 301 043.0 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/21/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI C
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
179.5	Ground Surface							20 40 60 80 100				
179.3	0.2 m PEAT		1	AS	-		179	○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE				
0.2	FINE SAND trace silt brown to 2.1 m, grey/brown below, wet loose to compact (inferred)		2	SS	- **		178	w _p w w _L PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
			3	SS	- **		177	WATER CONTENT (%)				
			4	SS	- **		176					
			5	SS	- **		175					
			6	TW	PH		174					
175.5	CLAY grey soft to firm		7	SS	- **		173					
4.0												
172.8	End of borehole											
8.9	Borehole advanced 0.9 m right of median centre line * Water level at ground surface (not stabilized) and hole open to 0.6 m on completion. **No N-value, 22.7 kg hammer used.											

+ 3, x 3: Numbers refer to
Sensitivity

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(%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 13+227; 22 m Lt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 125.6; E 301 051.1 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/13/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE							
179.8	Ground Surface						20	40	60	80	100				
179.5	PEAT dark brown to black, wet		1	AS	-								○		
0.3			2	SS	- **								○		
	FINE SAND trace silt, trace rootlets to 2.1 m organic stained to 0.7 m, brown below wet, loose (inferred)		3	SS	- **								○		
			4	SS	- **								○		
			5	SS	- **								○		
176.1			6	SS	- **									○	
3.7	CLAY grey soft to stiff		7	SS	- **									○	
173.2			8	SS	- **									○	
6.6	End of borehole														
	* Water level at 0.6 m (not stabilized) and hole open to 1.5 m on completion.														
	**No N-value, 22.7 kg hammer used.														

RECORD OF BOREHOLE No 13+230 20 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 145.6; E 301 013.6 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
 DATUM Geodetic DATE 3/22/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
179.8	Ground Surface													
179.6 0.2	0.2 m PEAT		1	AS	-									
	FINE SAND trace silt, trace rootlets to 2.1 m, wet very loose to compact (inferred) brown grey		2	SS	-**		179							0 93 6 1
			3	SS	-**		178							
			4	SS	-**		177							
			5	SS	-**		176							
			6	AS	-**		175							
175.8 4.0	CLAY grey firm		7	SS	-**		174							
172.9 8.9	End of borehole * Water level at 0.3 m (not stabilized) and hole open to 0.6 m on completion. **No N-value, 22.7 kg hammer used.						173							

+³, x³: Numbers refer to
Sensitivity

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15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 13+255 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 114.2; E 301 016.9 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/13/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE							W _p	W	W _L
180.0	Ground Surface						20	40	60	80	100	20	40	60			
0.0	0.3 m Topsoil organic stained, some organics		1	AS	-							○			0 76 21 3 Flowing sands at 3.0 m		
			2	SS	- **							○					
			3	SS	- **							○					
	FINE SAND trace silt, trace rootlets to 2.9 m brown, wet loose to compact (inferred)		4	SS	- **							○					
			5	SS	- **							○					
	some clay, firm		6	SS	- **							○					
175.6																	
4.4			7	SS	- **		+ ²										
	CLAY trace silt to 5.6 m grey firm						+ ²							○			
								+ ³									
173.4			8	SS	- **												
6.6	End of borehole												○				
	Borehole advanced 0.4 m right of median centre line. * Water level at 0.1 m (not stabilized) and hole open to 2.7 m on completion. **No N-value, 22.7 kg hammer used.																

SPT 1055

RECORD OF BOREHOLE No 13+279; 19 m Lt 1 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 083.6; E 301 020.5 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
DATUM Geodetic DATE 3/23/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
180.0	Ground Surface											
179.8 0.2	0.2 m PEAT		1	SS	2		180					
	FINE SAND trace silt dark brown to brown trace organics to 1.4 m wet, very loose to loose		2	SS	6		179					1 88 10 1
			3	SS	6		178					
			4	SS	2		177					
176.3 3.7	SILT some sand, trace clay grey, wet, very loose		5	SS	1		176					
175.6 4.4			6	SS	1		175					
			7	SS	2		174					
	CLAY grey soft to firm		8	TW	PH		173				15.1	0 1 55 44
			9	SS	2		172					
			10	SS	2		171					
169.9 10.1	SILT to SANDY SILT trace to some clay, occasional sandy silt seams grey, very loose		11	SS	2		170					
			12	SS	1		169					
			13	SS	2		168					
							167					
							166					

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT 1055

RECORD OF BOREHOLE No 13+279; 19 m Lt 2 OF 2 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 083.6; E 301 020.5 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers & DCPT COMPILED BY M.L.
 DATUM Geodetic DATE 3/23/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
185.0 15.0	SILT to SANDY SILT trace to some clay, occasional sandy silt seams grey, very loose		14	SS	3									
164.0 18.0														
161.7 18.3	End of borehole													
161.7 18.3	End of Dynamic Cone Penetration Test * Water level at 0.6 m (not stabilized) and hole open to 5.5 m on completion. Dynamic Cone Penetration Test (D.C.P.T) performed from 16.1 m to 18.3 m.													

RECORD OF BOREHOLE No 13+282; 19 m Rt 1 OF 1 METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 101.9; E 300 986.7 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
 DATUM Geodetic DATE 3/22/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE							
180.1	Ground Surface							20 40 60 80 100							
179.8 0.2	0.2 m PEAT		1	AS	-		180								
	FINE SAND trace silt brown to 2.1 m, grey/brown below wet, very loose to loose (inferred)		2	SS	- **		179								0 82 7 1
			3	SS	- **		178								
			4	SS	- **		177								
			5	SS	- **		176								
							175								
176.1 4.0	CLAY occasional sand and silt inclusions reddish grey		6	SS	- **		174								
			7	SS	- **										
173.2 8.9	End of borehole														
	* Water level at ground surface (not stabilized) and hole open to 1.5 m on completion.														
	**No N-value, 22.7 kg hammer used.														

SPT 1055

RECORD OF BOREHOLE No 13+307 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, Sault Ste. Marie, ON - Coords: N 5 149 070.9; E 300 989.0 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY M.L.
DATUM Geodetic DATE 3/23/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
180.1	Ground Surface											
179.9 0.2	0.2 m PEAT		1	AS	-		180					
	FINE SAND trace silt, with rootlets and organics to 0.7 m dark brown to 0.7 m, brown below wet, very loose to loose (inferred)		2	SS	- **		179					
			3	SS	- **		178					0 95 4 1
			4	SS	- **		177					
			5	SS	- **		176					
176.1 4.0	CLAY reddish gray soft to firm		6	SS	- **		175					
			7	SS	- **		174					
173.2 6.9	End of borehole Borehole advanced 0.4 m right of median centre line. * Water level at 0.1 m (not stabilized) and hole open to 1.8 m on completion. **No N-value, 22.7 kg hammer used.											

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR1

1 OF 1

METRIC

GWP 354-84-00 LOCATION Sta. 11+493, Highway 638, Coords: N 5 149 473.4; E 300 917.3 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/12/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	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	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			N-VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
177.7 0.0	Ground Surface		1	AS	-											
	EMBANKMENT FILL. Gravelly Sand some silt grey, wet		2	SS	-											
			3	SS	-											
175.5 2.2			4	SS	-											
	CLAY with silty clay zones, grey soft		5	SS	-											
			6	TW	PH											
172.1 5.6	End of borehole															
	* Water level at ground surface (not stabilized) and hole open to 1.0 m on completion. ** No N-value, 22.7 kg hammer used.															

SPT1055

1 OF 2

METRIC

LOCATION Sta. 11+527, Highway 638, Coords: N 5 149 473.3; E 300 951.0

ORIGINATED BY Y.L.

HWY 17 (New)BOREHOLE TYPE D.C.P.T.

COMPILED BY Y.L.

DATUM Geodetic

DATE 4/30/2002

CHECKED BY Z.O

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR2

2 OF 2

METRIC

GWP 354-94-00 LOCATION Sta. 11+527, Highway 638, Coords: N 5 149 473.3; E 300 951.0 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 4/30/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	W _N VALUES			20	40	60	80	100					
162.5																	
15.0																	
162.3																	
15.3	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test performed from 0.9 m to 15.3 m.																

+ 3, x 3: Numbers refer to
Sensitivity

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15
10
(%) STRAIN AT FAILURE


SPT1055

RECORD OF BOREHOLE No PR3

1 OF 3

METRIC

GWP 354-04-00 LOCATION Sta. 11+551, Highway 638, Coords: N 5 149 476.5; E 300 975.9 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 4/30/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED + FIELD VANE					
								● POCKET PENETR. × LAB VANE					
178.4 0.0	Ground Surface					20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L				
	EMBANKMENT FILL Silty Sand trace gravel, trace clay brown, damp to moist compact to dense		1	AS	-								
			2	SS	30								
			3	SS	38								
			4	SS	18								
175.5 2.9	some sand and gravel <												

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR3

2 OF 3

METRIC

GWP 354-84-00 LOCATION Sta. 11+551, Highway 638, Coords: N 5 149 476.5; E 300 975.9 ORIGINATED BY Y.L.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 4/30/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES								
163.4													
15.0													
163.0													
15.4	SILT trace to some clay grey, wet and dilatant very loose to loose		12	SS	2								
	SILTY CLAY occasional silt seams and pockets grey/brown stiff												
161.8													
16.8	End of borehole												

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No PR3

3 OF 3

METRIC

GWP 354-94-00 LOCATION Sta. 11+551, Highway 638, Coords: N 5 149 478.5; E 300 975.9

ORIGINATED BY Y.L.

DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T.

COMPILED BY Y.L.

DATUM Geodetic DATE 4/30/2002

CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
148.4 30.0							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE 20 40 60 80 100	20 40 60					
148													
147													
146													
145													
144													
143													
142.4 36.0	End of Dynamic Cone Penetration Test * Wet cave at 1.2 m on completion. Dynamic Cone Penetration Test performed from 17 m to 36 m.												

SPT1055

RECORD OF BOREHOLE No PR4

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 11+569, Highway 638, Coords: N 5 149 473.3; E 300 992.8 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/12/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N-VALUES			20	40	60	80	100			W _p
177.5 0.0	Ground Surface		1	AS	-										
	EMBANKMENT FILL Gravelly Sand some silt brown, moist		2	SS	-										
			3	SS	-										
175.4 2.1															
	CLAY with silty clay zones grey firm to stiff		4	SS	-										
171.9 5.6															
	End of borehole														

* Water level at ground surface (not stabilized) and hole open to 0.6 m on completion
** No N-value, 22.7 kg hammer used.

SPT1055

RECORD OF BOREHOLE No PR5

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 11+800, Highway 638, Coords: N 5 149 464.6; E 301 022.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/11/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
177.5	Ground Surface												
177.2	PEATY TOPSOIL		1	AS	-								
0.3	wt												
176.9	SANDY SILT		2	SS	- **								
0.6	rootlets, grey, wt												
	CLAY		3	SS	- **								
	trace rootlets to 2.1 m												
	grey		4	SS	- **								
	very soft to soft												
			5	SS	- **								
			6	SS	- **								
171.9	End of borehole												
5.6													
	* Water level at ground surface (not stabilized) and hole open to 5.2 m on completion												
	** No N-value 22.7 kg hammer used.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR6

1 OF 1

METRIC

GWP 354-04-00 LOCATION Sta. 11+623, Highway 638, Coords: N 5 149 458.0; E 301 044.5 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
 DATUM Geodetic DATE 3/11/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N ^o VALUES			SHEAR STRENGTH kPa						
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR. × LAB VANE				
177.4	Ground Surface						20	40	60	80	100			
0.0	PEAT:dark brown to black wet		1	AS	-									
0.3	SANDY SILT													
176.7	trace clay, grey, wet													
0.7	CLAY grey very soft to soft		2	SS	- **									
			3	SS	- **									
			4	SS	- **									
			5	SS	- **									
			6	SS	- **									
171.8	End of borehole													
5.6	* Water level at ground surface (not stabilized) and hole open to 4.9 m on completion													
	** No N-value 22.7 kg hammer used.													


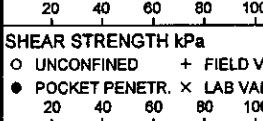
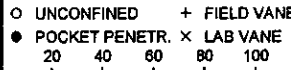
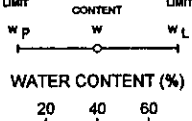
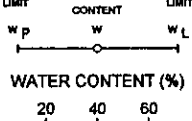
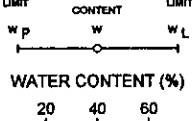
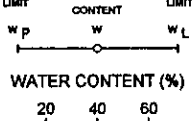
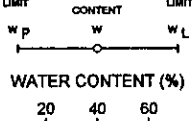
SPT1055

RECORD OF BOREHOLE No PR7

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 11+845, Highway 638, Coords: N 5 149 453.0; E 301 066.2 ORIGINATED BY S.O.
DIST 82 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/9/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL								
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
177.3 0.0	Ground Surface 0.15 m Peat		1	AS	-	177				13.5										
176.8 0.7	SANDY SILT trace clay, grey, wet		2	SS	- **							176		○						
CLAY trace rootlets to 1.4 m grey very soft to soft			3	SS	- **										175		●			
			4	SS	- **													174		●
			5	TW	PH															
171.7 5.6			End of borehole	6	SS										- **	172		●		
* Water level at 0.3 m (not stabilized) and hole open to 5.2 m on completion. ** No N-value 22.7 kg hammer used.																				

SPT1055

1 OF 4

METRIC

LOCATION HWY 638 (New) 11+680; 4 m LL - Coords: N 5 149 436.1; E 301 097.7

ORIGINATED BY S.O.

HWY 17 (New)

BOREHOLE TYPE Hollow Stem Augers and D.C.P.T.

COMPILED BY Y.L.

DATUM Geodetic

DATE 4/2/2002

CHECKED BY **Z.O.**

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

2 OF 4

METRIC

LOCATION HWY 638 (New) 11+580; 4 m LT - Coords: N 5 149 436.1; E 301 097.7

ORIGINATED BY S.O.

HWY 17 (Now)

BOREHOLE TYPE Hollow Stem Augers and D.C.P.T.

COMPILED BY Y.L.

DATUM Geodetic

DATE 4/2/2002

CHECKED BY **Z.O.**

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No C1

3 OF 4

METRIC

GWP 354-94-00 LOCATION HWY 638 (New) 11+680; 4 m LT. - Coords: N 5 149 436.1; E 301 097.7 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
 DATUM Geodetic DATE 4/2/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
148.0 30.0	CLAY reddish gray, wet soft												
147.0 31.0			17	SS	0								
End of Bore Hole * Water level at 0.3 m (not stabilized) on completion ** Consolidation Test performed using sample TW 6													

Continued Next Page

+ 3, x 3. Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE



SPT1055

RECORD OF BOREHOLE No C1

4 OF 4

METRIC

GWP 354-94-00 LOCATION HWY 638 (New) 11+880; 4 m Lt. - Coords: N 5 149 436.1; E 301 097.7 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 4/2/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE								
133.0												
45.0												
125.2												
52.8	End of Dynamic Cone Penetration Test Dynamic Cone Penetration Test performed from 31 m to 52.7 m.											

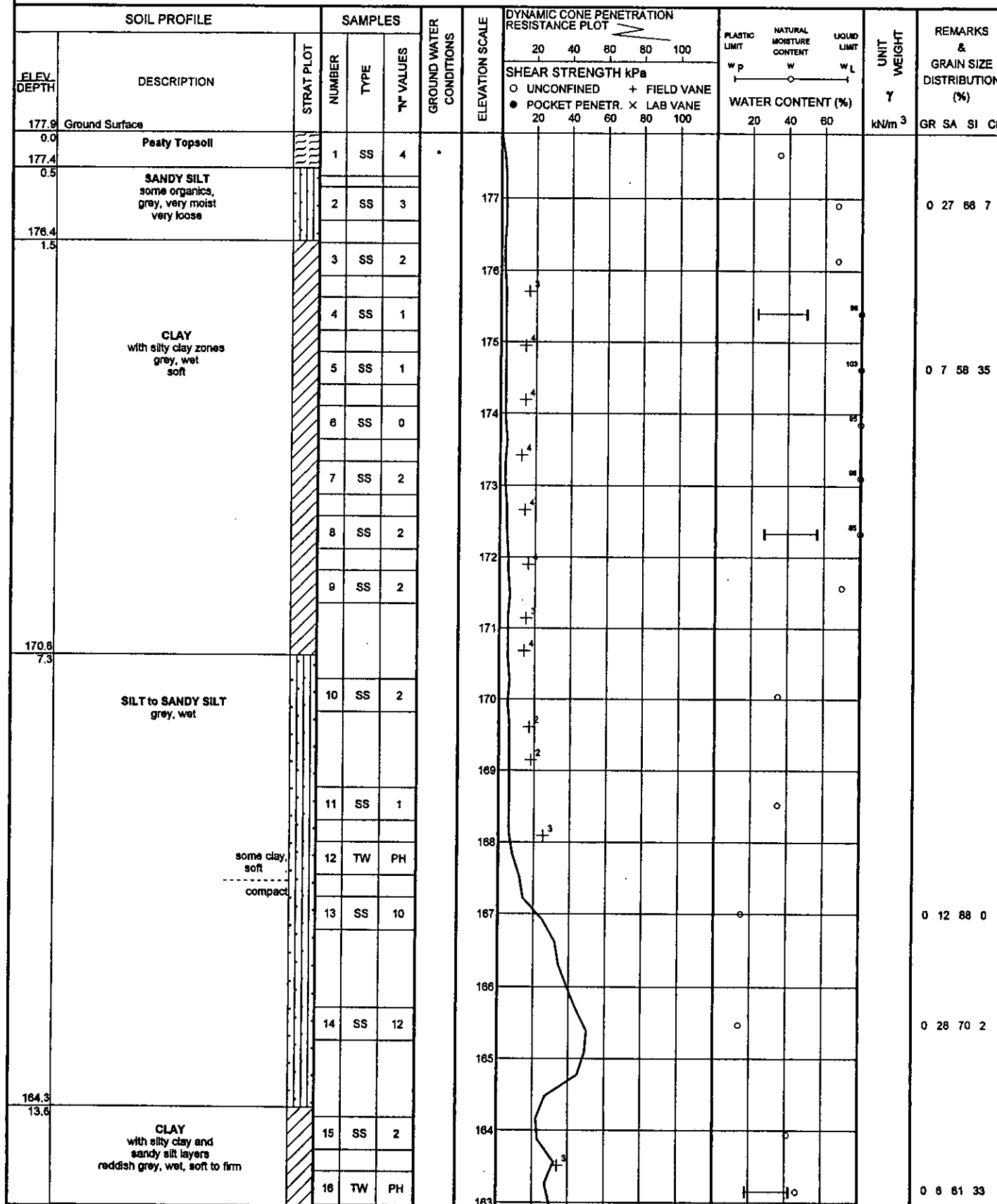
SPT1055

RECORD OF BOREHOLE No C1-A

1 OF 2

METRIC

GWP 354-94-00 LOCATION HWY 638 (New) 11+686; 12 m Rt. - Coords: N 5 149 419.9; E 301 094.6 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 12/13/2002 CHECKED BY Z.O.



SPT1055

2 OF 2

METRIC

GWP 354-94-00

LOCATION HWY 638 (New) 11+688; 12 m Rt. - Coords: N 5 149 419.9; E 301 094.6

ORIGINATED BY G.I.

DIST 62

HWY 17 (New)

BOREHOLE TYPE Hollow Stem Augers and D.C.P.T.

COMPILED BY Y.L.

DATUM Geodetic

DATE 12/13/2002

CHECKED BY ZO

+ 3, X 3; Numbers refer to Sensitivity

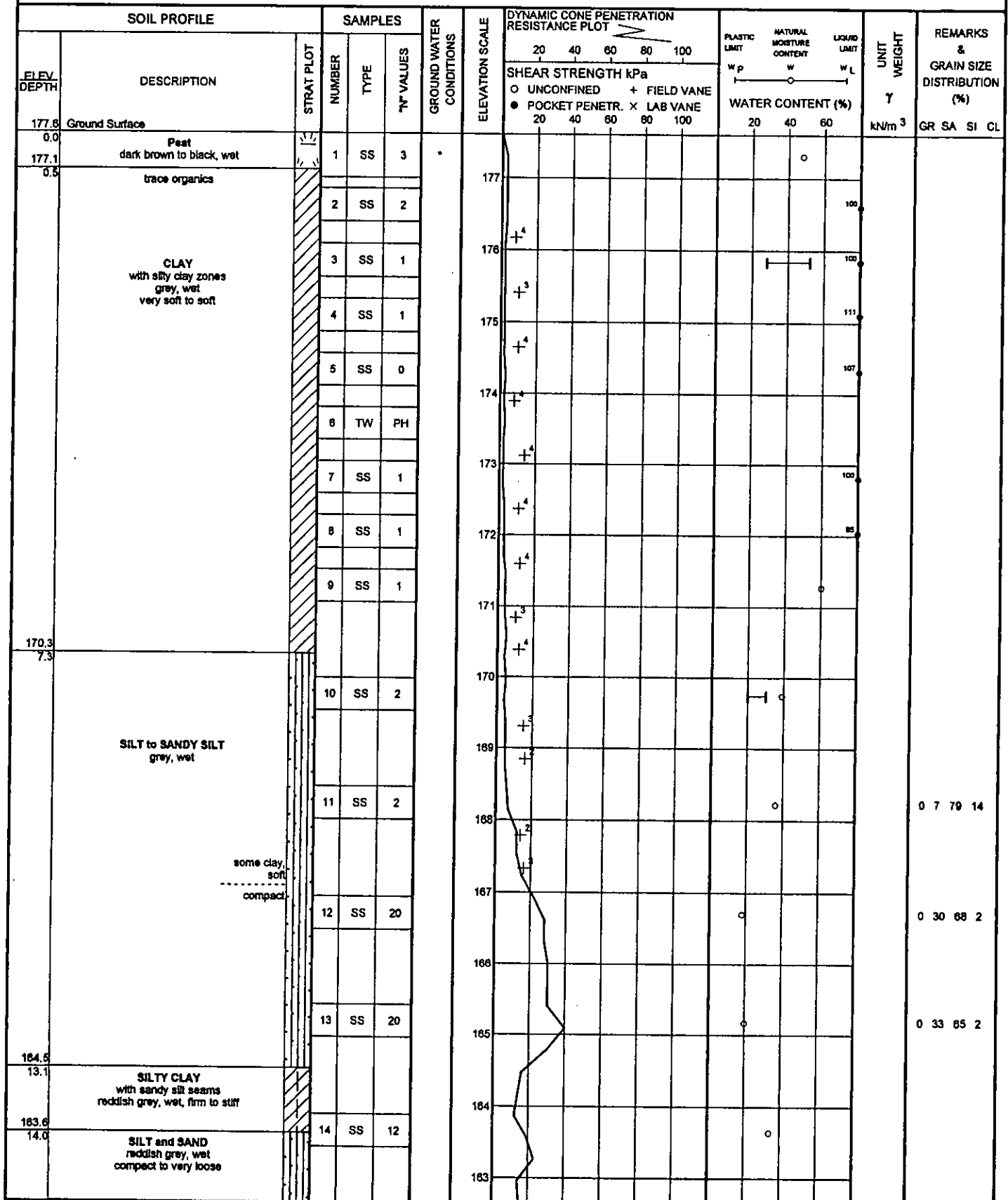
SPT1055

RECORD OF BOREHOLE No C1-B

1 OF 2

METRIC

GWP 354-94-00 LOCATION HWY 638 (New) 11+675; 14 m LL - Coords: N 5 149 447.5; E 301 098.2 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 12/12/2002 CHECKED BY Z.O.



