



DETAIL FOUNDATION INVESTIGATION REPORT

for

DEEP CUTS AT MEADOW CREEK BRIDGE

HIGHWAY 577, SITE 39E-077

G.W.P. 181-92-00

COCHRANE DISTRICT, IROQUOIS FALLS

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Carried Out by Shaheen & Peaker Ltd. (GEOCRES No. 42A-66)

DETAIL FOUNDATION INVESTIGATION REPORT

for

Deep Cuts at Meadow Creek Bridge

Highway 577, Site 39E-077

G.W.P. 181-92-00

Cochrane District, Iroquois Falls

1. INTRODUCTION

This report summarises the results of a detail foundation investigation carried out for deep cut slopes along the proposed realignment of Highway 577 (Monteith Road) at the crossing of Meadow Creek south of the Town of Iroquois Falls, Ontario. The investigation was conducted for Stantec Consulting Ltd. (Stantec) on behalf of the Ministry of Transportation of Ontario.

Highway 577 passes over Meadow Creek at approximate Sta. 19+893 (ref. Preliminary General Arrangement drawing prepared by Stantec in December 2008). The realignment of the highway will result in cut slopes to the south and north of the creek within respective distances of some 450 and 150 m from the bridge. The section of the realigned highway south of the creek is designated in the report as area 1 and the section to the north of the creek as area 2.

A preliminary investigation for the project was carried out by Shaheen & Peaker Ltd. in 2006 (GEOCRE No. 42A-66); the preliminary data was considered for this report.

This report provides subsurface information pertaining to the planned cut slopes along the realigned sections of Highway 577.

2. SITE DESCRIPTION AND GEOLOGY

At the location of the bridge, Highway 577 runs in the approximate south-north direction. The flow of water in Meadow Creek is from west to east towards the Abitibi River, with the confluence some 900 m downstream.

Highway 577 makes a sharp 90° turn in area 1 because of hydro towers some 100 m west of the alignment. The slopes to the east of the existing highway are approximately 1 to 4 m high, their maximum inclination being about 2H:1V. A roadside ditch and swale located to the west of and parallel to the existing highway drains northerly to Meadow Creek.



The subject site is located in the Abitibi Uplands, part of the Canadian Shield physiographic province. The Abitibi Uplands is a peneplain that straddles the Hudson Bay / St. Lawrence drainage divide with modern drainage towards James Bay. The local topography is very flat so that low relief results in small stream gradients.

The typical soils of the Cochrane Till are non-sorted, non-stratified silty clay, silty clay loam or silt loam. Overlain by clayey deposits at about 25 m depth are sandy soils containing cobbles and boulders.

Bedrock is described as paragneiss and migmatitic paragneiss, commonly with abundant granitic and pegmatitic rocks. These rocks are primarily igneous in origin and tend to be relatively hard. The bedrock is at depths of more than 30 m at the site.

3. INVESTIGATION PROCEDURES

The field work for this study was carried out during the period of October 16 to 25, 2008 and comprised six boreholes drilled to depths of 5.5 to 11.6 m at the locations shown on Drawing 2-1. Boreholes 201 to 204 were located south of Meadow Creek (area 1) and boreholes 205 and 206 to the north of the creek (area 2). The current boreholes put down for the cut slopes investigation were numbered in the 200-series to distinguish them from boreholes that were drilled at the site during the preliminary investigation in 2006 which were identified by the numbers 1 to 11. The records of boreholes, figures and drawings from the GEOCREs No. 42A-66 preliminary report are reproduced in Appendix A.

The locations of the boreholes for the current investigation were established in the field by Peto MacCallum Ltd. (PML). The ground surface elevations at the boreholes were provided by Talbot Survey Ltd. All elevations in this report are geodetic and expressed in metres.

The boreholes were advanced using continuous flight hollow stem augers, powered by a track-mounted Morooka MST-1100 drill rig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of our engineering staff.



Representative samples of the soil were recovered at frequent depth intervals using a conventional split spoon sampler during drilling. Standard penetration tests were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata. Penetrometer and in-situ vane shear testing was performed to assess the shear strength of the cohesive soils. The shear strength values obtained using penetrometer tests are typically lower than the actual values due to sample disturbance.

Groundwater conditions at the borehole locations were assessed during drilling by visual examination of soil, the sampler and drill rods as the samples were retrieved and, when appropriate, by measurement of the water level in open boreholes. Two piezometers were installed in boreholes 202 and 203, with piezometer readings taken over an 8-day period. Water levels were also measured in piezometers that were installed in boreholes 8, 9 and 10 during the preliminary investigation. The boreholes were backfilled with a bentonite/cement mixture where required in accordance with the MTO guidelines and MOE Reg. 903 for borehole abandonment procedures.

All of the recovered samples were returned to our laboratory for detailed visual examination, classification and routine moisture content determination. Further, 14 Atterberg limits tests, 14 grain size distribution analyses and a consolidated-undrained (with pore pressure measurement) triaxial test were conducted on selected samples, with the results presented in Figures PC-2-1 to PC-2-3, GS-2-1 to GS-2-3 and CU-2-1. In addition, 2 unconfined compression tests were performed. The laboratory test results are shown on the Record of Borehole sheets.

4. SUMMARISED SUBSURFACE CONDITIONS

Reference is made to the appended Record of Borehole sheets for details of the subsurface conditions including soil classification, inferred stratigraphy, boundary elevations, standard penetration test data, penetrometer and in-situ vane shear strength values, piezometer arrangements and groundwater observations. The results of laboratory unconfined compressive strength tests, Atterberg limits testing, grain size distribution analyses and moisture content determination are also shown on the Record of Borehole sheets. The borehole locations are indicated on Drawing 2-1.



The stratigraphic profiles and cross-sections are presented on Drawings 2-2 to 2-4. The boundaries between soil strata have been established at the borehole locations only. Between and beyond the boreholes, the boundaries are assumed and may vary.

The subsurface conditions revealed in the boreholes drilled at the site for the current investigation was generally consistent with the results of the preliminary investigation. The subsurface stratigraphy in area 1 (boreholes 201 to 204) and area 2 (boreholes 205 and 206) is similar and also consistent with the findings of the 2006 preliminary investigation. The typical soil stratigraphy comprised surficial fill or topsoil overlying a cohesive deposit of clay / silty clay through the depths investigated. The strata encountered are summarised below.

4.1 Fill

Surficial fill was present in boreholes 202 (area 1) and 205 (area 2) and was penetrated at respective depths of 3.7 and 2.2 m (elevation 264.8 and 255.0). The fill was made of mixed topsoil, silty clay, organic silty clay with a firm consistency. The fill had a moisture content of 29 to 39% in borehole 202 and 23 to 31% in borehole 205.

4.2 Topsoil

Topsoil was present surficially in boreholes 201, 203, 204 (area 1) and 206 (area 2). The silty/clayey topsoil was about 300 mm thick and penetrated at 0.3 m depth, elevation 265.9 to 269.5 in area 1 and elevation 260.7 in area 2.

4.3 Clay / Silty Clay

Underlying the fill or topsoil at variable depths of 0.3 to 3.7 m (elevation 264.8 to 269.5) in boreholes 201 to 204, at 2.2 m depth (elevation 255.0) in borehole 205 and a depth of 0.3 m (elevation 260.7) in borehole 206 was a deposit of cohesive clay / silty clay (with layers of clayey silt in borehole 203). The deposit was not penetrated upon termination of drilling at depths of 7.0 to 11.6 m (elevation 254.6 to 261.5) in boreholes 201 to 204 (area 1) and at depths of 5.5 and 7.0 m (elevation 251.7 and 254.0) in boreholes 205 and 206 (area 2).



This deposit was soft to stiff, typically firm in consistency. The results of in-situ vane testing carried out in the deposit yielded undisturbed shear strength values in a range of 24 to 40 kPa, locally 56 kPa in boreholes 201 to 204 (area 1) and 32 to 38 kPa, locally 76 kPa in boreholes 205 and 206 (area 2), with soil sensitivity values of 2 to 4. Penetrometer tests on cohesive samples indicated a shear strength varying from 13 to 187 kPa, typically 38 to 88 kPa. Unconfined compression testing on two Shelby tube samples of the silty clay from boreholes 201 and 202 (area 1) gave an undrained shear strength of 12 and 16 kPa (strain at failure of 6.9 and 10.9%). The results of a consolidated-undrained (with pore pressure measurement) triaxial test gave a cohesion of 5 kPa and friction angle of 28° , as reported in Figure CU-2-1.

The shear strength obtained in the preliminary investigation (boreholes 1 to 11) typically ranged from 40 to 90 kPa. The upper layers of the silty clay in borehole 9 to about elevation 258 exhibited a stiff to very stiff consistency. This zone has been somewhat desiccated as indicated by typical natural water content values in the 23 to 30% range which is lower than the natural water content of the underlying layers (typically 35 to 40%).

The results of Atterberg limits testing and grain size distribution analyses conducted on 14 cohesive samples are presented in respective Figures PC-2-1 to PC-2-3 and GS-2-1 to GS-2-3. A summary of the Atterberg test results is presented in the attached Table 1. The liquid and plastic limits of the clay ranged from 51 to 54 and from 20 to 24 respectively, with the plasticity index of 28 to 31. The silty clay had a liquid limit of 39 to 48, plastic limit of 20 to 22, its plasticity index being 18 to 26. The liquid and plastic limits of the clayey silt were 33 and 19, thus giving the plasticity index of 14. The moisture content of the deposit varied between 24 and 46%.

4.4 Groundwater

In the course of the field work, groundwater was observed in boreholes 201 to 205. In the process of augering, water was detected at depths of 3.1 to 4.6 m (elevation 261.6 to 266.1) in boreholes 201 to 204 (area 1) and at 3.1 m depth (elevation 254.1) in borehole 205 (area 2). Upon completion of drilling, groundwater was measured in borehole 201 (area 1) to be at a depth of 4.0 m (elevation 265.8). No water was observed in borehole 206 (area 2) during or upon completion of drilling.



Two piezometers were installed in boreholes 202 and 203 (area 1). Piezometer readings subsequently taken showed water levels to be at the following depths/elevations:

Date	Borehole 202		Borehole 203	
	Depth, m	Elev.	Depth, m	Elev.
October 22, 2008	1.5	267.0	6.7	262.5
October 25, 2008	1.6	266.9	6.4	262.8
October 26, 2008	1.7	266.8	6.3	262.9
October 27, 2008	1.2	267.3	5.9	263.3
October 28, 2008	1.4	267.1	5.6	263.6
October 30, 2008	1.6	266.9	5.2	264.0

Water level measurements were also taken in the found piezometers that were installed in boreholes 8, 9 and 10 during the preliminary investigation. The current water levels in these piezometers were as follows:

Date	Borehole 8		Borehole 9		Borehole 10	
	Depth, m	Elev.	Depth, m	Elev.	Depth, m	Elev.
October 15, 2008	5.3	252.0	6.2	257.4	—	—
October 30, 2008	5.3	252.0	6.3	257.3	4.3	262.4

The water level in the Meadow Creek is controlled by dams located both upstream and downstream of the site and was reported to be maintained at approximate elevation 248.0.

Groundwater levels may fluctuate subject to seasonal variations and precipitation patterns.

5. MISCELLANEOUS

The field work was carried out under the supervision of Mr. F. Portela, Senior Technician, and direction of Mr. C. M. P. Nascimento, P.Eng., Senior Project Engineer. The drilling equipment was supplied by Abraflex (2004) Ltd. The testing of selected soil samples was carried out in the PML laboratory in Toronto.



This report was prepared by Mr. G.O. Degil, PhD, P.Eng., Senior Foundation Engineer, and reviewed by Mr. C.M.P. Nascimento, P.Eng., Senior Project Engineer. Mr. B.R. Gray, MEng, P.Eng., MTO Designated Principal Contact, conducted an independent review of the report.

Yours very truly,

Peto MacCallum Ltd.



Grigory O. Degil, PhD, P.Eng.
Senior Foundation Engineer



C. M. P. Nascimento, P.Eng.
Senior Project Engineer



Brian R. Gray, MEng, P.Eng.
MTO Designated Principal Contact

GD/CN/BRG:gd-mi



TABLE 1
ATTERBERG LIMITS AND MOISTURE CONTENT RESULTS

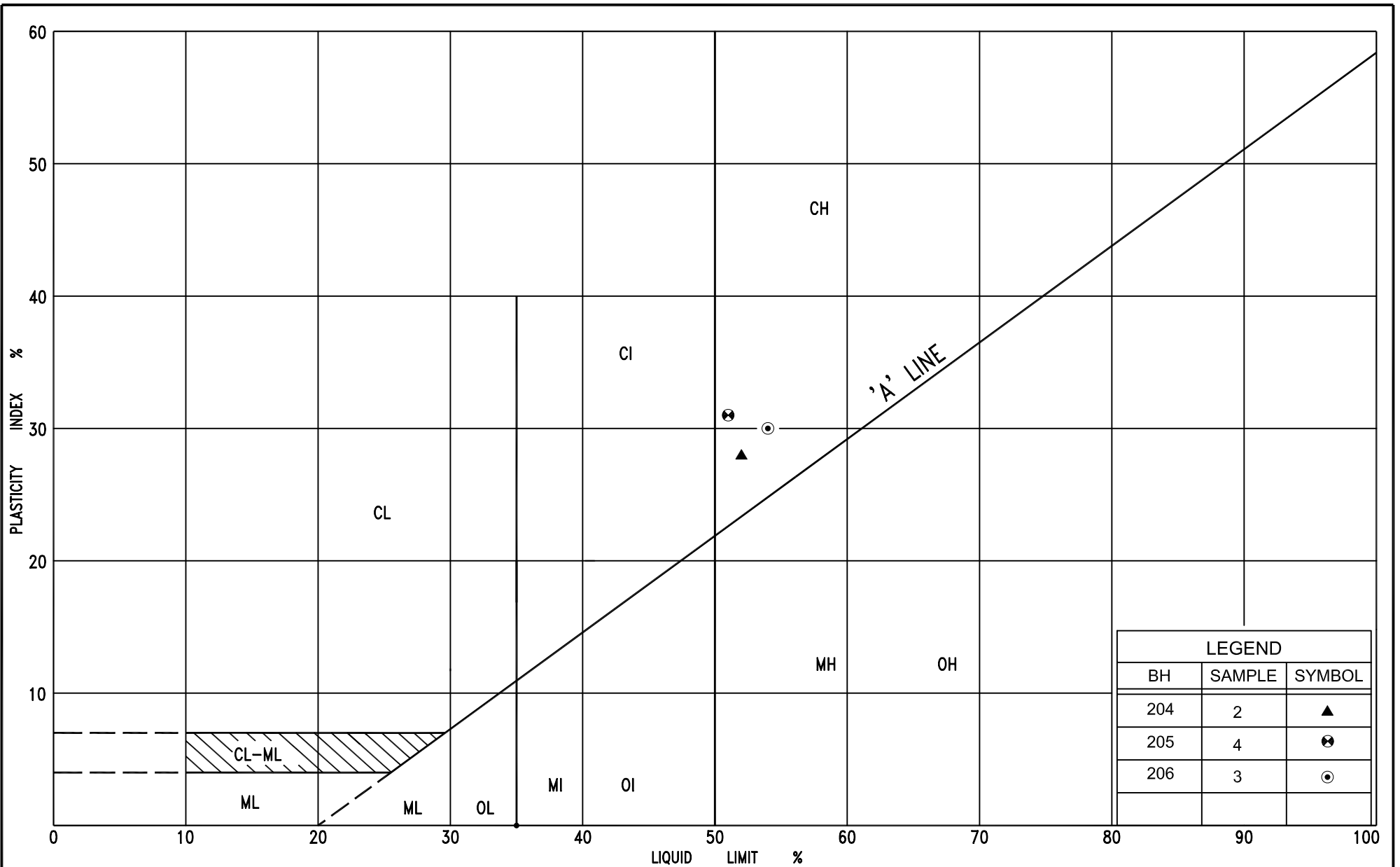
AREA 1 (Sta. 19+450 to 19+680)

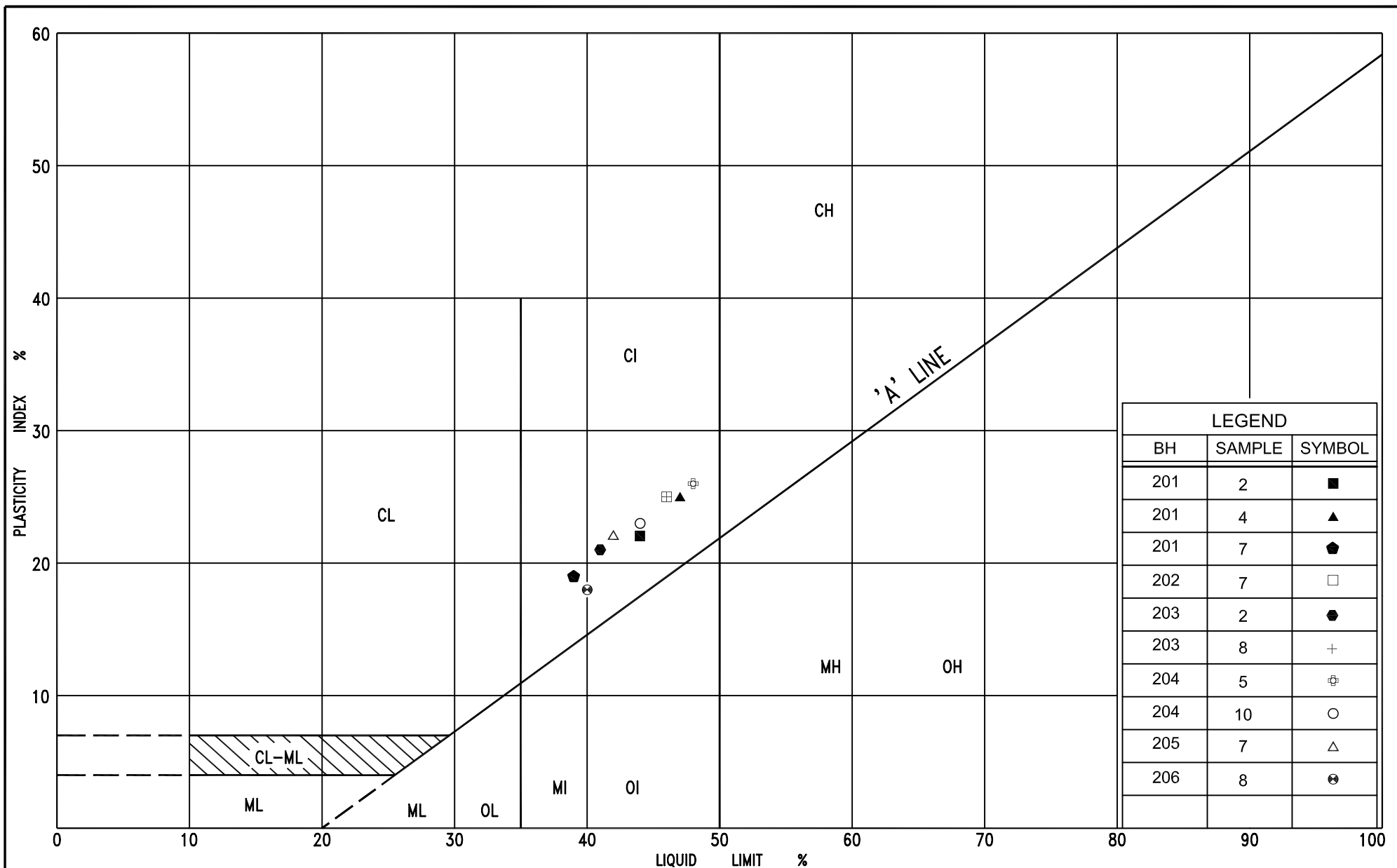
Depth (m)	Borehole No.	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	Moisture Content (%)	Liquidity Index
0.7 - 1.3	201	2	44	22	22	28	0.28
1.5 - 2.1	203	2	41	20	21	24	0.19
	204	2 (*)	52	24	28	27	0.11
3.1 - 3.7	201	4	47	22	25	37	0.60
4.6 - 5.2	202	7	46	21	25	39	0.72
	203	5	33	19	14	43	1.71
5.3 - 5.8	204	5	48	22	26	38	0.62
7.6 - 8.1	201	7	39	20	19	40	1.05
	203	8	46	21	25	39	0.72
9.1 - 9.7	204	10	44	21	23	37	0.70

AREA 2 (Sta. 19+990 to 20+130)

Depth (m)	Borehole No.	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	Moisture Content (%)	Liquidity Index
1.5 - 2.1	206	3 (*)	54	24	30	35	0.37
2.3 - 2.9	205	4 (*)	51	20	31	35	0.48
4.6 - 5.2	205	7	42	20	22	40	0.91
6.1 - 6.7	206	8	40	22	18	38	0.89

- Notes:
1. Test results listed in order of increasing depth.
 2. All soil samples are classified as silty clay except those marked thus (*) which are classified as clay.





