

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M5-150

DIST. 4 REGION

W.P. No. 199-77-12

CONT. No. 91-22

W. O. No.

STR. SITE No. 10-1337-339

HWY. No. Q.E.W. / 403

LOCATION Q.E.W. S - 403 E Ramp

No. of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976

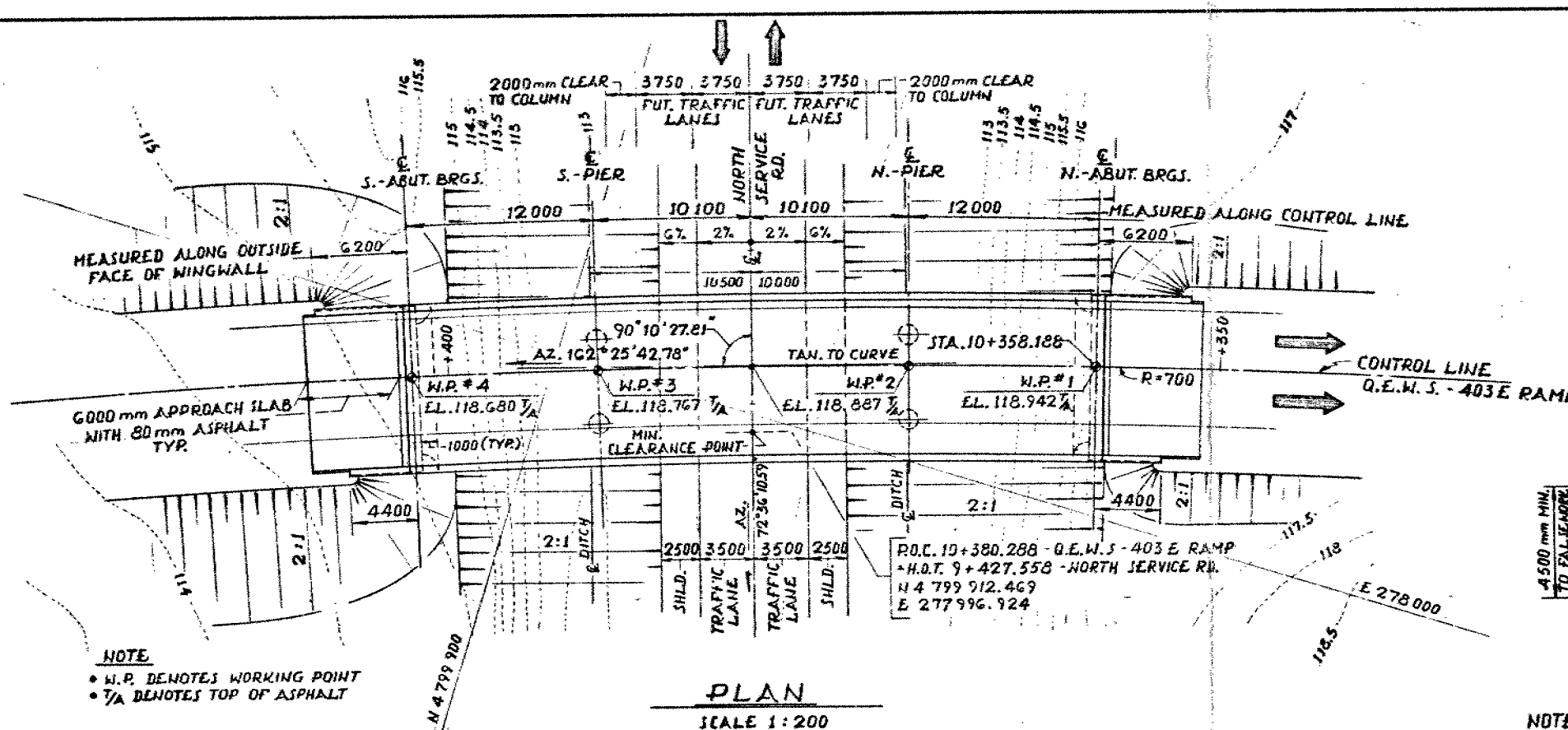
METRIC
DIMENSIONS ARE IN METRES
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DIST. 4
CONT No
WP No 199-77-12

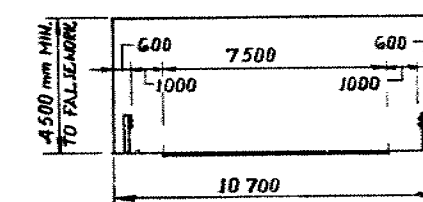


**Q.E.W.S. - HWY. 403 E RAMP
OVER NORTH SERVICE ROAD
GENERAL ARRANGEMENT**

SHEET



PLAN
SCALE 1:200



2 LANE FACILITY
(1 LANE IN EACH DIRECTION)

NOTE: ALL HORIZONTAL DIMENSIONS ARE MINIMUM DIMENSIONS REQUIRED AND MEASURED PERPENDICULAR TO PAVEMENT.

NOTES

- CLASS OF CONCRETE**
- FOOTINGS & MASS CONC. — 20 MPa
 - DECK & PIER COLUMNS — 35 MPa
 - REMAINDER — 30 MPa

- CLEAR COVER TO REINFORCING STEEL**
- FOOTINGS — 100 ± 25
 - ABUTMENTS: FRONT FACE — 80 ± 20
 - WINGWALLS: BACK FACE — 70 ± 20
 - PIER COLUMNS — 80 ± 20
 - DECK: TOP — 70 ± 20
 - BOTTOM AND SIDES — 50 ± 20
 - BARRIER WALLS & APPR. SLABS — AS PER STD. DNGS.
 - REMAINDER — 70 ± 20

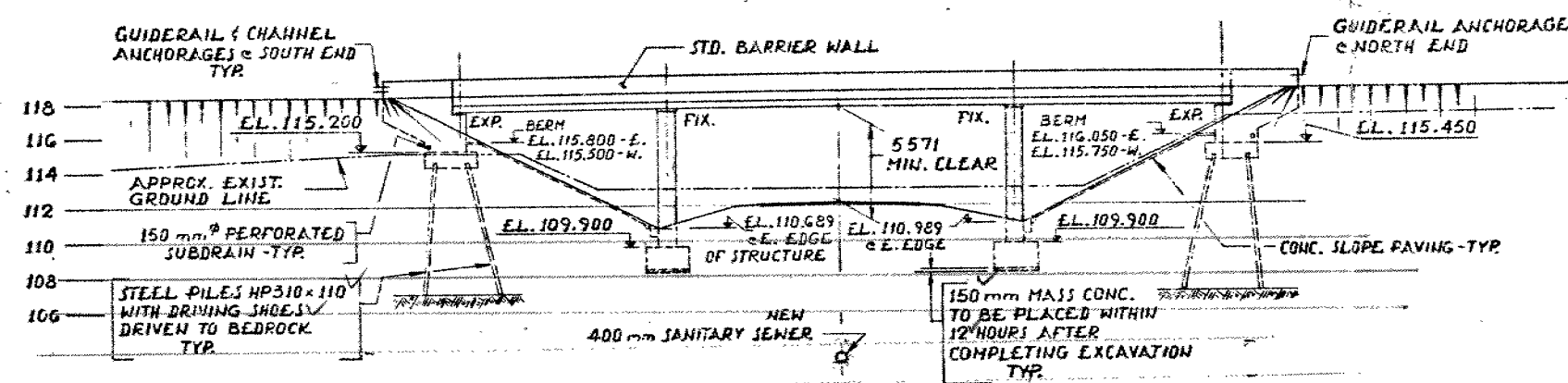
REINFORCING STEEL
REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS.