SPT1055

RECORD OF BOREHOLE No C1-B

2 OF 2

METRIC

GWP 354-94-00 LOCATION HWY 638 (New) 11+675; 14 m Lt. - Coords: N 5 149 447.5; E 301 098.2 ORIGINATED BY G.I.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
 DATUM Geodetic DATE 12/12/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
162.6																	
15.0	SILT and SAND																
162.1	reddish grey, wet, compact to very loose		15	SS	2		162										0 48 50 2
15.5	SILTY CLAY																
161.6	grey, wet, firm																
16.0	End of borehole.																
	* Water level at 1.5 m (not stabilized) and hole open to 11.6 m on completion.																

RECORD OF BOREHOLE No PR8

1 OF 1

METRIC

GWP 354-84-00

LOCATION Sta. 11+697, Highway 638, Coords: N 5 149 423.6; E 301 110.7

ORIGINATED BY S.O.

DIST 62

HWY 17 (New)

BOREHOLE TYPE Solid Stem Augers

COMPILED BY Y.L.

DATUM Geodetic

DATE 3/9/2002

CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			
177.6 0.0	Ground Surface							20 40 60 80 100			
176.9 0.7	PEAT wet		1	AS	-			20 40 60 80 100			
	0.1 m thick grey Silt seam (trace sand, trace clay) CLAY trace rootlets to 1.4 m grey very soft to soft		2	SS	-						
			3	SS	-						
			4	SS	-						
			5	SS	-						
			6	SS	-						
			7	SS	-						
172.0 5.6	End of borehole										
* Water level at 0.3 m (not stabilized) and hole open to 4.6 m on completion											
** No N-value 22.7 kg hammer used.											

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR9

1 OF 2

METRIC

GWP 354-94-00 LOCATION Sta. 11+722, Highway 638, Coords: N 5 149 410.4; E 301 131.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/7/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● POCKET PENETR. × LAB VANE						
177.5	Ground Surface						20	40	60	80	100	20	40	60		
0.0	PEAT		1	SS	5										** frozen to 0.5 m	
177.0	with decayed wood pieces dark brown to black, wet, soft		2	SS	2											
0.5			3	SS	1											
			4	SS	1											
	CLAY trace rootlets to 2.1 m grey very soft to soft		5	SS	1											
			6	SS	1											
			7	SS	2											
	occasional silt seams		8	SS	1											
170.4			9	SS	6											
7.1			10	SS	30											
	SILT to SANDY SILT trace clay, grey wet		11	SS	8											
	very loose to loose		12	SS	21									0 40 57 3		
	compact															
	loose															
164.2	CLAY reddish grey, very soft to soft															
13.3	0.2 m thick sandy silt seam															

Continued Next Page

+ 3 x 3: Numbers refer to Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

2 OF 2

METRIC

ORIGINATED BY G.I.

COMPILED BY Y.L

CHECKED BY Z0

+ 3, × 3: Numbers refer to Sensitivity

SPT1055

RECORD OF BOREHOLE No PR10

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 11+744, Highway 638, Coords: N 5 149 399.5; E 301 150.1 ORIGINATED BY G.I.
DIST 82 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/8/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N ^o VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● POCKET PENETR.	+ FIELD VANE x LAB VANE						
177.1	Ground Surface							20 40 60 80 100							
0.0	PEATY TOPSOIL		1	SS	4		177							** frozen to 0.3 m	
176.7	dark brown to black, wet, soft		2	SS	2		176								
0.4	CLAY trace rootlets to 1.4 m soft		3	TW	PH		175								
			4	SS	2		174								
			5	SS	1		173								
172.2	SILT to SANDY SILT grey, wet very loose to loose	6	SS	2	172								0 1 72 27		
4.9		7	SS	5	171										
		8	SS	3	170										
169.8	End of Borehole														
7.2	* Water level at 2.7 m (not stabilized) and hole open to 3.7 m on completion.														

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR11

1 OF 1

METRIC

GWP 354-84-00 LOCATION Sta. 11+837, Highway 638, Coords: N 5 149 348.5; E 301 227.9 ORIGINATED BY S.O.
 DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
 DATUM Geodetic DATE 7/3/2002 CHECKED BY Z.O.

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

+³, x³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No PR12

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 148 333.0; E 301 251.3 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/8/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI C	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	TV VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
								20 40 60 80 100					
								20 40 60 80 100					
179.1	Ground Surface												
178.8	PEAT: wet		1	AS	-								
0.3													
	SILTY SAND trace rootlets and organics to 0.7 m grey/brown, wet		2	SS	- **								
177.7													
1.4			3	SS	- **								
	CLAY reddish grey, trace rootlets to 2.1 m very soft to soft		4	SS	- **								
	occasional dilatant silt seams		5	SS	- **								
			6	SS	- **								
174.7													
4.4			7	SS	- **								
	SILT and SAND trace clay, brown, wet and dilatant												
173.3			8	SS	- **								
5.8	End of borehole												
	* Wet cave at 1.5 m.												
	** No N-value 22.7 kg hammer used.												

SPT1055

RECORD OF BOREHOLE No PR13

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 316.8; E 301 277.4 ORIGINATED BY S.O.
DIST 62 HWY 17 (New) BOREHOLE TYPE Solid Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/8/2002 CHECKED BY Z.O.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			N ^o VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W _p	W	W _L			
179.6	Ground Surface															
179.3	PEAT: wet		1	AS	-											
178.3	SILTY SAND trace organics organic stained to gray, wet		2	SS	-											
178.2			3	SS	-											
177.4	CLAY gray		4	TW	PH											
	very soft to soft		5	SS	-											
	soft to firm		6	SS	-											
174.0	End of borehole															
5.6	* Water level at 0.9 m (not stabilized) and hole open to 1.5 m on completion. ** No N-value 22.7 kg hammer used.															

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

SPT1055

1 OF 2

METRIC

LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 304.9; E 301 298.3

ORIGINATED BY G.I.

HWY 17 (New)

BOREHOLE TYPE Hollow Stem Augers and D.C.P.T.

COMPILED BY Y.L.

DATUM Geodetic

DATE 3/9/2002

CHECKED BY Z.O

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No PR14

2 OF 2

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 304.9; E 301 298.3 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers and D.C.P.T. COMPILED BY Y.L.
DATUM Geodetic DATE 3/9/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
165.1													
15.0	CLAY soft to firm		13	SS	8								
164.1	occasional grey silt seams												
16.0	End of borehole												
180.0													
20.1	End of Dynamic Cone Penetration Test * Water level at 2.7 m (not stabilized) and hole open to 5.2 m on completion Dynamic Cone Penetration Test performed from 16.2 m to 20.1 m.												



SPT1055

RECORD OF BOREHOLE No PR17

1 OF 1

METRIC

GWP 354-94-00 LOCATION Echo River to Bar River Road, ON - Coords: N 5 149 290.0; E 301 318.7 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 3/9/2002 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N ^o VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								UNCONFINED + FIELD VANE POCKET PENETR. x LAB VANE							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		
179.7	Ground Surface						20	40	60	80	100	20	40	60			
0.0	0.1 m Topsoil, occasional fine gravel		1	SS	4											**frozen to 0.4 m	
	SILTY SAND brown, wet compact		2	SS	21												
			3	SS	14												
177.6			4	SS	2												
2.1	CLAY firm to 2.9 m very soft to soft below		5	SS	1												
			6	SS	1												
			7	SS	1												
172.5	End of Bore Hole																
7.2	* Water level at 0.9 m (not stabilized) and hole open to 2.1 m on completion																

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE



SPT1055

RECORD OF BOREHOLE No 12+000 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 12+000, Highway 638, Coords: N 5 149 373.7; E 301 332.4 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 6/1/2003 CHECKED BY R.M.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED ● POCKET PENETR.	+ FIELD VANE × LAB VANE				
179.5 0.0	Ground Surface 0.3 m Topsoil		1	SS	10								
178.3 1.2	CLAY reddish grey soft to firm		2	SS	7								
			3	SS	2								
			4	SS	0								
			5	SS	3								
			6	SS	2								
			7	SS	2								
172.2 7.3	End of Borehole. * Wet cave at 3.0 m on completion. ** Spoon sinking under weight of hammer and rods												

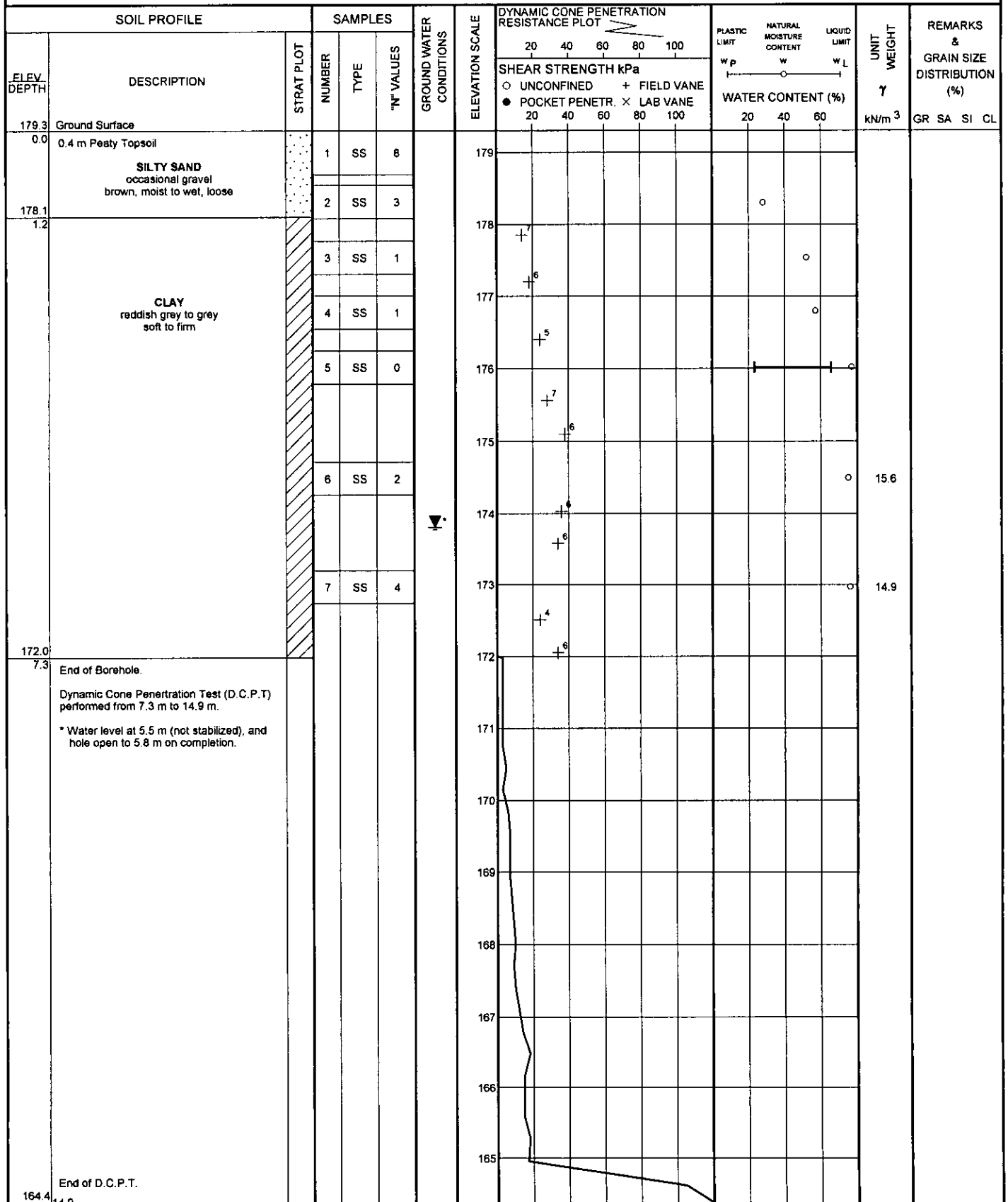
SPT1055

RECORD OF BOREHOLE No 12+142 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 12+142, Highway 638, Coords: N 5 149 502.4; E 301 392.4 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 6/1/2003 CHECKED BY R.M.



Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT1055

RECORD OF BOREHOLE No 12+260 CL

1 OF 1

METRIC

GWP 354-94-00 LOCATION Sta. 12+260, Highway 638, Coords: N 5 149 809.3, E 301 442.3 ORIGINATED BY G.I.
DIST 62 HWY 17 (New) BOREHOLE TYPE Hollow Stem Augers COMPILED BY Y.L.
DATUM Geodetic DATE 6/1/2003 CHECKED BY R.M.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								○ UNCONFINED ● POCKET PENETR.	+ FIELD VANE × LAB VANE			
179.1	Ground Surface						20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L		
0.0	0.4 m Topsoil		1	SS	5			WATER CONTENT (%)				
178.4	SILTY SAND brown, wet, very loose to loose		2	SS	2							
0.7	SANDY SILT occasional clay pockets grey, wet, very loose		3	SS	4							
177.0	CLAY reddish grey, wet soft to firm		4	SS	0	**						
2.1			5	SS	0	*						
			6	SS	2							
			7	SS	3							
			8	SS	3							
			9	SS	51							
			10	SS	60/0	***						
169.7		Heterogeneous mixture of silt, sand and gravel, gray, wet, very dense (SILTY SAND TILL)										
9.4	End of Borehole.											
169.2	* Water level at 6.1 m (not stabilized), and hole open to 6.7 m on completion.											
9.9	** Spoon sinking under weight of hammer and rods.											
	*** Sampler refusal probably on a cobble or boulder.											
166.3	End of D.C.P.T.											
12.8	Dynamic Cone Penetration Test (D.C.P.T.) performed from 9.7 m to 12.8 m.											

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

W.P. 903-72-01

LOCATION CO-ORDS. 894,085N 988,030 E

ORIGINATED BY HS

DIST. 18 HWY. 17

BORING DATE March 6-7, 1975

COMPILED BY AP

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger and Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
584.0	Ground Level															
583.0	Topsoil															
1.0	Sandy silt with organics.															
579.0																
4.0	silty clay. to Clay		1	SS	1/18"	580										M/C 97% Org. 1.8%
	Soft		2	SS	1/18"											
			3	SS	1/18"	570										
564.0																
20.0	Clayey silt to silt.		4	TW	PH	560										
	Firm		5	SS	2											
557.0																
27.0	Silt to sandy silt.		6	SS	10	550										0 5 91 4
	Loose to Compact		7	SS	23											0 18 78 4
546.0																
38.0	silty clay to clay (stratified)		8	SS	1/18"	540										
	with silt layers.		9	SS	1/18"											
			10	TW	PH	530										
	Firm to Stiff		11	SS	3											
						520										
						510										
						500										
494.0																
90.0	End of Borehole															

Cone Test

90-100 Ft. 9-9-9-10-12-12-13-13-13-14
 100-110 Ft. 16-21-22-22-25-24-23-24-24-24
 110-120 Ft. 51-50-50-49-52-42-39-37-37-34
 120-130 Ft. 40-40-36-36-37-39-37-35-39-40

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6

W.P. 903-72-01 LOCATION CO-ORDS. 893,295 N 987,740 E ORIGINATED BY HS
 DIST. 18 HWY. 17 BORING DATE March 8-10, 1975 COMPILED BY AP
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p w w_L WATER CONTENT %	UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
589 ±	Ground Level													
588.	Topsoil													
586.	Sandy silt with orgs.													
3.0	silty clay to clay Soft		1	AS	-									
			2	AS	-									
			3	SS	1/18"	580								
			4	TW	PH									
			5	AS	-	570								
			6	SS	1/18"									
557.0			7	SS	1/18"	560								
32.0	Silt to sandy silt Loose to Compact		8	SS	13									
			9	SS	13	550								
			10	SS	1									
541.0						540								
48.0	silty clay to clay (stratified) with silt layers Firm to Stiff		11	SS	1/18"									
			12	SS	1/18"	530								
			13	SS	5	520								
						510								
			14	SS	2									
504.														
85.0	End of Borehole					500								

Cone Test

85 - 90 Ft. 3-4-6-8-9
 90-100 Ft. 11-12-11-13-13-15-15-16-21-25
 100-110 Ft. 25-26-28-28-27-25-26-27-30-36
 110-120 ft. 47-46-45-45-41-39-37-36-39-43
 120-130 Ft. 45-40-41-44-55-58-53-51-51-51

PROJECT: 941-1364

RECORD OF PROBE HOLE 95-PH1

SHEET 1 OF 2

LOCATION: SEE FIGURE 3E

BORING DATE: SEPT. 26/95

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, K, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa	nat V - rem V -	+ ●	Q - ● U - O	Wp	W	Wt			
								20	40	60	80	20	40	60	80		
0	TRACK MOUNTED CME SS POWER AUGER 100mm ID HOLLOW STEM AUGERS	GROUND SURFACE		178.90													
		Organic silt, some sand, fibrous		0.00													
		Very soft.		0.15	1	50	DO										
		Dark brown															
1		Silty clay, trace sand, frequent															
		sand and organic matter pockets.															
		Very soft															
		Brownish grey to grey				2	50	DO									
					175.50												
					1.40												
2	Sandy silt, trace organic																
	Loose				3	50	DO										
	Grey																
				174.70													
				2.20													
3	Irregularly layered silty clay																
	and clayey silt, trace sand,																
	occ. fibrous peat layers.																
	Soft				4	50	DO	WH									
	Brownish grey to grey																
				173.50													
				3.40													
4	TRACK MOUNTED CME SS POWER AUGER 100mm ID HOLLOW STEM AUGERS	Irregularly layered silty clay to clay and clayey silt to silt, interlayers of silty sand and organic inclusions. Soft Greyish to reddish brown															
5																	
6																	
7																	
8																	
9																	
10																	

CONTINUED ON NEXT PAGE

DATA INPUT: P8 JAN 22/98

PROBE

DEPTH SCALE

Golder Associates

LOGGED: GEB

CHECKED: ASP

PROJECT: 841-1384

RECORD OF PROBE HOLE 95-PH1

SHEET 2 OF 2

LOCATION: SEE FIGURE 3E

BORING DATE: SEPT.28/95

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP: 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP: 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, K, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT	
								CU, kPa	U, kPa			Wp	Wi
10	TRACK MOUNTED CME SS POWER AUGER 100mm ID HOLLOW STEM AUGERS	CONTINUED FROM PREVIOUS PAGE											
11		Irregularly layered silty clay to clay and clayey silt to silt, interlayers of silty sand and organic inclusions. Soft Greyish to reddish brown											
12													
13		END OF BOREHOLE		184.10 12.60									
14													
15													
16													
17													
18													
19													
20													

Water level in
open hole at
about 2.4m depth
(but still rising)
upon completion
of drilling.

DEPTH SCALE

Golder Associates

LOGGED: GEB

CHECKED: ASP

PROJECT: 941-1384

RECORD OF PROBE HOLE 95-PH2

SHEET 1 OF 2

LOCATION: SEE FIGURE 3E

BORING DATE: SEPT. 26/95

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP: 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	WATER CONTENT, PERCENT Wp	W		
0		GROUND SURFACE		178.80							
		Organic silt, fibrous		0.00							
		Very soft		178.55							
		Black		0.25							
		Organic sandy silt, some gravel, occ. cobble		178.35							
		Very soft		0.45							
		Brown									
1					1	50 DO	PM				
2					2	50 DO	PM				
3					3	50 DO	PM				
4					4	50 DO	PM				
5					5	50 DO	PM				
6											
7											
8											
9											
10											

TRACK MOUNTED CME 55 POWER AUGER
108mm ID HOLLOW STEM AUGERS

Irregularly layered silty clay
to clay and clayey silt to silt,
trace sand, trace organic matter
from 0.45m to 1.10m depth.
Soft to firm
Brownish grey to greyish brown

ORG
= 77%

MH

BENTONITE SEAL

CUTTINGS

BENTONITE SEAL

SAND

BENTONITE SEAL

CUTTINGS

CONTINUED ON NEXT PAGE

CONTINUED ON NEXT PAGE

DEPTH SCALE

Golder Associates

LOGGED: GEB

CHECKED: ASP

DATA INPUT: PS JAN. 22/98

PROBE

J3840P2.BHS

PROJECT: 941-1384

RECORD OF PROBE HOLE 95-PH2

SHEET 2 OF 2

LOCATION: SEE FIGURE 3E

BORING DATE: SEPT.28/95

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, K, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		c _u , kPa		Wp				W	
10	TRACK MOUNTED CME 55 POWER AUGER 108mm ID HOLLOW STEM AUGERS	CONTINUED FROM PREVIOUS PAGE															
11		Irregularly layered silty clay to clayey silt, trace sand, occ. grey silt inclusion below 9.0m depth. Soft to firm Brownish grey		6	50	1											
12				164.91	11.89												
13		END OF BOREHOLE															
14																	
15																	
16																	
17																	
18																	
19																	
20																	

CUTTINGS

Water level in
open hole at
about 10.7m depth
below ground
surface upon
completion of
drilling
Water level in
piezometer at
Elev. 176.7m on
October 8, 1995.