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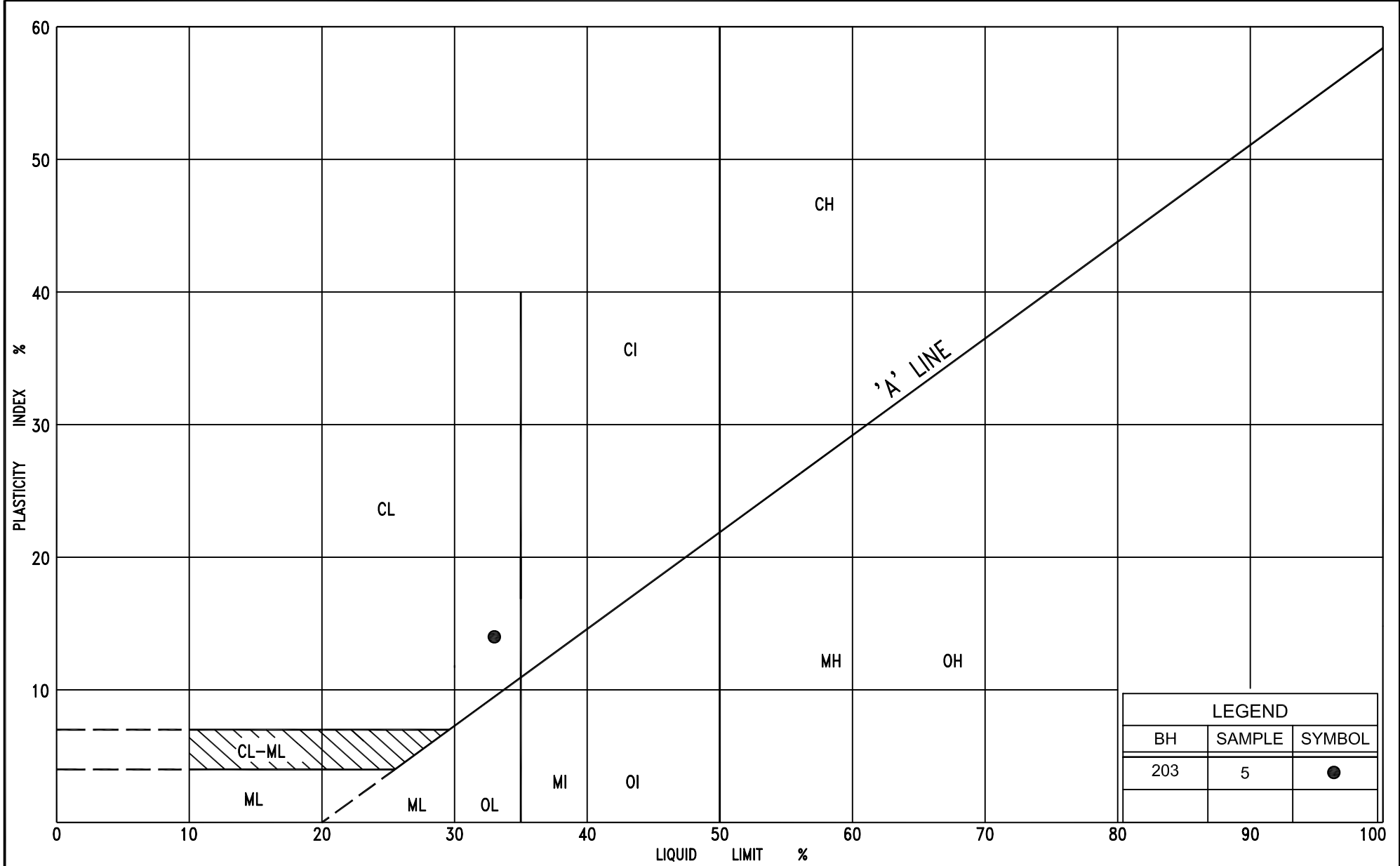
PLASTICITY CHART

SILTY CLAY, trace sand

FIG No. PC-2-2

HWY: 577

G.W.P. No. 181-92-00



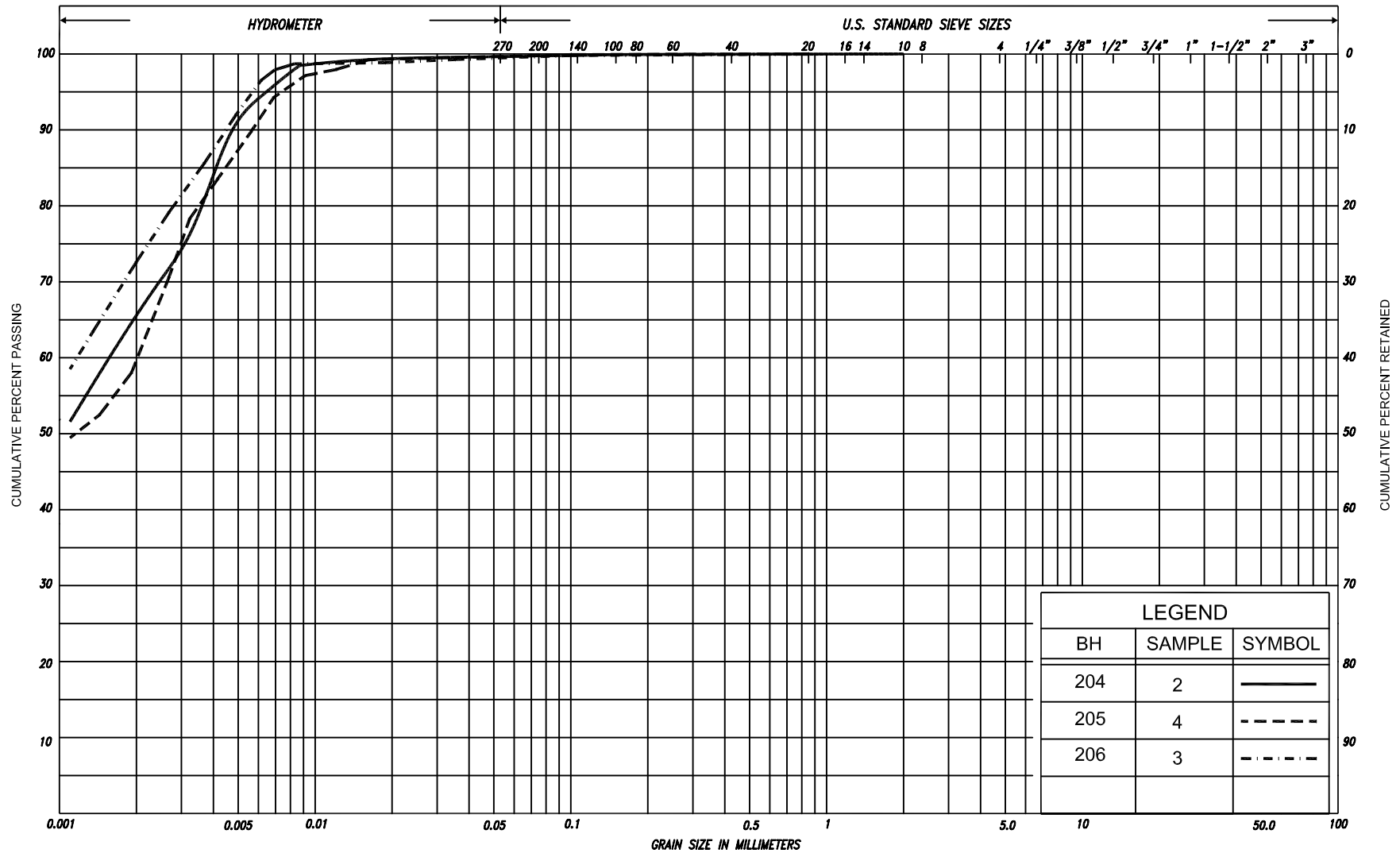
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PLASTICITY CHART CLAYEY SILT

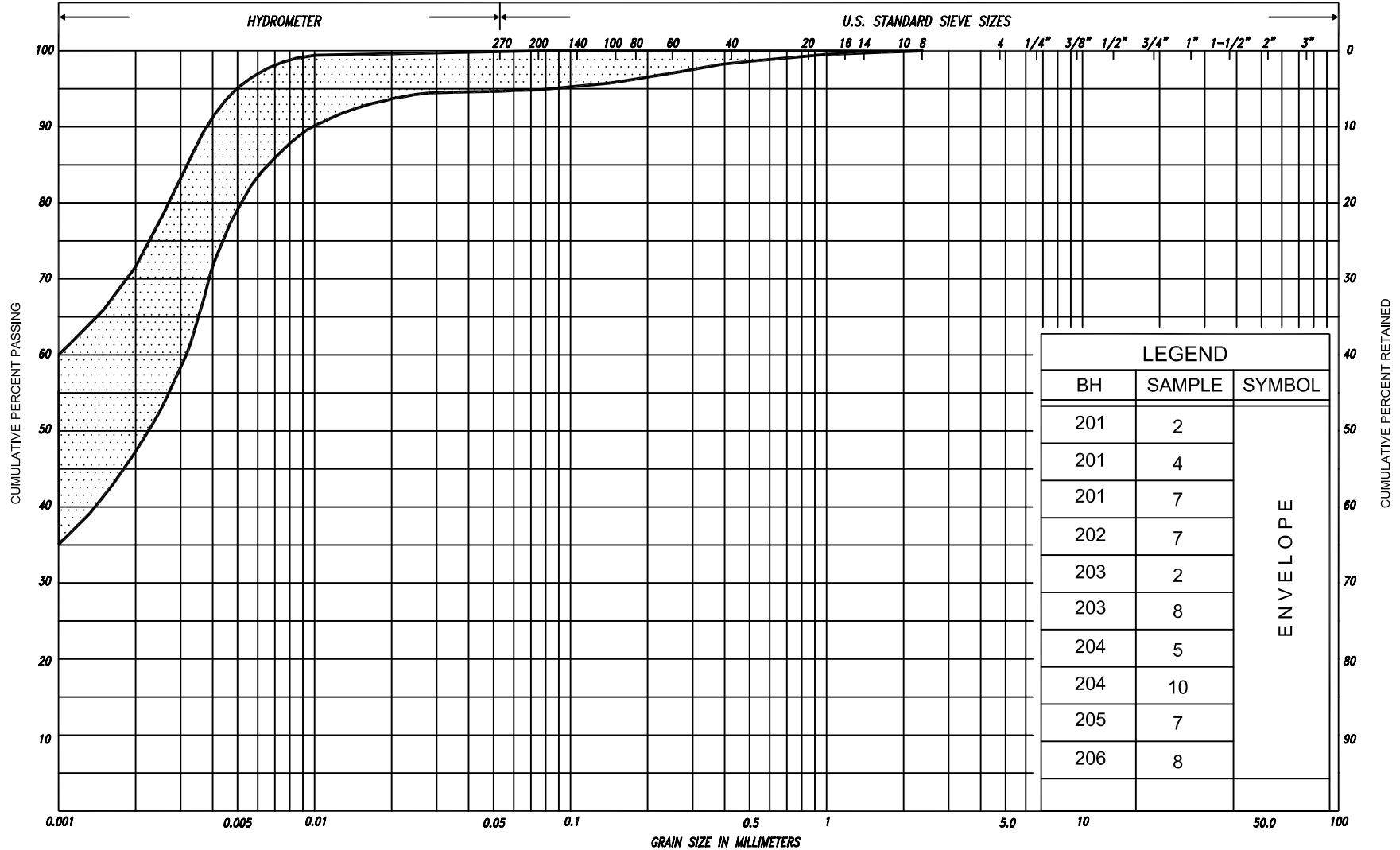
FIG No. PC-2-3

HWY: 577

G.W.P. No. 181-92-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE	GRAVEL			COBBLES	M.I.T.	
	SILT					FINE		SAND		MEDIUM		COARSE	GRAVEL			COBBLES
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						COBBLES	U.S. BUREAU



SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL		COB BLES	UNIFIED
CLAY	SAND			FINE		MEDIUM		COARSE	GRAVEL		COBBLES	M.I.T.
	SILT			SAND		SAND		COARSE	GRAVEL		COBBLES	U.S. BUREAU
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL				

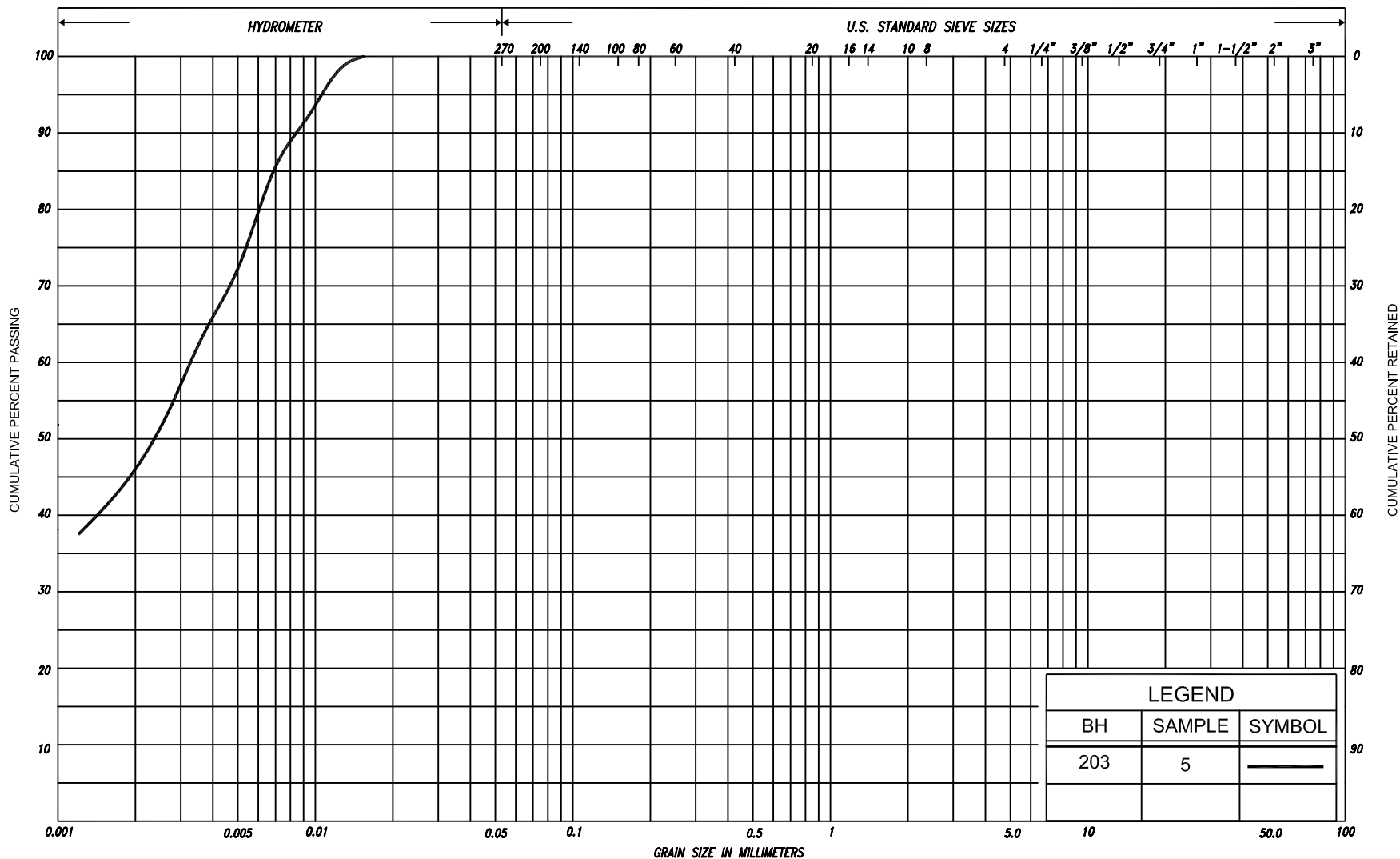
GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand

FIG No. GS-2-2

HWY: 577

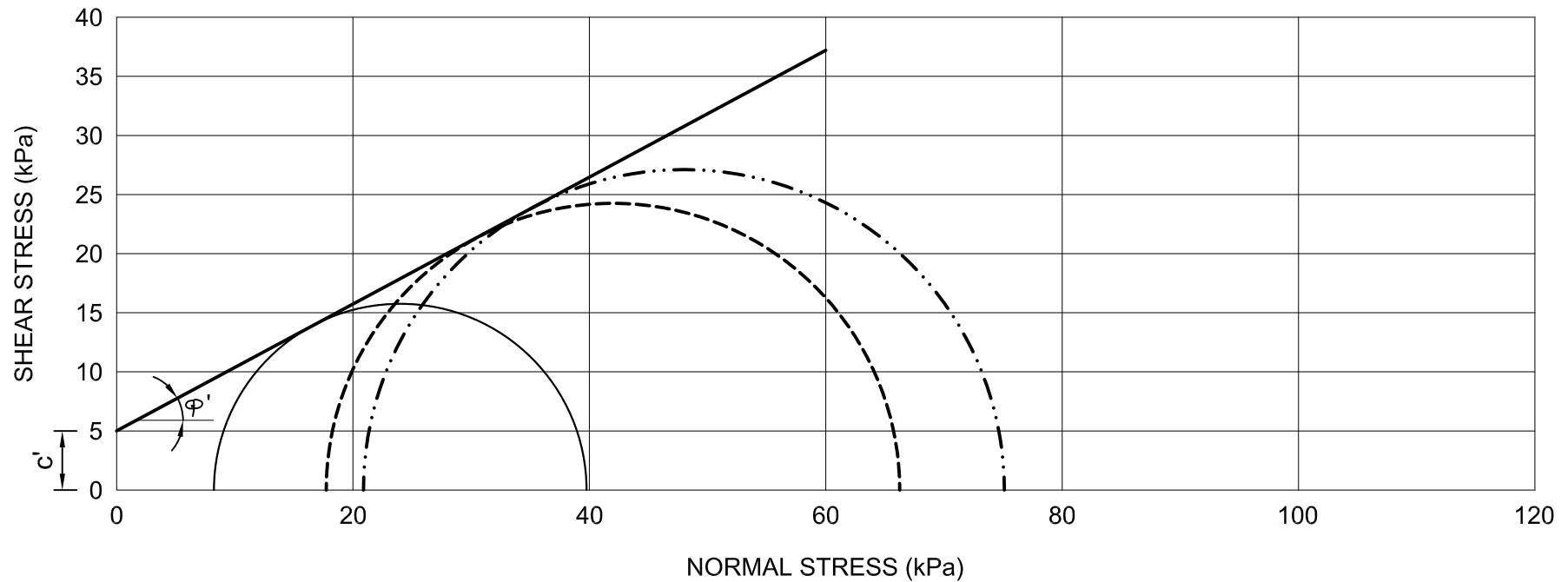
G.W.P. No. 181-92-00



SILT & CLAY			FINE			MEDIUM			COARSE			GRAVEL			COB BLES	UNIFIED
CLAY			FINE			MEDIUM			COARSE			GRAVEL			COBBLES	M.I.T.
CLAY			SILT			SAND			GRAVEL			GRAVEL			U.S. BUREAU	

EFFECTIVE STRESS MOHR CIRCLES

Borehole 203, Sample 5
Depth 4.6 - 5.2 m



TEST RESULTS:

	CONSOLIDATION PRESSURE (kPa)	PORE PRESSURE (kPa)	UNIT WEIGHT (kN/m ³)	VOID RATIO	MOISTURE CONTENT (%)
————	10	2	17.8	0.54	43.6
-----	20	3	17.7 ³	0.54	45.2
- · - · -	40	19	18.1 ³	0.53	30.8

SOIL TYPE: CLAYEY SILT $C' = 5$ kPa ; $\phi' = 28^\circ$	FIGURE No: CU-2-1
	HIGHWAY: 577 / MEADOW CREEK
	G.W.P. 181-92-00

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

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

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE
F V	FIELD VANE		

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	e_{max}	1, %	VOID RATIO IN LOOSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	e_{min}	1, %	VOID RATIO IN DENSEST STATE
ρ_w	kg/m^3	DENSITY OF WATER	S_r	%	DEGREE OF SATURATION	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
γ_w	kN/m^3	UNIT WEIGHT OF WATER	w_L	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_p	%	PLASTIC LIMIT	D_n	mm	n PERCENT - DIAMETER
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_s	%	SHRINKAGE LIMIT	C_u	1	UNIFORMITY COEFFICIENT
ρ_d	kg/m^3	DENSITY OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	q	m^3/s	RATE OF DISCHARGE
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	i	1	HYDRAULIC GRADIENT
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL	WTPL		WETTER THAN PLASTIC LIMIT	j	kN/m^3	SEEPAGE FORCE
e	1, %	VOID RATIO						

RECORD OF BOREHOLE No 201

1 of 1

METRIC

G.W.P. 181-92-00 LOCATION Meadow Creek/ HWY 577 Co-ords: 5 400 938 N; 328 346 E ORIGINATED BY F.P.
DIST 54 HWY 577 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY G.D.
DATUM Geodetic DATE October 16, 2008 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
															w _p w w _L		
269.8	Ground Surface							20	40	60	80	100					
0.0	Topsoil		1	SS	5												
269.5	Silty clay, trace sand organics to 0.7m Stiff Brown Moist Firm —																

METRIC

RECORD OF BOREHOLE No 203

1 of 2

METRIC

G.W.P. 181-92-00 LOCATION Meadow Creek/ HWY 577 Co-ords: 5 400 981 N; 328 345 E ORIGINATED BY F.P.
DIST 54 HWY 577 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY G.D.
DATUM Geodetic DATE October 17, 2008 CHECKED BY C.N.