CONSTRUCTION NOTES
THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3 mm.

ASPHALT AND WATERPROOFING SYSTEM IS NOT PART OF THIS CONTRACT.

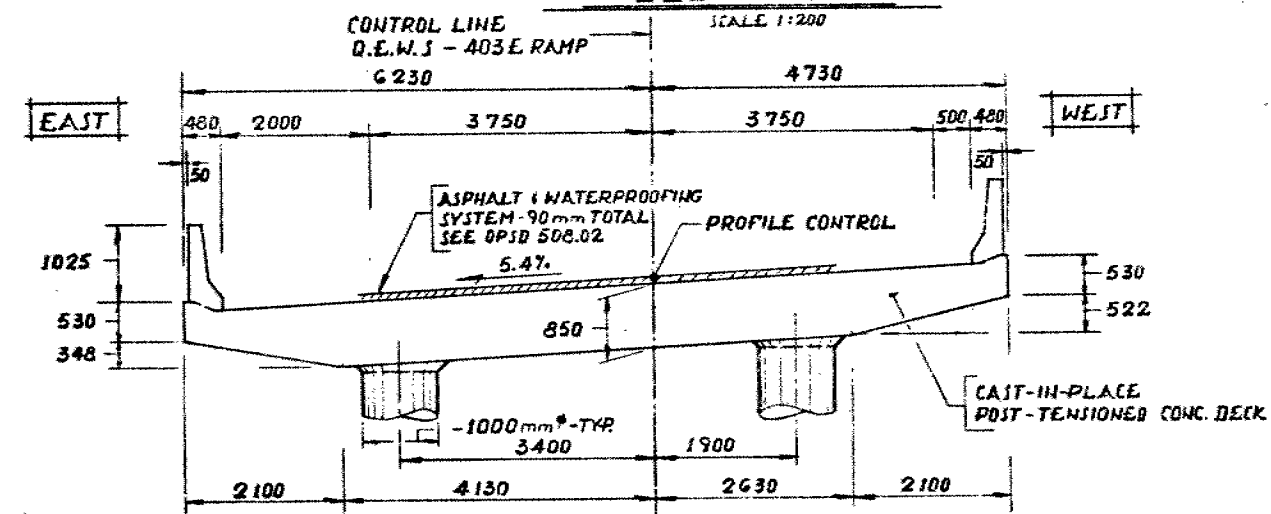
LIST OF DRAWINGS

- 1 - GENERAL ARRANGEMENT
- 2 - BORE HOLE LOCATIONS & SOIL STRATA
- 3 - FOOTING LAYOUT & REINF.
- 4 - NORTH ABUTMENT
- 5 - SOUTH ABUTMENT
- 6 - PIER
- 7 - DECK DETAILS
- 8 - LONGITUDINAL CABLE DETAILS
- 9 - TRANSVERSE CABLE DETAILS
- 10 - DECK REINFORCING I
- 11 - DECK REINFORCING II
- 12 - BARRIER WALLS
- 13 - 6000 mm APPROACH SLAB
- 14 - AS CONSTRUCTED ELEV. & DIM.
- 15 - JOINT ANCHORAGE AND ARMOURING
- 16 - BRIDGE DATA & SITE NUMBER DATA
- 17 - DETAILS OF CONC. SLOPE PAVING
- 18 - QUANTITIES
- 19 - QUANTITIES

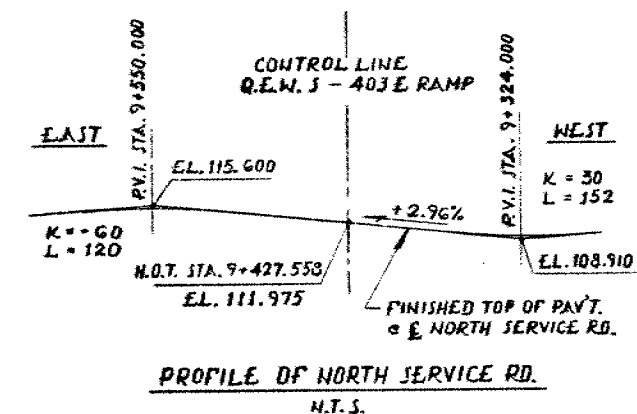


ELEVATION

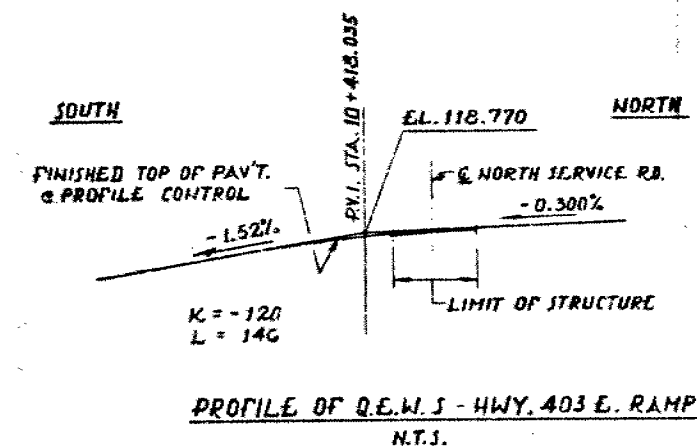
SCALE 1:200



TYP. DECK SECTION
SCALE 1:50



PROFILE OF NORTH SERVICE RD.
N.T.S.



PROFILE OF Q.E.W.S. - HWY. 403 E. RAMP
N.T.S.

B.M. 111.109
GEODETIC DATUM
TOP SW BOLT OF TRAFFIC SIGN NW
COR. 10.7 LT. 10+010.900



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION	DATE	PER
DESIGN	10/10/97	M.G.	LOADING	10/10/97	M.G.
DRAWING	10/10/97	M.G.	SITE No 10-1237-475	10/10/97	M.G.