DATA INPUT: PS JAN22/96

ROBE

DEPTH SCALE

Golder Associates

LOGGED: GEB

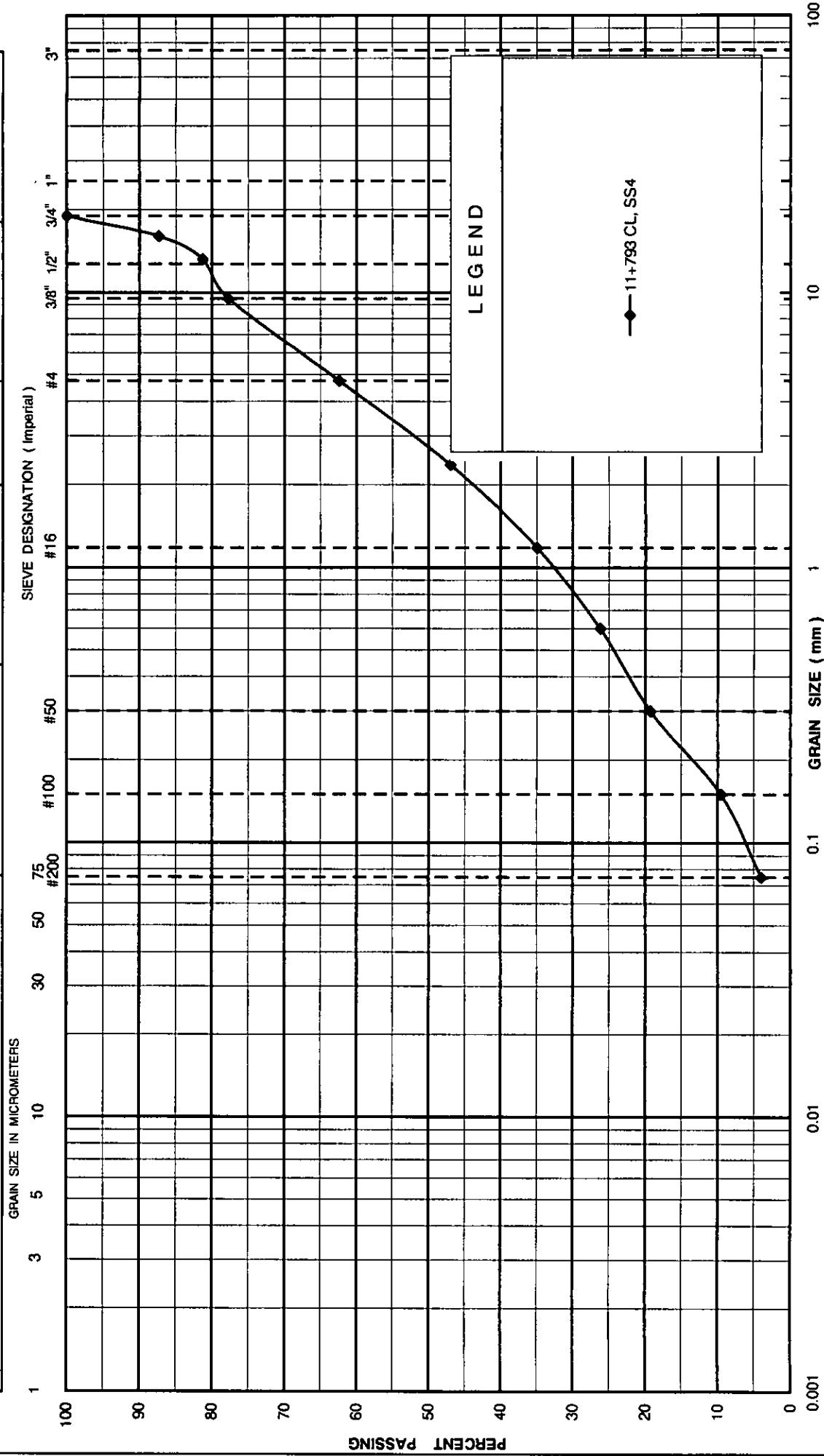
CHECKED: ASP

Appendix B5

Laboratory Test Results

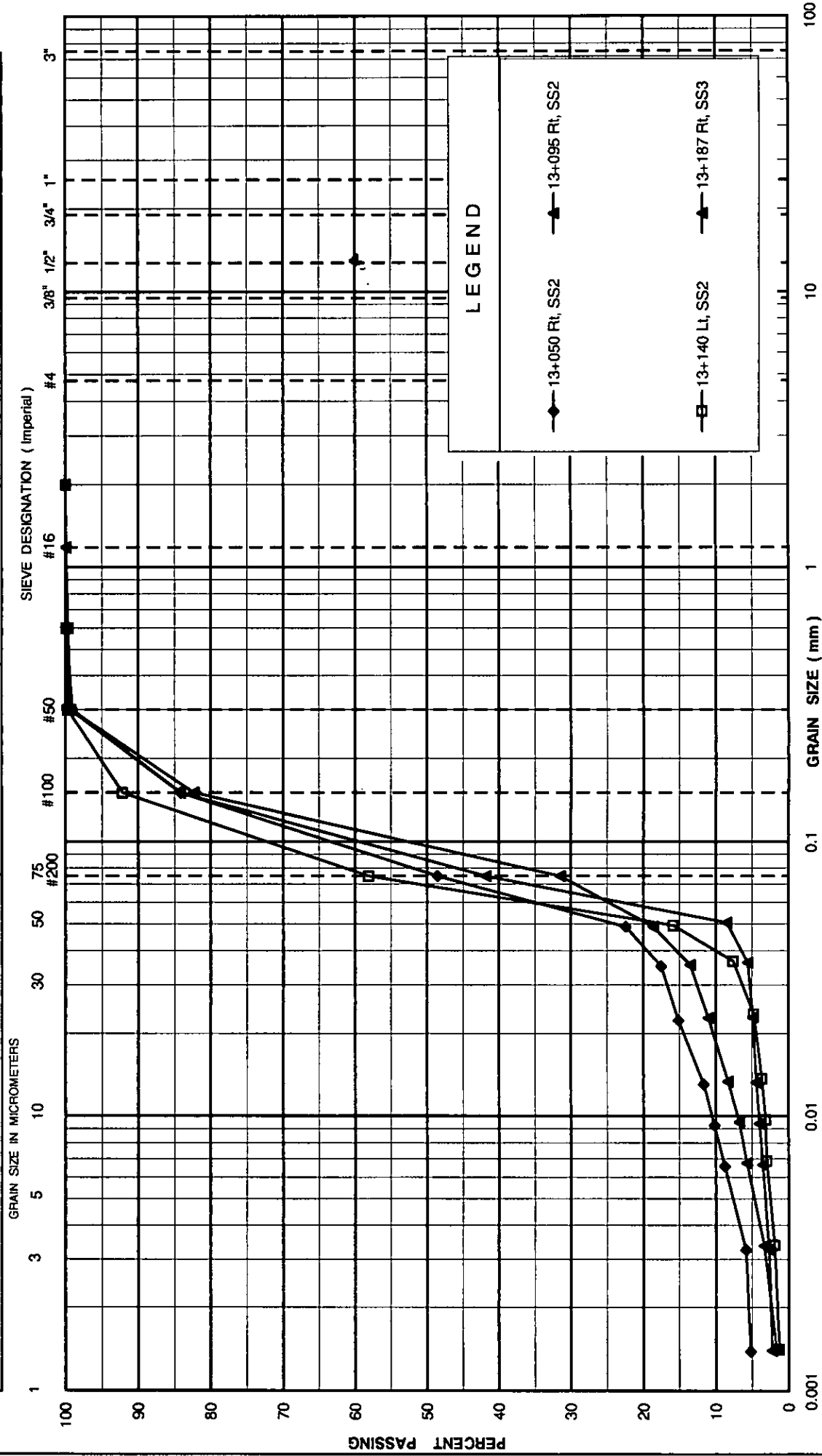
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



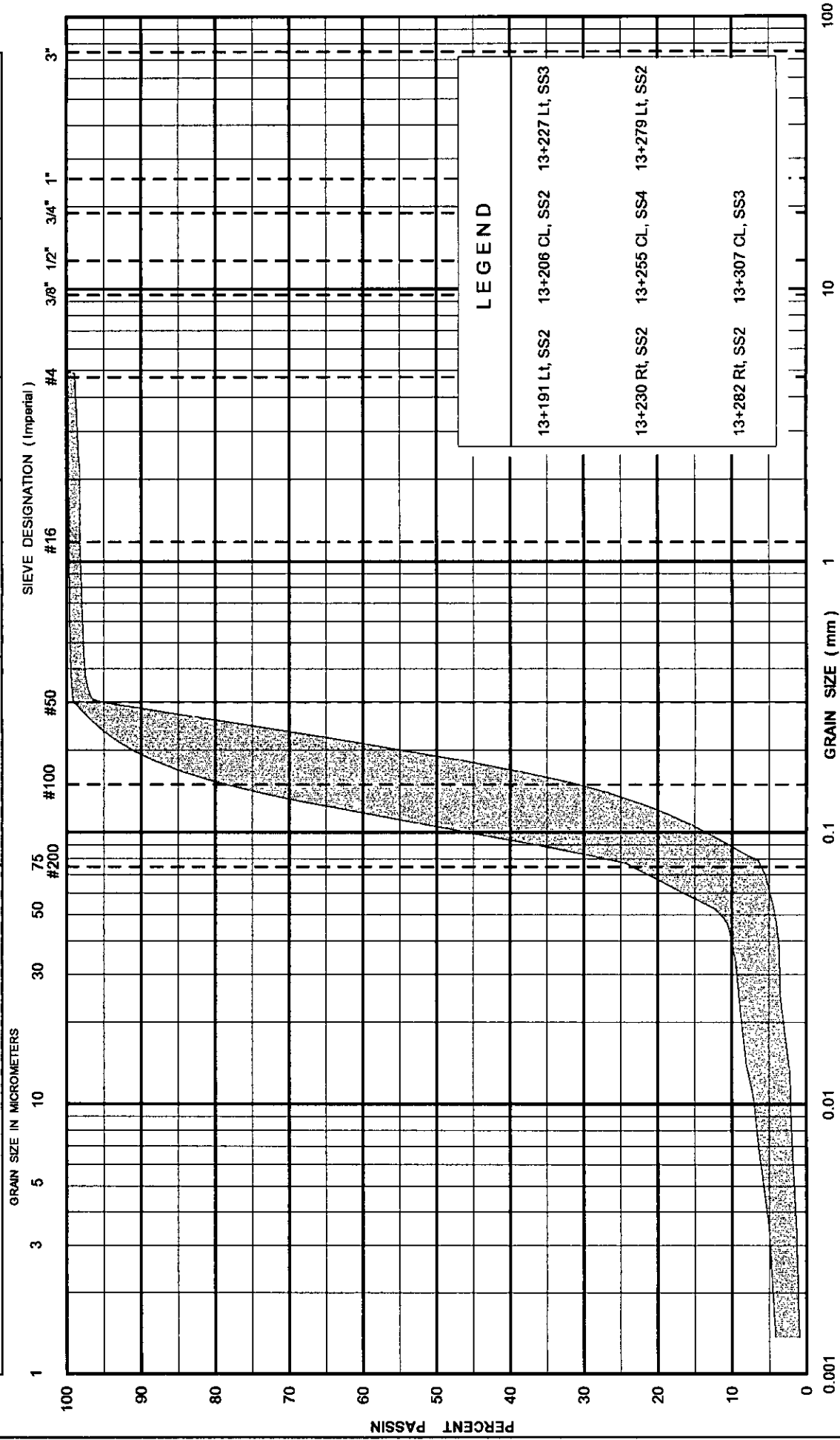
GRAIN SIZE DISTRIBUTION SURFICIAL SILTY SAND

SHAHEEN & PEAKER LIMITED

FIG. No. B5-2
REF. No. SPT 1055
G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION FINE SAND

SHAHEEN & PEAKER LIMITED

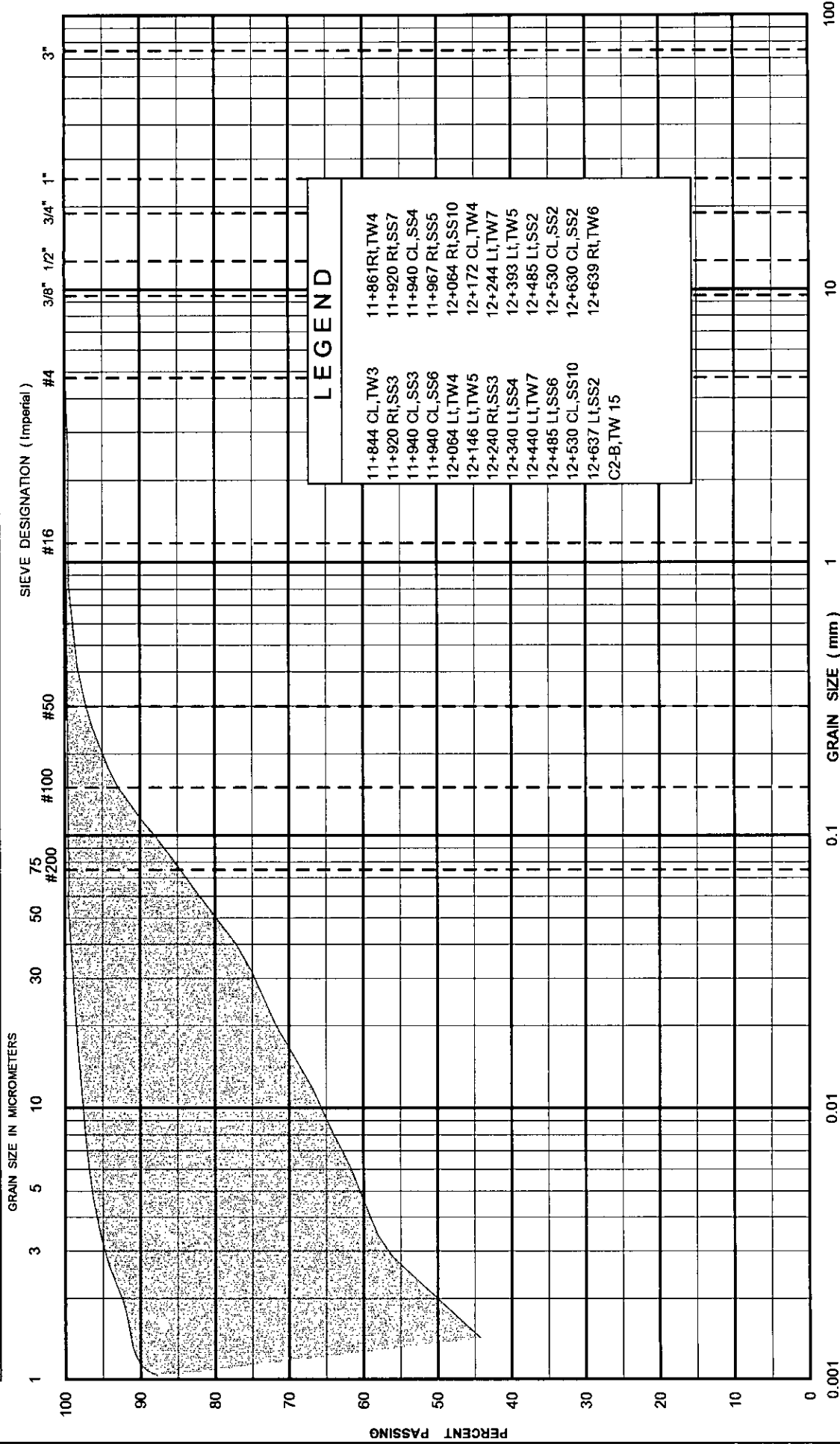
FIG. No. B5-3

REF. No. SPT 1055

G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL			
		Fine	Medium	Coarse	Fine	Coarse		



GRAIN SIZE DISTRIBUTION CLAY

SHAHEEN & PEAKER LIMITED

FIG. No. B5-4

REF. No. SPT 1055

G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	

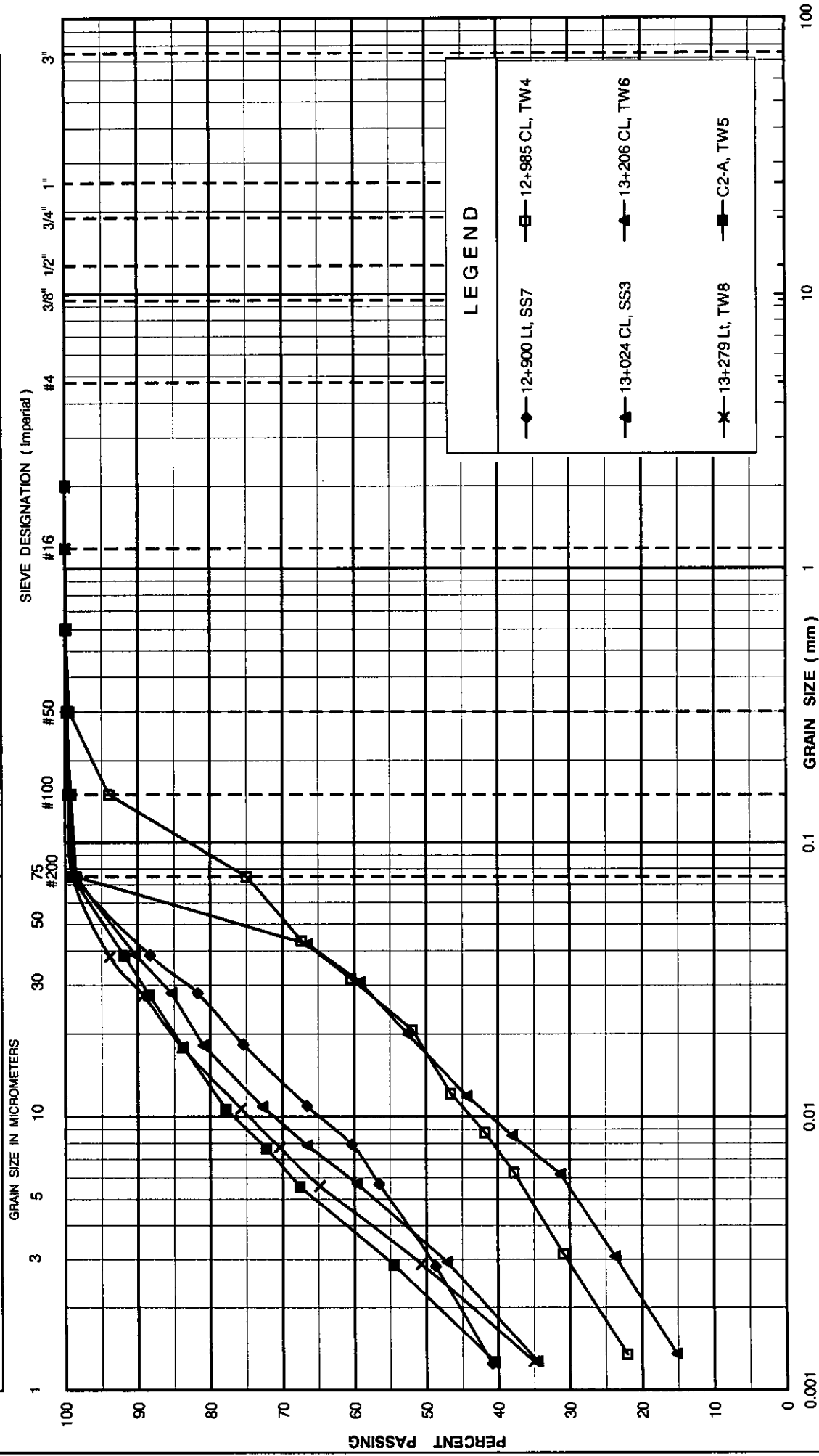
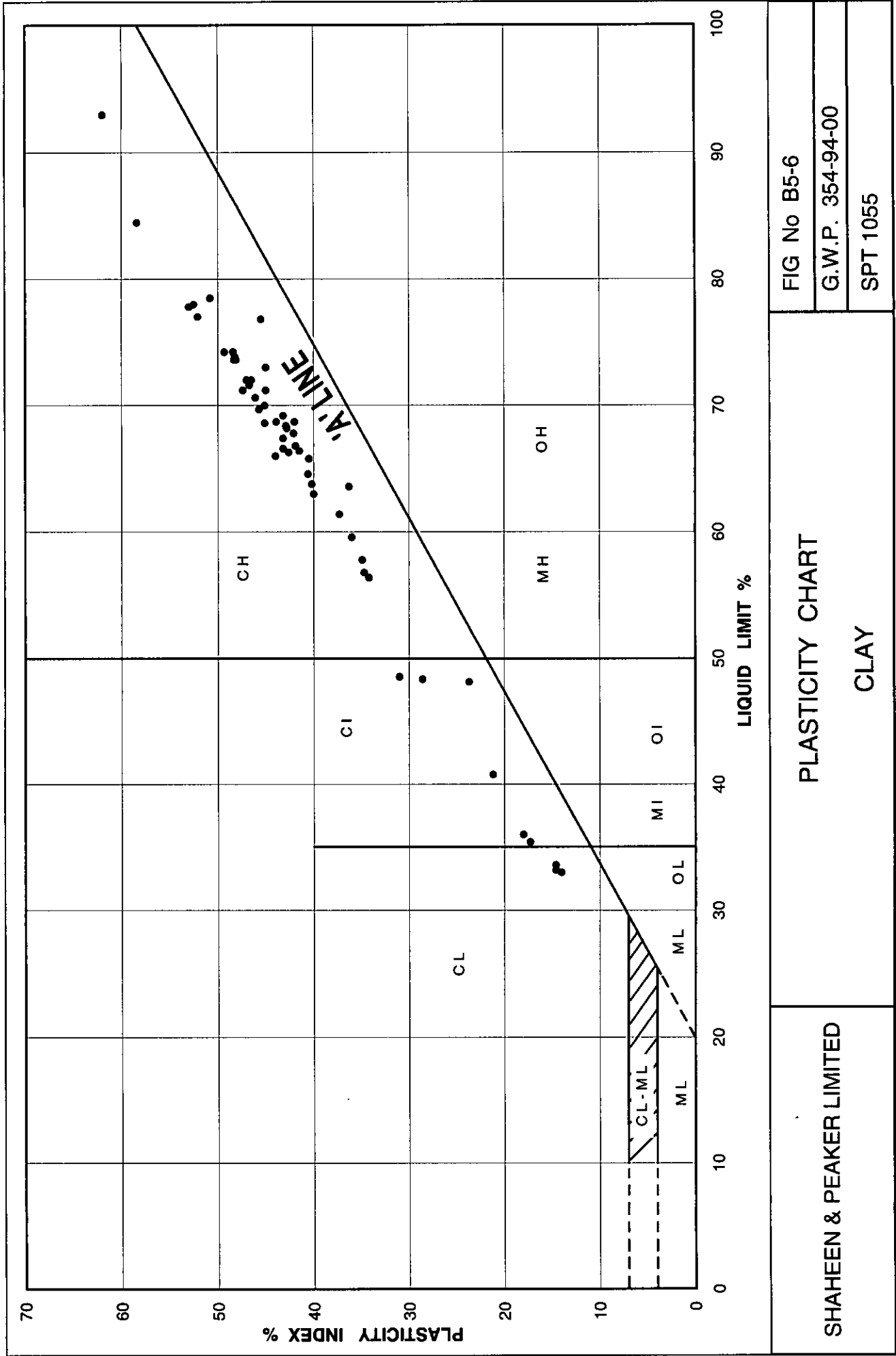