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									
269.2	Ground Surface							20	40	60	80	100					
0.0	Topsoil		1	SS	8		269							○			
268.9	Silty clay organics to 1.0m																
0.3	Stiff to Brown Moist firm		2	SS	5		268							○			
							267										
	layers of clayey silt						266							○			
	Grey Wet		3	SS	2		265							○			
				FV													
			4	SS	WH**		264							○			
				FV													
			5	TW	PH		263							○			
							262										
			6	SS	2		261							○			
				FV													
			7	SS	1									○			
				FV													
			8	SS	1									○			
260.7	End of borehole																
8.5																	

* 2008 10 17

Water level observed
during drilling

WH** Denotes penetration due
to weight of rods and
hammer

Penetrometer test

Piezometer Legend :

Bentonite seal

Native cuttings

Filter sand

Screen

Sand bed

Cont'd

RECORD OF BOREHOLE No 203

2 of 2

METRIC

G.W.P. 181-92-00 LOCATION Meadow Creek/ HWY 577 ORIGINATED BY F.P.
 DIST 54 HWY 577 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY G.D.
 DATUM Geodetic DATE October 17, 2008 CHECKED BY C.N.

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			20	40	60	80	100	W _p	W	W _L																					
254.2																																				
	<u>Water Level Readings:</u> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev.</th> </tr> </thead> <tbody> <tr> <td>10/22/2008</td> <td>6.7</td> <td>262.5</td> </tr> <tr> <td>10/25/2008</td> <td>6.4</td> <td>262.8</td> </tr> <tr> <td>10/26/2008</td> <td>6.3</td> <td>262.9</td> </tr> <tr> <td>10/27/2008</td> <td>5.9</td> <td>263.3</td> </tr> <tr> <td>10/28/2008</td> <td>5.6</td> <td>263.6</td> </tr> <tr> <td>10/30/2008</td> <td>5.2</td> <td>264.0</td> </tr> </tbody> </table>	Date	Depth (m)	Elev.	10/22/2008	6.7	262.5	10/25/2008	6.4	262.8	10/26/2008	6.3	262.9	10/27/2008	5.9	263.3	10/28/2008	5.6	263.6	10/30/2008	5.2	264.0														
Date	Depth (m)	Elev.																																		
10/22/2008	6.7	262.5																																		
10/25/2008	6.4	262.8																																		
10/26/2008	6.3	262.9																																		
10/27/2008	5.9	263.3																																		
10/28/2008	5.6	263.6																																		
10/30/2008	5.2	264.0																																		

RECORD OF BOREHOLE No 204

1 of 1

METRIC

G.W.P. 181-92-00 LOCATION Meadow Creek/ HWY 577 Co-ords: 5 401 040 N; 328 299 E ORIGINATED BY F.P.
DIST 54 HWY 577 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY G.D.
DATUM Geodetic DATE October 20 & 21, 2008 CHECKED BY C.N.

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	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE									
266.2	Ground Surface																			
0.0	Topsoil																			
265.9	Clay																			
0.3	Stiff Brown Moist		1	SS	5															
			2	SS	5															
263.6	Silty clay																			
2.6	Firm Brown Wet																			
	Grey																			
			3	SS	3															
			4	SS	1															
				FV																
			5	SS	WH**															
				FV																
			6	TW	PH															
				FV																
			7	SS	WH															
				FV																
			8	TW	PH															
				FV																
			9	SS	WH															
				FV																
			10	SS	WH															
				FV																
			11	SS	1															
				FV																

METRIC

ON_MOT VER3 08TF009.GPJ ON_MOT.GDT 6/17/2009 3:32:58 PM

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 206

1 of 1

METRIC

G.W.P. 181-92-00 LOCATION Meadow Creek/ HWY 577 Co-ords: 5 401 506 N; 328 257 E ORIGINATED BY F.P.
DIST 54 HWY 577 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY G.D.
DATUM Geodetic DATE October 25, 2008 CHECKED BY C.N.

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									
261.0	Ground Surface																
0.0	Topsoil		1	SS	7												
0.3	Clay																
	Stiff to firm Brown Moist to wet		2	SS	11												
			3	SS	9												
			4	SS	3												
			5	SS	2												
257.4	Silty clay			FV													
3.7	Firm Grey Wet		6	SS	WH**												
				FV													
			7	TW	PH												
				FV													
			8	SS	1												
				FV													
254.0	End of borehole																
7.0																	
											</						

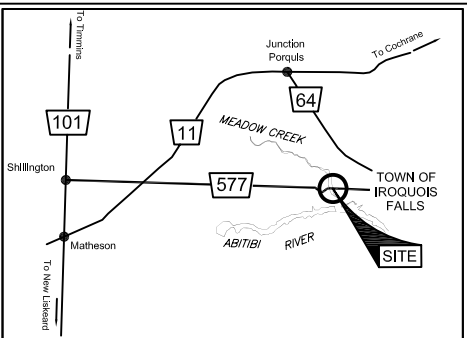
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES

CONT No
GWP No 181-92-00
**MEADOW CREEK BRIDGE
AND CUT SLOPES**
HIGHWAY 577
BOREHOLE LOCATIONS



SHEET

PML **Peto MacCallum Ltd.**
CONSULTING ENGINEERS



KEY PLAN
SCALE
0 10 20 30 km

LEGEND

- Borehole
- Dynamic Cone Penetration Test (Cone)
- Borehole & Cone
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation Oct 2008 and Aug-Sept 2006
- Head
- ARTESIAN WATER Encountered
- PIEZOMETER

(Legend Continued)

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
1	253.3	5 401 244.8	328 268.2
2	247.8	5 401 275.1	328 241.6
3	251.5	5 401 293.3	328 274.1
4	247.8	5 401 327.1	328 279.7
5	251.6	5 401 378.6	328 263.9
6	248.1	5 401 385.1	328 322.5
7	253.6	5 401 414.2	328 262.0
8	257.3	5 401 470.6	328 278.8
9	263.6	5 401 206.7	328 310.6
10	266.7	5 401 025.4	328 382.8
11	261.2	5 401 545.4	328 261.7

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
101	253.0	5 401 261	328 281
102	251.2	5 401 283	328 269
103	251.5	5 401 387	328 274
104	253.3	5 401 417	328 274
201	269.8	5 400 938	328 346
202	268.5	5 400 952	328 373
203	269.2	5 400 981	328 345
204	266.2	5 401 040	328 299
205	257.2	5 401 459	328 252
206	261.0	5 401 506	328 257

(Legend Continues)

NOTE

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

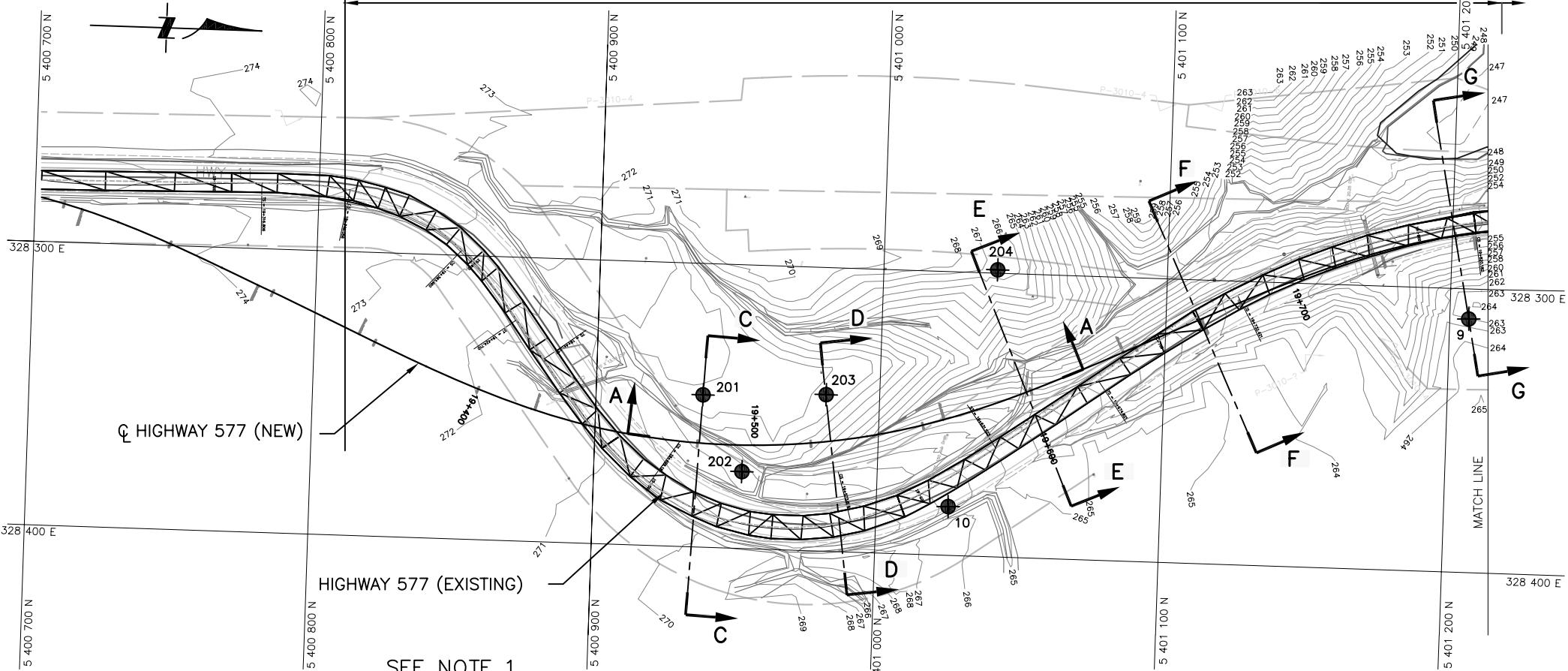
REVISIONS	DATE	BY	DESCRIPTION

Geocres No. 42A-76

HWY No	577	DIST	COCHRANE
SUBM'D	GD	CHECKED	GD
DATE	JUNE 15, 2009	SITE	39E-077
DRAWN	NA	CHECKED	CN
APPROVED	BRG	DWG	2-1

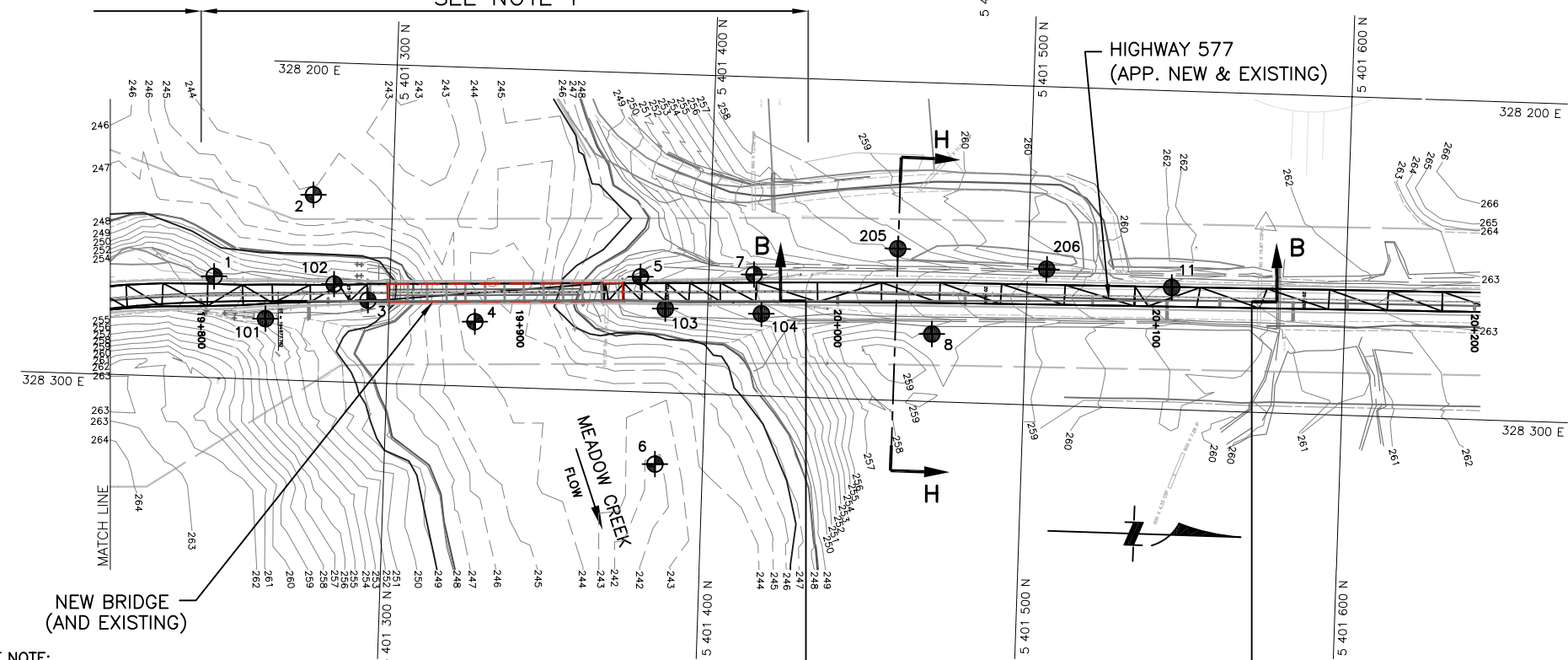
REF No. STANTEC DRAWING: 181-92-00.dwg and
E0810577001.dwg; DATED DECEMBER 2008

AREA 1



SEE NOTE 1

HIGHWAY 577
(APP. NEW & EXISTING)



NEW BRIDGE
(AND EXISTING)

AREA 2

PLAN
SCALE

20 0 20 40m

DRAFT NOTE:

AS PER INSTRUCTIONS OF STANTEC CONSULTING LTD., THE COORDINATES ON THE REFERENCE DRAWING WERE SHIFTED ABOUT 220m SOUTH AND 7m WEST TO MATCH COORDINATES WITH THOSE OF BRIDGE GENERAL ARRANGEMENT DRAWING.

NOTES:

1. REFER TO DRAWING 2-2 FOR CENTRELINE PROFILES A-A, B-B AND DRAWING 2-3 FOR SECTIONS C-C, D-D, E-E, F-F, G-G AND H-H. REFER TO SEPARATE FOUNDATION INVESTIGATION FOR NEW BRIDGE STRATA (GEOCRES No. 42A-75).

2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.

3. BOREHOLES 1 TO 11 WERE DRILLED FOR THE PRELIMINARY INVESTIGATION IN 2006 (GEOCRES No. 42A-66)

METRIC

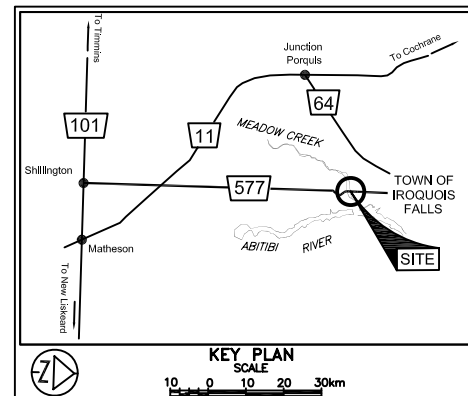
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES

CONT No
GWP No 181-92-00

MEADOW CREEK BRIDGE
AND CUT SLOPES
HIGHWAY 577
SOIL STRATA

SHEET

PML **Peto MacCallum Ltd**
CONSULTING ENGINEERS



LEGEND			
	Borehole		
	Dynamic Cone Penetration Test (Cone)		
	Borehole & Cone		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60° Cone, 475 J/blow)		
WH	Penetration due to weight of hammer and rods		
PH	Thinwall Sample - Advanced Hydraulically		
	W L at time of investigation Oct 2008 and Aug-Sept 2006*		
	Head		
	ARTESIAN WATER Encountered		
	PIEZOMETER		

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
SEE DRAWING 2-1 FOR DETAILS.			

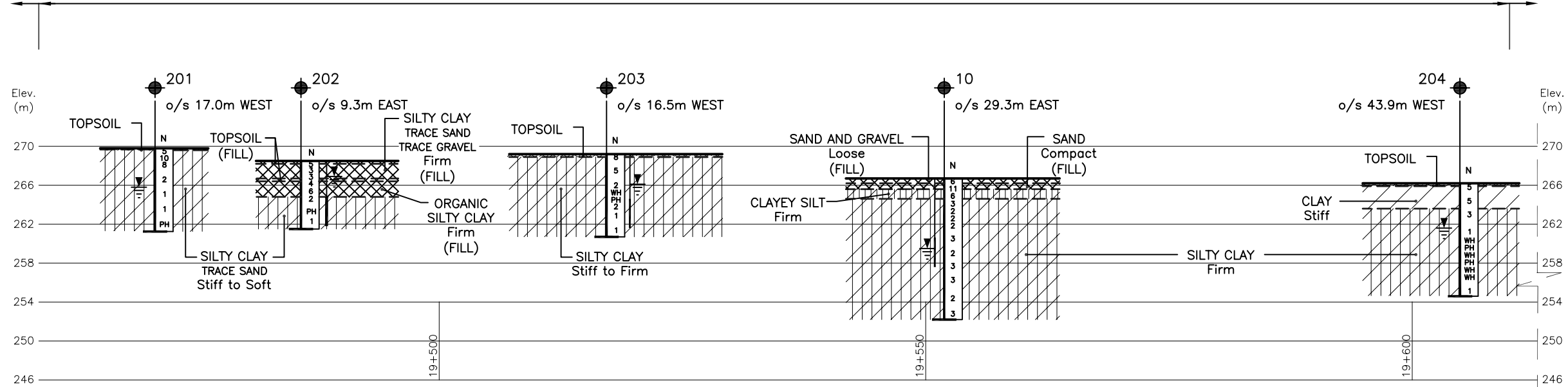
NOTE
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No. 42A-76

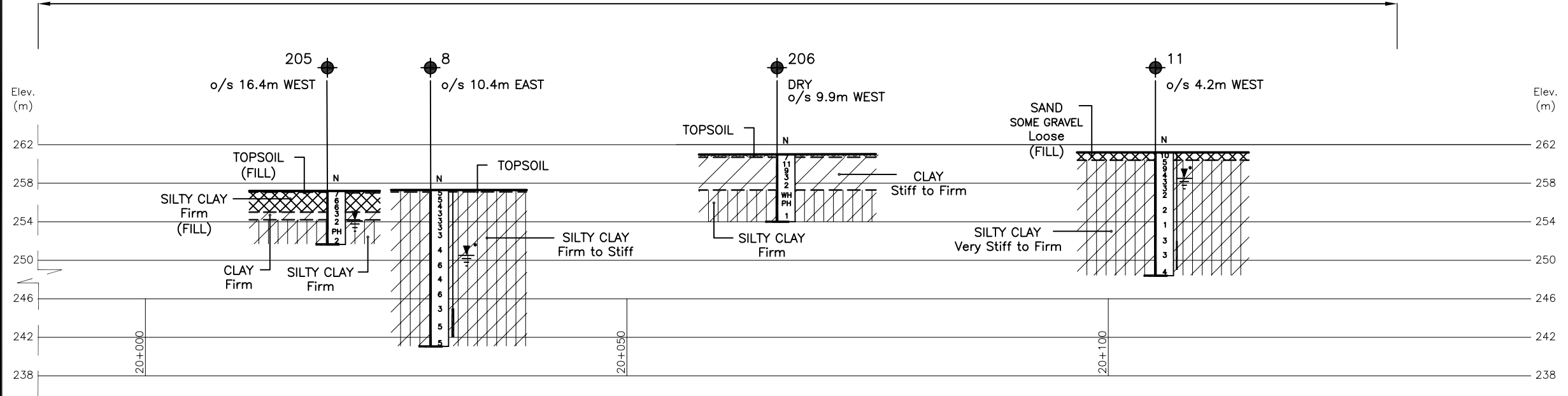
HWY No	577	DIST	COCHRANE
SUBM'D	GD	CHECKED	GD
DATE	JUNE 15, 2009	SITE	39E-077
DRAWN	NA	CHECKED	CN
APPROVED	BRG	DWG	2-2

AREA 1



PROFILE A-A CL HIGHWAY 577 (NEW)