* DIMENSIONS ARE MEASURED ON THE CONTROL LINE

METRIC

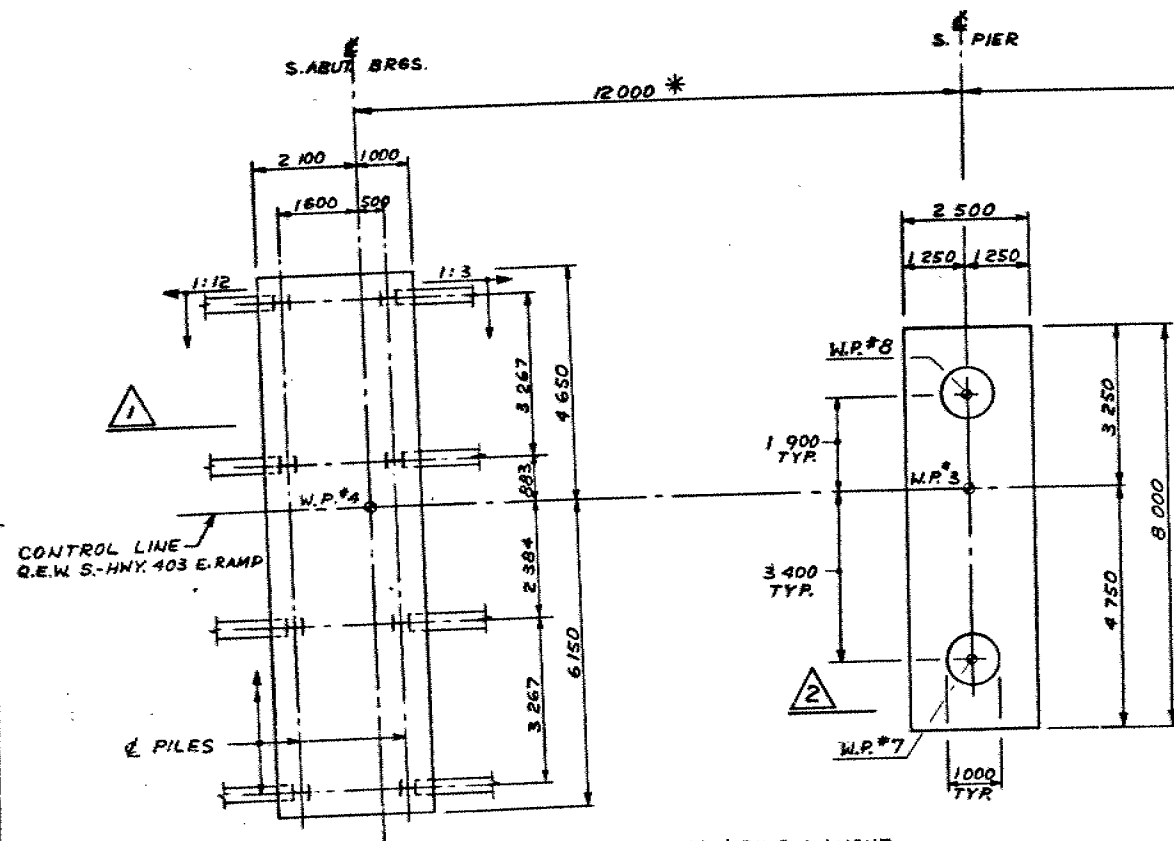
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No WP No 199-77-12

Q.E.W. S.-HWY. 403 E. RAMP OVER NORTH SERVICE ROAD FOOTING LAYOUT AND REINF.



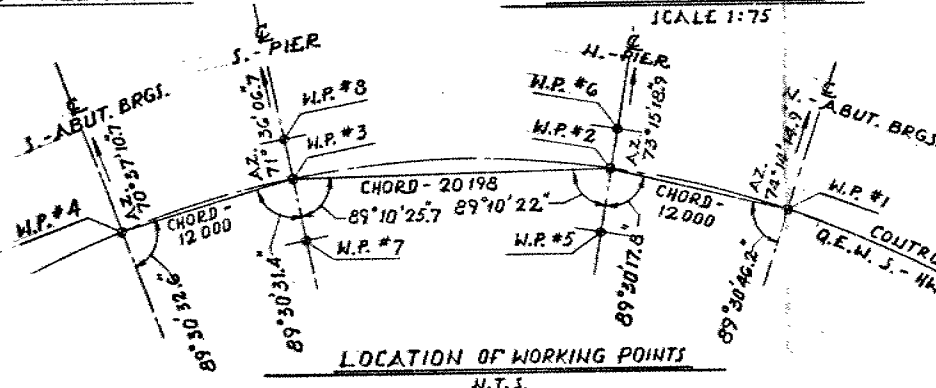
SHEET



DIMENSIONS & PILE LAYOUT

- NOTES**
- ALL SPIRALS HAVE A PITCH OF 60 MM. AND ARE EMBEDDED FOR 90 MM. INTO THE FOOTING
 - THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWINGS N° 1, 4, 5 & 6.

FOOTING LAYOUT SCALE 1:75



LOCATION OF WORKING POINTS N.T.S.