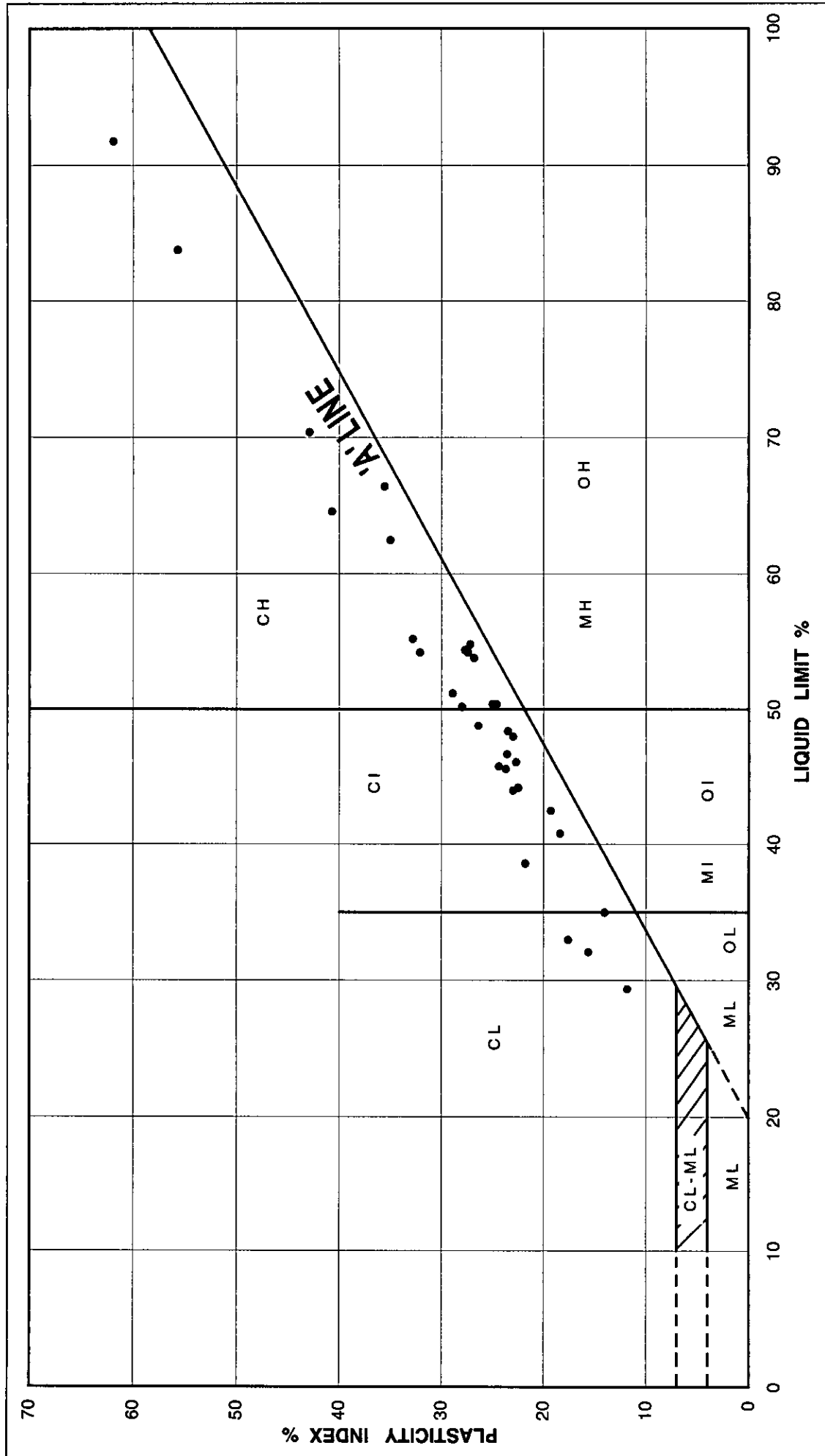
FIG. No. B5-5

REF. No. SPT 1055

G.W.P. 354-94-00

SHAHEEN & PEAKER LIMITED





SHAHEEN & PEAKER LIMITED

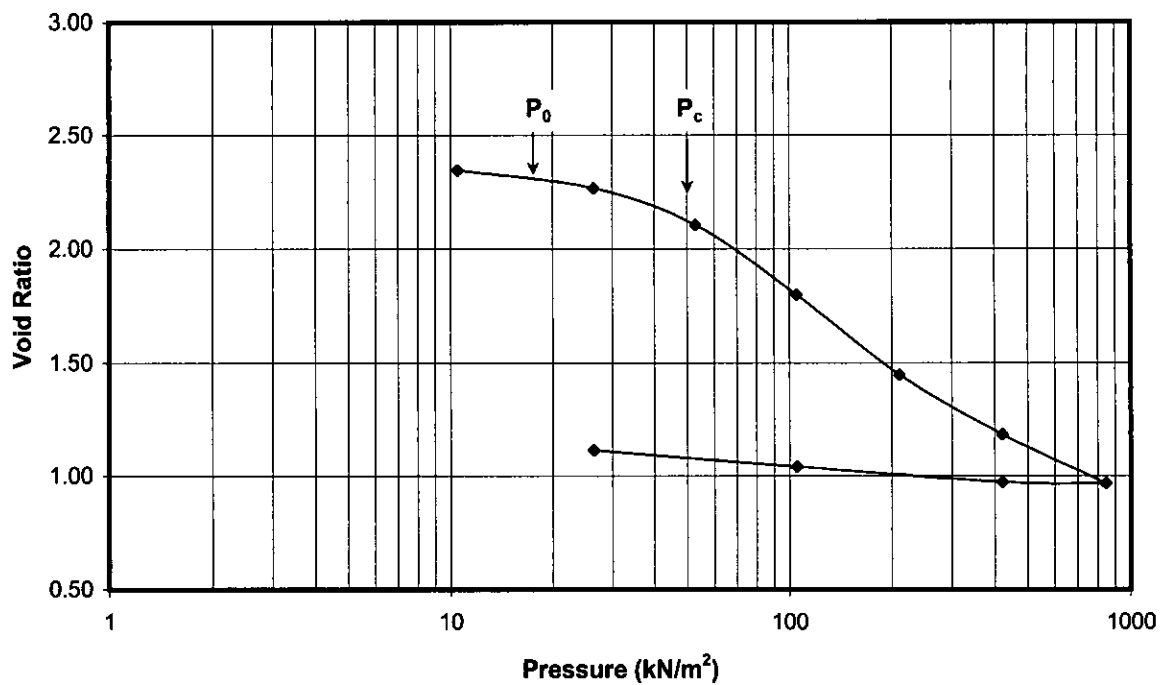
PLASTICITY CHART

FIG No B5-7

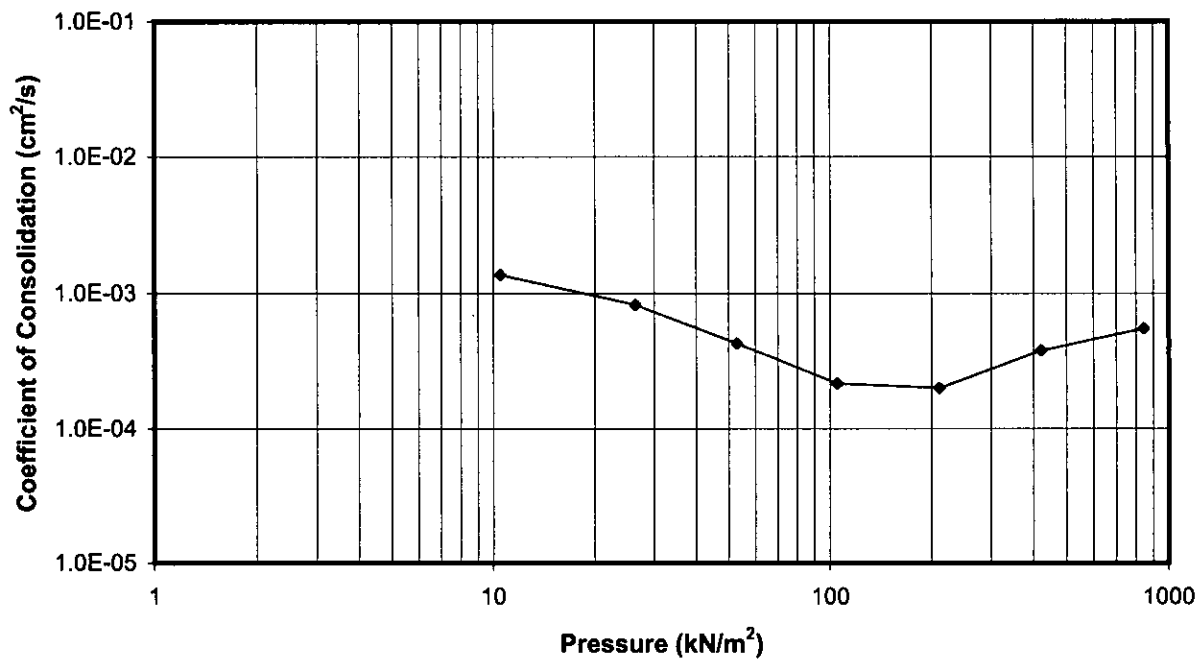
G.W.P. 354-94-00

SPT 1055

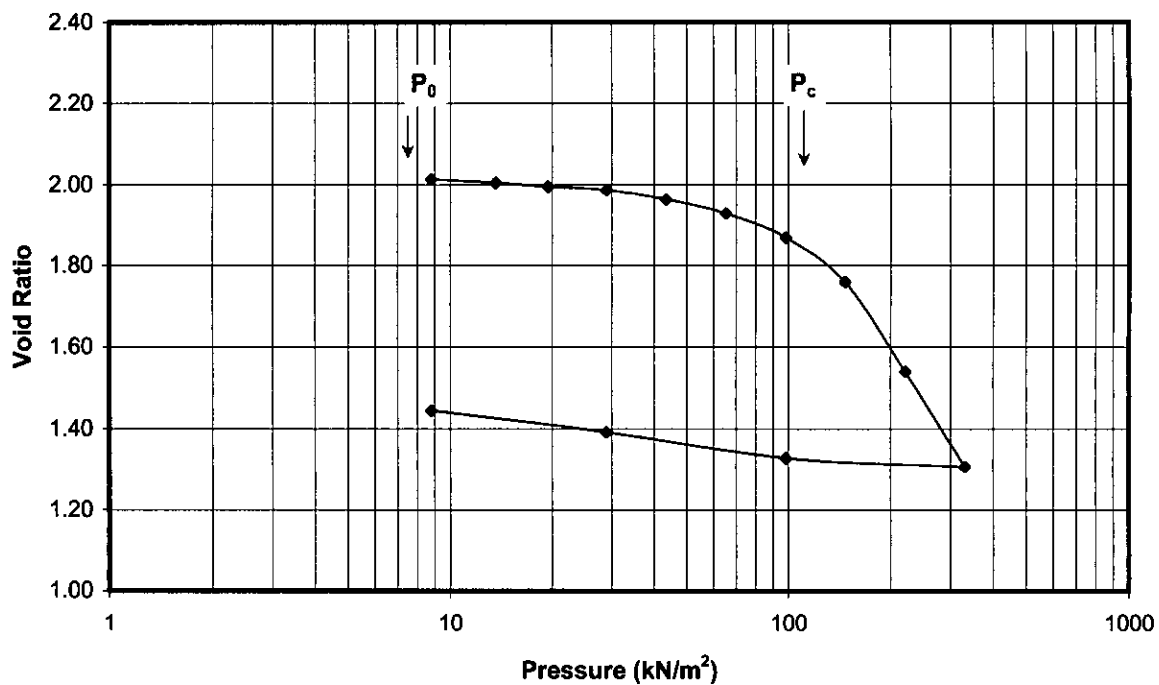
Void Ratio versus Pressure



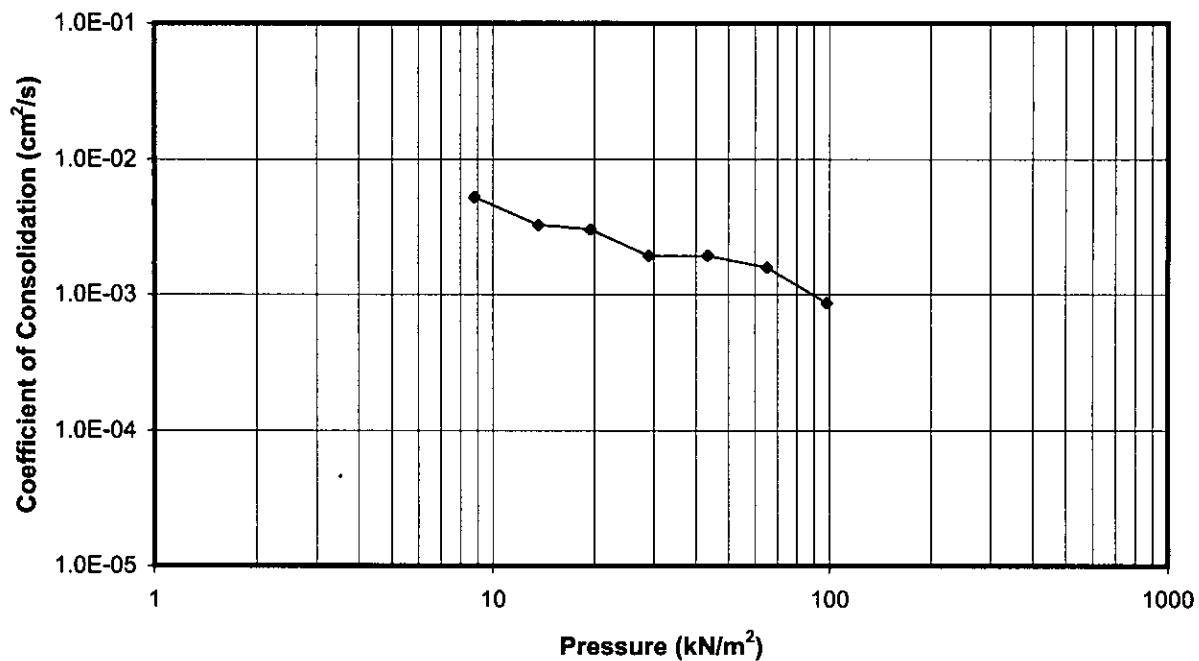
Coefficient of Consolidation vs. Pressure



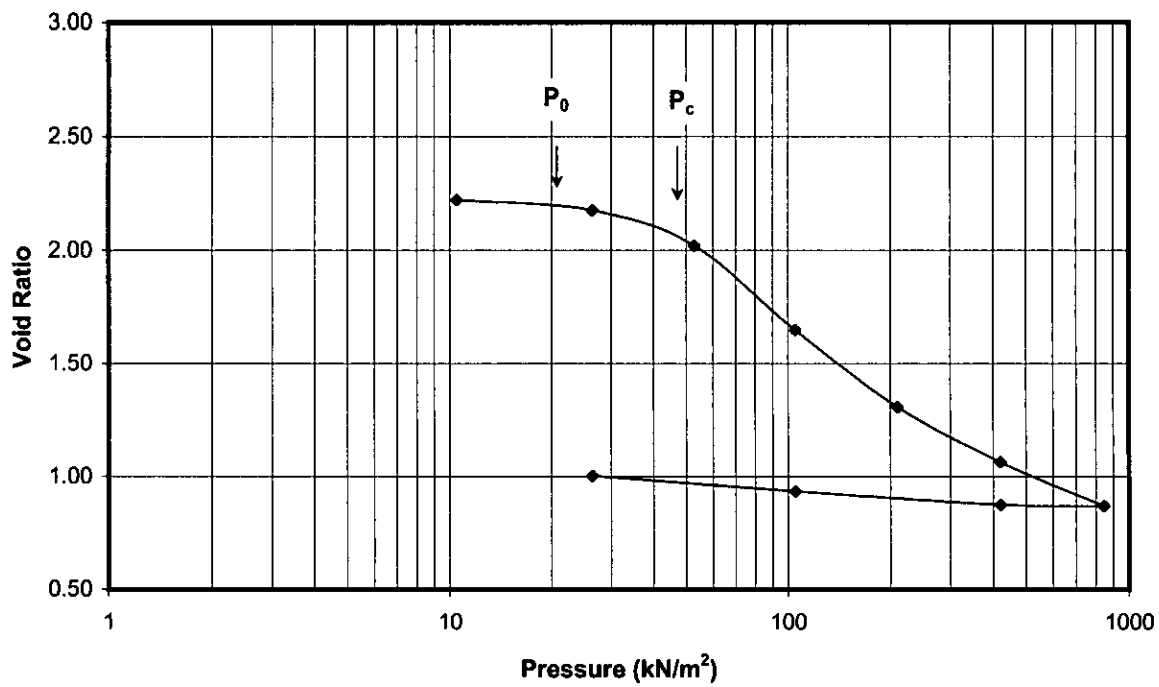
Void Ratio versus Pressure



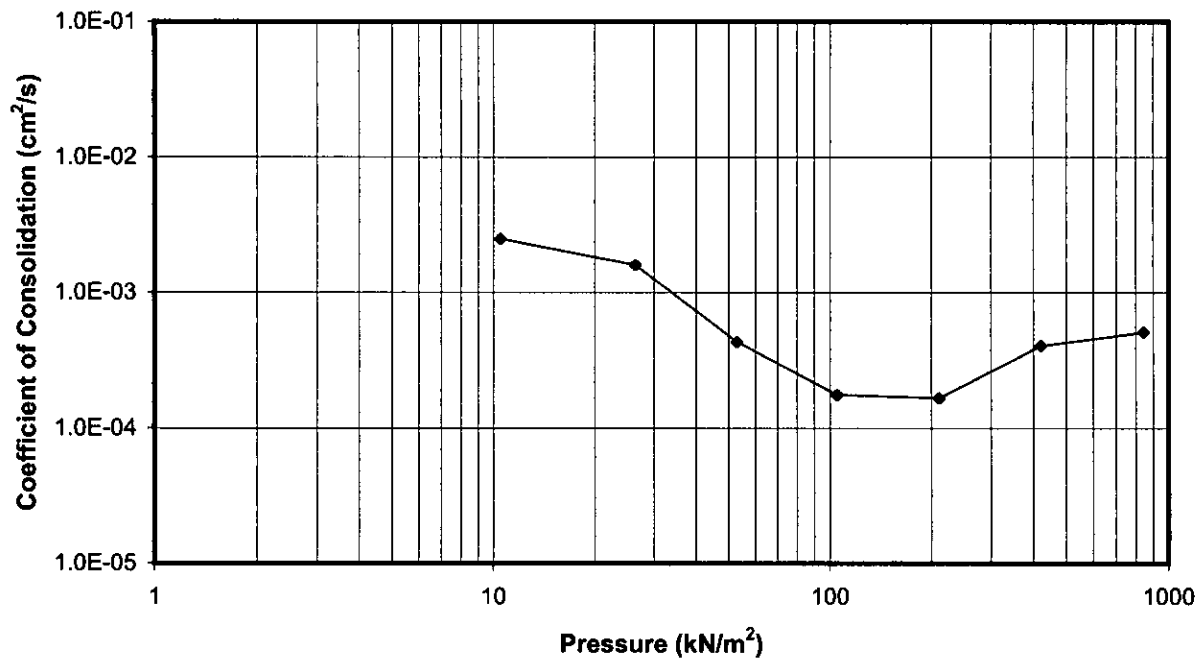
Coefficient of Consolidation vs. Pressure



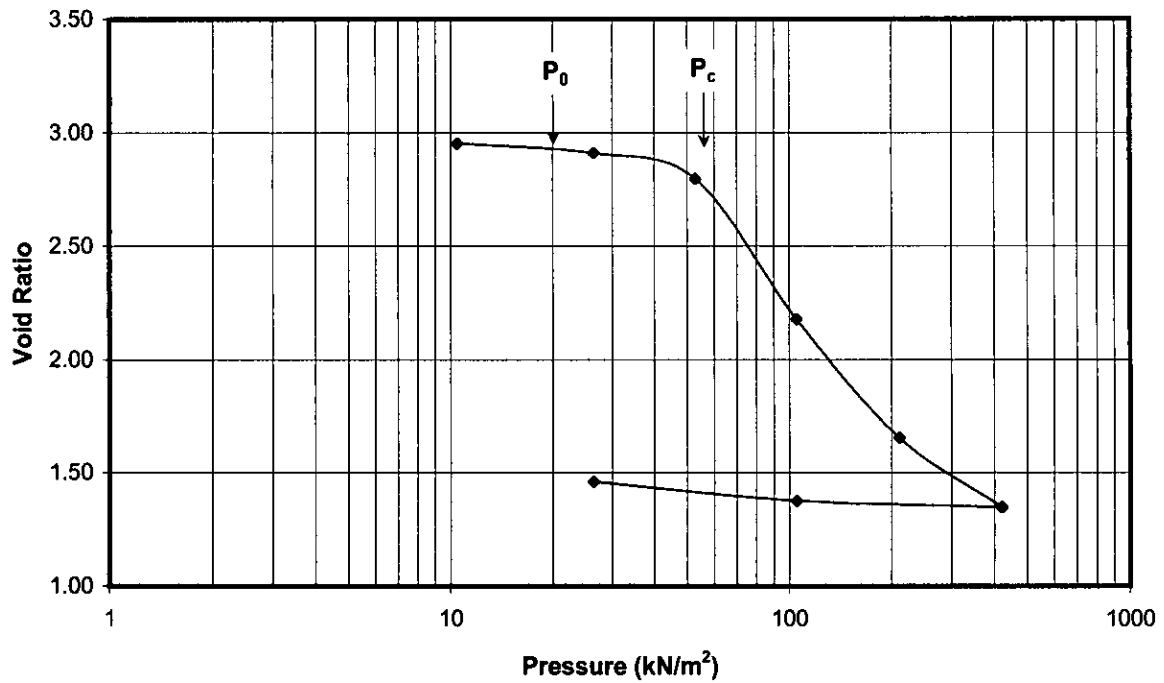
Void Ratio versus Pressure



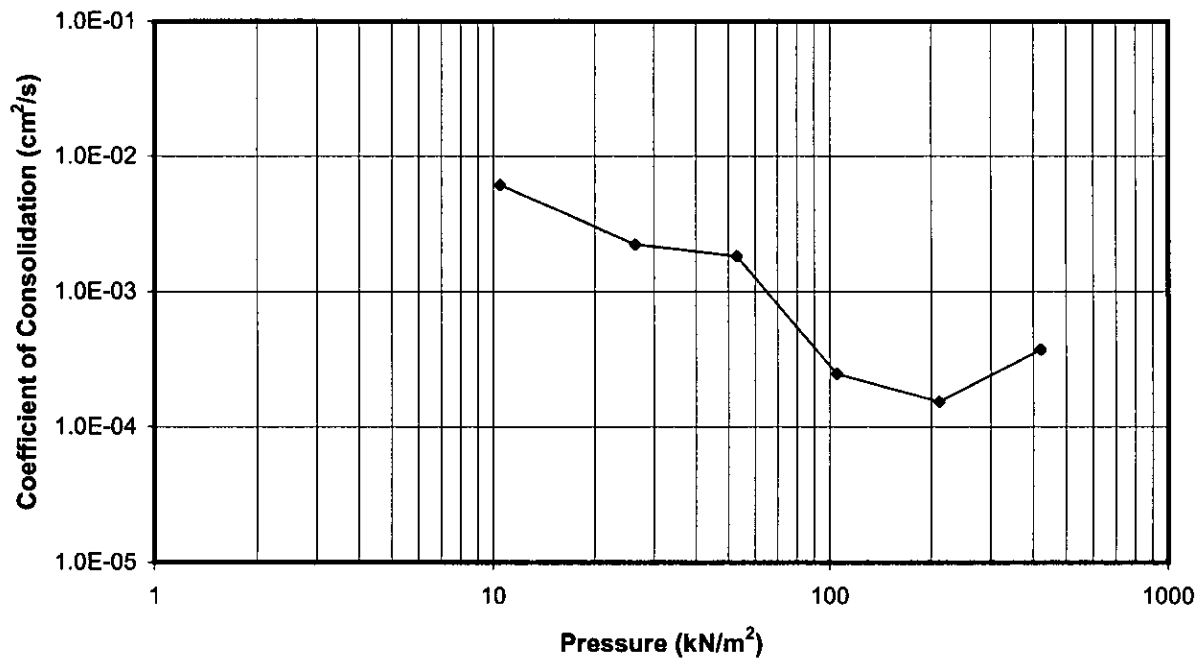
Coefficient of Consolidation vs. Pressure