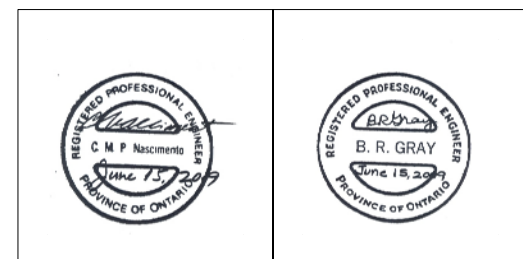
AREA 2



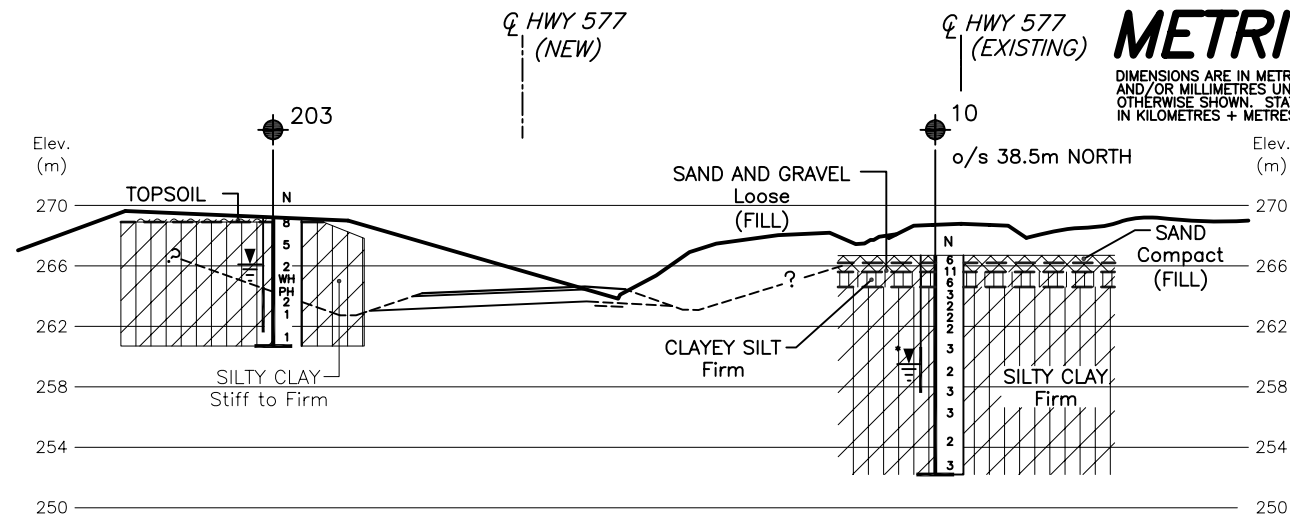
PROFILE B-B CL HIGHWAY 577 (NEW)

NOTES:

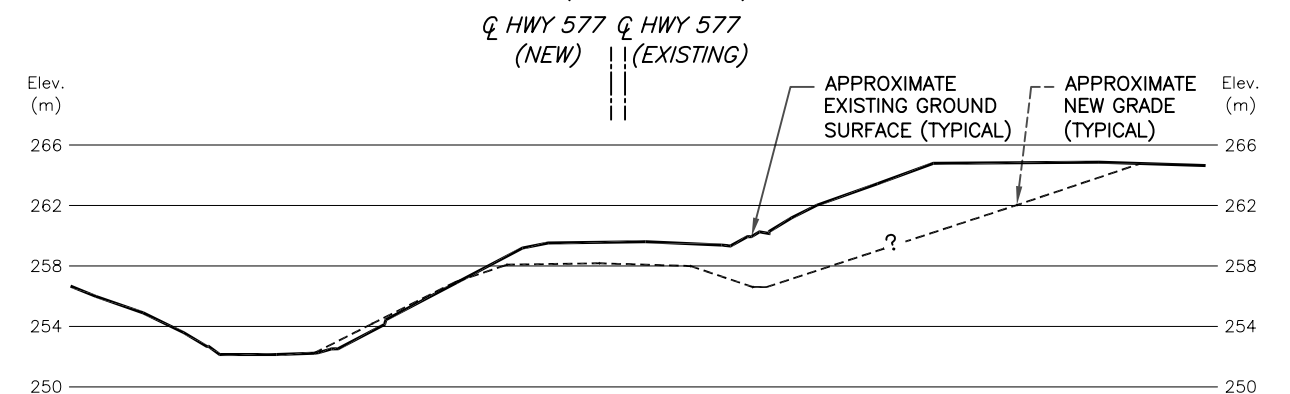
- REFER TO DRAWING 2-1 FOR BOREHOLE LOCATIONS PLAN AND DRAWING 2-3 FOR SECTIONS C-C, D-D, E-E, F-F, G-G AND H-H.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
- BOREHOLES 1 TO 11 WERE DRILLED FOR THE PRELIMINARY INVESTIGATION IN 2006 (GEOCREs No. 42A-66)



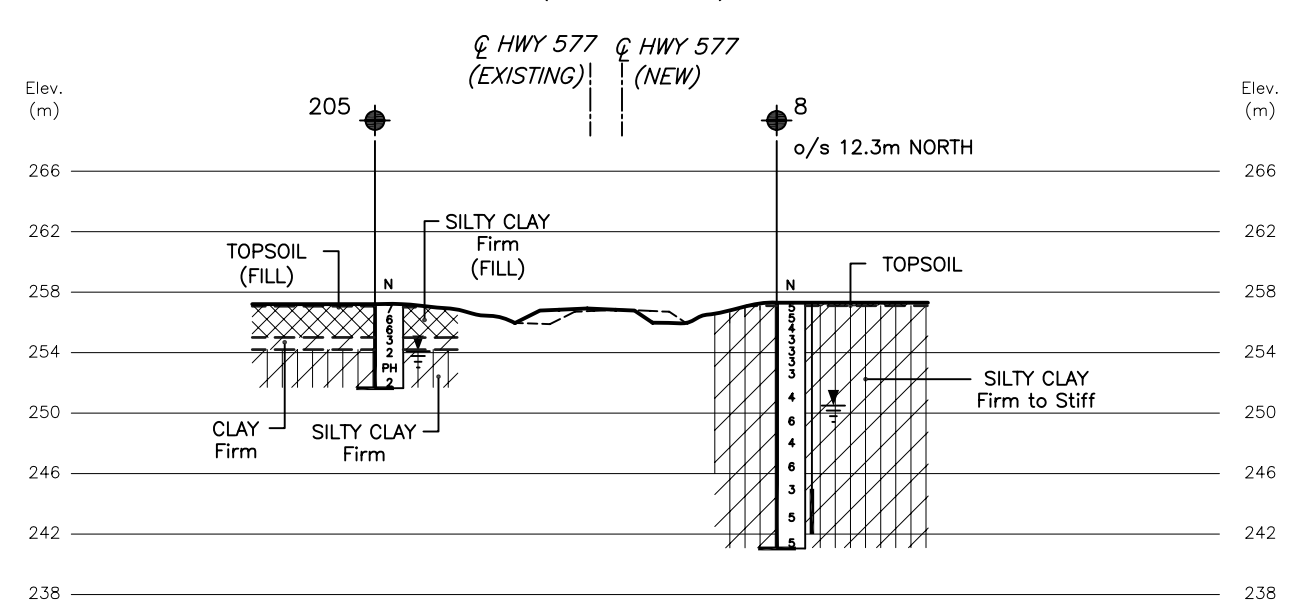
REF No. STANTEC DRAWING: 181-92-00.dwg and E0810577001.dwg; RECEIVED ON DECEMBER 18, 2008



SECTION D-D
(~Sta. 19+527)



SECTION F-F
(~Sta. 19+665)



SECTION H-H
(~Sta. 20+020)

NOTES:

1. REFER TO DRAWING 2-1 FOR BOREHOLE LOCATIONS PLAN AND DRAWING 2-2 FOR CENTRELINE PROFILES A-A AND B-B.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
3. BOREHOLES 1 TO 11 WERE DRILLED FOR THE PRELIMINARY INVESTIGATION IN 2006 (GEOCREs No. 42A-66)



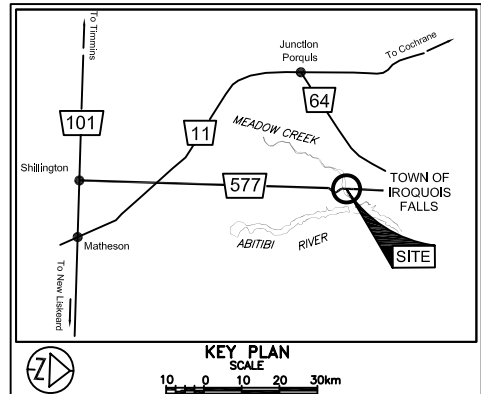
REF No. STANTEC DRAWING: 181-92-00.dwg and
E0810577001.dwg; RECEIVED ON DECEMBER 18, 2008








CONT No
GWP No 181-92-00

MEADOW CREEK BRIDGE
AND CUT SLOPES
HIGHWAY 577
SOIL STRATA



Peto MacCallum Ltd.
CONSULTING ENGINEERS



LEGEND			
	Borehole		
	Dynamic Cone Penetration Test (Cone)		
	Borehole & Cone		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60° Cone, 475 J/blow)		
WH	Penetration due to weight of hammer and rods		
PH	Thinwall Sample – Advanced Hydraulically		
	W L at time of investigation Oct 2008 and Aug–Sept 2006 *		
	Head		
	ARTESIAN WATER Encountered		
	PIEZOMETER		
		CO-ORDINATES	
BH No	ELEVATION	NORTHINGS	EASTINGS
SEE DRAWING 2-1 FOR DETAILS.			

- NOTE -

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

REVISIONS			
DATE	BY	DESCRIPTION	

Geocres No. 42A-76

HWY No	577			DIST	COCHRANE
SUBM'D	GD	CHECKED	GD	DATE	JUNE 15, 2009
DRAWN	NA	CHECKED	CN	APPROVED	BRG
				DWG	2-3



APPENDIX A

RECORD OF BOREHOLE SHEETS AND
DRAWINGS FROM PRELIMINARY INVESTIGATION
CARRIED OUT BY SHAHEEN & PEAKER LTD. (GEOCRES NO. 42A-66)

SPT1167

RECORD OF BOREHOLE No 1

1 OF 3

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 244.8, E 328 268.2

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE Hollow Stem Augering, N-casing and Wash Boring

COMPILED BY JZ

DATUM Geodetic

DATE 8/10/2006

CHECKED BY RM

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. x LAB VANE						
253.3	Ground Surface						20 40 60 80 100	20 40 60 80 100	10 20 30					
0.0	FILL: SAND & GRAVEL (0.35m)		1	SS	5		253							
252.9	brown, loose		2	SS	9		252							
0.4	FILL: SILTY CLAY													
	with some clayey silt and silt seams/lenses,		3	SS	8		251							
	occasional rootlets		4	SS	4		250							
250.4	SILTY CLAY (poss. fill)		5	SS	4		249							
2.9	with 0.1m thick peat seam overlying silt		6	SS	4		248							
249.7	brown, firm to stiff		7	TW	PH		247							
3.6	some peat and silt seam		8	SS	2		246							
			9	SS	3		245							
			10	TW	PH		244							
			11	SS	2		243							
			12	SS	3		242							
			13	SS	3		241							
							240							
							239							
238.3														

Continued Next Page

+ 3 x 3

Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 1

2 OF 3

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 244.8; E 328 268.2

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE Hollow Stem Augering, N-casing and Wash Boring

COMPILED BY JZ

DATUM Geodetic

DATE 8/10/2006

CHECKED BY RM

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 ○ UNCONFINED + FIELD VANE ● POCKET PENETR × LAB VANE	WATER CONTENT (%) w _p w w _L					
15.0	SILTY CLAY grey, damp to moist stiff		14	SS	6		238							
							237							
							236							
			15	SS	3		235							
							234							
	clayey silt & silt seams						233							
			16	SS	11		232							
							231							
230.3							230							
23.0	CLAYEY SILT with silt and some thin clay seams, occasional silty fine sand seams grey, wet, very stiff dilatant		17	SS	20		229							
							228							
227.8							227							
25.5	SANDY SILT to SILTY FINE SAND with silt layers occasional embedded gravel grey, wet dense to compact		18	SS	36		226							
							225							
	occ. gravel		19	SS	29									
224.6	coarse sand & gravel, some broken rock pieces at 28.5m		20	SS	100/5									
28.7	End of borehole. Refusal to casing advancement and tricone (probably on a boulder) * Water level at 9.7m (not stabilized) and hole open to 23.5m on completion													

Continued Next Page

+ 3 × 3

Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 1

3 OF 3

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords. N 5 401 244.8; E 328 268.2

ORIGINATED BY GI

DIST _____ HWY 577

BOREHOLE TYPE Hollow Stem Augering; N-casing and Wash Boring

COMPILED BY JZ

DATUM Geodetic

DATE 8/10/2006

CHECKED BY RM

[illegible]

+ 3, X 3 Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 2

1 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 275.1; E 328 241.8

DIST HWY 577

BOREHOLE TYPE N-casing, Wash Boring and Rock Coring

ORIGINATED BY GI

DATUM Geodetic

DATE 9/5/2006

COMPILED BY HL

CHECKED BY RM

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	WATER CONTENT (%)	GR SA SI CL		
247.8 0.0	Water Surface													
246.3 1.5	FILL: SAND, trace GRAVEL		1	SS	2									
246.0 1.8	FILL: SILTY CLAY greyish brown/grey soft to stiff		2	SS	2									
			3	SS	1									
			4	TW	PH									
			5	SS	4									
			6	SS	5									
241.6 6.2	PEAT with thin clay seams black, firm		7	SS	7									
240.8 7.0			8	SS	11									
			9	SS	4									
	SILTY CLAY		10	TW	PH									
			11	SS	5									
			12	SS	6									
			13	SS	10									
232.6														

Continued Next Page

+ 3 . X 3 Numbers refer to Sensitivity

20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 2

2 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 275.1; E 328 241.6

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE N-casing, Wash Boring and Rock Coring

COMPILED BY HL

DATUM Geodetic

DATE 9/5/2006

CHECKED BY RM

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	SHEAR STRENGTH kPa	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L		
15.0	SILTY CLAY grey, firm to stiff		14	SS	12								
228.3 19.5	SAND some gravel, cobbles and boulders grey, vrey dense, wet		16	SS	57								
225.3 22.5	FINE SAND some silt grey, very dense, wet		17	SS	100/0								
223.3 24.5	COBBLES and BOULDERS in a matrix of sand and gravel grey, very dense, wet		18	RC	—								
221.8 26.0	End of Borehole at 26.0m DCPT performed from 26.0 to 26.35m 26.0—26.3 115 blows/30 cm 26.3—26.35 100 blows/5 cm		19	SS	155								
			20	SS	118								
			21	SS	100/12								
			22	SS	100/12								

+ 3, x 3 Numbers refer to Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 3

1 OF 3

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 293.3; E 328 274.1

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE Hollow Stem Augers, N - Casing & Wash Boring

COMPILED BY JZ

DATUM Geodetic

DATE 8/23/2006

CHECKED BY RM

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 ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE	WATER CONTENT (%)	GR SA SI CL					
251.5	Ground Surface		1	SS	26										
250.5	100mm Asphaltic concrete 75mm fill (sand+gravel) 75mm asphaltic concrete FILL: SAND and GRAVEL		2	SS	13										
248.5	FILL: SILTY CLAY trace organics and rootlets brown, stiff to firm		3	SS	11										
246.5			4	SS	7										
244.3	FILL: SILTY CLAY with clayey silt zones brown and grey, some dark grey to blackish slightly organic to organic zones, occasional thin peat seams/lenses firm to very stiff		5	SS	5										
244.0			6	SS	6										
244.0			7	SS	4										
244.0			8	SS	4										
244.0			9	SS	7										
244.0	SILTY CLAY somewhat organic, some peat seams dark grey to black, firm		10	SS	9										
244.0			11	SS	4										
244.0			12	TW	PH										
244.0			13	SS	4										
244.0			14	SS	4										
236.5	SILTY CLAY with occasional clayey silt and silt seams/ lenses firm to stiff														
	stiff to very stiff brown grey														
	frequent clayey silt & silt seams below 12m														

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

0 0 23 77
Consolidation
Test

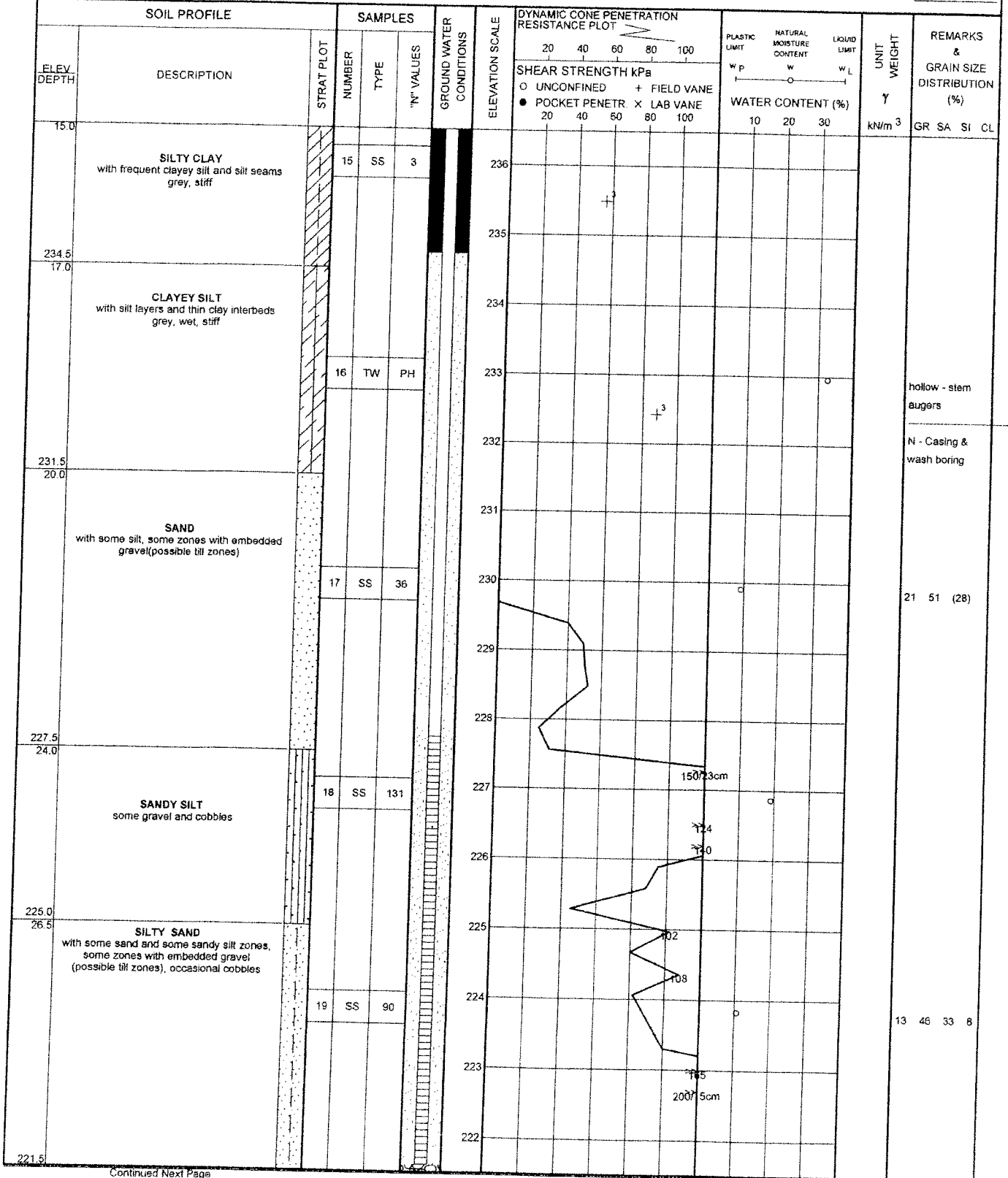
SPT1167

RECORD OF BOREHOLE No 3

2 OF 3

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 293.3; E 328 274.1 ORIGINATED BY GI
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers, N - Casing & Wash Boring COMPILED BY JZ
DATUM Geodetic DATE 8/23/2006 CHECKED BY RM



Continued Next Page

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

SPT1167

RECORD OF BOREHOLE No 3

3 OF 3

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 293.3; E 328 274.1
 DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers, N - Casing & Wash Boring
 DATUM Geodetic DATE 8/23/2006
 ORIGINATED BY GI
 COMPILED BY JZ
 CHECKED BY RM