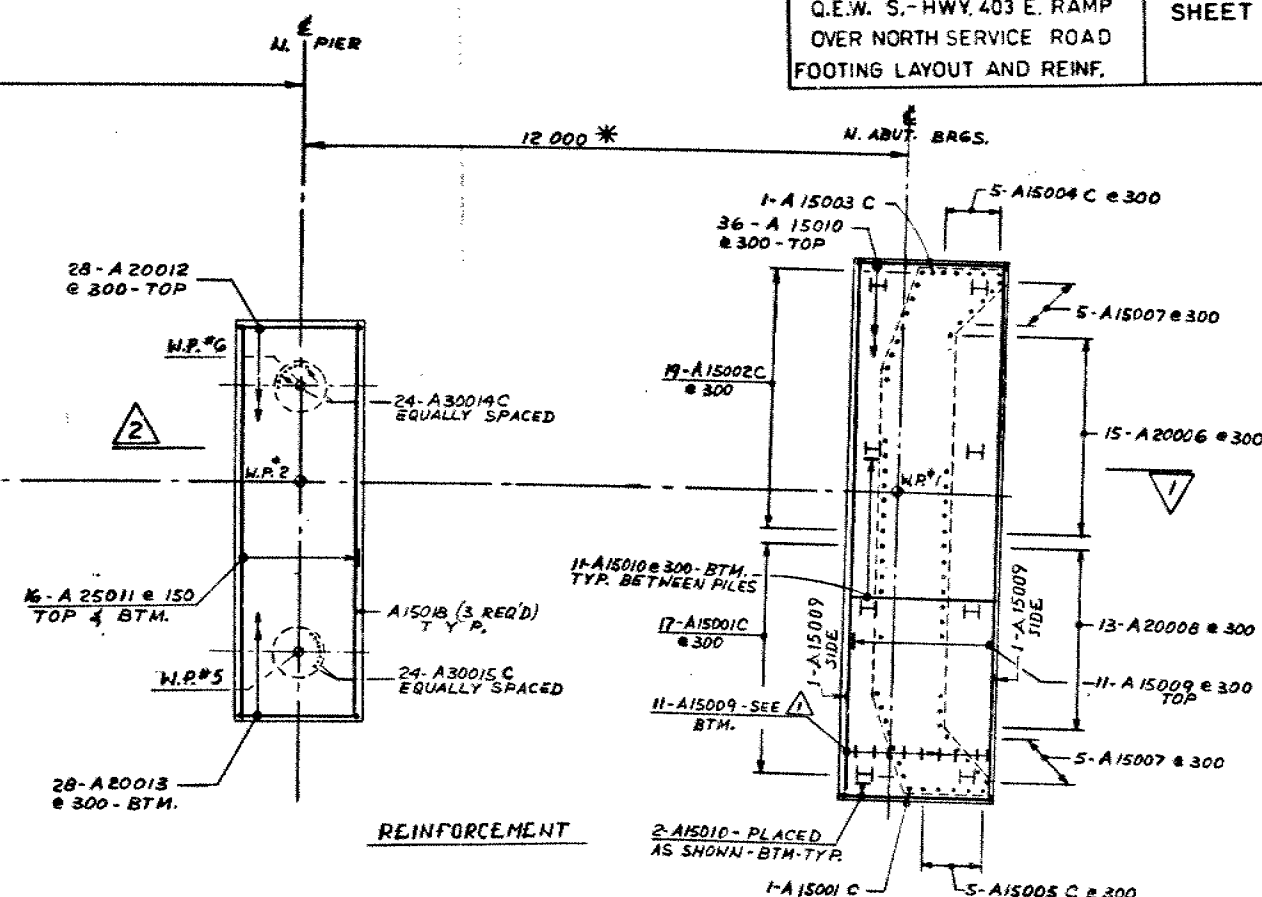
LIST OF PILES

BATTER	S-ABUTMENT		N-ABUTMENT	
	N ₂	LENGTH	N ₂	LENGTH
1:12	4	8 750	4	9 000
1:3	4	9 250	4	9 500

PILE DESIGN DATA
CAPACITY AT S.L.S. TYPE II 1150 kN.
FACTORED CAPACITY A U.L.S. 1600 kN.

COORDINATES

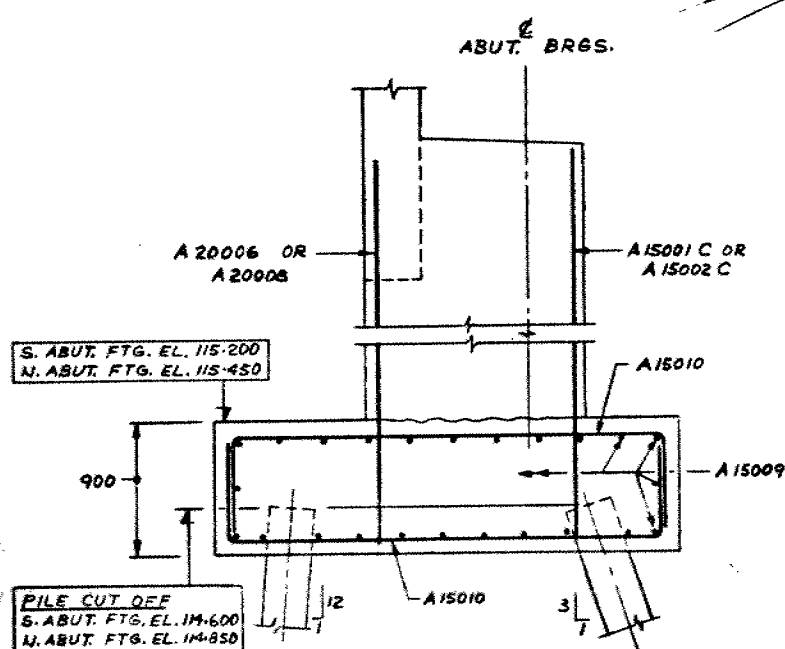
POINT	STATION	NORTH	EAST
W.P. #1	10+358.128	4799 933.641	277 990.582
W.P. #2	10+370.128	4799 922.120	277 993.940
W.P. #3	10+390.328	4799 902.864	278 000.038
W.P. #4	10+402.388	4799 891.510	278 003.923
W.P. #5	—	4799 923.100	277 997.196
W.P. #6	—	4799 921.575	277 992.121
W.P. #7	—	4799 903.937	278 003.265
W.P. #8	—	4799 902.264	277 998.236



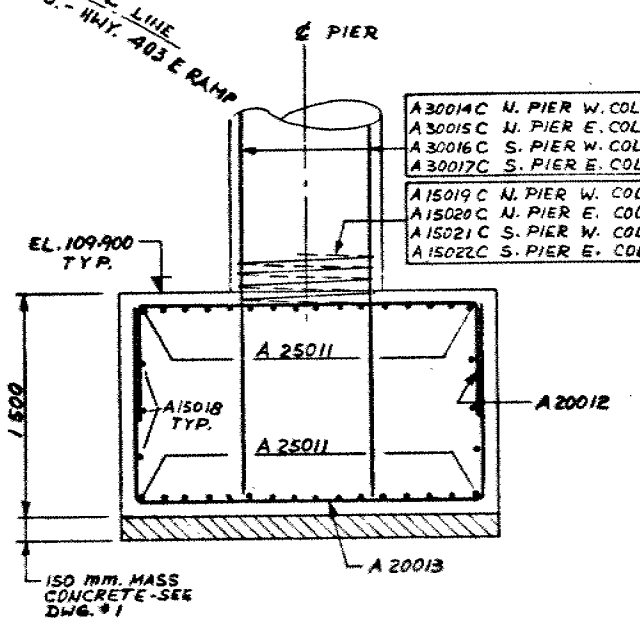
REINFORCEMENT

NOTES

- ALL PILES TO BE HP 310 x 110.
- PILE SPACING MEASURED AT UNDERSIDE OF FOOTING.
- ALL PILES TO HAVE DRIVING SHOES.
- PILE LENGTH SHOWN ON DRAWING IS THE THEORETICAL LENGTH BELOW CUT OFF.
- PILES TO BE DRIVEN TO BEDROCK
- FOOTING DIMENSIONS, PILE LAYOUT AND REINFORCEMENT ARE SIMILAR FOR BOTH ABUTMENTS, LIKEWISE FOR BOTH PIERS.



