

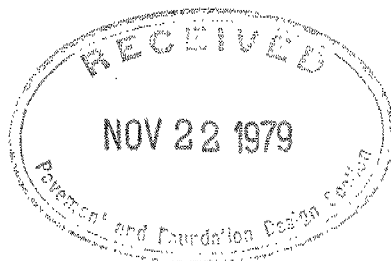
G.I.-30 SEPT. 1976

GEOCRES No. 41I-108DIST. 13 REGION W.P. No. CONT. No. 79-702W. O. No. 77-50165STR. SITE No. 46-211HWY. No. LocLOCATION Danoust Creek BridgeNo of PAGES -=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

INDEX

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2	Abbreviations & Symbols
3-13	Foundation Investigation Report For Daoust Creek Bridge Township of Bigwood

NOTE: For purposes of the Contract this report supercedes all other foundation reports prepared by or for the Ministry in connection with the above mentioned project.



'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS  $N_c$ .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

$S_u$ (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

#### ABBREVIATIONS & SYMBOLS

##### LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG.  $\bar{C}IU$  = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

##### FIELD SAMPLING

SS SPLIT SPOON  
WS WASH SAMPLE  
ST SLOTTED TUBE SAMPLE  
BS BLOCK SAMPLE  
CS CHUNK SAMPLE  
TW THINWALL OPEN  
TP THINWALL PISTON  
OS OSTERBERG SAMPLE  
FS FOIL SAMPLE  
RC ROCK CORE  
PH T.W. ADVANCED HYDRAULICALLY  
PM T.W. ADVANCED MANUALLY

##### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  ANGLE OF WALL FRICTION  
 $k_o$  COEFFICIENT OF EARTH PRESSURE AT REST  
 $k_A$  COEFFICIENT OF ACTIVE EARTH PRESSURE  
 $k_P$  COEFFICIENT OF PASSIVE EARTH PRESSURE  
 $i$  ANGLE OF INCLINATION OF SURCHARGE  
 $w$  SLOPE ANGLE-BACKFACE OF WALL  
 $\beta$  ANGLE OF SLOPE  
 $N_q, N_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

##### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  UNIT WEIGHT OF SUBMERGED SOIL  
 $G_s$  SPECIFIC GRAVITY OF SOLIDS  
 $e$  VOIDS RATIO  
 $e_o$  INITIAL VOIDS RATIO  
 $e_{max}$   $e$  IN LOOSEST STATE  
 $e_{min}$   $e$  IN DENSEST STATE  
 $D_r$  RELATIVE DENSITY =  $\frac{e_{max} - e}{e_{max} - e_{min}}$   
 $n$  POROSITY  
 $w$  WATER CONTENT  
 $w_L$  LIQUID LIMIT  
 $w_P$  PLASTIC LIMIT  
 $w_S$  SHRINKAGE LIMIT  
 $I_P$  PLASTICITY INDEX =  $w_L - w_P$   
 $I_L$  LIQUIDITY INDEX =  $\frac{w - w_P}{I_P}$   
 $I_c$  CONSISTENCY INDEX =  $\frac{w_L - w}{I_P}$   
 $A_c$  ACTIVITY =  $\frac{I_P \text{ of soil}}{I_P \text{ of } 2\mu m \text{ Soil Fraction}}$   
 $Om$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u (\text{undisturbed})}{S_u (\text{remoulded})}$

##### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  RESIDUAL SHEAR STRENGTH  
 $c$  COHESION INTERCEPT  
 $\sigma_1, \sigma_2, \sigma_3$  NORMAL PRINCIPAL STRESSES  
 $u$  PORE WATER PRESSURE  
 $u_e$  EXCESS  $u$   
 $r_u$  PORE PRESSURE RATIO  
 $q_u$  UNCONFINED COMPRESSIVE STRENGTH  
 $s_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $k_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

##### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  COEFFICIENT OF VISCOSITY  
 $k$  COEFFICIENT OF HYDRAULIC CONDUCTIVITY  
 $k_h$   $k$  IN HORIZONTAL DIRECTION  
 $k_v$   $k$  IN VERTICAL DIRECTION  
 $\alpha_v$  COEFFICIENT OF VOLUME CHANGE  
 $c_v$  COEFFICIENT OF CONSOLIDATION  
 $C_c$  COMPRESSION INDEX  
 $C_r$  RECOMPRESSION INDEX  
 $d$  DRAINAGE PATH DISTANCE  
 $T_v$  TIME FACTOR  
 $U$  DEGREE OF CONSOLIDATION  
 $O_c$  OVERCONSOLIDATION RATIO (OCR)

## FOUNDATION INVESTIGATION REPORT

For

Daoust Creek Bridge  
Township of Bigwood  
3.5 Miles West of Hwy. 69, Township Road  
Site 46-211, District 13, North Bay

INTRODUCTION

This report contains the results of the foundation investigation for the above project. Fieldwork consisted of 3 sampled boreholes and 13 dynamic cone penetration tests advanced during the period September 27, 1977 to October 4, 1977 employing a skid mounted diamond drill.