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													
30.0	SAND some silt, gravel, occasional cobbles		20	SS	174/15	221	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE 20 40 60 80 100	WATER CONTENT (%) 10 20 30				GR SA SI CL Sample 21: No recovery, bouncing on a cobble						
216.6	End of Borehole Sampler bounding, refusal to casing advance and tricone. Dynamic Cone Penetration Test (DCPT) from 21.8 to 24.2m from 24.8 to 27.2m from 27.8 to 28.8m from 30.5 to 31.2m from 33.7 to 34.9m Water level at 5.2m(not stabilized) and hole open to 23.5m upon completion Piezometer installed to 29.8m Date W.L.m.Piezometer 8/25/06 5.2m(EL.246.3m) 8/26/06 5.2m(EL.246.3m) 9/04/06 5.6m(EL.245.9m) 9/06/06 5.4m(EL.246.1m) 9/07/06 5.5m(EL.246.0m) 9/09/06 5.5m(EL.246.0m) 9/09/06 5.3m(EL.246.0m) 9/12/06 5.3m(EL.246.2m) 9/14/06 5.3m(EL.246.2m)		21	SS	100/3	218						Sample 22: No recovery, bouncing (probably boulder)						
34.9			22	SS	100/3	217												

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

SPT1167

RECORD OF BOREHOLE No 4

1 OF 2

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 327.1; E 328 279.7 ORIGINATED BY GI
DIST HWY 577 BOREHOLE TYPE N - casing and Wash Boring COMPILED BY HL
DATUM Geodetic DATE 9/7/2006 CHECKED BY RM

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								
247.8 0.0	Water Surface												
	Water												
243.4 4.4	ROCK FILL with silt & sand infill		1	SS	1								
242.7 5.1	SILTY CLAY somewhat organic dark grey, firm		2	SS	5								
242.4 5.4	PEAT with ORGANIC SILT/CLAY some silty clay layers, dark grey/blackish soft to firm, wet		3	SS	4								
			4	SS	2								
240.2 7.6	Trace of organic		5	SS	2								
	darkish grey grey		6	SS	2								
			7	SS	1								
	SILTY CLAY grey, firm to stiff		8	TW	PH								
			9	SS	3								
			10	SS	4								
232.8	some clayey silt layers												

Continued Next Page

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

RECORD OF BOREHOLE No 4

2 OF 2

METRIC

GWP 181-92-00

LOCATION

Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 327.1; E 328 279.7

ORIGINATED BY G1

DIST HWY 577

BOREHOLE TYPE N - casing and Wash Boring

COMPILED BY HL

DATUM Geodetic

DATE 9/7/2006

CHECKED BY RM

[illegible]

1 3 3

Numbers refer to
Sensitivity

20
15 10 5

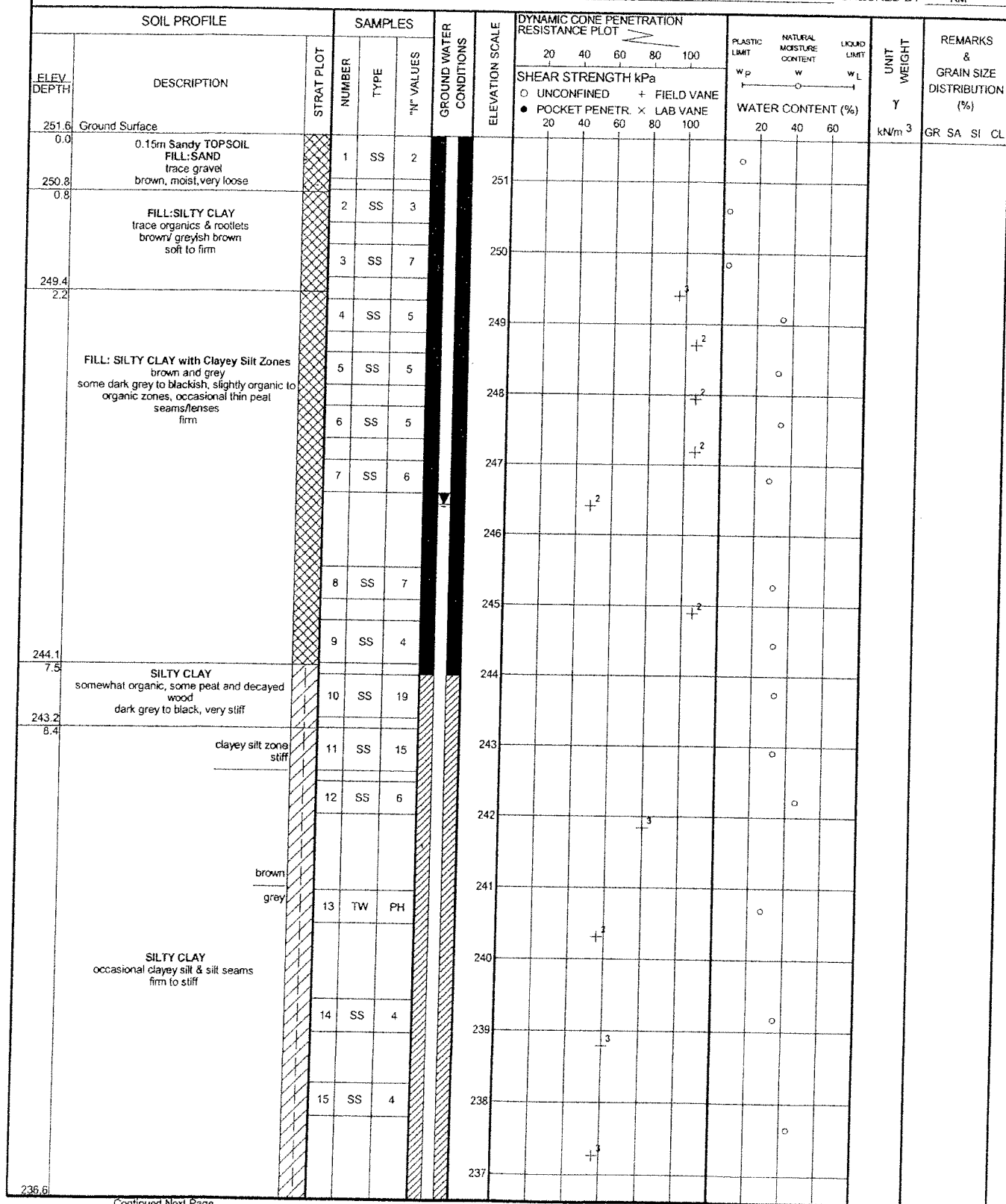
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 5

1 OF 3

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 378.6; E 328 263.9
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers, N-casing and Wash Boring
DATUM Geodetic DATE 8/14/2006 to 8/15/2006
ORIGINATED BY GI
COMPILED BY JZ
CHECKED BY RM



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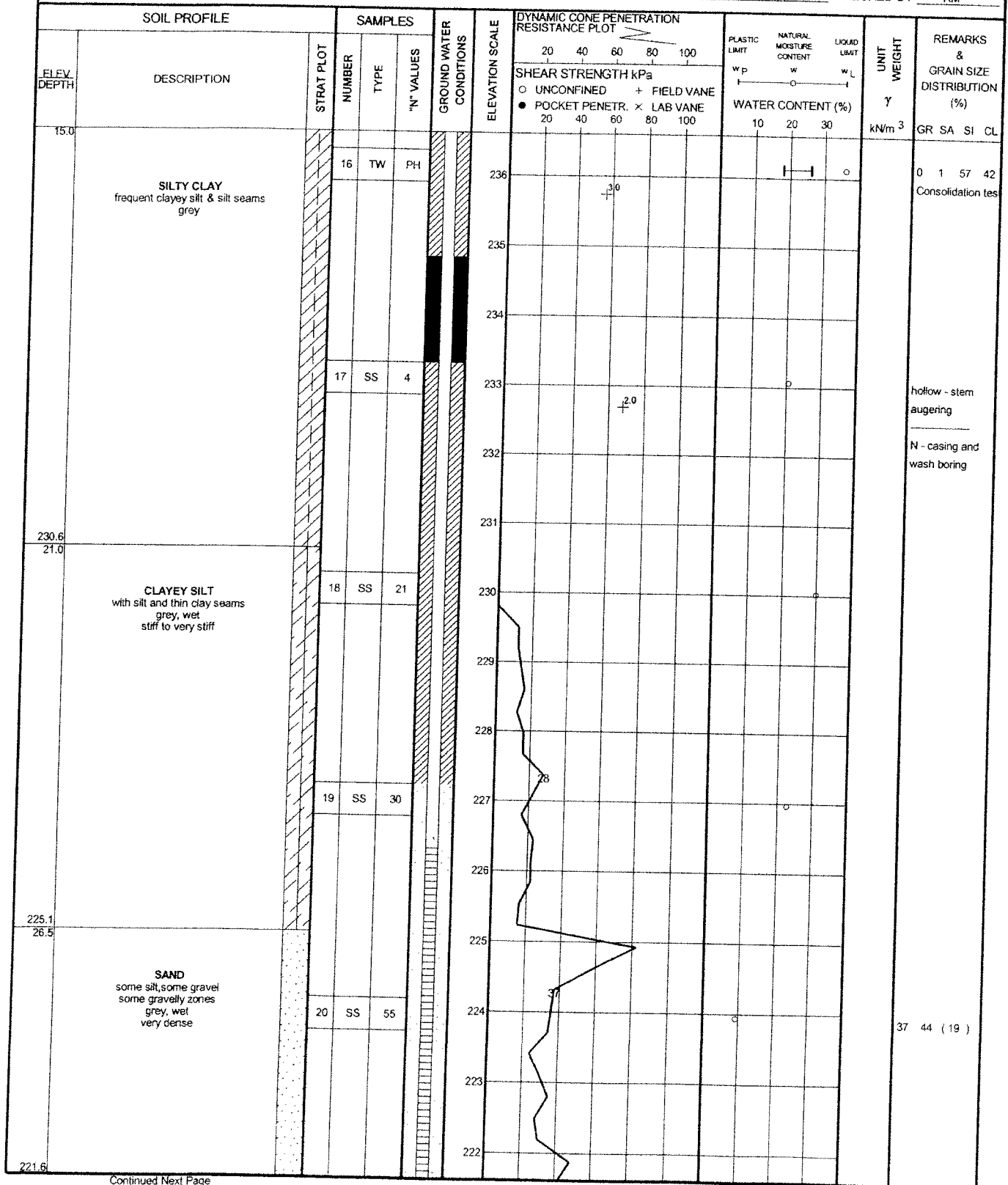
+ 3, x 3. Numbers refer to 20
Sensitivity 15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 5

2 OF 3

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 378.6; E 328 263.9
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers, N-casing and Wash Boring
DATUM Geodetic DATE 8/14/2006 to 8/15/2006
ORIGINATED BY GI
COMPILED BY JZ
CHECKED BY RM



Continued Next Page

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

RECORD OF BOREHOLE No 5

3 OF 3

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 378.6; E 328 263.9
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers, N-casing and Wash Boring
DATUM Geodetic DATE 8/14/2006 to 8/14/2006
ORIGINATED BY GI
COMPILED BY JZ
CHECKED BY RM

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								
30.0	SAND with gravel, some silt, some cobbles grey, wet very dense		21	SS	56							GR SA SI CL
218.7												
32.9	End of Borehole Sample bouncing, refusal to advancing with casing and tricone on a boulder or on bedrock Dynamic Cone Penetration Test (DCPT) conducted: from 21.7 to 24.4m from 24.7 to 27.4m from 27.8 to 30.4m from 31.0 to 31.8m Water level in open borehole at 5.2m (not stabilized) and hole open to 32m upon completion Date Water Level (m) Pizometer 8/16/06 5.2m (El. 246.4m) 8/18/06 5.3m (El. 246.3m) 8/23/06 5.2m (El. 246.4m) 8/25/06 5.2m (El. 246.4m) 8/26/06 5.2m (El. 246.4m) 9/04/06 5.2m (El. 246.4m) 9/05/06 5.3m (El. 246.3m) 9/07/06 5.2m (El. 246.4m) 9/09/06 5.1m (El. 246.5m) 9/12/06 5.4m (El. 246.2m) 9/14/06 5.2m (El. 246.4m)	22	SS	100/0							no recovery (sampler bouncing)	

RECORD OF BOREHOLE No 6

1 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 385.1; E 328 322.5

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE N-casing, Wash Boring, and Rock Coring

COMPILED BY HL

DATUM Geodetic

DATE 9/11/2006

CHECKED BY RM

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			SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE	PLASTIC LIMIT W _p			
248.1 0.0	Water Surface											
	WATER											
243.8 4.3	Logs at river bottom surface (river bottom sediments) SILT and CLAY very loose/very soft		1	SS	1							
242.8 5.3	ORGANIC SILTY CLAY with peat seams, dark grey, very soft		2	SS	1							
242.5 5.6	PEAT black, soft to stiff		3	SS	11							
241.7 6.4	SILTY CLAY somewhat organic some peat seams, dark grey stiff		4	SS	14							
240.8 7.3	SILTY CLAY grey		5	SS	8							
			6	TW	PH							
			7	SS	3							
			8	TW	PH							
			9	SS	5							
			10	SS	2							

Continued Next Page

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

RECORD OF BOREHOLE No 6

2 OF 2

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 385.1; E 328 322.5
 DIST HWY 577 BOREHOLE TYPE N-coring, Wash Boring, and Rock Coring
 DATUM Geodetic DATE 9/11/2006
 ORIGINATED BY GI
 COMPILED BY HL
 CHECKED BY RM

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 20 40 60 80 100	PLASTIC LIMIT Wp	NATURAL MOISTURE CONTENT W	LIQUID LIMIT WL	WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES									
15.0	SILTY CLAY very frequent clayey silt and silt layers grey		11	SS	4	233								
			12	SS	8	232								
			13	SS	17	231								
			14	SS	20	230								
			15	SS	26	229								
225.8	CLAYEY SILT TILL grey, hard		16	SS	82	228								
225.2			17	SS	155/22	227								
225.2	SANDY SILT to SILTY SAND TILL trace of clay near top, occ. fine sand layers, frequent cobbles and boulders grey, very dense, wet		18	RC	—	226								
22.9			18	SS	177	225								
			19	SS	100/12	224								
219.3	End of borehole DCPT conducted from 28.8m to 29.15m Blow counts: 28.8---29.1m---140blows/30cm 29.1---29.15m---100blows/5cm					223								
28.8						222								
						221								
						220								

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

RECORD OF BOREHOLE No 7

1 OF 3

METRIC

GWP 181-92-00

LOCATION

Meadow Creek Bridge, Ingois Falls, ON, Coords: N 5 401 414.2; E 328 262.0

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE

Hollow Stem Augers & Wash Boring

COMPILED BY JZ

DATUM Geodetic

DATE

8/16/2006 to 8/18/2006

CHECKED BY RM

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								
253.6	Ground Surface												
0.0	0.3m TOPSOIL FILL: SAND and GRAVEL brown, moist, loose		1	SS	4								
252.8			2	SS	5								
0.8	FILL: SILTY CLAY some silt lenses, brown, firm		3	SS	6								
252.2			4	SS	6								
1.4	FILL: SILTY CLAY somewhat organic, occasional peat lenses, dark brown/grey/dark grey/black firm		5	SS	10								
250.6			6	TW	PH								
3.0			7	SS	4								
			8	SS	4								
			9	SS	6								
			10	SS	6								
			11	SS	6								
			12	TW	PH								
			13	SS	4								
239.6													

Continued Next Page

+ 3, x 3. Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 7

2 OF 3

METRIC

GWP 181-92-00

LOCATION

Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 414.2; E 328 262.0

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE

Hollow Stem Augers & Wash Boring

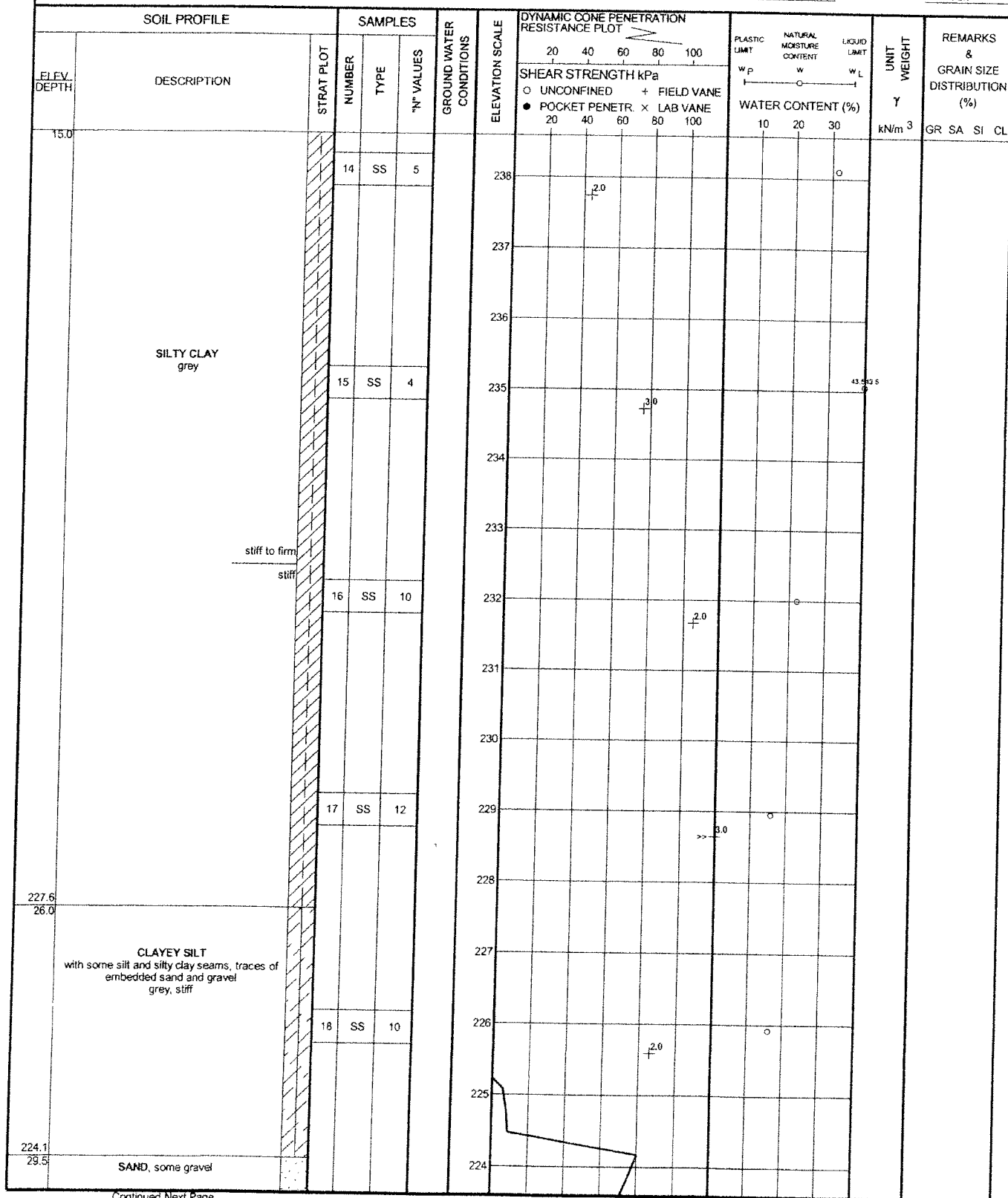
COMPILED BY JZ

DATUM Geodetic

DATE _____

8/16/2006 to 8/18/2006

CHECKED BY RM



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 $+3 \times 3$

Numbers refer to
Sensitivity

A vertical number line with tick marks at 10, 15, and 20. A circle is drawn around the number 15.