1:25



2:25

DRAWING NOT TO BE SCALED 100 mm ON ORIGINAL DRAWING



REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

CONT 91-22

WP 199-77-12

DIST 4

HWY

STR SITE 10-1337-339

Q.E.W. S - 403 E Ramp over North Service Road

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GEOCRES 30M5-150

DATE

MAY - 2 1985

MAY - 2 1985

FOUNDATION INVESTIGATION REPORT

For

Q.E.W. S - 403 E Ramp over North Service Road

W.P. 199-77-12, Site 10-1337-339

District 4, Burlington

INTRODUCTION

This report summarizes the factual information obtained from a foundation investigation performed at the above-mentioned site. Fieldwork consisted of four sampled boreholes and eight dynamic cone penetration tests advanced between 85 02 14 and 85 02 19. A track mounted auger machine was employed for the investigation. Borings were advanced for depths ranging from 2.9 m to 12.1 m. Bedrock was cored utilizing BXL size in all four boreholes.

SITE DESCRIPTION

The site is located approximately 550 m west of existing Brant St. and about 130 m north of the existing North Service Road in the City of Burlington, Regional Municipality of Halton.

It is proposed to construct a three span precast concrete structure to accommodate traffic movements from the Q.E.W. south to the future 403 eastbound over the relocated North Service Road. This site has been used as a borrow area for existing contracts and therefore the proposed relocated North Service Road, which is located in a cut in this vicinity, has been excavated approximately to subgrade.

The site is located in the physiographic region known as the South Slope. The area is characterized by a ground moraine of limited relief. The underlying bedrock is a red shale with siltstone, of the Queenston Formation.

SUBSURFACE CONDITIONS

General

This report must be read in conjunction with the Record of Borehole Sheets located in the Appendix as well as Dwg. #1997712-A which shows the locations and elevations of the borings along with an estimated stratigraphical profile based on the borehole data.

The subsoil conditions are fairly uniform across the site. Exposed at ground surface at boreholes 1, 3 and 7, and underlying approximately 1.0 m of silty clay fill at borehole 5, is a heterogeneous mixture of silty clay containing varying proportions of sand and gravel and occasional cobbles and boulders. This deposit overlies bedrock.

The various soil types encountered are described in the following paragraphs.

Fill

An approximately 1.0 m thick layer of silty clay, trace organics and gravel was encountered at borehole 5. Based on one Standard Penetration Test 'N' value, the consistency of this deposit is considered to be stiff.

Heterogeneous Mixture of Silty Clay, Sand and Gravel (Glacial Till)

This deposit is the predominant soil type across the site. It was encountered in all boreholes and ranged in thickness from 6.2 m at borehole 7 to 9.4 m at borehole 1. It consists of a heterogeneous mixture of silty clay with varying proportions of sand and gravel. Occasional cobbles and boulders were encountered during the investigation.

The results of water content and Atterberg Limit testing are plotted on the Plasticity Chart, Figure #1 and are summarized as follows:

		Range	Average
Water Content	(W)%	8-18	13
Liquid Limit	(W _L)%	25-28	26
Plastic Limit	(W _p)%	15-17	16
Plasticity Index	(I _p)%	9-12	10

Grain size distribution tests were carried out on representative samples and the results of these tests are shown in envelope form on Figure #2 in the Appendix.

Standard Penetration Test 'N' values ranged from 13 to over 100 blows per 0.3 m penetration. Based on these results, the consistency of this deposit varies from stiff to hard.

Bedrock

Bedrock was proven by obtaining up to 3.0 m of BXL rock core.

Generally, the bedrock is a red shale with green unweathered siltstone (approx. 10%) of the Queenston Formation. The upper portion of the bedrock is highly weathered. A detailed description of the rock core was prepared by Mr. E. Magni, M.T.C. Geologist and his report is located in the Appendix.

Groundwater

The groundwater level was not encountered during the drilling operations.

DISCUSSION AND RECOMMENDATIONS

As part of the proposed Q.E.W./403 - Freeman I/C in Burlington, it is proposed to construct a 3 span precast concrete girder structure to carry future Ramp Q.E.W. S - 403 E over the relocated North Service Road.

General recommendations which are applicable to all foundations for these structures are given below. The recommendations which lead to the most economical design should be adopted.

GENERAL RECOMMENDATIONS

Earth Pressure Calculations

Backfill to structures should consist of Granular 'A' or 'B' in accordance with Standard Special Provision No. 121 dated October, 1983. Earth pressures should be computed in accordance with Section 6.6.1.2.1 of the O.H.B.D.C. The recommended foundations for the abutments are considered to be non-yielding and the at rest condition (K_0) applies. For design purposes, the physical properties of the backfill material are as follows:

MATERIAL	ϕ	UNIT WEIGHT (γ)
Granular 'A'	35	22.8 kN/m ³
Granular 'B'	30	21.2 kN/m ³

Settlements

Total and differential settlements should not exceed 25 mm for footings designed in accordance with the recommendations given in this report.

Slope Stability

The relocated North Service Road will be located in a cut which has been partially completed. No stability problems are anticipated for this cut with slopes of 2 horizontal to 1 vertical.

Frost Protection

The minimum cover requirement for frost protection is 1.2 m.

Dewatering

Dewatering is not anticipated to be a major problem. It is expected that water entering into footing excavations can be controlled by pumping from corner sumps. All soft or loose material should be removed from the base of the excavations prior to pouring the footings.

Footing Excavations

Excavations in bedrock may be accomplished without blasting techniques.

All soft or loose material at the base of the proposed footing locations should be removed and the base of the excavation should be covered with a 15 cm pad of mass concrete within 12 hours of exposure.

Resistance to Lateral Forces

For design purposes, the following unfactored friction coefficients may be assumed to apply between the base of the footing and the founding stratum.

Overburden	$\tan 22^\circ$
Weathered Shale Bedrock	$\tan 22^\circ$
Sound Shale Bedrock	$\tan 25^\circ$

If lateral resistance in addition to that provided by friction is required, a key should be cut into the sound shale bedrock below the footing. The minimum depth should be 0.5 m. Provided that concrete is placed against the "undisturbed" rock face, then the key should provide a resisting pressure of 1.0 MPa.

STRUCTURE FOUNDATIONS

ABUTMENTS

Both abutments for this structure should be supported on steel H-piles driven to shale bedrock. The following O.H.B.D.C. parameters are recommended:

	Factored Capacity at U.L.S. (kN)	Capacity at S.L.S. Type II (kN)
HP 310 x 110	1600	1150

The piles should be equipped with standard tip reinforcement. To facilitate pile driving, the fill material through which piles will be driven should be restricted to a maximum size of 75 mm.

The hammer should be capable of providing a minimum driving energy of 50,000 J/blow.