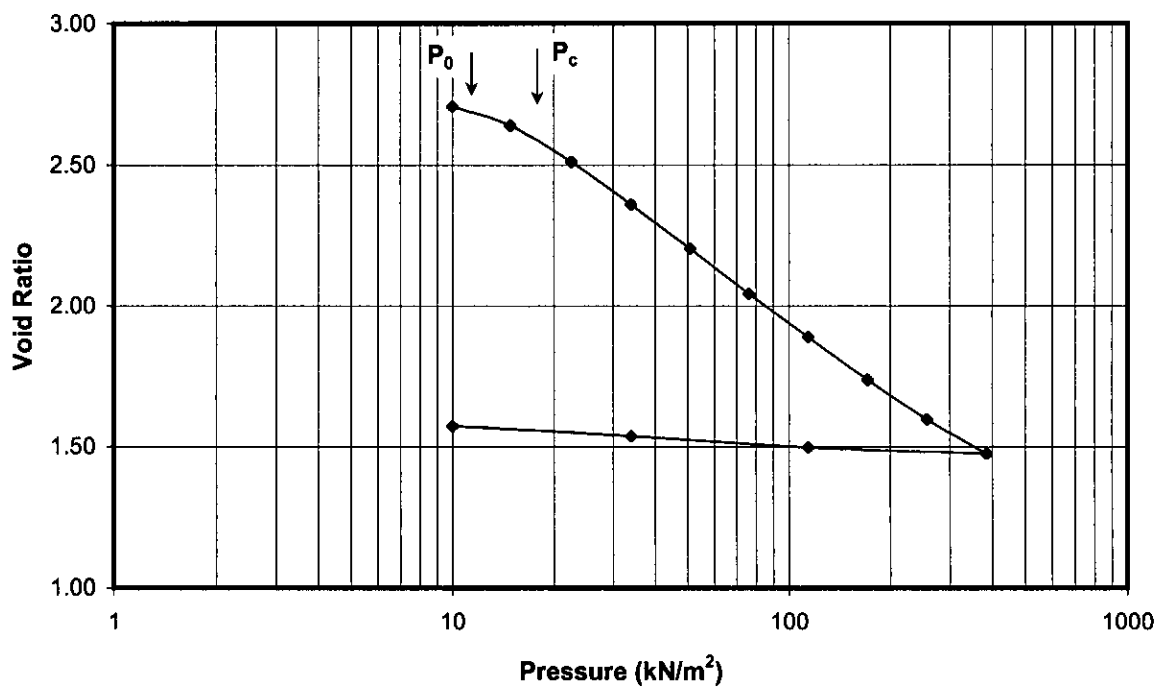
Void Ratio versus Pressure



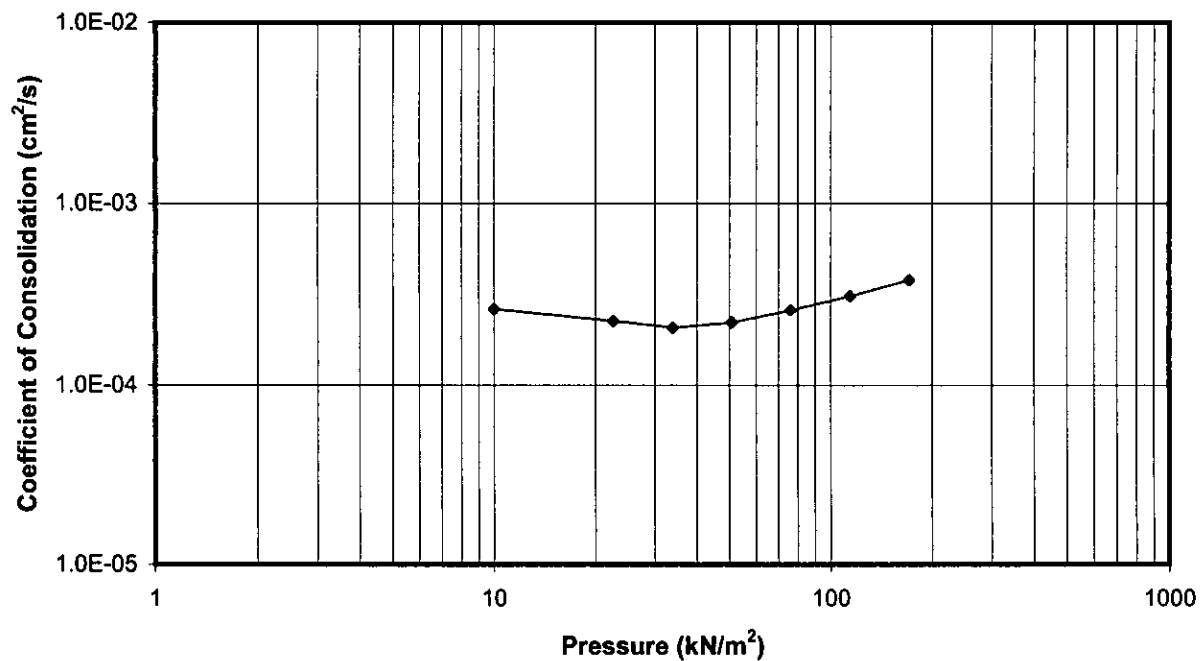
Coefficient of Consolidation vs. Pressure



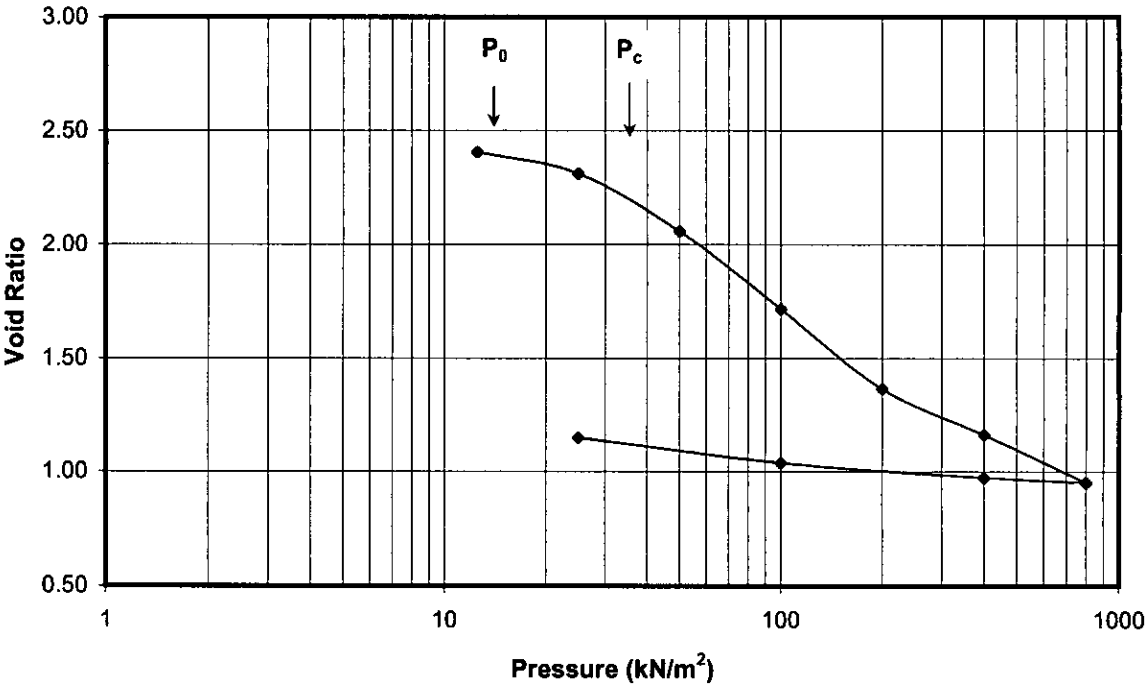
Void Ratio versus Pressure



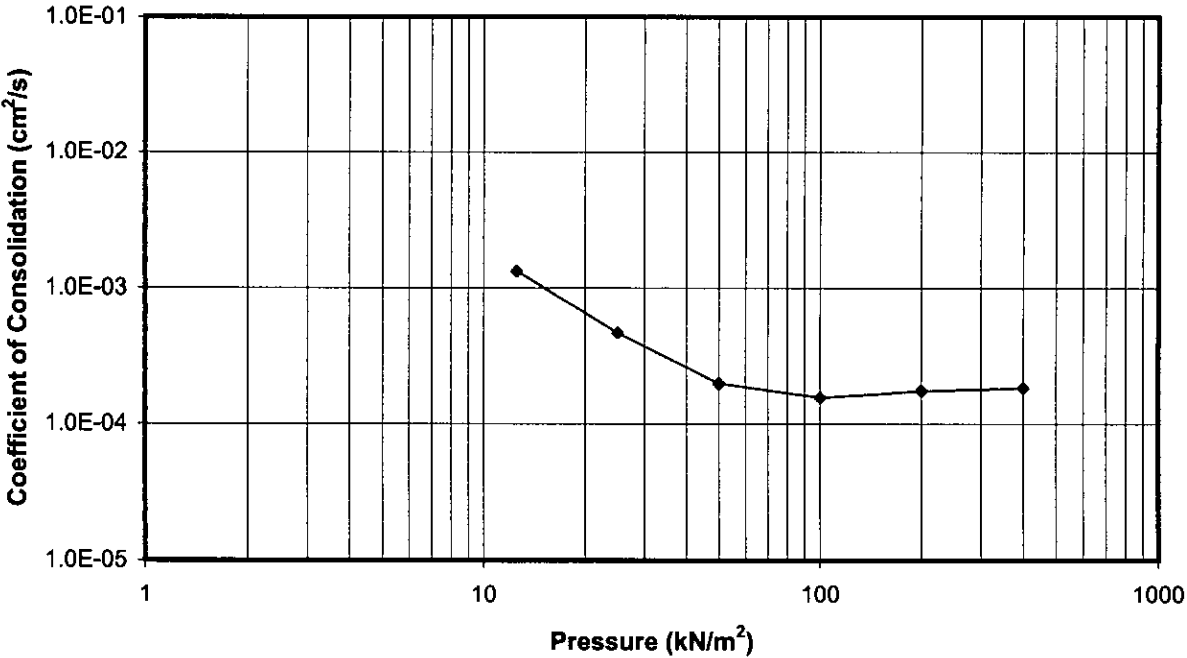
Coefficient of Consolidation vs. Pressure



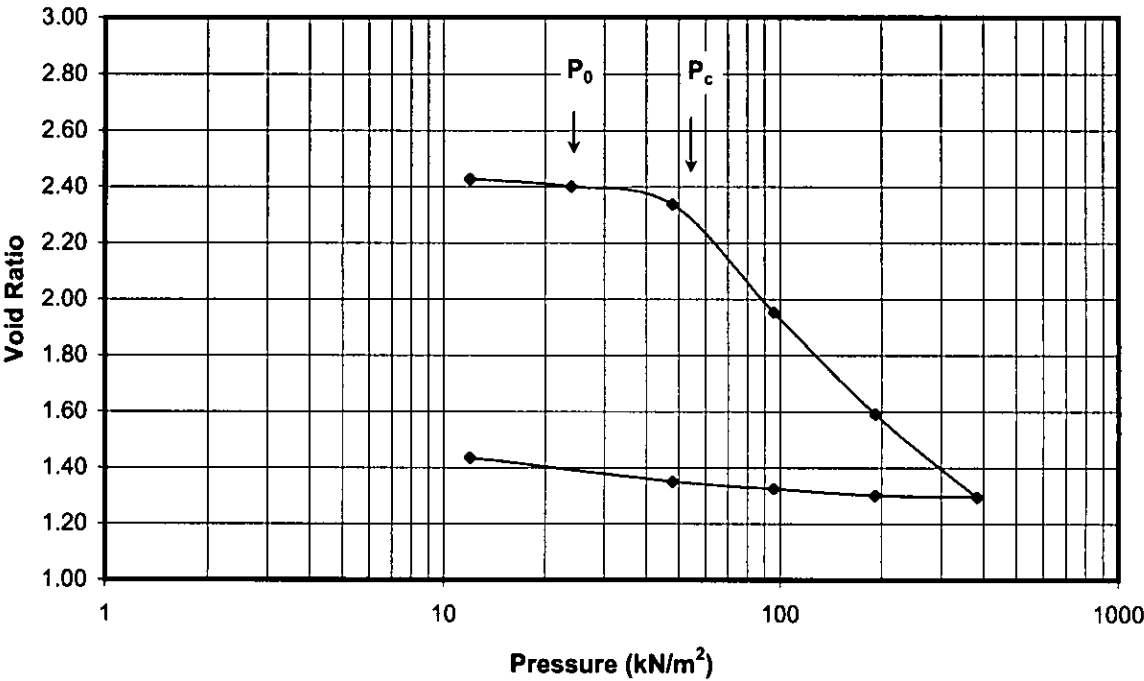
Void Ratio versus Pressure



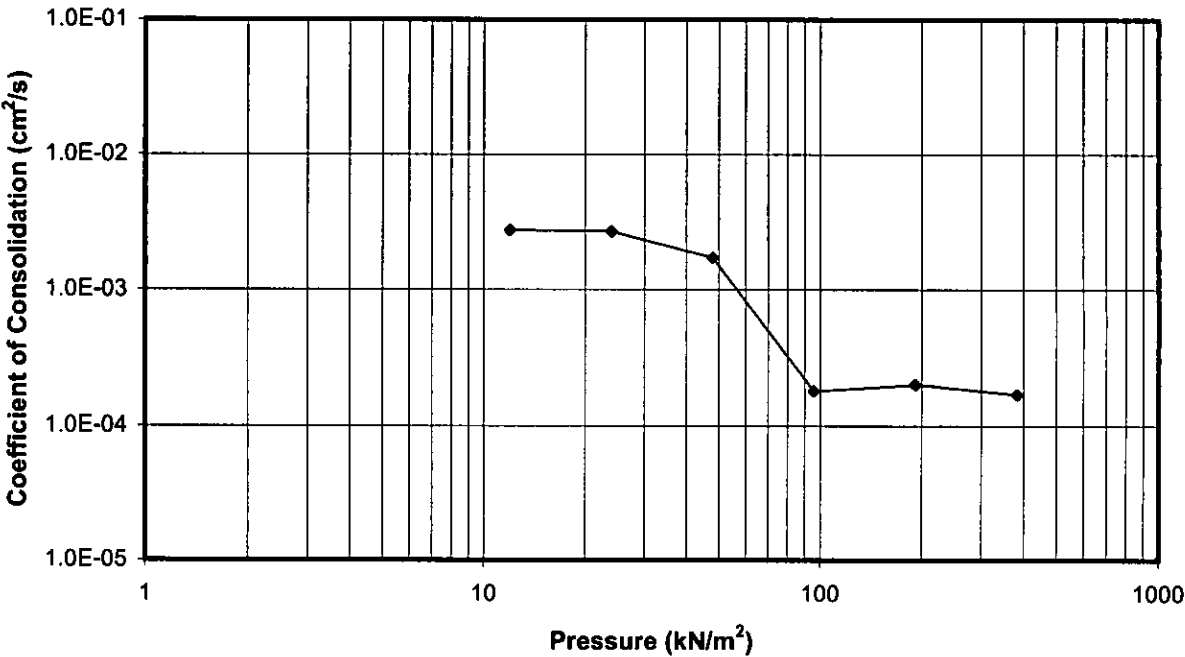
Coefficient of Consolidation vs. Pressure



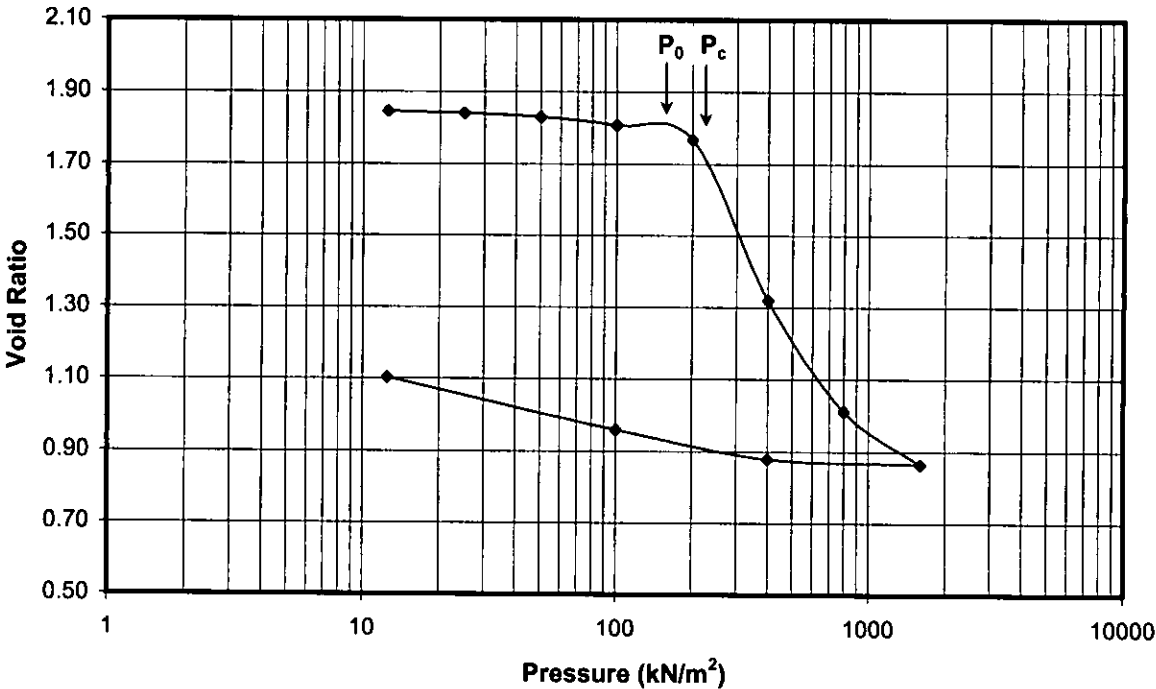
Void Ratio versus Pressure



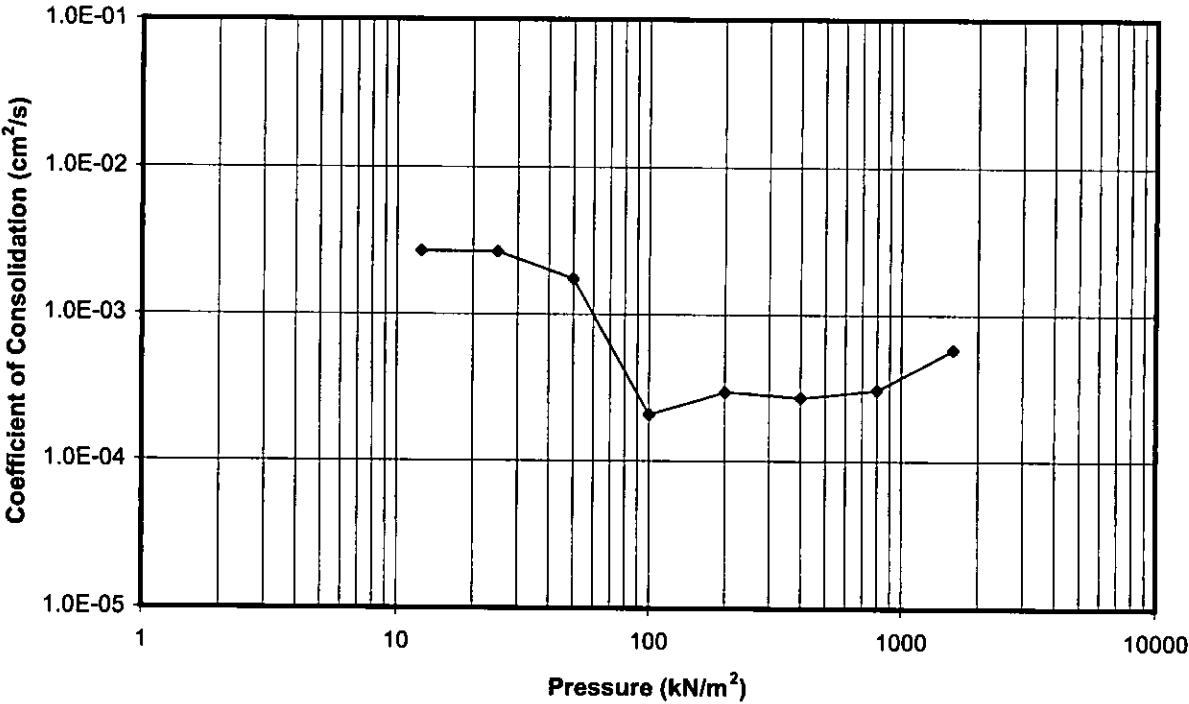
Coefficient of Consolidation vs. Pressure