(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 7

3 OF 3

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 414.2; E 328 262.0
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers & Wash Boring
DATUM Geodetic DATE 8/16/2006 to 8/18/2006
ORIGINATED BY GI
COMPILED BY JZ
CHECKED BY RM

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 20 40 60 80 100	PLASTIC LIMIT W _P NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELFV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
	SAND with some silt and gravel, occasional cobbles grey, wet, very dense		19	SS	118		223					
							222					
							221					
220.0							220					
33.6	Sampler bouncing on probable boulder.		20	SS	100/5							cored through a boulder from 33.6
219.7			21	RC								to 33.9m
33.9	End of borehole											
	Dynamic Cone Penetration Test (DCPT) conducted from 28.0m to 30.5m. DCPT conducted from 30.9 to 31.5m. * Water level at 6.0m (not stabilized) and hole open to 27m upon completion											

RECORD OF BOREHOLE No 8

1 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 470.6, E 328 278.8

ORIGINATED BY GI

DIST HWY 577

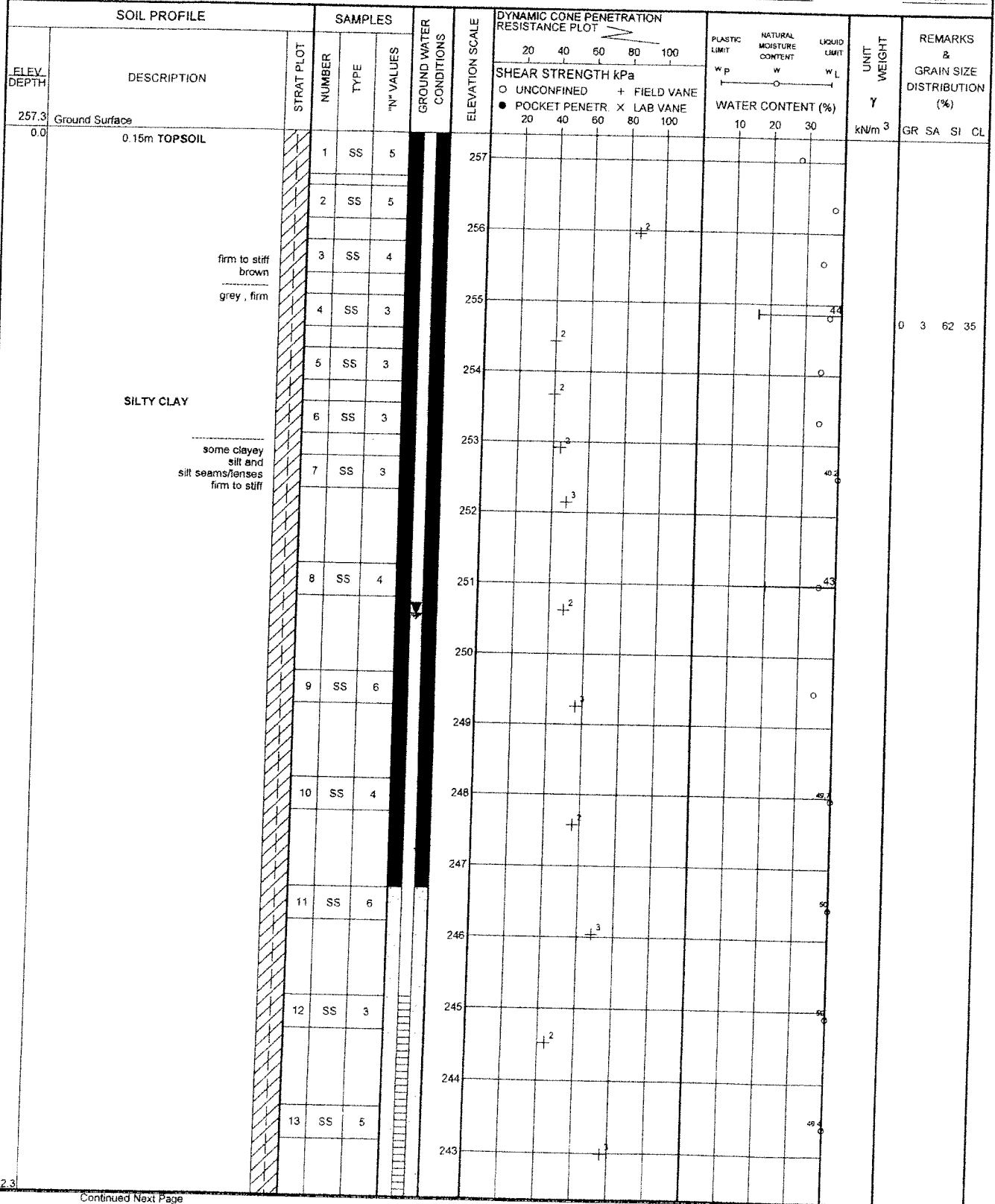
BOREHOLE TYPE Hollow Stem Augers

COMPILED BY JZ

DATUM Geodetic

DATE 8/18/2006

CHECKED BY RM



Continued Next Page

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

RECORD OF BOREHOLE No 8

2 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 470.6; E 328 278.8

ORIGINATED BY GI

DIST HWY 577


BOREHOLE TYPE Hollow Stem Augers

COMPILED BY JZ

DATUM Geodetic

DATE 8/18/2006

CHECKED BY RM

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								
15.0	SILTY CLAY some thin silt seams grey, stiff		14	SS	5		242	20	40	60	80	100				
241.3																
16.0	End of borehole. Borehole dry on completion (water level not stabilized) Piezometer installed to 15m. Date W. L. in Piezometer 8/23/06 11.4m(El. 245.9m) 8/24/06 10.8m(El. 246.5m) 8/25/06 10.3m(El. 247.0m) 8/26/06 10.1m(El. 247.2m) 9/04/06 7.0m(El. 250.3m) 9/07/06 6.8m(El. 250.5m) 9/11/06 6.8m(El. 250.5m) 9/14/06 6.8m(El. 250.5m)															

+ 3 x 3

Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 9

1 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords. N 5 401 206.7, E 328 310.6

ORIGINATED BY GI

DIST HWY 577

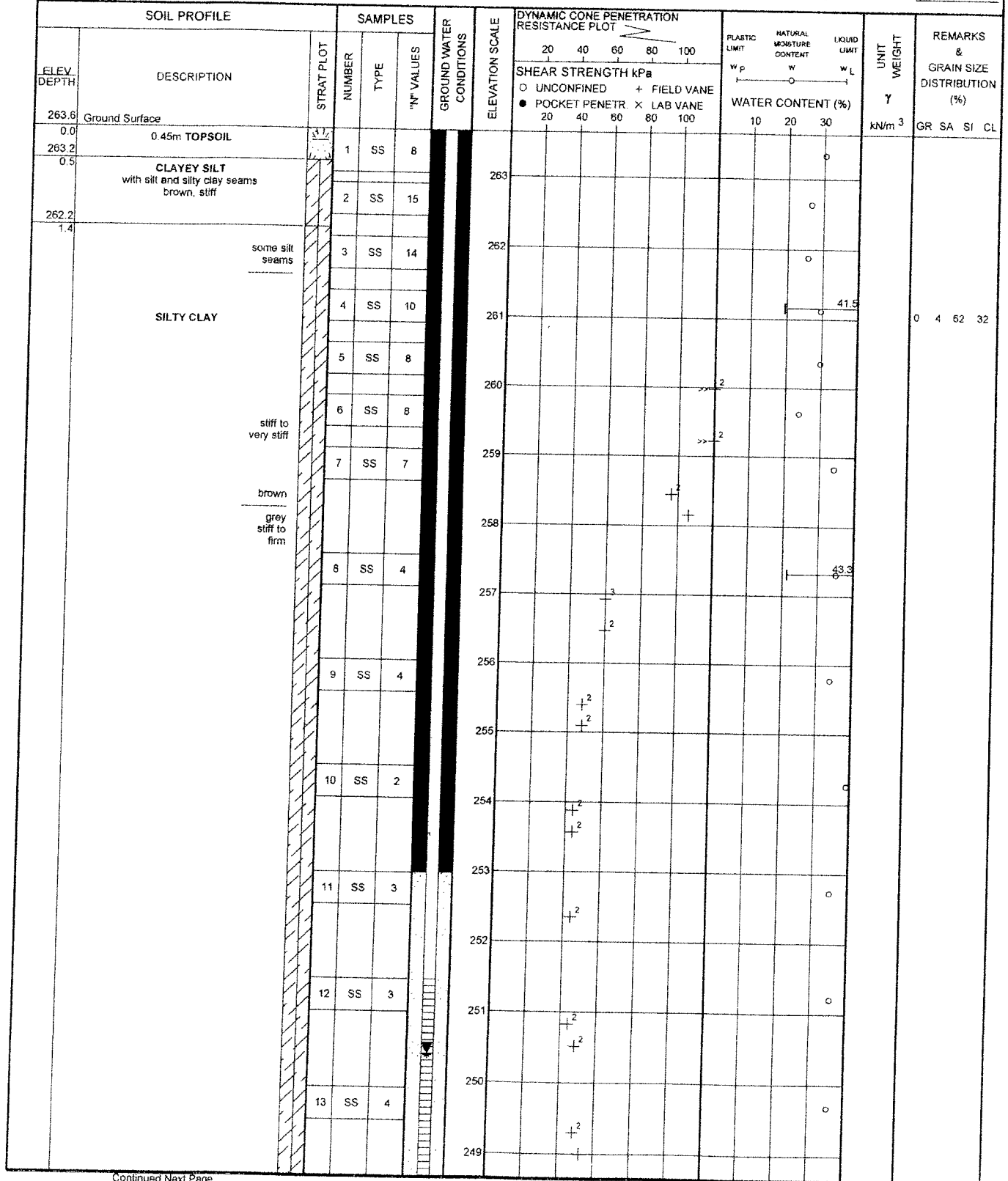
BOREHOLE TYPE Hollow Stem Augers

COMPILED BY JZ

DATUM Geodetic

DATE 8/12/2006

CHECKED BY RM



+ 3, x 3

Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

SPT1167

RECORD OF BOREHOLE No 9

2 OF 2

METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 206.7; E 328 310.6 ORIGINATED BY GI
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers COMPILED BY JZ
DATUM Geodetic DATE 8/12/2006 CHECKED BY RM

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 NATURAL MOISTURE CONTENT LIQUID LIMIT W _p — W — W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES								
244.1	SILTY CLAY grey, firm to stiff		14	SS	2		248	2.0					
							247						
							246	3.0	2.0				
							245	3.0	3.0				
19.5	End of borehole.		16	SS	4								
<p>Borehole dry upon completion (not stabilized).</p> <p>Piezometer installed in 18.2m</p> <p>Date W. L. in Piezometer:</p> <p>8/16/06 17.6m(EI. 246.0m)</p> <p>8/18/06 17.0m(EI. 246.6m)</p> <p>8/19/06 16.9m(EI. 246.7m)</p> <p>8/22/06 15.9m(EI. 247.7m)</p> <p>8/24/06 15.6m(EI. 248.0m)</p> <p>8/26/06 15.4m(EI. 248.2m)</p> <p>9/04/06 13.9m(EI. 249.7m)</p> <p>9/08/06 13.8m(EI. 249.8m)</p> <p>9/11/06 13.5m(EI. 250.1m)</p> <p>9/13/06 13.3m(EI. 250.3m)</p> <p>9/14/06 13.2m(EI. 250.4m)</p> <p>* W. L. possibly not stabilized.</p>													

RECORD OF BOREHOLE No 10

1 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 025.4; E 328 382.8

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY JZ

DATUM Geodetic

DATE 8/13/2006 to 8/14/2006

CHECKED BY RM

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 (%)					
266.7	Ground Surface													
0.0	FILL: SAND and GRAVEL brown, loose		1	SS	6									
266.2	FILL: FINE SAND brown, moist, compact		2	SS	11									
0.5														
265.6	CLAYEY SILT with silt and silty clay seams brown, firm		3	SS	6									
1.1														
264.6			4	SS	3									
2.1			5	SS	2									
	SILTY CLAY grey, firm		6	SS	2									
			7	SS	2									
			8	SS	3									
			9	SS	2									
			10	SS	3									
			11	SS	3									
			12	SS	2									
			13	SS	3									
252.2	End of borehole.													
14.5														

Continued Next Page

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

RECORD OF BOREHOLE No 10

2 OF 2

METRIC

GWP 181-92-00

LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 025.4; E 328 382.8

ORIGINATED BY GI

DIST HWY 577

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY JZ

DATUM Geodetic

DATE 8/13/2006 to 8/14/2006

CHECKED BY RM

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 Y 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						
							20 40 60 80 100						

+ 3 x 3

Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 11

1 OF 1

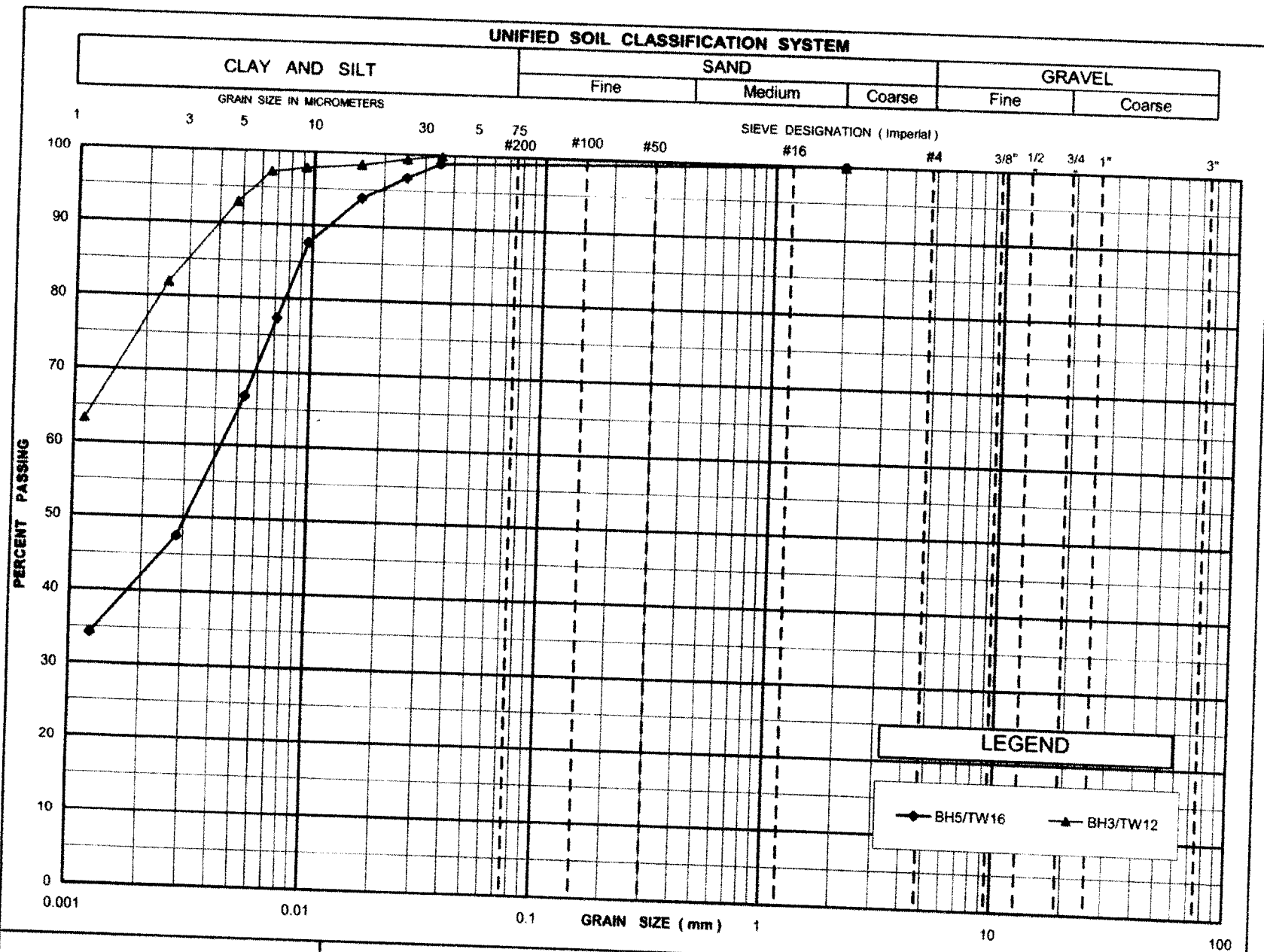
METRIC

GWP 181-92-00 LOCATION Meadow Creek Bridge, Iroquois Falls, ON, Coords: N 5 401 545.4; E 328 261.7 ORIGINATED BY GI
DIST HWY 577 BOREHOLE TYPE Hollow Stem Augers COMPILED BY HL
DATUM Geodetic DATE 8/22/2006 CHECKED BY RM

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 20 40 60 80 100	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES								
261.2	Ground Surface												
0.0	FILL: Sand, some gravel brown, loose, wet		1	SS	10		261						borehole drilled from shoulder of road
260.4			2	SS	5		260						
0.8			3	SS	9		259						
			4	SS	4		258						
	brown, stiff to v. stiff		5	SS	3		257						
	grey, firm		6	SS	3		256						
	SILTY CLAY		7	SS	2		255						
			8	SS	2		254						
			9	SS	1		253						
			10	SS	3		252						
			11	SS	3		251						
			12	SS	4		250						
248.4							249						
12.8	End of borehole. Water level at 1.2m in open hole upon completion (perched water, not stabilized). Piezometer installed at 12m depth. Date W. L. in Piezometer 8/23/06 0.6m(EI. 260.6m) 8/24/06 2.3m(EI. 258.9m) 8/26/06 2.8m(EI. 258.4m) 9/04/06 2.8m(EI. 258.4m) 9/06/06 2.7m(EI. 258.5m) 9/09/06 2.7m(EI. 258.5m) 9/12/06 2.7m(EI. 258.5m) 9/14/06 2.7m(EI. 258.5m)												