For design purposes, it is estimated that the piles will attain their recommended design capacities at about elevation 107 m.

PIERS

Spread Footings on Hard Silty Clay

Both of the piers may be supported on spread footings placed on the hard silty clay overburden. In this case a value of 750 kPa may be used for the factored bearing capacity at U.L.S. The bearing capacity at S.L.S. Type II will not govern the design. The following founding elevations are recommended:

UNIT	APPLICABLE BOREHOLE	ELEVATION (m)
North Pier	7	110.4
South Pier	3	110.0

Spread Footings on Weathered Shale

As an alternative, the piers may be founded on spread footings placed on weathered shale bedrock. In this case a value of 1000 kPa may be used for the factored bearing capacity at U.L.S. The bearing capacity at S.L.S. Type II will not govern the design. The following founding elevations are recommended:

UNIT	APPLICABLE BOREHOLE	ELEVATION (m)
North Pier	7	107.2
South Pier	3	106.7

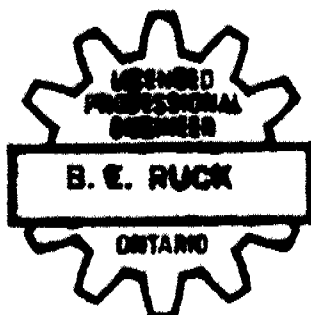
Spread Footings on Sound Shale Bedrock

Both piers may be founded on spread footings placed on sound shale bedrock. In this case, a value of 1500 kPa may be used for the factored bearing capacity at U.L.S. The bearing capacity at S.L.S. Type II will not govern the design. The following founding elevations are recommended:

UNIT	APPLICABLE BOREHOLE	ELEVATION (m)
North Pier	7	106.6
South Pier	3	106.1

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. R. Thomas, Student Specialist Engineer, utilizing equipment owned and operated by Atcost Soil Drilling Inc., Concord. This report was written by Mr. B. Ruck, Project Foundations Engineer and reviewed by Mr. K. Selby, Chief Foundations Engineer (West).



Brian Ruck

B. E. Ruck, P.Eng.
Project Foundations Engineer

K. G. Selby

K. G. Selby, P.Eng.
Chief Foundations Engineer (West)

APPENDIX

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_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_a	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_f	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

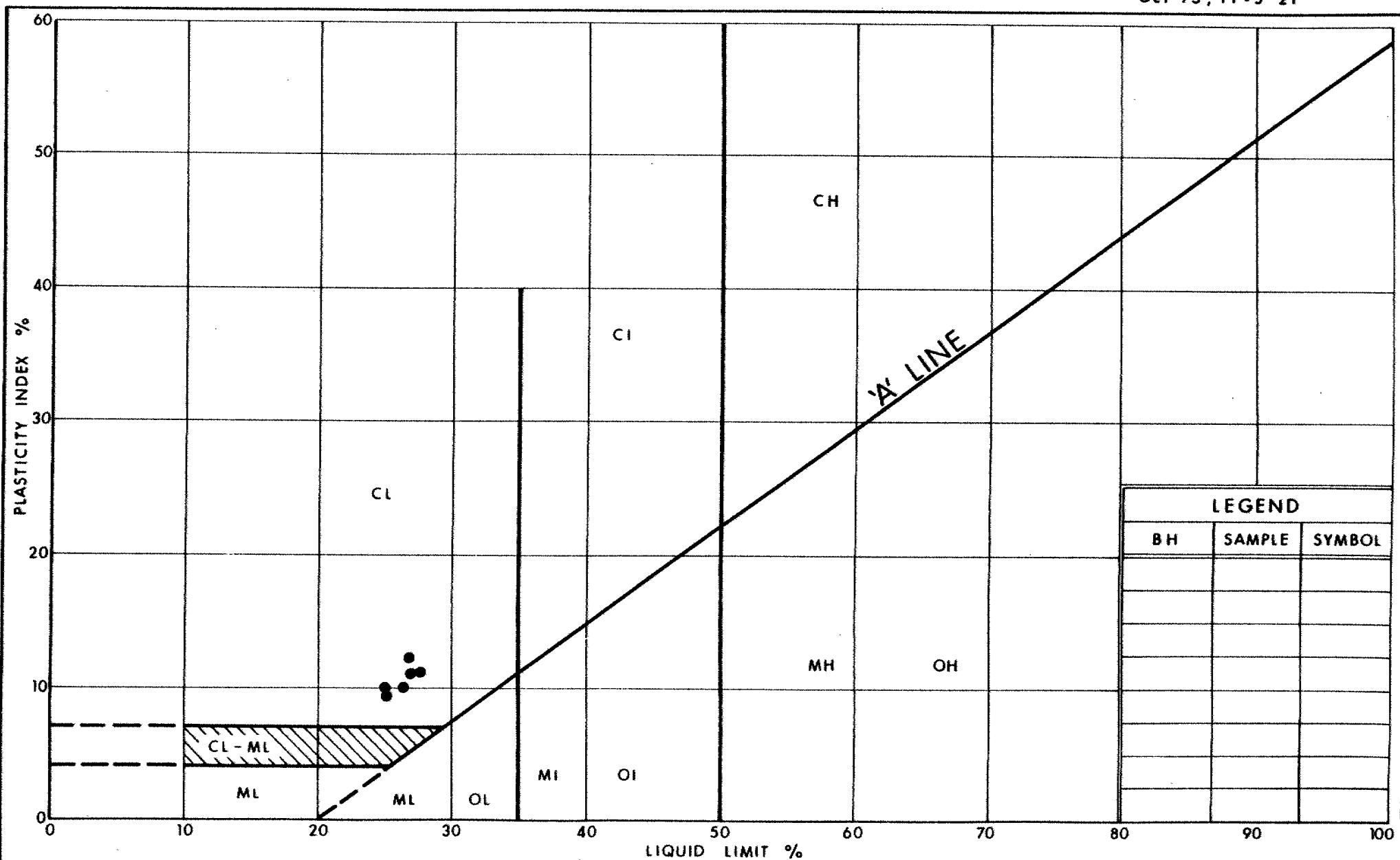
PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m^2	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

DESCRIPTION OF ROCK CORE - W.P. 199-77-12

BOREHOLE NUMBER				CORE DESCRIPTION	
	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
1	10.49-12.07	94	74	10.49-10.67	Shale (100%), red, highly weathered
				10.67-12.07	Shale (90%), red, unweathered, medium spaced joints, with siltstone (10%), green, unweathered; highly weathered shale layer 11.76 - 11.86 m
3	6.76- 8.33	95	52	7.76- 9.78	Shale (90%), red, slightly weathered to 7.06 m, becoming unweathered, medium spaced joints, with siltstone (10%), green, unweathered
	8.33- 9.78	100	100		
5	8.41- 9.88	100	72	8.41- 9.88	Shale (90%), red, unweathered, medium spaced joints, with siltstone (10%), green, unweathered
7	6.84- 8.33	97	73	6.84- 8.33	Shale (90%), red, unweathered, medium spaced joints, with siltstone (10%), green, unweathered; highly weathered zone from 8.0 - 8.05 m