Void Ratio versus Pressure

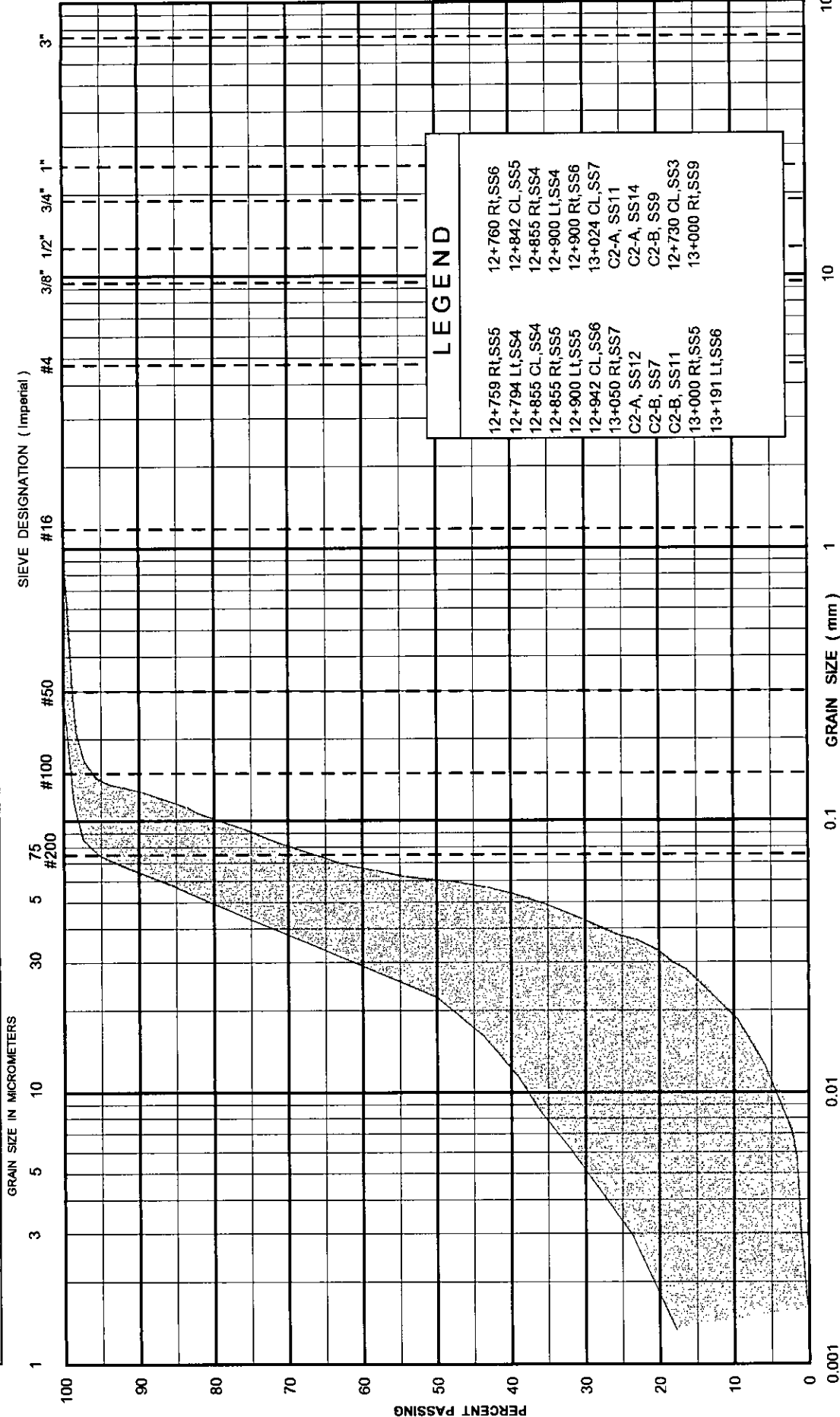


Coefficient of Consolidation vs. Pressure



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION

SILT to SANDY SILT

SHAHEEN & PEAKER LIMITED

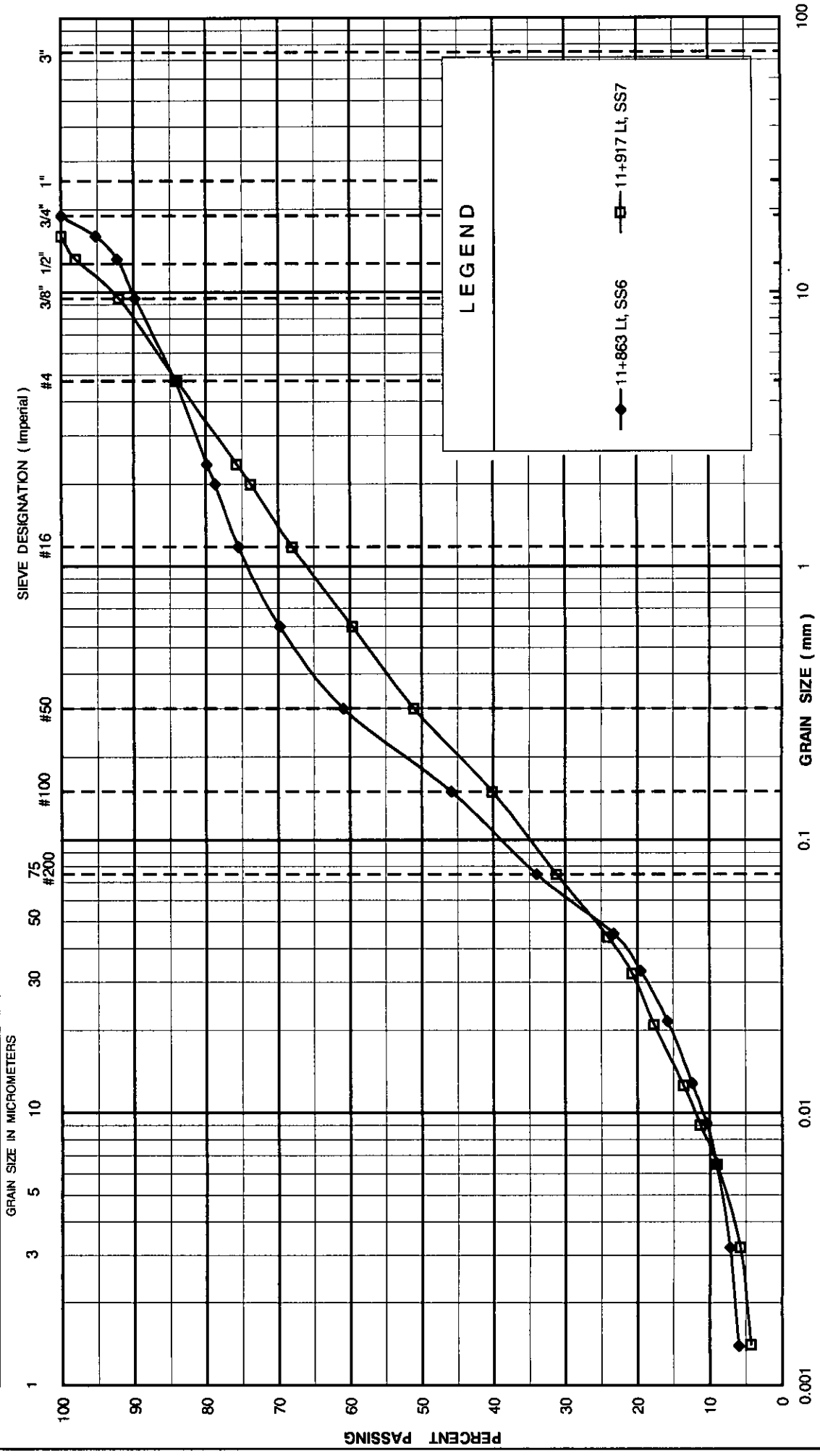
FIG. No. B5-16

REF. No. SPT 1055

G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



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GRAIN SIZE DISTRIBUTION

SILTY SAND, some gravel (Probable Till)

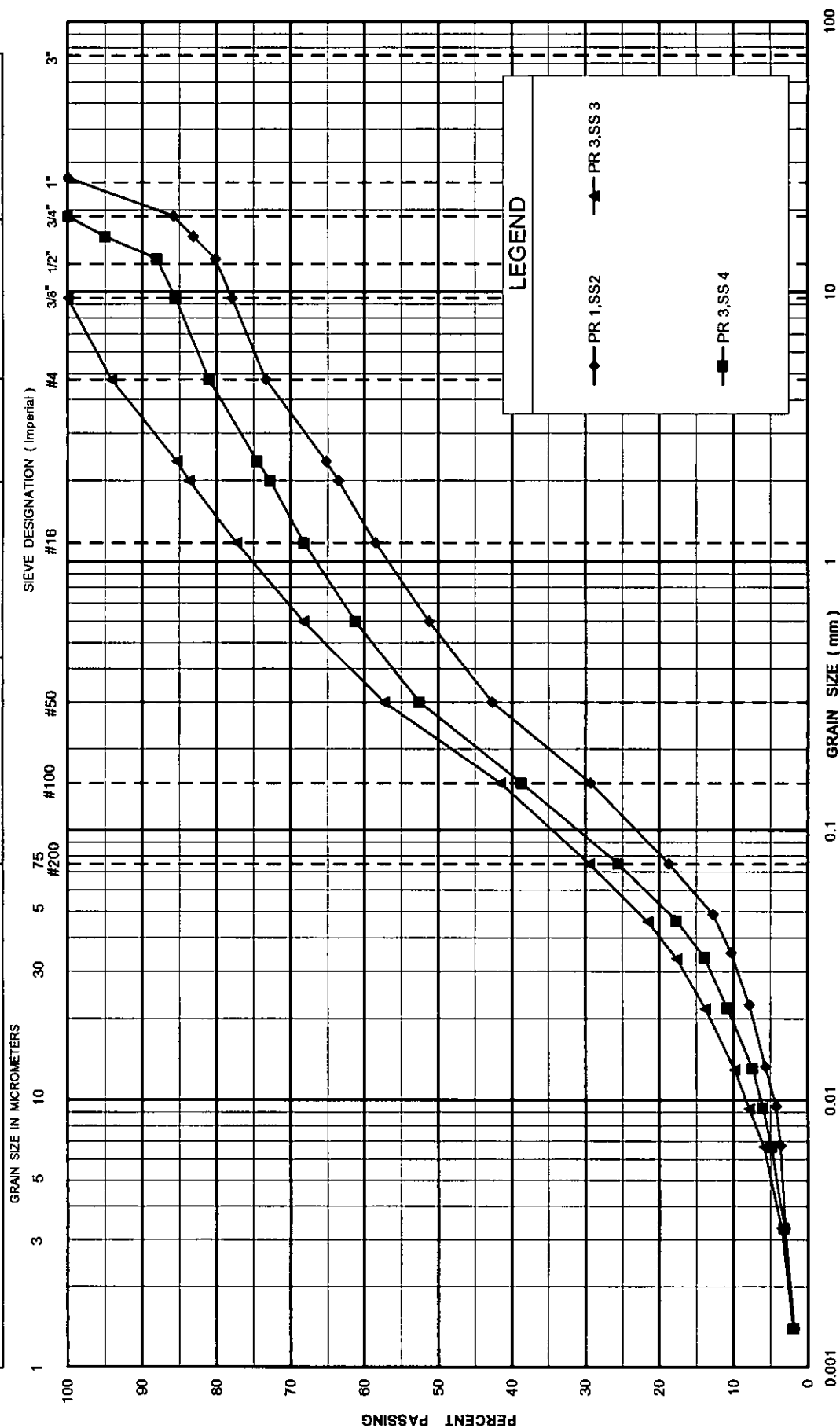
FIG. No. B5-17

REF. No. SPT 1055

G.W.P. 354-94-00

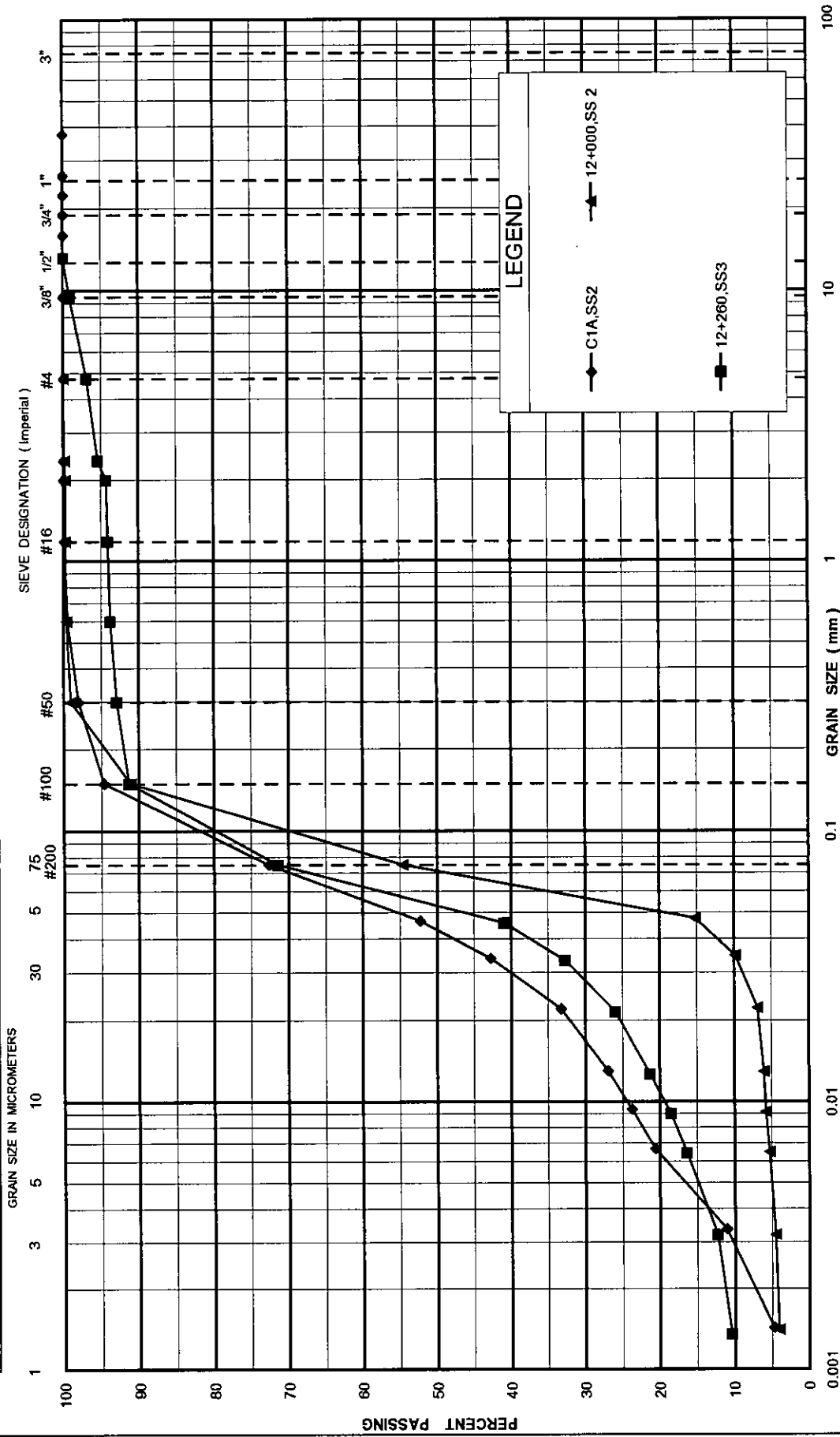
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
GRAIN SIZE IN MICROMETERS			Fine	Medium	Coarse	Fine	Coarse	



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



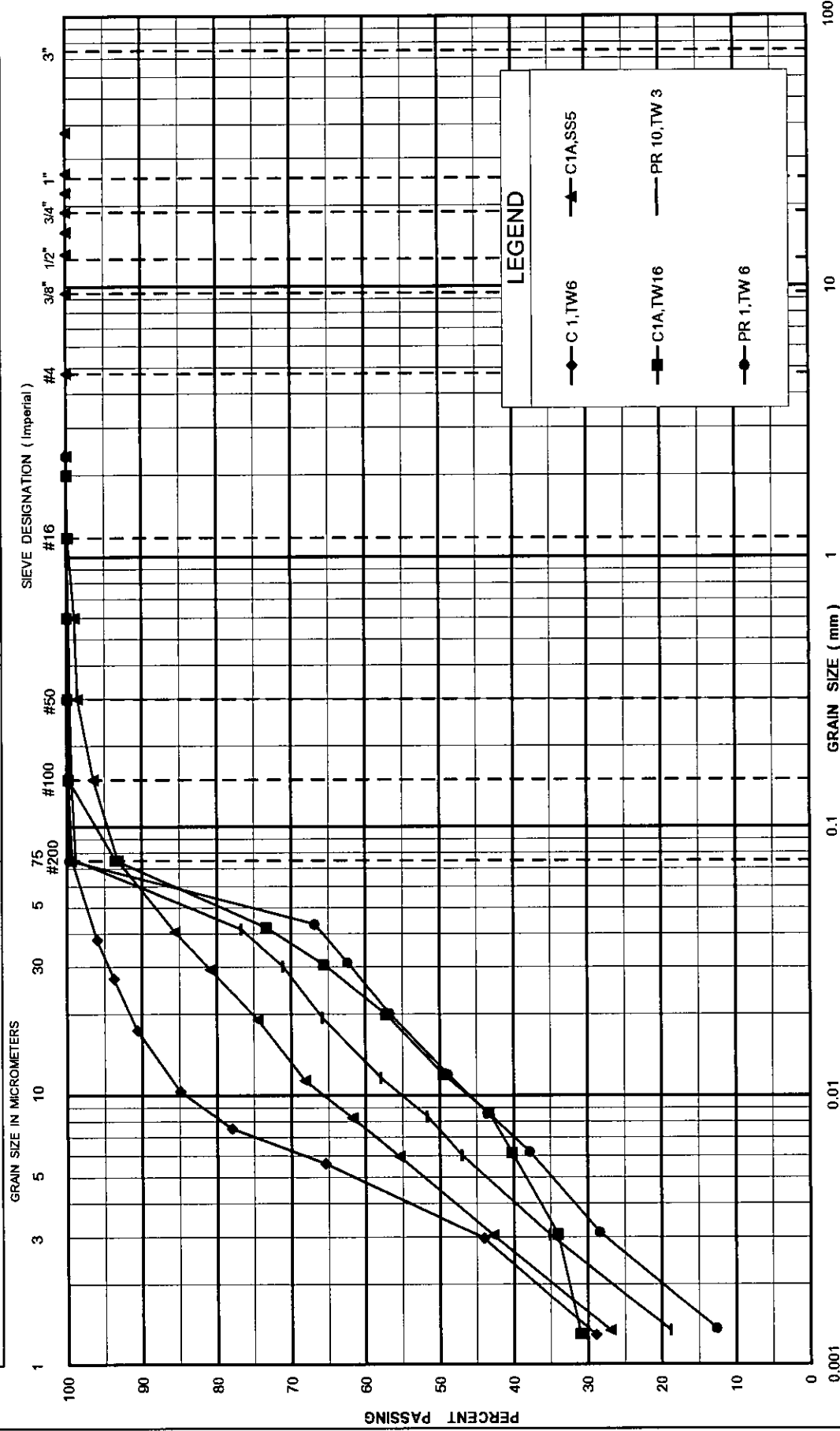
GRAIN SIZE DISTRIBUTION SANDY SILT

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FIGURE No. B5-19
REF. No. SPT 1055
G.W.P. 354-94-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