Appendix B

Laboratory Test Results



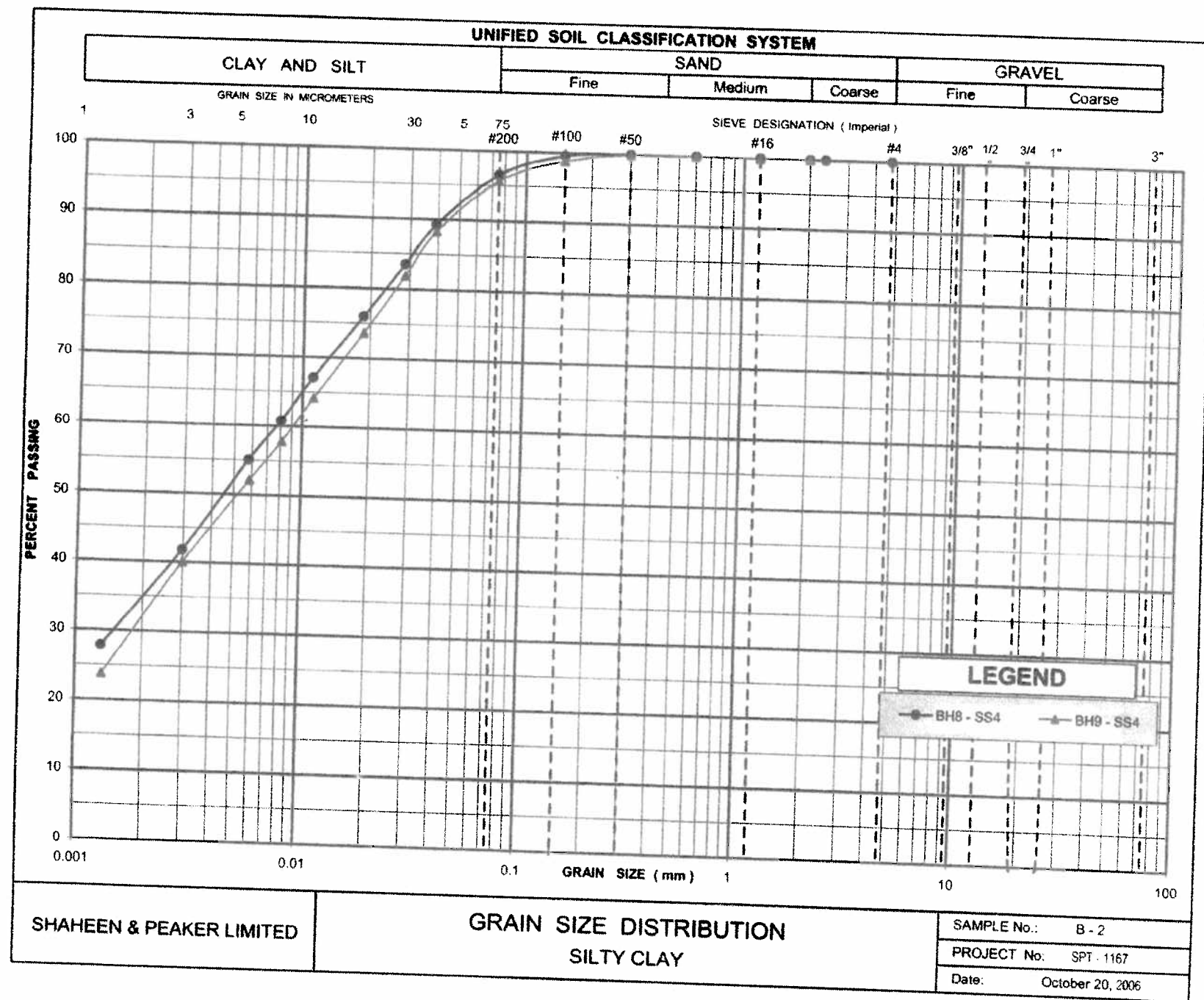
SHAHEEN & PEAKER LIMITED

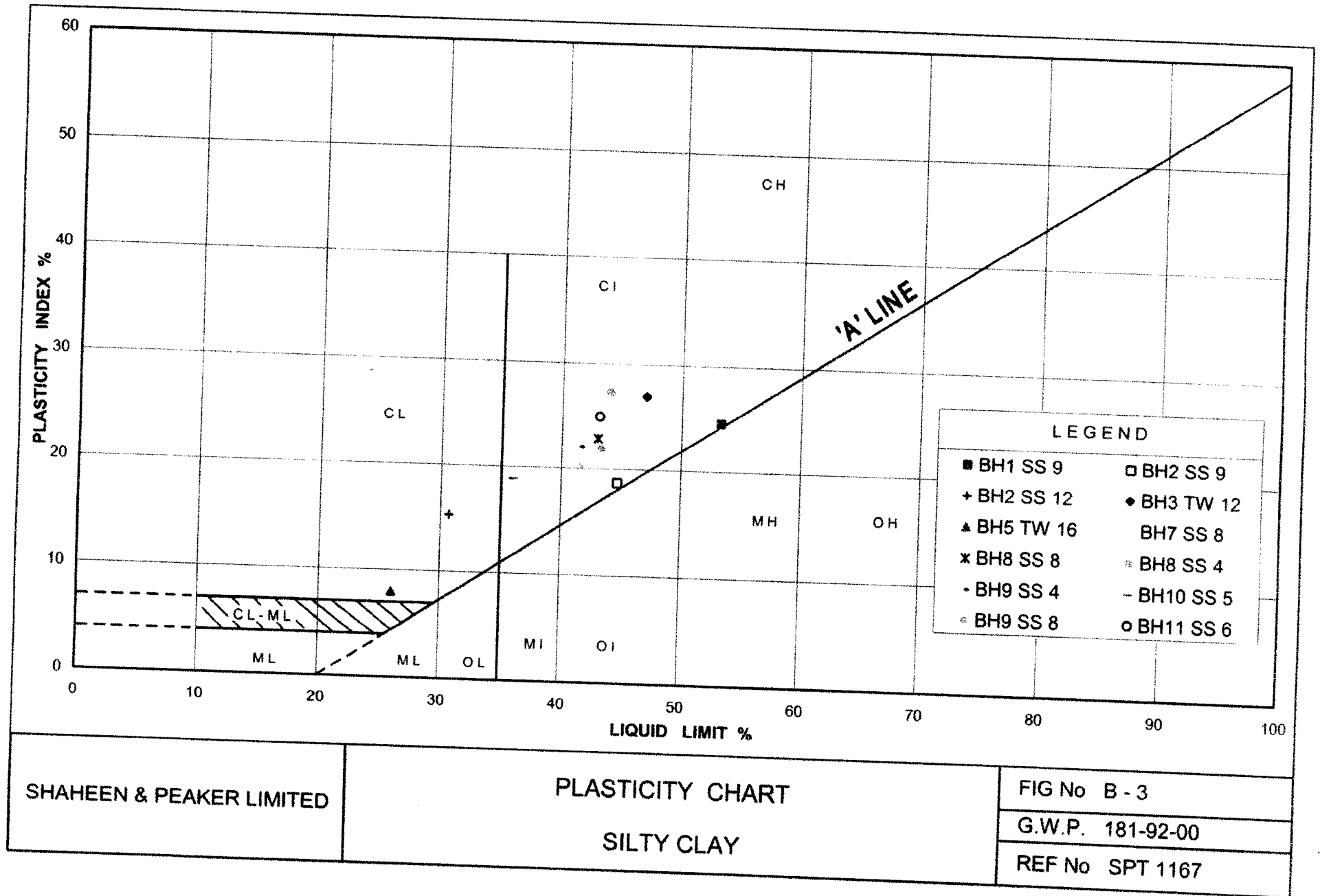
**GRAIN SIZE DISTRIBUTION
SILTY CLAY**

FIGURE No. B-1

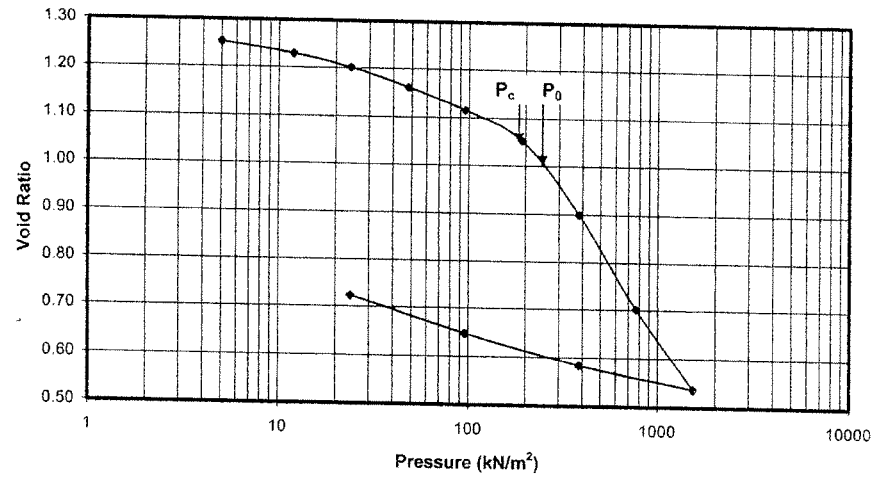
REF. No. SPT 1167

DATE SEPTEMBER, 2006





**Figure B - 4 Consolidation Test Results for Sample
BH3 - TW12 From 10.7 - 11.1m Depth**
Void Ratio versus Pressure



Coefficient of Consolidation vs. Pressure

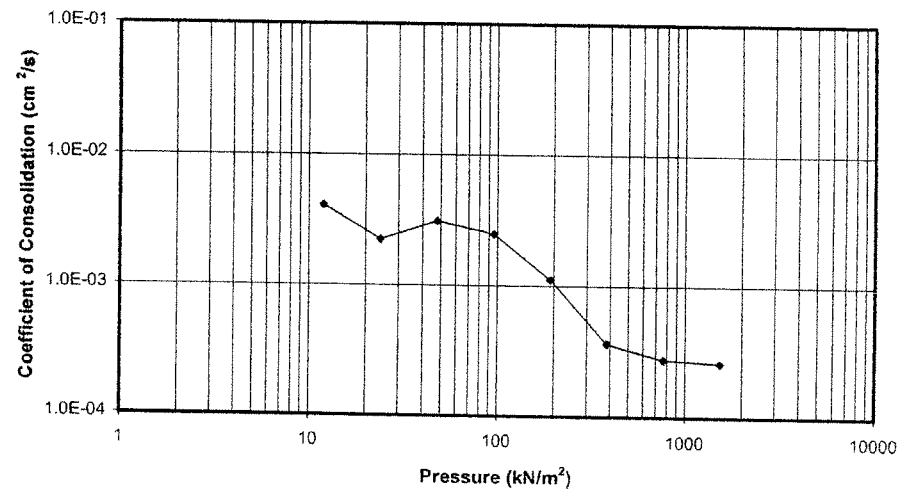
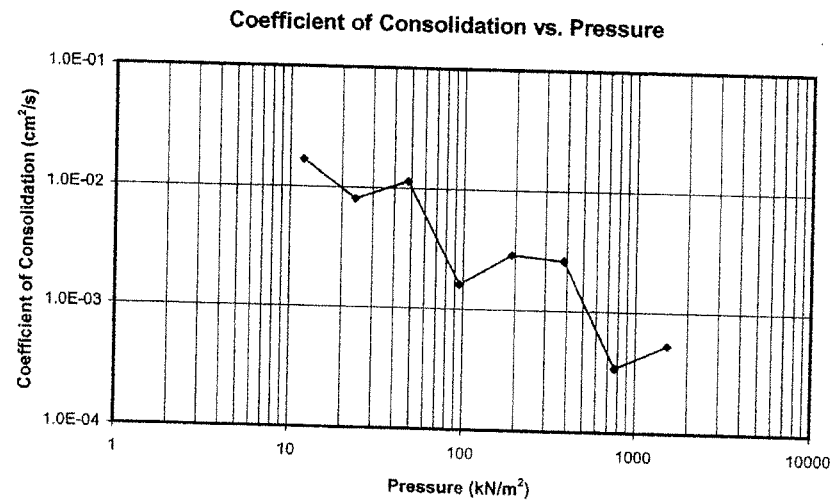
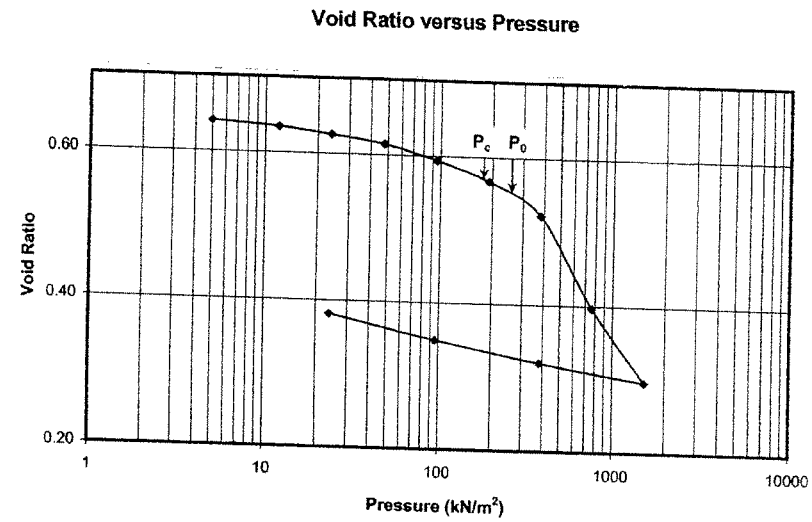
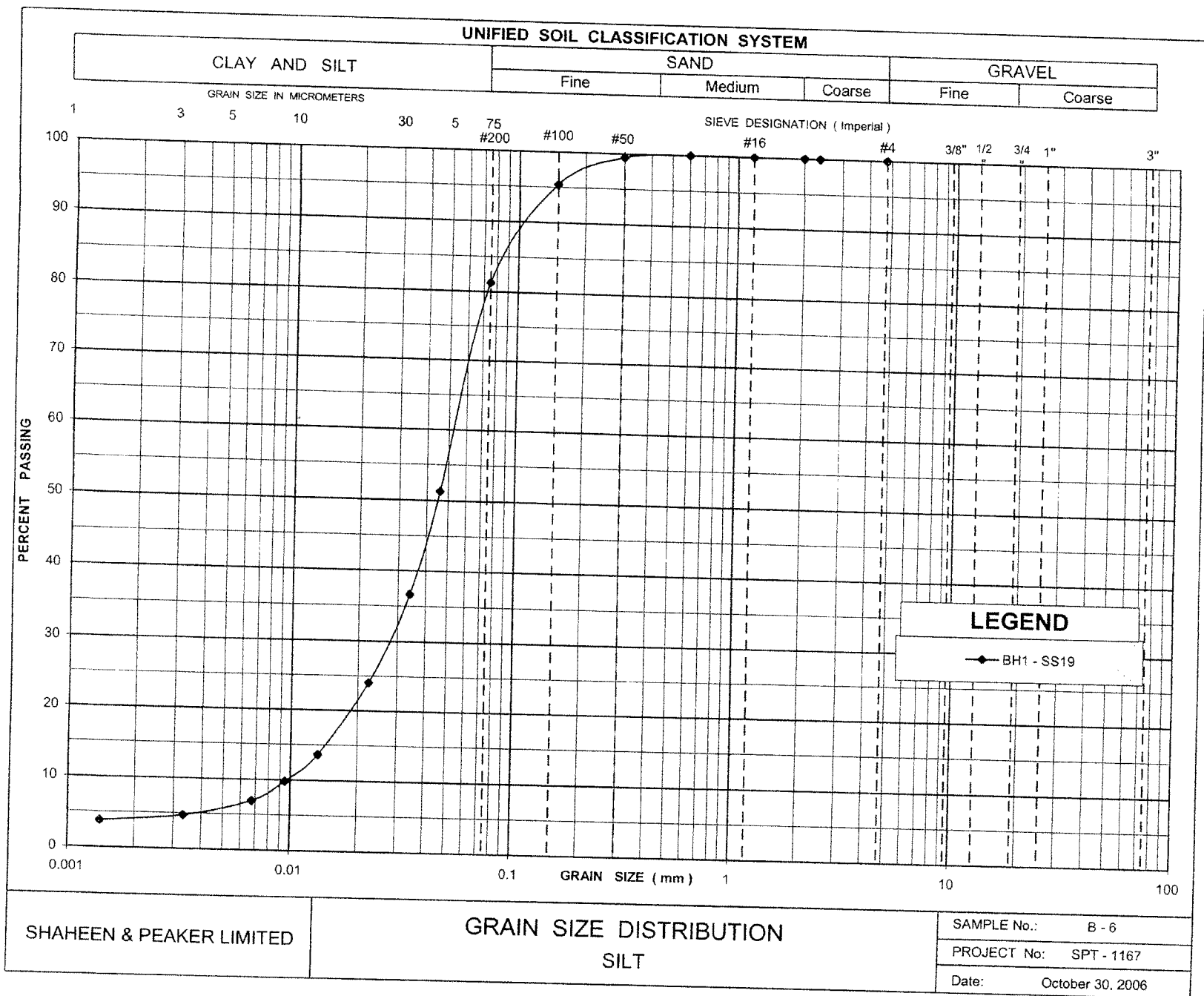
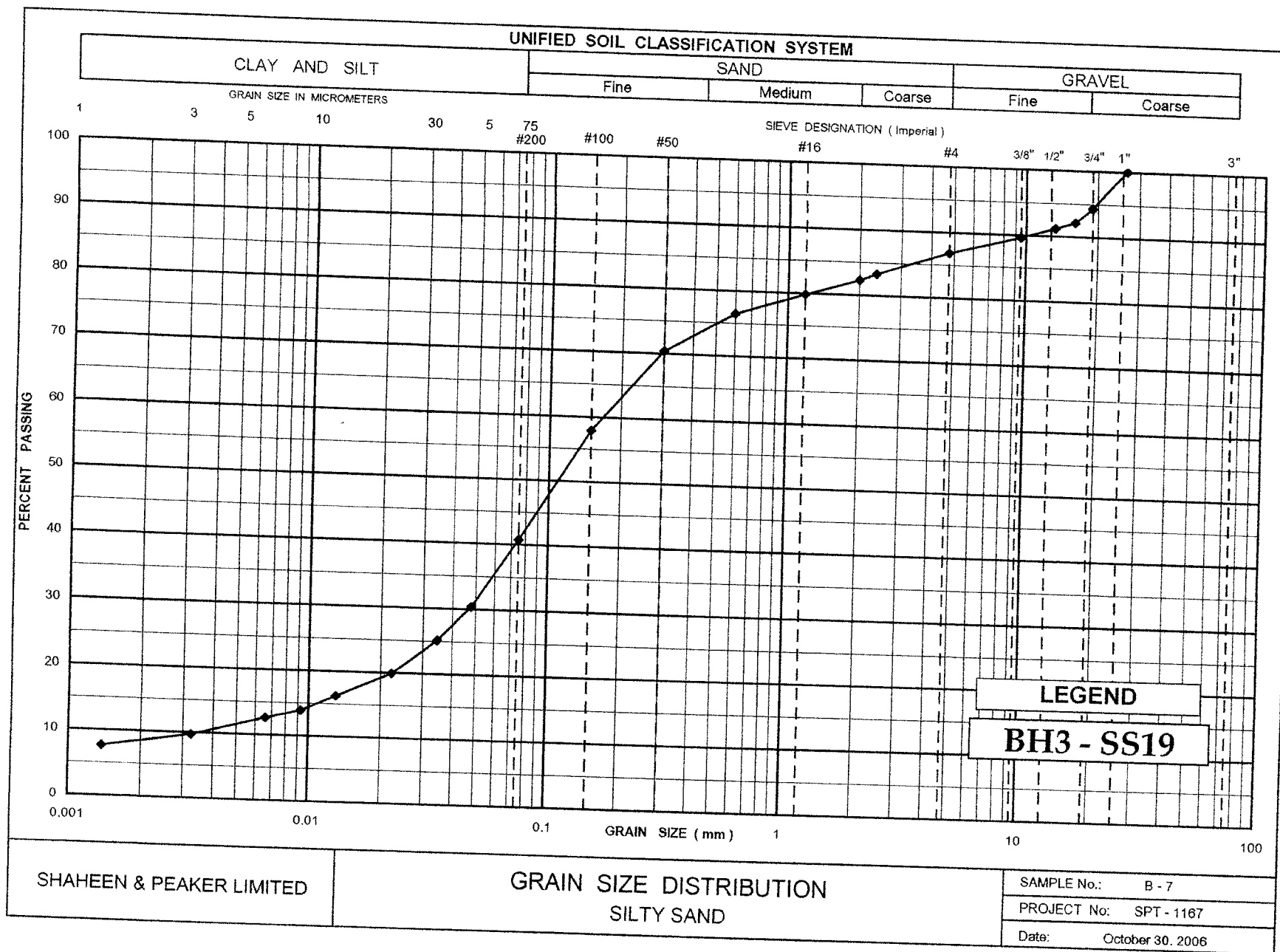
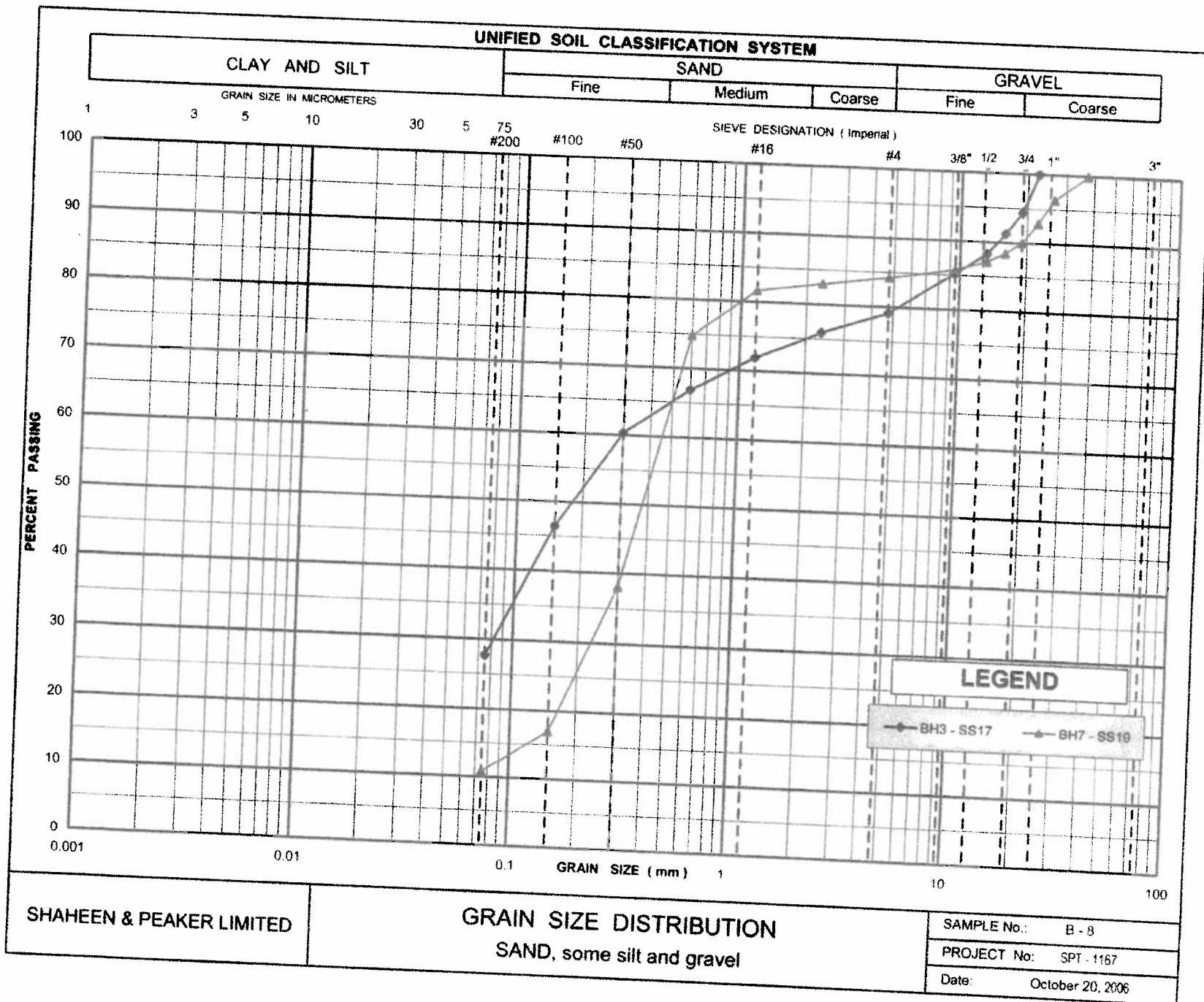


Figure B - 5 - Consolidation Test Results for Sample
BH5 - TW16 Depth 15.25 - 15.7m