* CR= CORE RECOVERY ; RQD = ROCK QUALITY DESIGNATION



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PLASTICITY CHART HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND & GRAVEL (Glacial Till)

FIG No 1

W P 199-77-12



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GRAIN SIZE DISTRIBUTION

HETEROGENEOUS MIXTURE OF SILTY CLAY, SAND & GRAVEL
(Glacial Till)

FIG No 2

W P 199-77-12

RECORD OF BOREHOLE No 1

METRIC

W P 199-77-12 LOCATION N 4 799 934 E 277 987 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger & BXL Rock Coring COMPILED BY BR
DATUM Geodetic DATE 85 02 19 CHECKED BY *BR*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
117.1	Ground Surface													
0.0														
	Heterogeneous Mixture of Silty Clay Sand and Gravel Stiff to Hard (Glacial Till)		1	SS	44									2 26 45 27
			2	SS	21									
			3	SS	17									
			4	SS	18									
			5	SS	13									
			6	SS	24									
			7	SS	29									
			8	SS	50									
			9	SS	100	30 cm								
107.7	Bedrock		10	SS	100	8 cm								
9.4	Weathered Sound (Queenston Shale)		11	BXL RC	REC 94%								RQD 74%	
105.0														
12.1	End of Borehole * Water Level Not Encountered													



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RECORD OF BOREHOLE No 2

METRIC

W P 199-77-12 LOCATION N 4 799 921 E 277 992 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY BR
DATUM Geodetic DATE 85 02 18 CHECKED BY BR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
113.4	Ground Surface											
0.0												
110.5												
2.9	End of Cone Test											

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 3

METRIC

W P 199-77-12 LOCATION N 4 799 902 E 277 998 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger - BXL Rock Coring COMPILED BY BR
DATUM Geodetic DATE 85 02 15 CHECKED BY *LB*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
113.0	Ground Surface													
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel Very Stiff to Hard (Glacial Till)		1	SS	20		112							
			2	SS	21									
			3	SS	38									
			4	SS	65									
			5	SS	81									
			6	SS	1007	20 cm								
			7	SS	1007	15 cm								
106.7	Grey Reddish Brown		8	SS	1007	15 cm								
6.3	Weathered Bedrock (Queenston Shale)		9	BXL RC	REC 95%									RQD 52%
103.2			10	BXL RC	REC 100%									RQD 100%
9.8	End of Borehole * Water Level not Encountered													

+3, x5: Numbers refer to
Sensitivity

20
15
10
5
5 (%) STRAIN AT FAILURE

**METRIC**

W P 199-77-12 LOCATION N 4 799 890 E 278 000 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY BR
DATUM Geodetic DATE 85 02 14 CHECKED BY [Signature]

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					
115.5	Ground Surface							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					GR SA SI CL
0.0													
112.1													
3.4	End of Cone Test						112						

+3, x5; Numbers refer to Sensitivity

OFFICE - REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5

METRIC

W P 199-77-12 LOCATION N 4 799 893 E 278 010 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger & BXL Rock Coring COMPILED BY BR
DATUM Geodetic DATE 85 02 14 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
115.1	Ground Surface													
0.0	Fill - Silty Clay trace organics and gravel Stiff		1	SS	13									
114.1			2	SS	28									
1.0			3	SS	26									
	Heterogeneous Mixture of Silty Clay Sand and Gravel		4	SS	37									
	Very Stiff to Hard		5	SS	37									
	Occasional Boulders		6	SS	33									
	Grey (Glacial Till)		7	SS	73	20 cm								4 25 47 24
107.2			8	SS	100	13 cm								
7.9	Weathered Sound		9	SS	100	5 cm								
	Bedrock		10	BXL RC	REC 100%									RQD 72%
105.2	(Queenston Shale)													
9.9	End of Borehole													



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RECORD OF BOREHOLE No 6

METRIC

W P 199-77-12 LOCATION N 4 799 904 E 278 004 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY BR
DATUM Geodetic DATE 85 02 15 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
112.9	Ground Surface											
0.0												
110.0												
2.9	End of Cone Test											

*3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

METRIC

W P 199-77-12 LOCATION N 4 799 923 E 277 996 ORIGINATED BY RT
DIST 4 HWY 403 BOREHOLE TYPE Solid Stem Auger - BXL Rock Coring COMPILED BY BR
DATUM Geodetic DATE 85 02 18 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
113.4	Ground Surface												
0.0	Heterogeneous Mixture of Silty Clay Sand and Gravel Very Stiff to Hard (Glacial Till)		1	SS	19								
			2	SS	20								
			3	SS	27								
			4	SS	84	23 cm							
			5	SS	78	23 cm							
			6	SS	72	23 cm							
	Grey Reddish Green		7	SS	100	8 cm							
107.2	Weathered Sound		8	SS	100	15 cm							
6.2	Bedrock (Queenston Shale)		9	BXL RC	REC 97%								RQD 73%
105.1	End of Borehole												
8.3	* Water Level not Encountered												

RECORD OF BOREHOLE No 8

METRIC

W P 199-77-12 LOCATION N 4 799 935 E 277 995
 DIST 4 HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test
 DATUM Geodetic DATE 85 02 19
 ORIGINATED BY RT
 COMPILED BY BR
 CHECKED BY