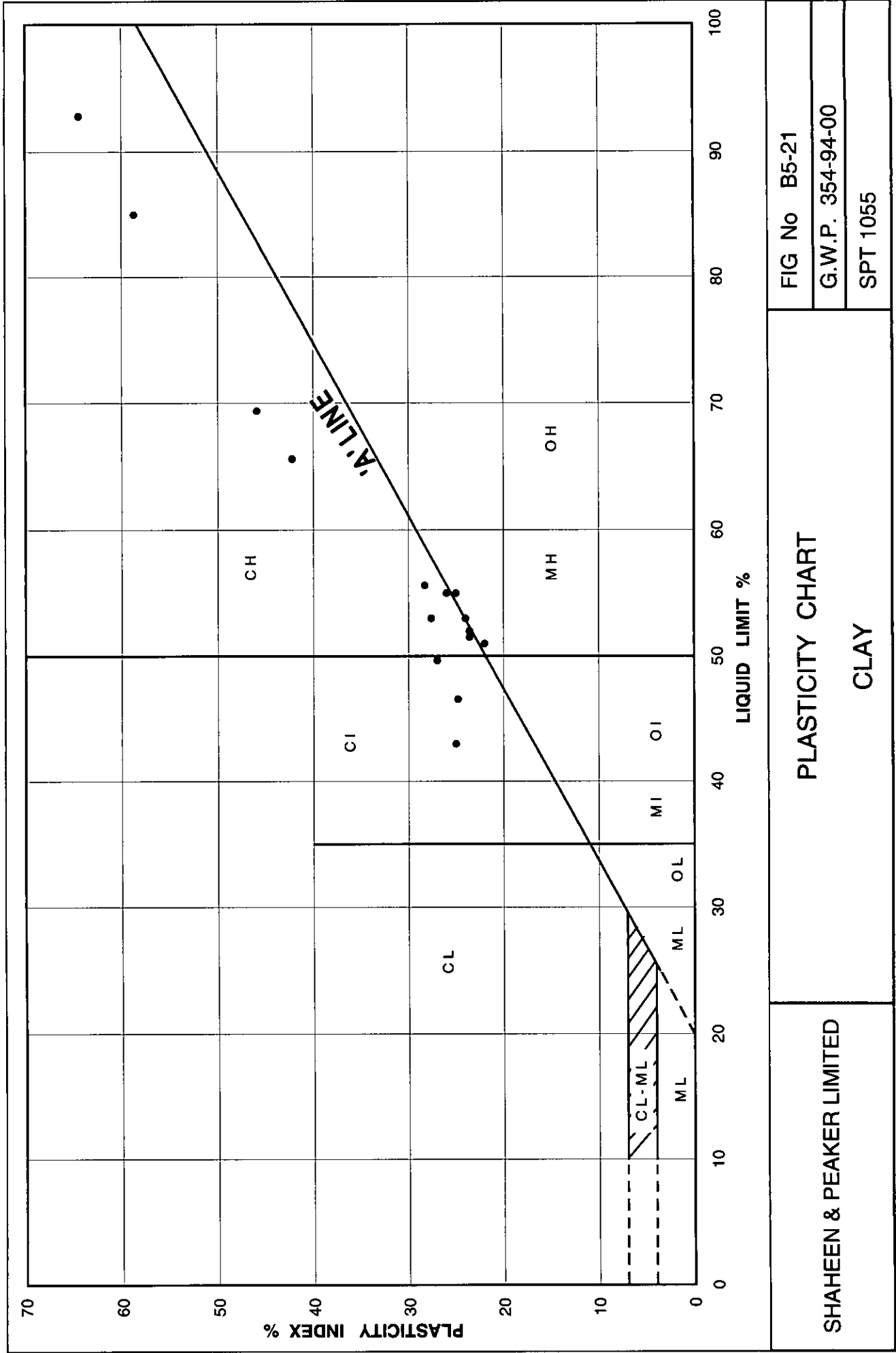
GRAIN SIZE DISTRIBUTION CLAY

SHAHEEN & PEAKER LIMITED

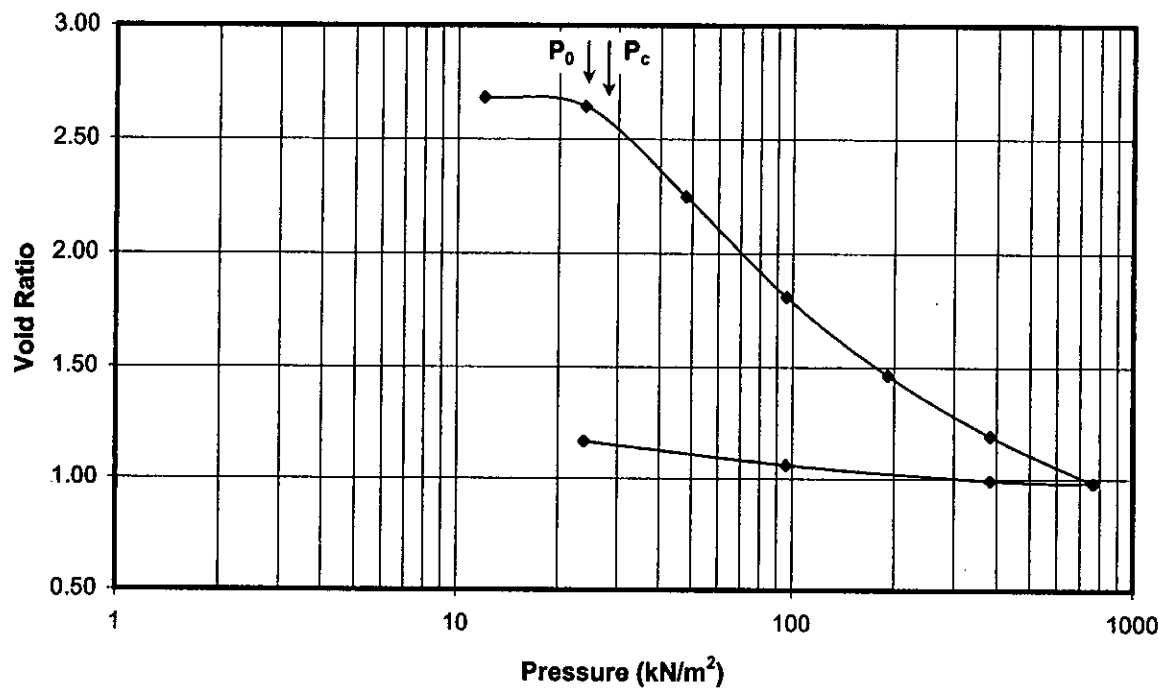
FIGURE No. B5-20

REF. No. SPT 1055

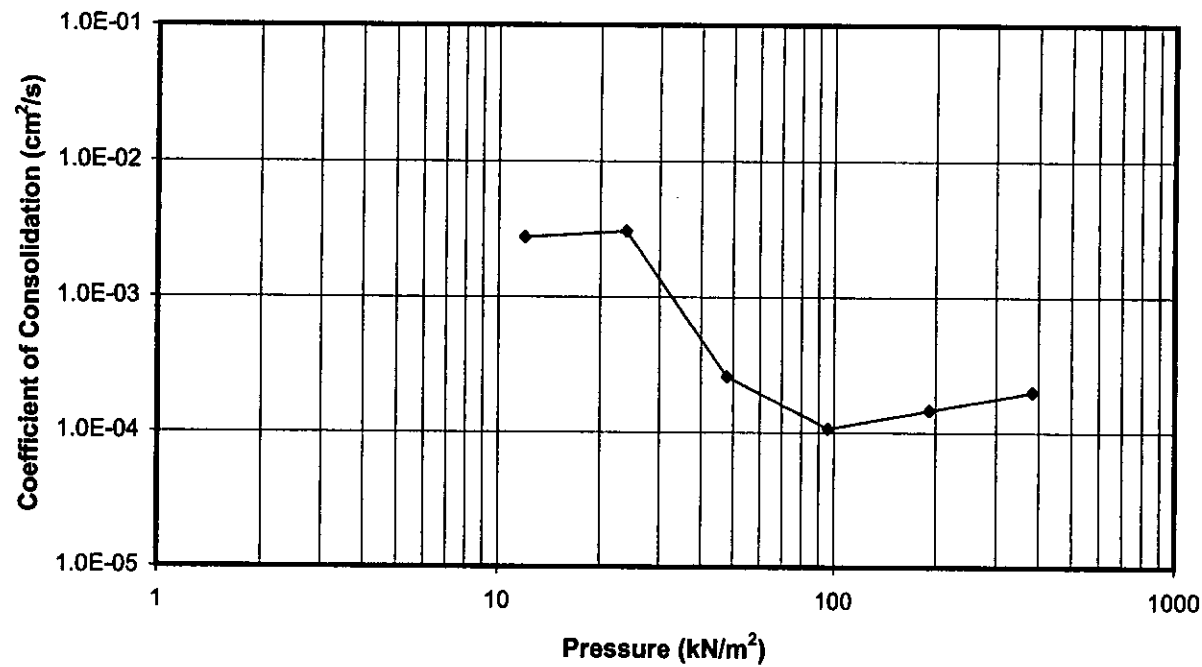
G.W.P. 354-94-00



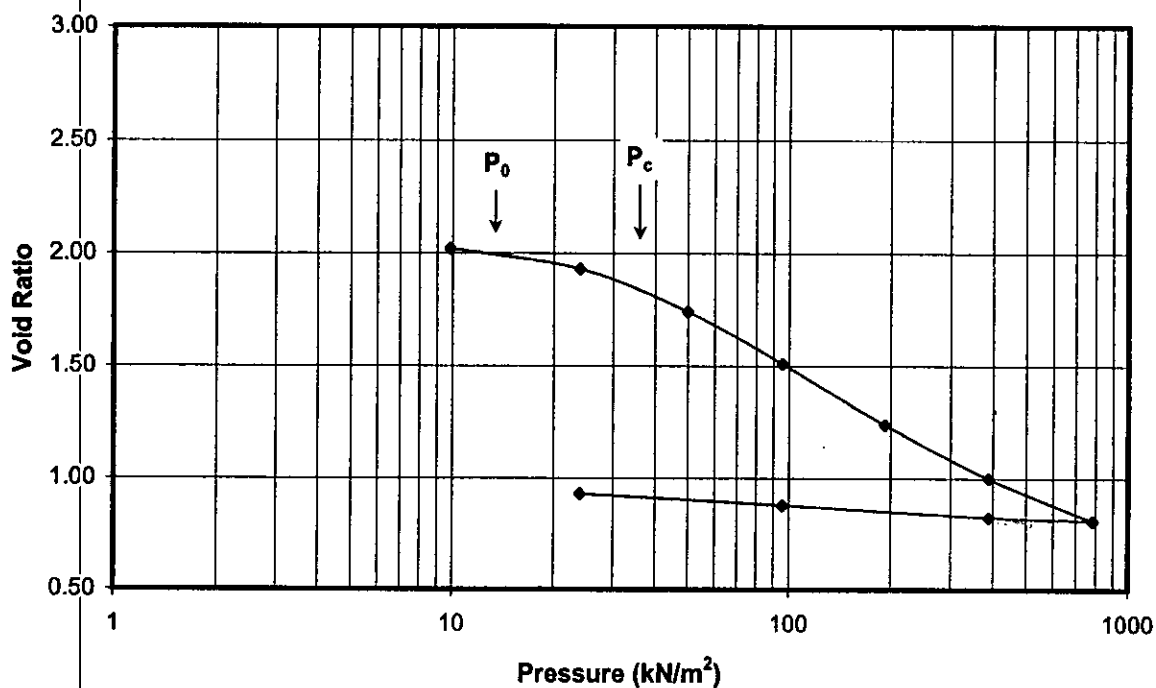
Void Ratio versus Pressure



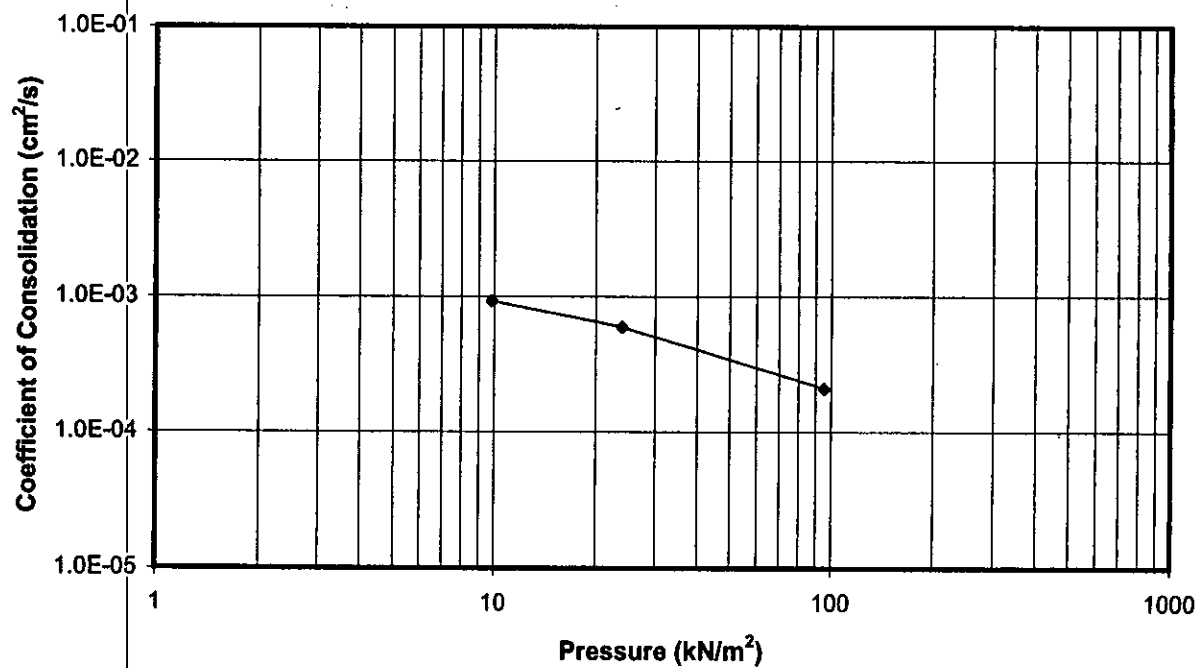
Coefficient of Consolidation vs. Pressure



Void Ratio versus Pressure

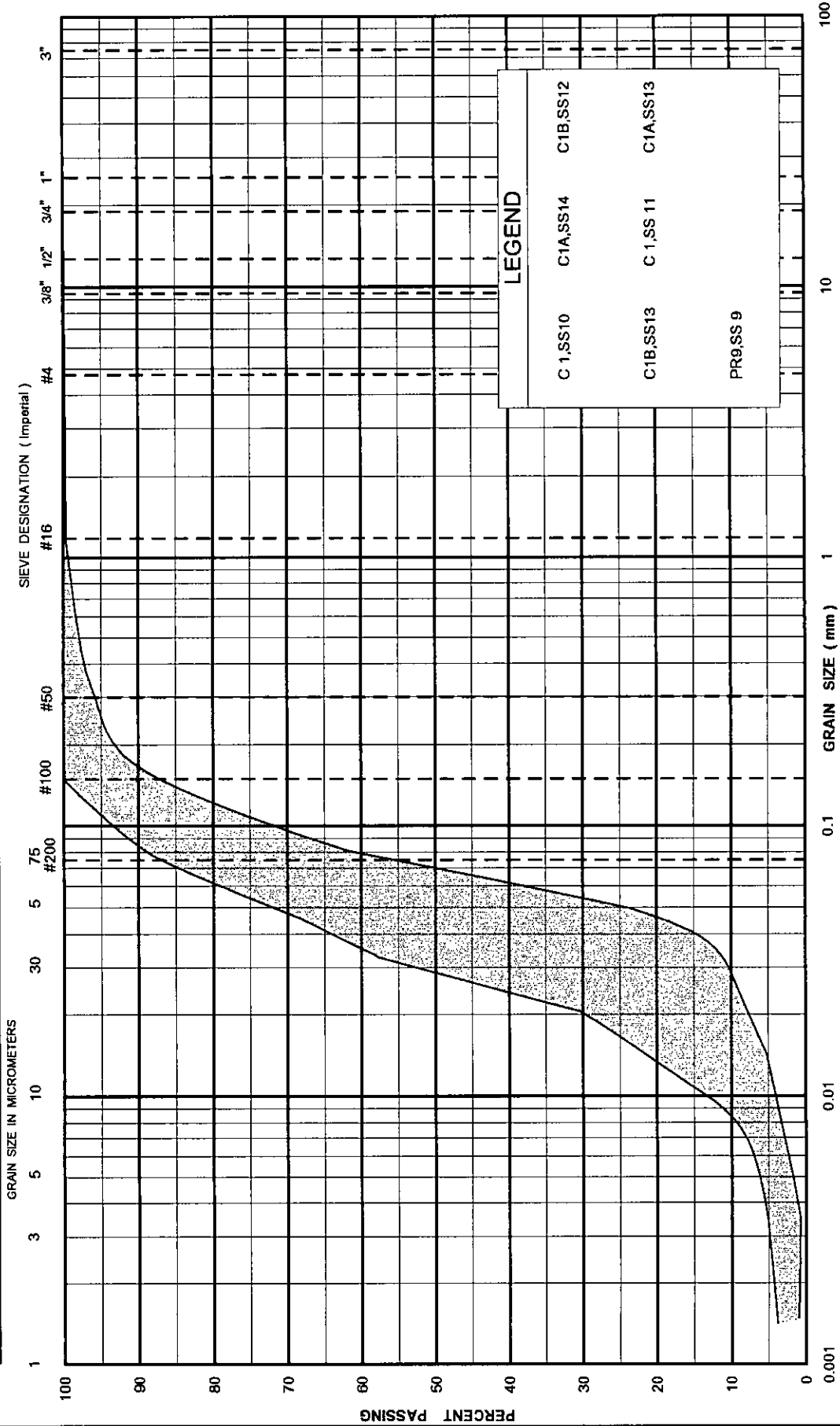


Coefficient of Consolidation vs. Pressure



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION SANDY SILT

SHAHEEN & PEAKER LIMITED

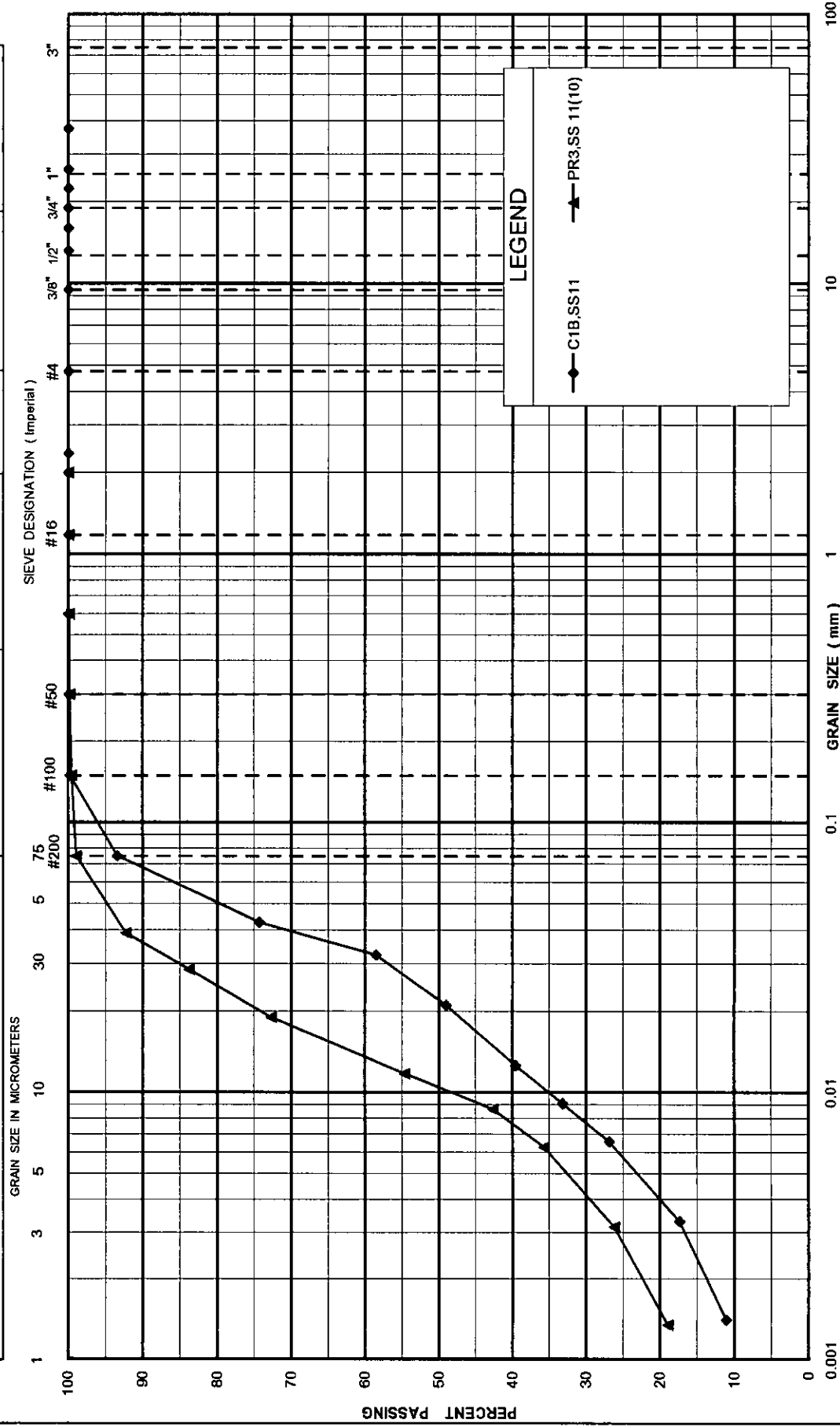
FIGURE No. B5-24

REF. No. SPT 1055

G.W.P. 354-94-00

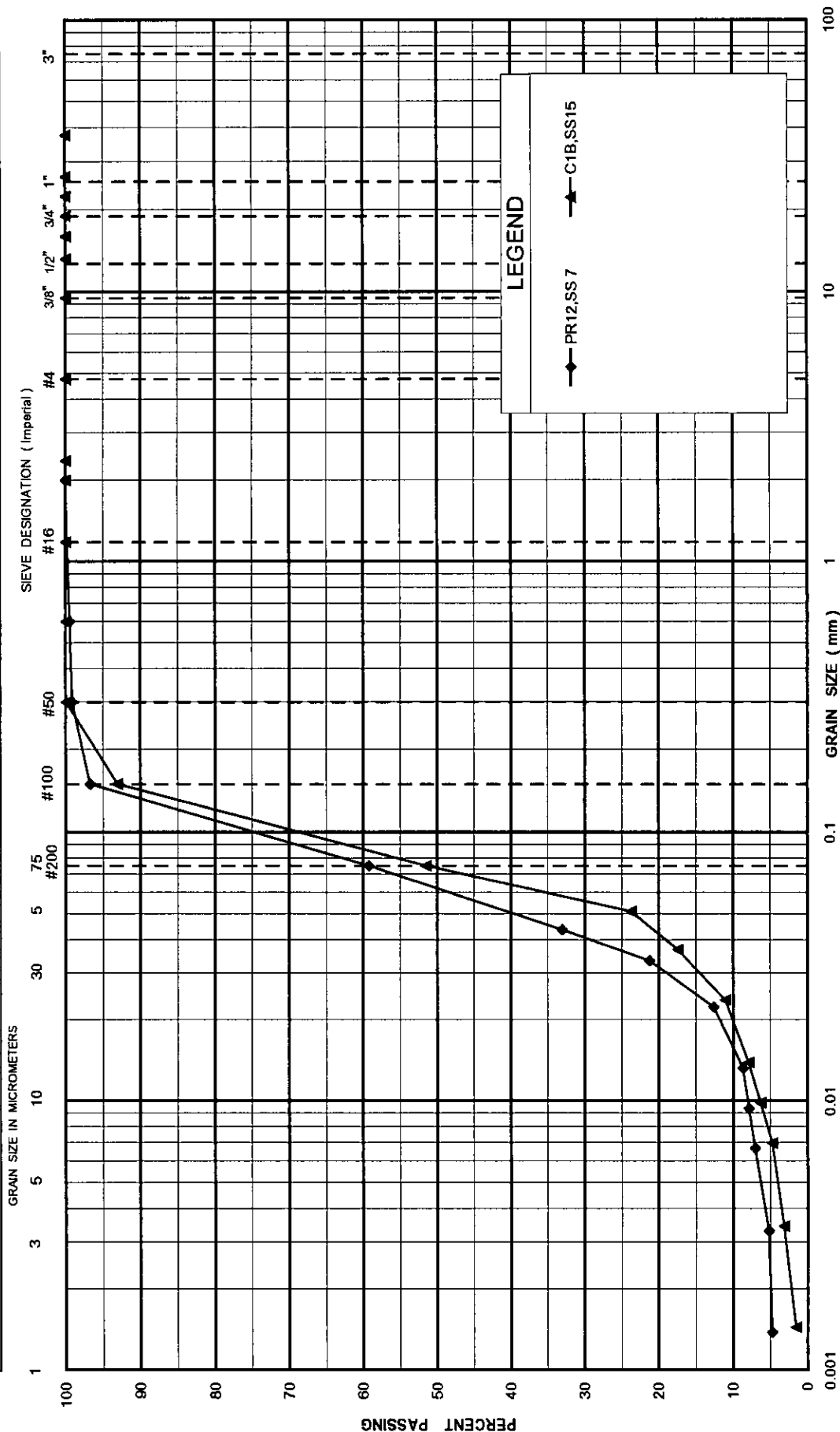
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
GRAIN SIZE IN MICROMETERS		Fine	Medium	Coarse	Fine	Coarse	



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL		
			Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION SILT and SAND