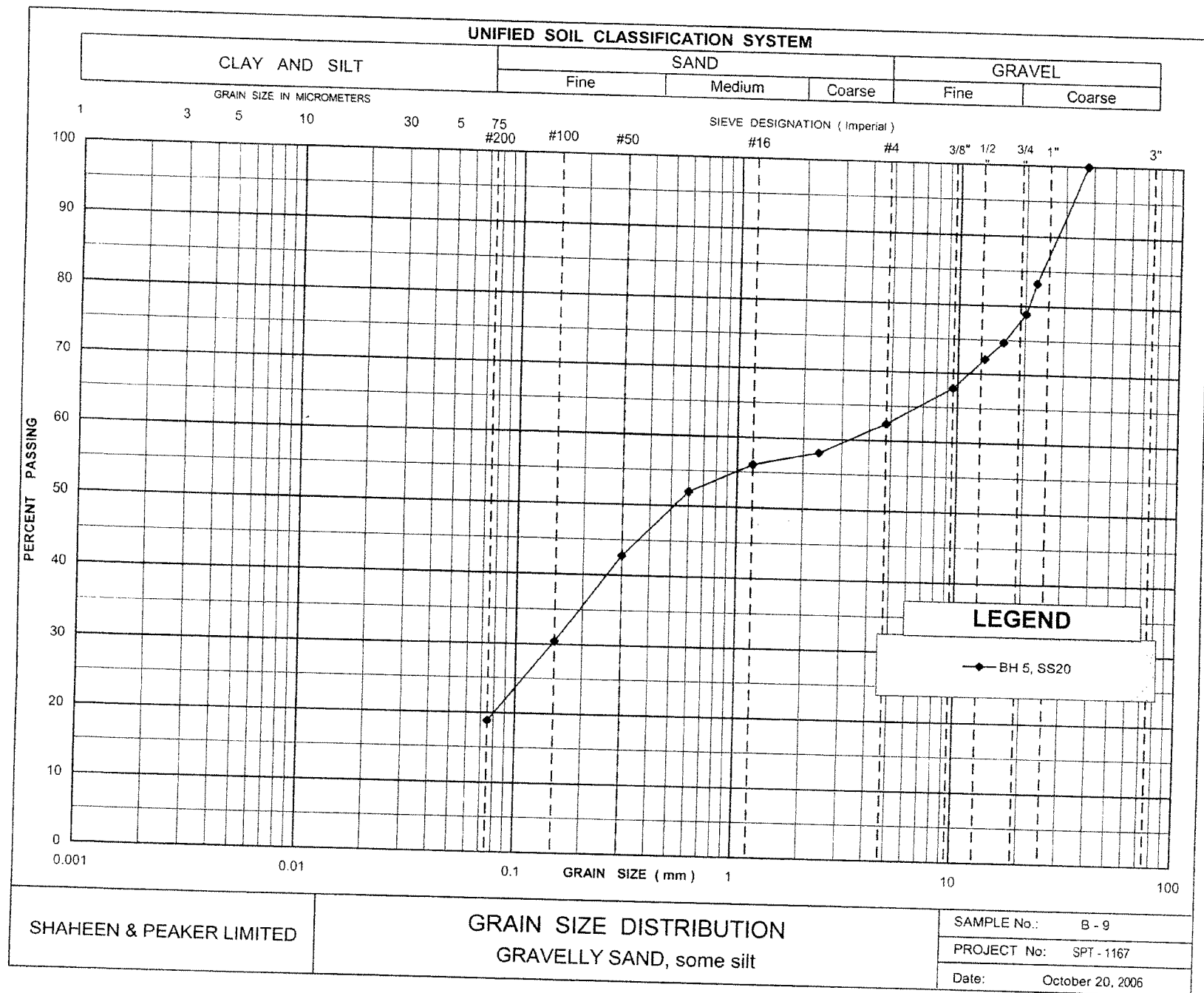


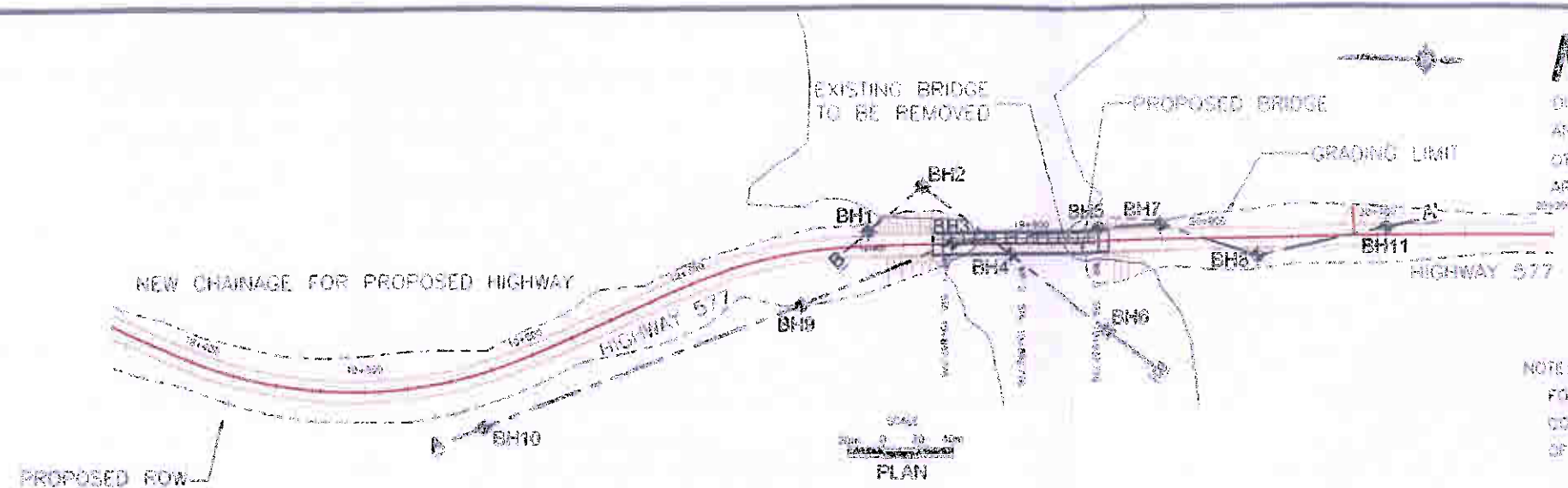




SHAHEEN & PEAKER LIMITED

SAMPLE No.:	B - 8
PROJECT No.:	SPT - 1167
Date:	October 20, 2006

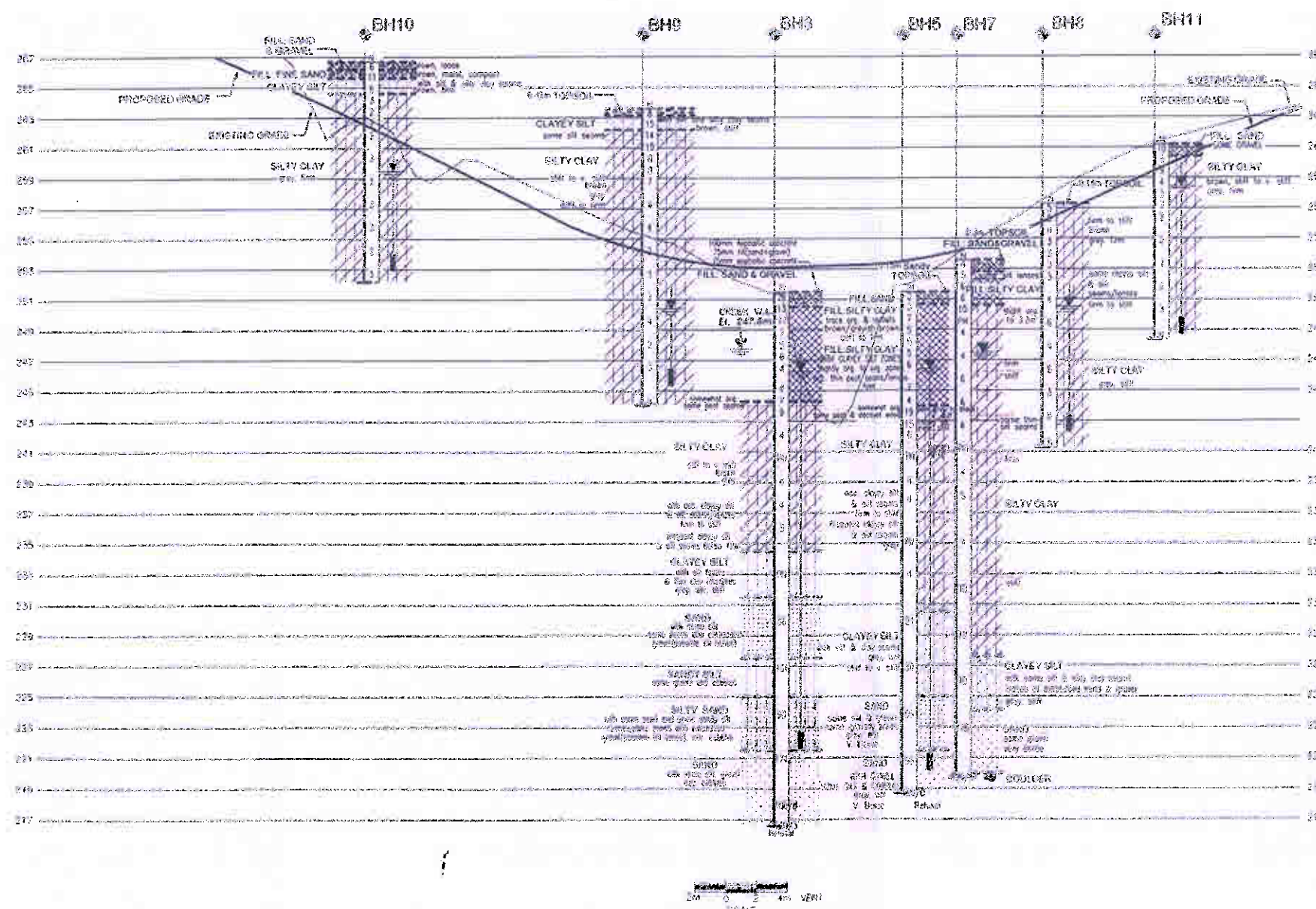




METRIC

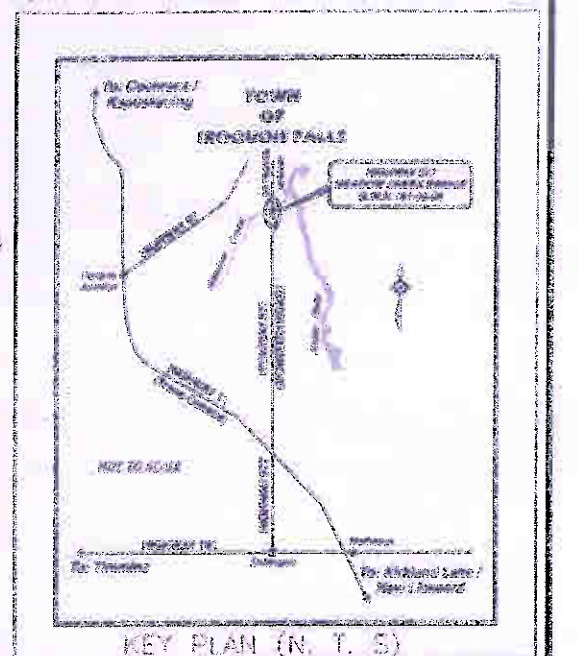
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
ARE IN KILOMETRES+METRES

NOTE:
FOR DETAILED SUBSURFACE
CONDITIONS REFER TO RECORD
OF BOREHOLE SHEETS








Meadow Creek Bridge, Iroquois Falls
SECTION AT STA. 19+80 TO 20+19
BORE HOLE LOCATIONS & SOIL STRATA

SHAHEEN & PEAKER LIMITED



LEGEND

- | | |
|---|--|
|  | Boreshole |
|  | Flow: 70.3 m (Std. Pen. Test. 475 J/Blow) |
|  | Water Level at Time of Investigation
Sept. 2006 (Not Stood/Red) |
|  | Water Level in Piezometer |
|  | Piezometer |

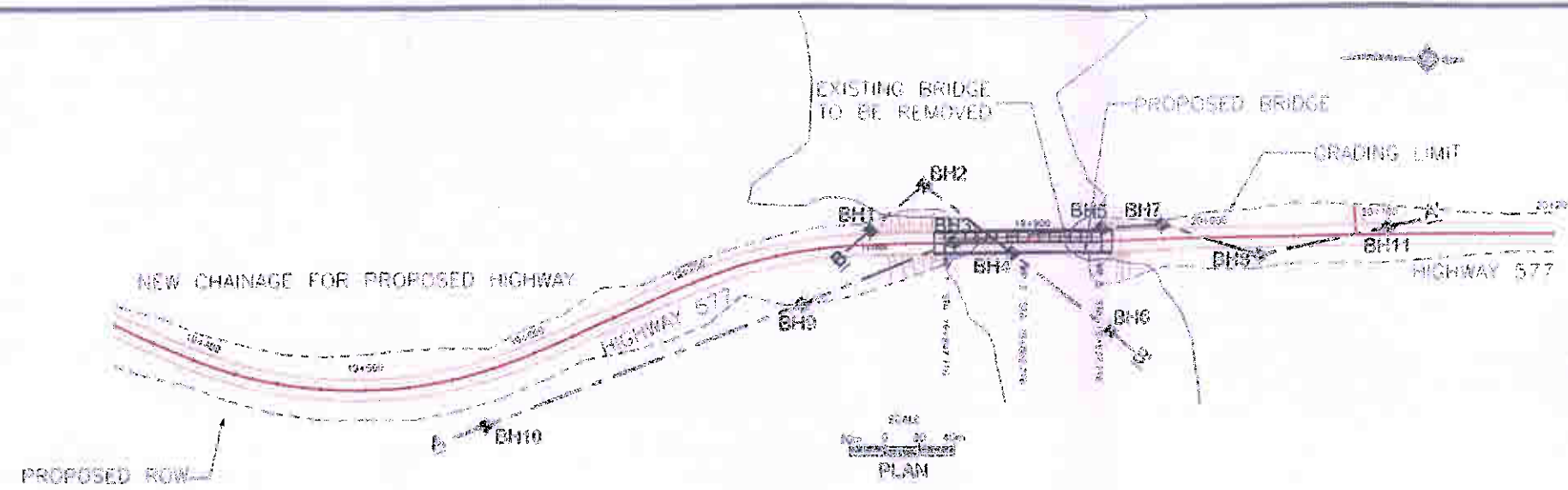
No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
BH 5	251.5	5 401 195.3	328 274.1
BH 5	251.9	5 401 578.6	328 265.9
BH 7	253.6	5 401 414.2	328 262.0
BH 8	257.3	5 401 470.6	328 275.8
BH 9	263.6	5 401 305.7	328 310.0
BH 10	266.7	5 401 025.4	328 382.6
BH 11	267.2	5 401 345.4	328 267.7

NOT

The boundaries between soil strata have been established only at bore hole locations. Between bore holes the boundaries are observed from geological evidence.

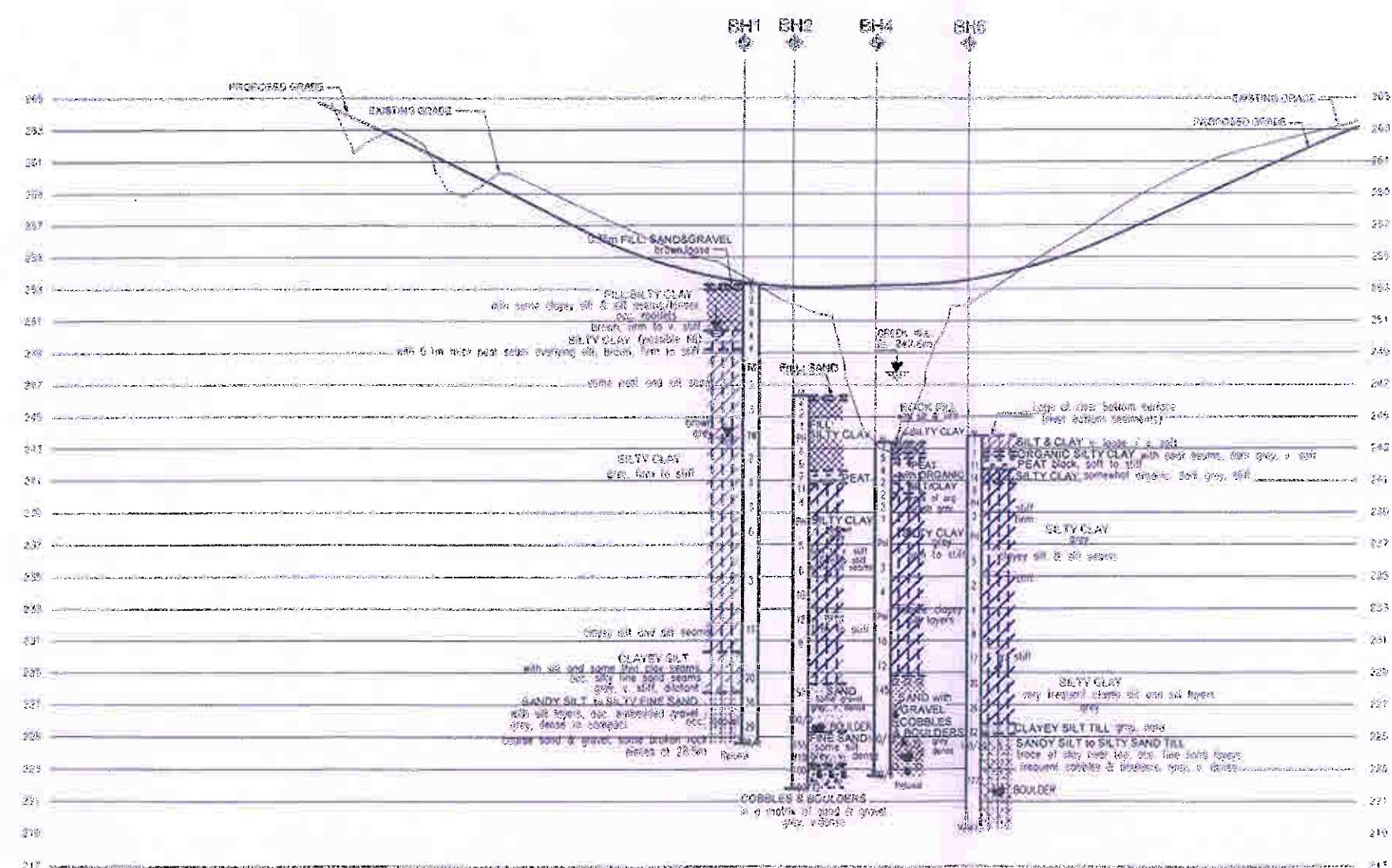
NOTE: The complete foundation investigation and design report for this project and other related documents may be obtained at the Materials Engineering and Research Office, DOWDAK. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section 60 2.07 of 89S Gen. Cons.

LEV			
	DATE	BY	DESCRIPTION
Geodes No. 42A-66			
MEADOW CREEK BRIDGE-HW157			Q1ST
SUBMD 20-CHECKED RM		DATE Nov. 2006	SITE 38E-077
DRAIN VS CHECKED FS		APPROVED 20	DWC 1



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

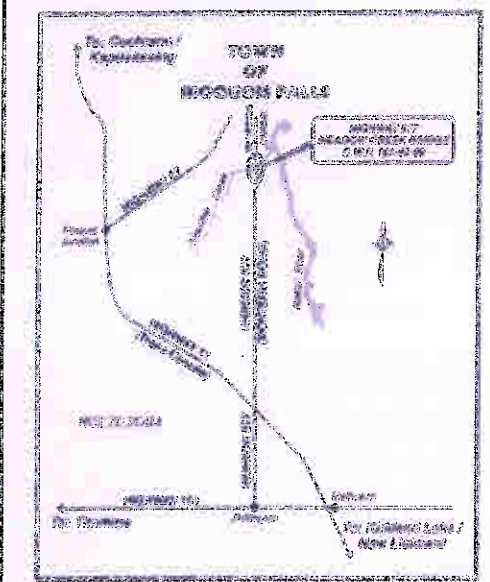
NOTE:
 FOR DETAILED SUBSURFACE
 CONDITIONS REFER TO RECORD
 OF BOREHOLE SHEETS



STRATIGRAPHIC PROFILE ALONG SECTION B-B'

CONT No.
 GWP: 181-92-00

Meadow Creek Bridge, Iroquois Falls
 SECTION AT STA. 19+001 TO 20+149
 BORE HOLE LOCATIONS & SOIL STRATA
SHAHEEN & PEAKER LIMITED



KEY PLAN (N. T. S.)

LEGEND

- Borehole
- ⊗ Borehole 0.3m (Sta. Pen. Test, 475 J/blow)
- ⊕ Water Level at Time of Investigation Sept., 2006 (Not Stationed)
- ⊖ Water Level in Piezometer
- ⊕ Piezometer

No.	ELEV.	CO-ORDINATES	
		NORTH	EAST
BH 1	253.3	5 401 244.8	328 265.2
BH 2	247.5	5 401 275.1	328 241.6
BH 4	247.6	5 401 327.1	328 279.7
BH 6	243.1	5 401 585.1	328 322.5

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 3.01 of GPS Gen. Cond.

REV.	DATE	BY	DESCRIPTION
1			

Geocres No. 42A-66	
MEADOW CREEK BRIDGE-HWY 577	DIST
SUB'D TO	CHECKED RM
DATE Nov. 2006	SHE 39E-077
DRAWN XS	CHECKED FS
APPROVED ZO	DWG 2