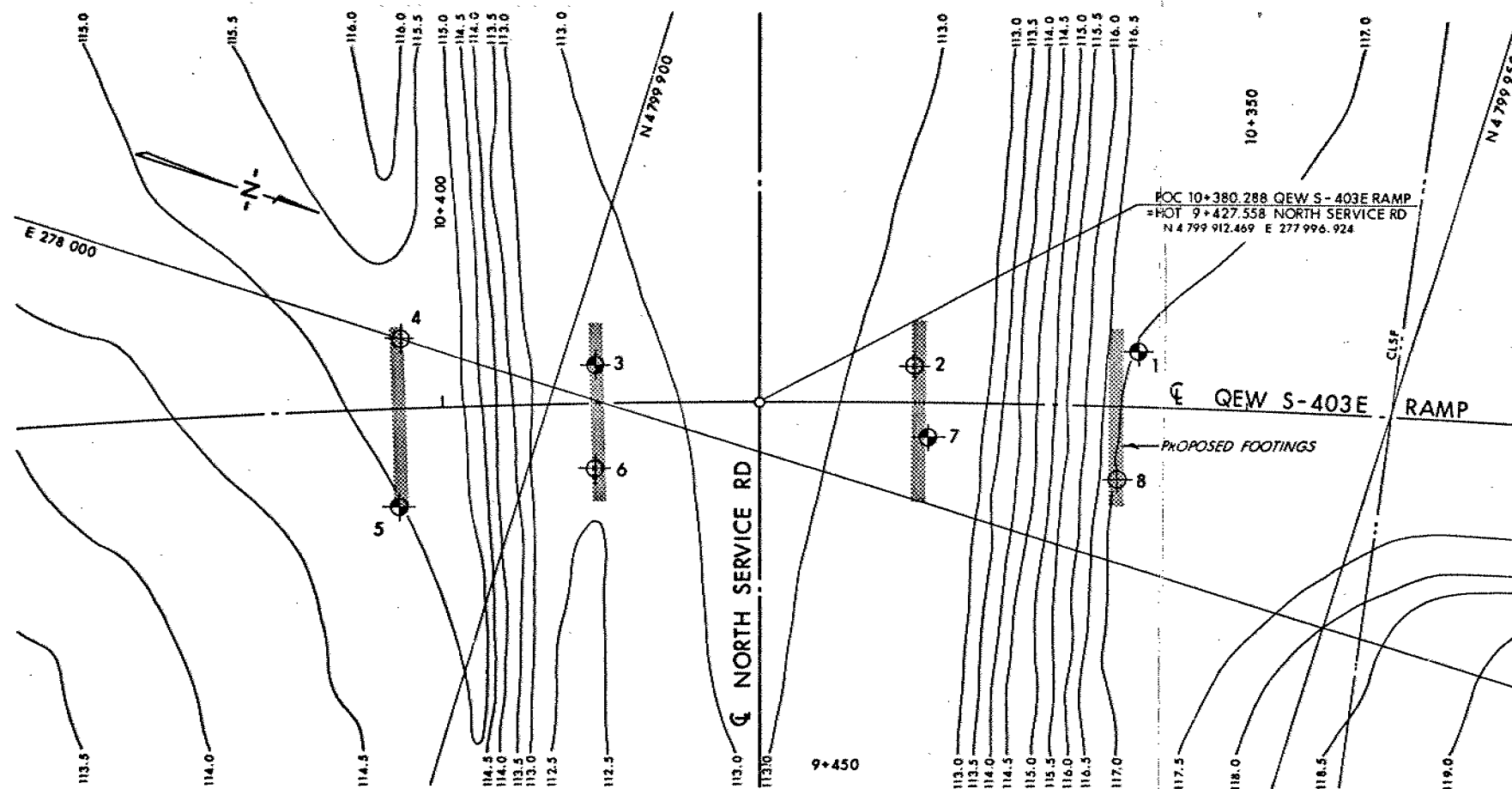
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
117.0	Ground Surface												
112.7	End of Cone Test												
4.3													

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

CONT No
WP No 199-77-12

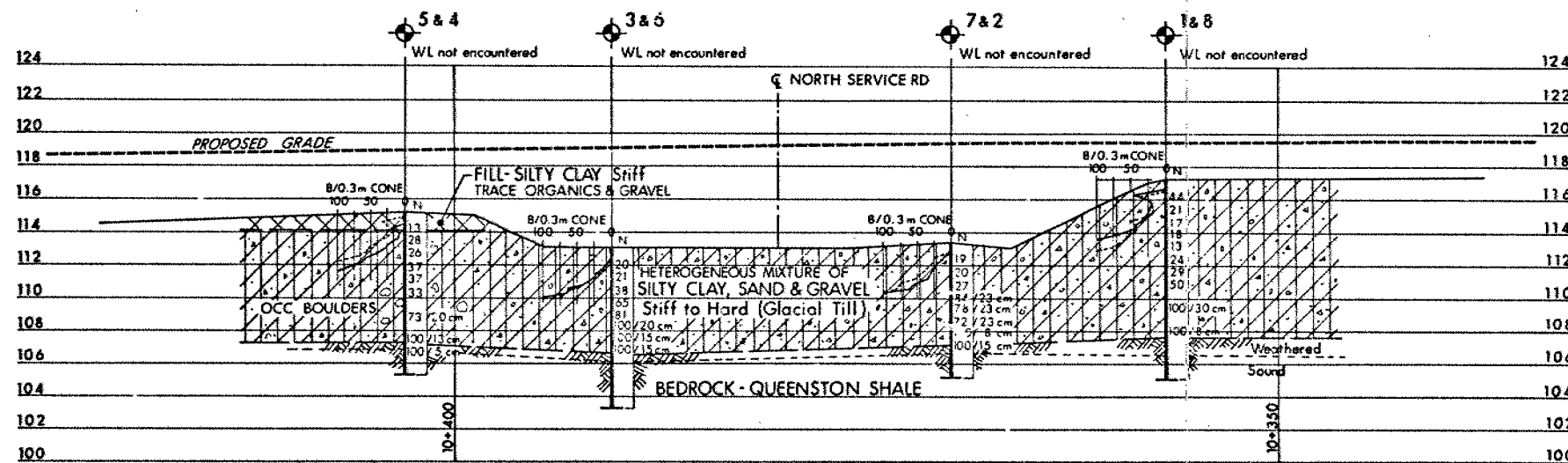
NORTH SERVICE ROAD
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



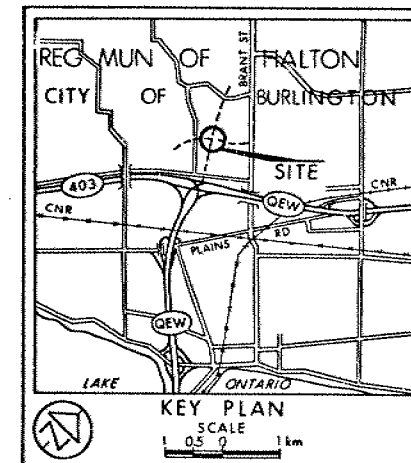
PLAN

SCALE
4m 2 0 4m



PROFILE QEW S-403E RAMP

SCALE
4m 2 0 4m



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & 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

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	117.1	4799934.0	277987.0
2	113.4	4799921.0	277992.0
3	113.0	4799902.0	277998.0
4	115.5	4799890.0	278000.0
5	115.1	4799893.0	278010.0
6	112.9	4799904.0	278004.0
7	113.4	4799923.0	277996.0
8	117.0	4799935.0	277995.0

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 Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.



REF NO E-6051-1

REV	DATE	BY	DESCRIPTION
1			

Geocres No 30M5-150
HWY No QEW S-403E RAMP
SUBMID BR CHECKED [] DATE 1985 04 25
DRAWN SO CHECKED []
DIST 4
SITE 10-1337-339
DWG 1997712-A