SHAHEEN & PEAKER LIMITED

FIGURE No. B5-26

REF. No. SPT 1055

G.W.P. 354-94-00

Appendix C5

Measured Undrained Shear Strength Results

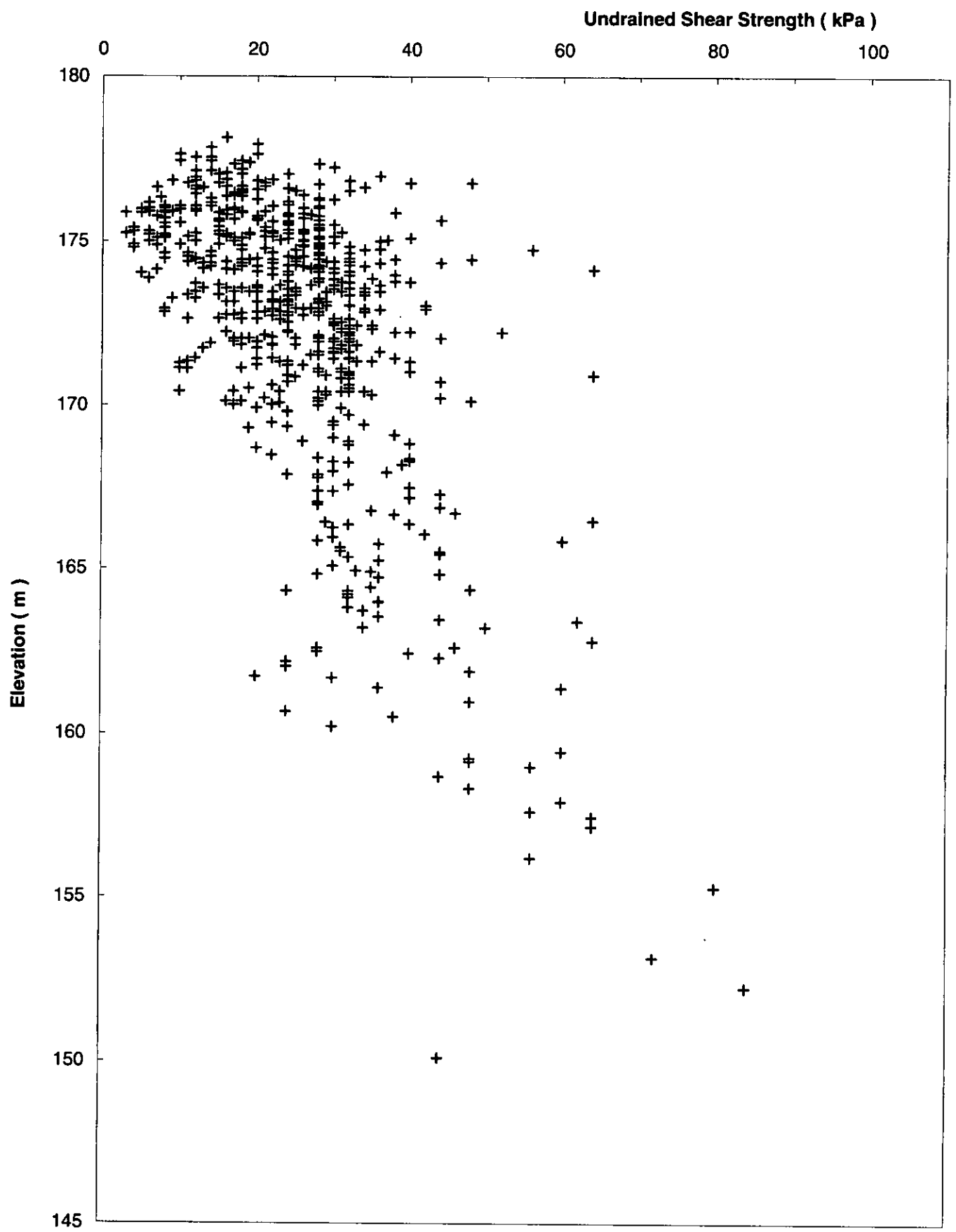


Fig. C5-1: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

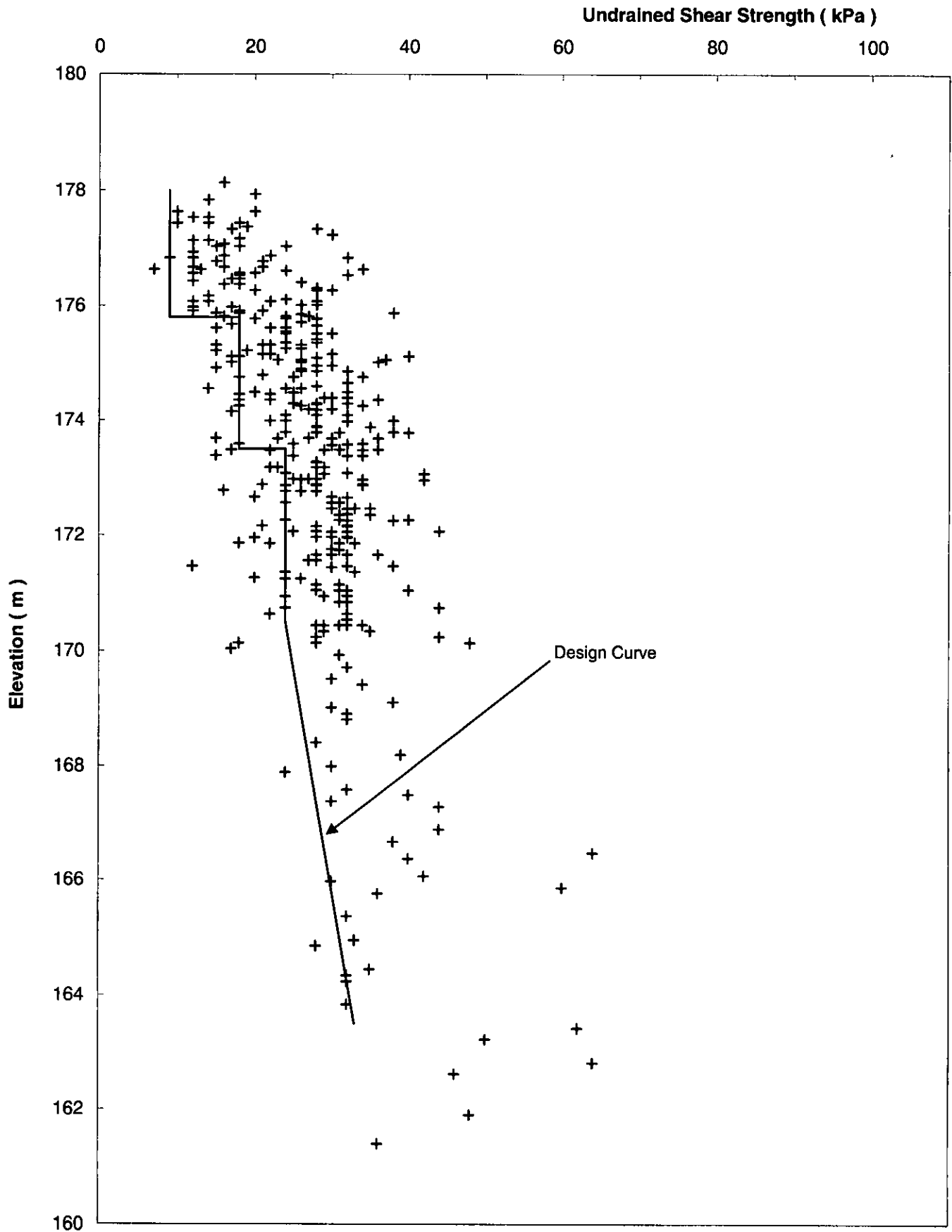


Fig. C5-2: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

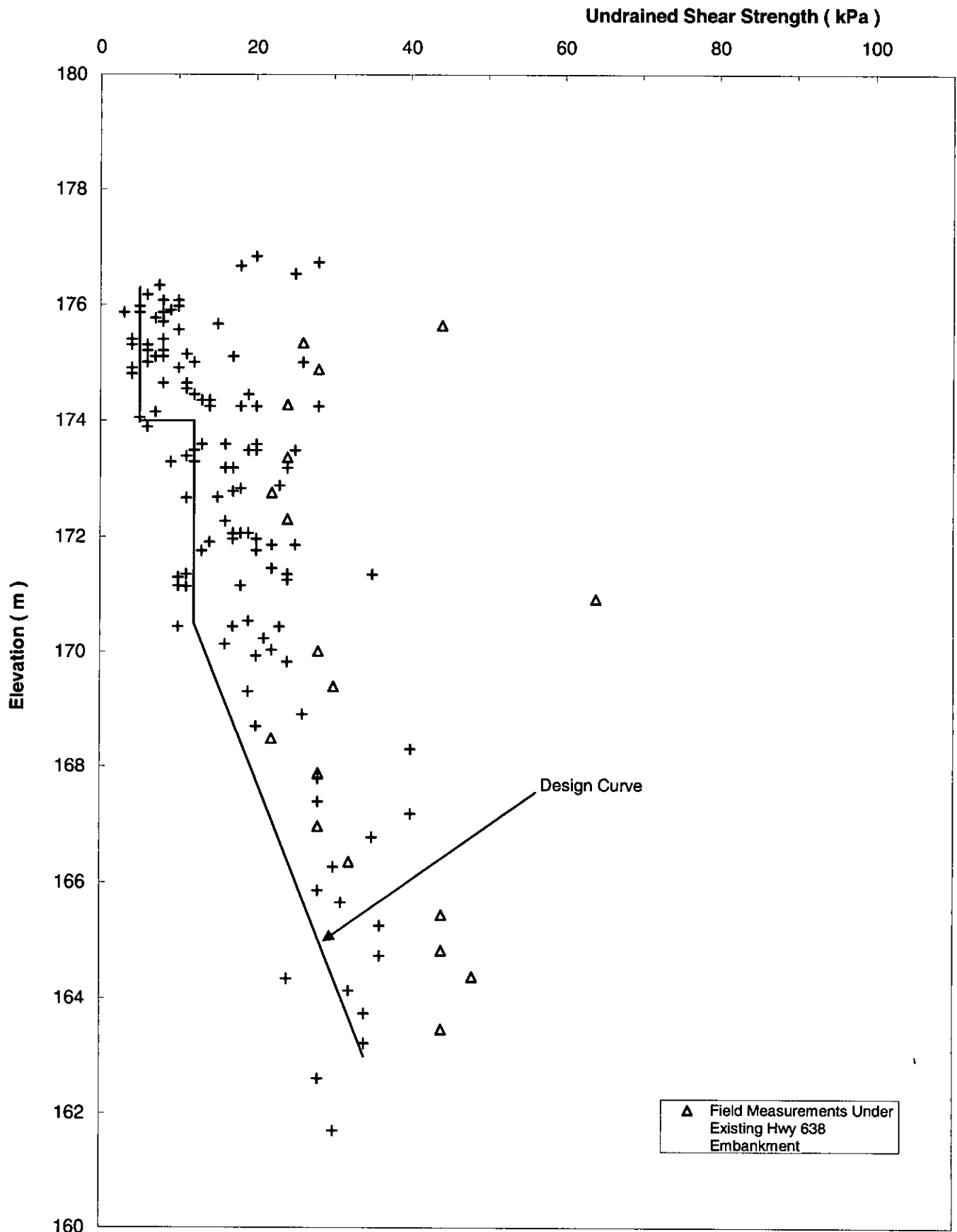


Fig. C5-3: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

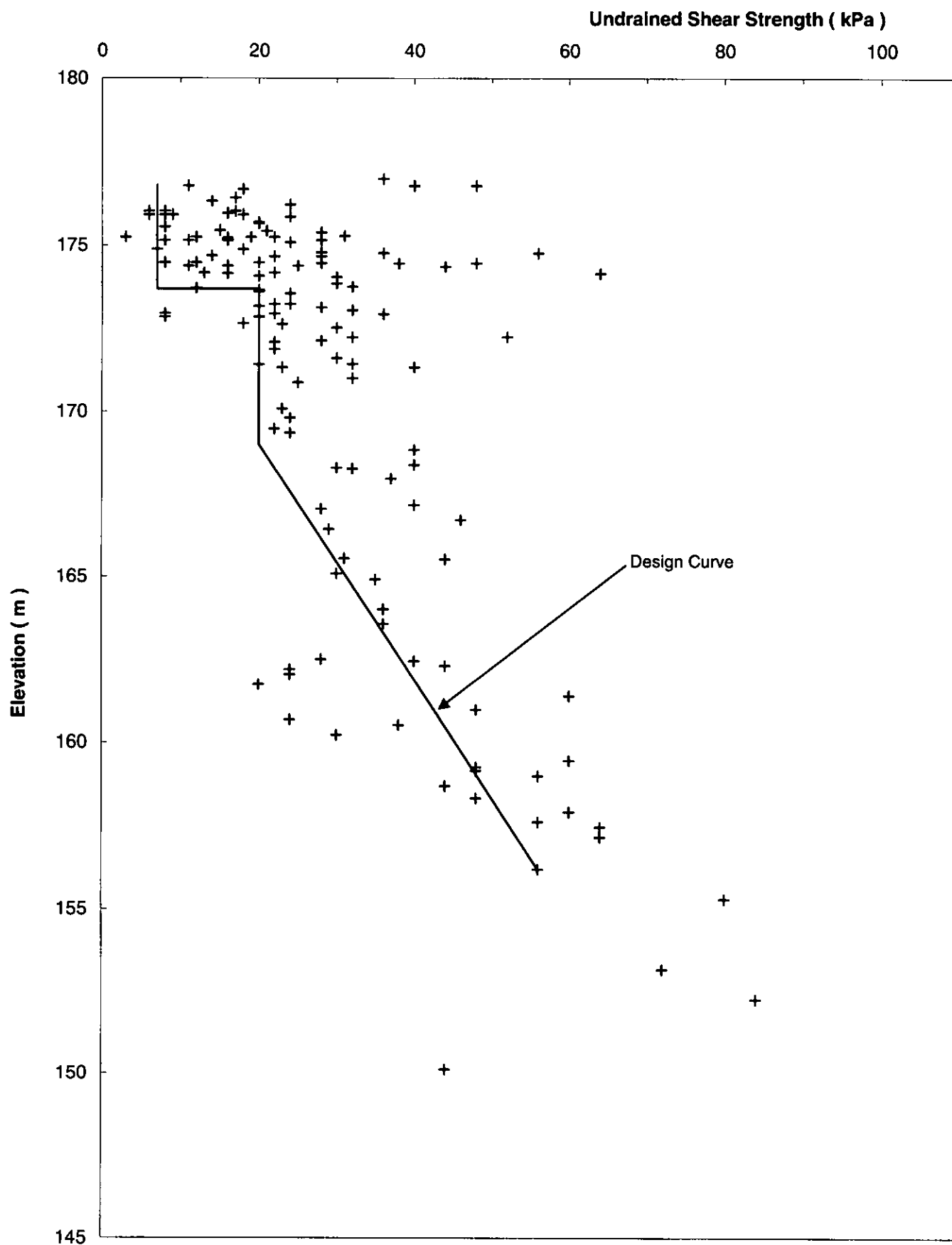


Fig. C5-4: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

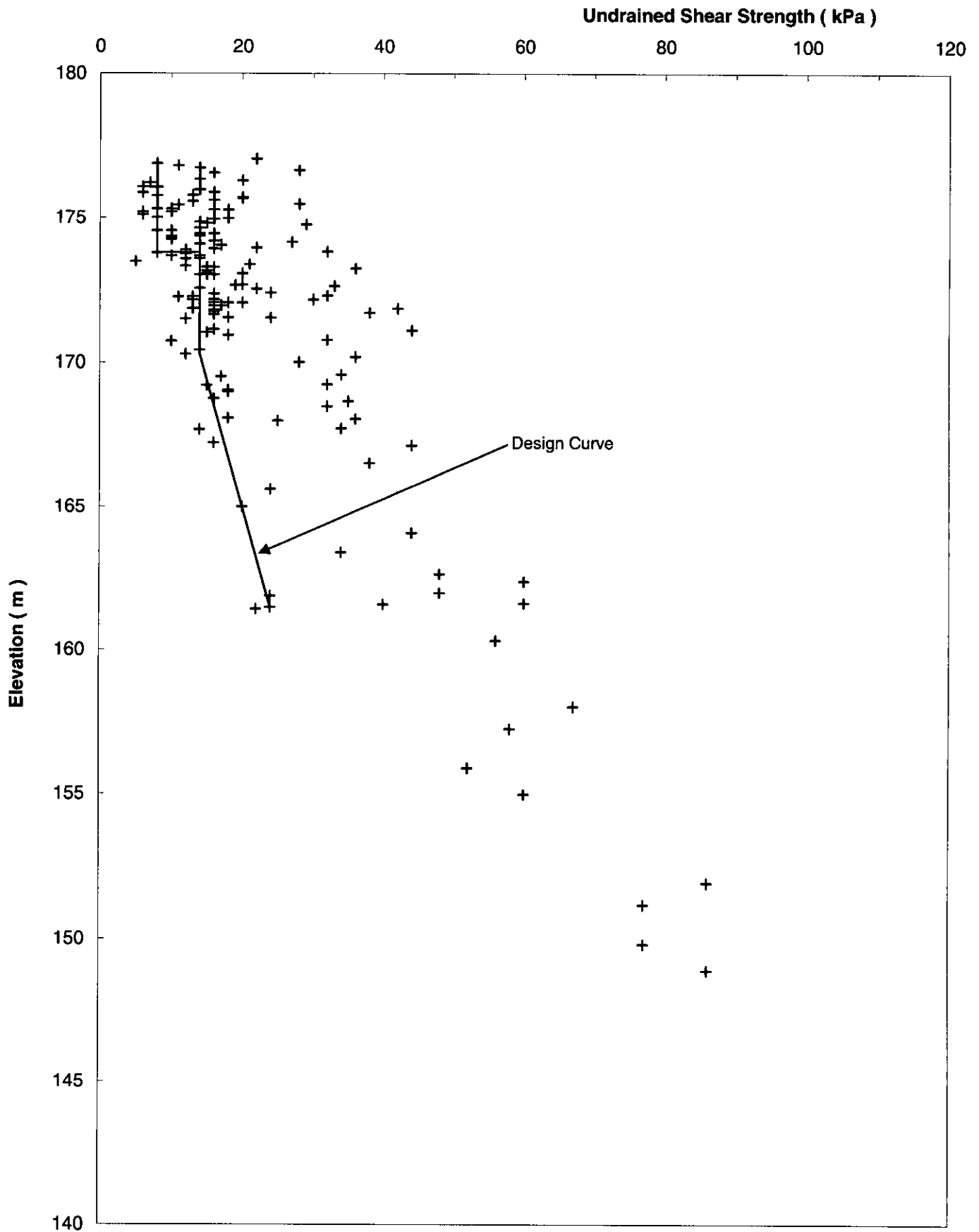


Fig. C5-5: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation

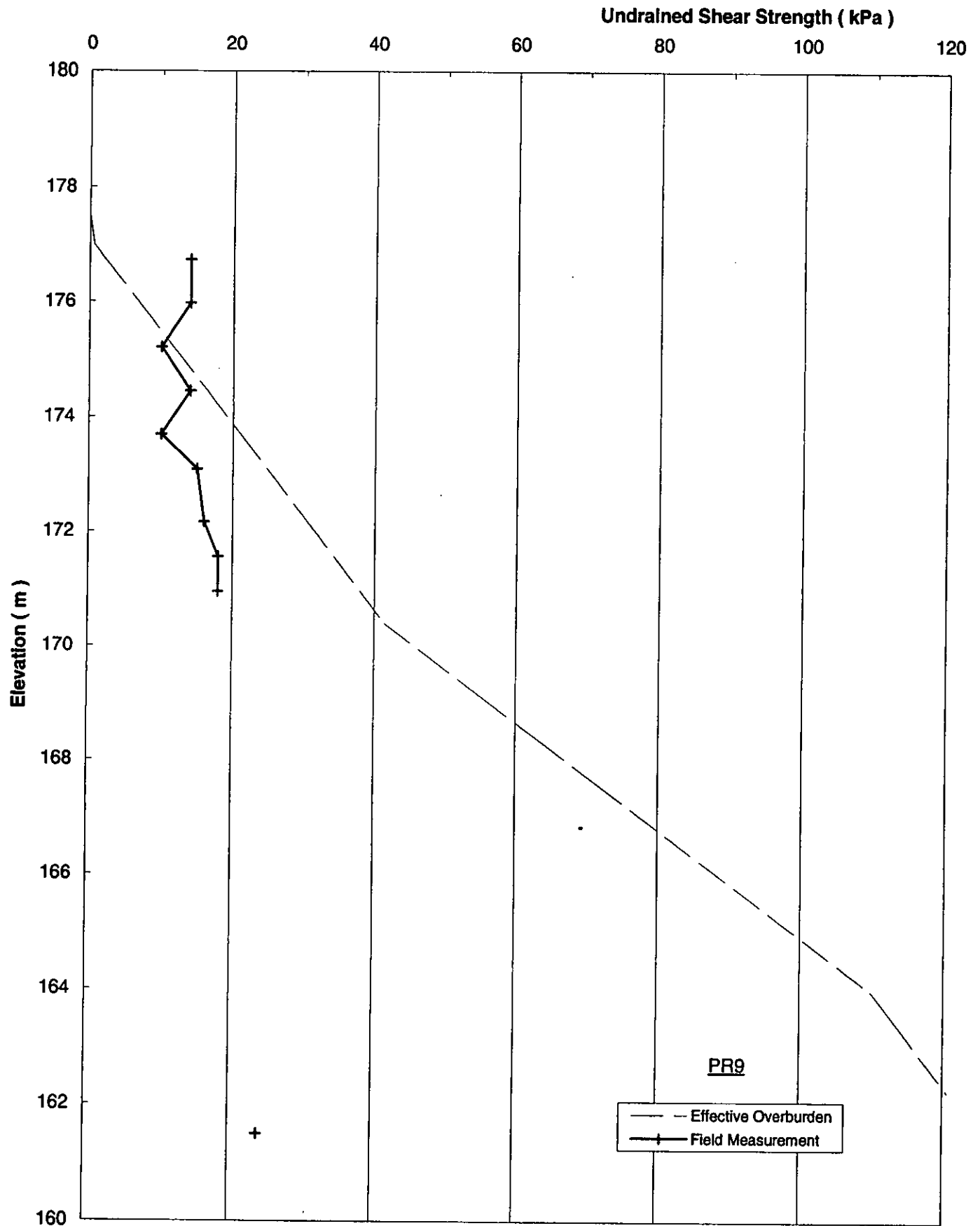


Fig. C5-6: Variation of Undrained Shear Strength (as measured by field vane tests) with Elevation (Borehole PR 9)