Locations and elevations of the borings, as well as an inferred subsoil stratigraphy, are shown in Drawing No. 46-211-2 of the Contract Drawings.

SITE DESCRIPTION

The site is located some 3.5 miles west of Hwy. 69 where the Township Road between the first and second Concession of Bigwood Township crosses Daoust Creek.

Clearings in the poplar and spruce forest have been created along this concession road in many places. However, these marginal farms are being abandoned with the fields returning to scrub brush.

Rock ridges running north south outcrop at frequent intervals creating sharp crests in the road. Daoust Creek also flows north south with its path being controlled by the parallel rock ridges. It is generally broad, marshy, and slow flowing with beaver dams creating long narrow interconnecting ponds.

Existing at the crossing is a four span timber structure with an effective opening of 56 feet. It shows considerable deterioration. The deck planking is rotten and has a number of holes where planks have broken. It remains in service due to longitudinal planking placed over the deck in the area of the wheel tracks. The upper portion of the timber piles have deteriorated with piles starting to crush and disintegrate where the bridge timbers rest on them.

The ground slopes up gently to the east of the stream so that the road dips slightly to allow relief flow during periods of high water. To the west a rock ridge, which outcrops for a considerable distance along the creek, creates a much steeper slope.

### SUBSURFACE CONDITIONS

#### General

This area is characterized by shallow overburden with ridges of bedrock outcropping at frequent intervals. At this site a pocket of soil fills a valley in the bedrock. The upper 15 feet of this soil consists of dark grey organic clay. Beneath this is a deposit of soft sensitive grey clay. In most of the area these deposits rest directly on the bedrock. However, in the area of deepest subsoil a layer of 6 to 8 feet of sand and gravel was found overlying the bedrock.

Reference should be made to the Record of Borehole Sheets found in the Appendix of this report which show the boundaries between different soil types and which contain a summary of all field and laboratory tests performed. More detailed descriptions of the soil types encountered are given below.

#### Organic Clay

This deposit has a maximum thickness of about 15 feet. It is soft to very soft and contains a trace of fine gravel in the upper portion. Physical properties of the deposit are listed below.

Undrained Shear Strength	- 200 to 400 psf
Organic Content	- 6%
Moisture Content	- 30% to 142%
Liquid Limit	- 62 to 133
Plastic Limit	- 25 to 40
Unit Weight	- 82 to 88 pcf
Sensitivity	- 4 to 5

#### Clay to Silty Clay

This deposit lies under the organic clay and is a soft sensitive clay to silty clay. The maximum thickness penetrated was 19 feet with the lower portion of the deposit showing an increasing silt content. Physical properties of the deposit are listed below.

Undrained Shear Strength	- 250 to 400 psf
Moisture Content	- 30% to 70%
Liquid Limit	- 29 to 57

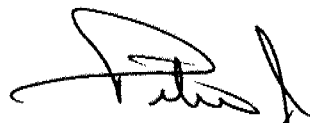
Plastic Limit	- 17 to 21
Unit Weight	- 100 pcf
Sensitivity	- 5 to 22

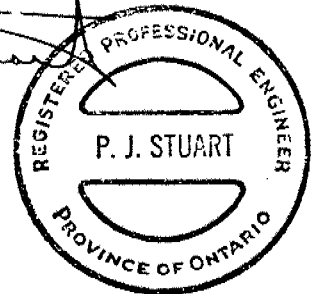
### Bedrock

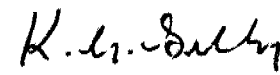
Bedrock at the structure site is a hard granitic gneiss dipping to the east at an angle of 15 degrees.

### Groundwater

Due to the relatively impervious nature of the subsoil, groundwater levels in the boreholes generally did not stabilize during the period of the fieldwork. It may be assumed, however, that the groundwater level is the same as or slightly higher than that of the creek. In any case no dewatering problems should be encountered due to the relatively impervious nature of the subsoil.

  
P. Stuart, P. Eng.  
Project Engineer



  
K.G. Selby, P. Eng.  
Supervising Engineer

## APPENDIX

RECORD OF BOREHOLE No 1

7

W O 77-50165 LOCATION Sta. 11+88 o/s 18' RT. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Washboring N Casing and Cone Test COMPILED BY G.P.  
DATUM Assumed DATE Sept. 27, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
98.5	Ground Level																
0.0	Dark Grey Organic Clay  Soft to Very Soft		1	SS	2	*										Om 6142	
			2	SS	3												
			3	SS	1/	18"	90										
			4	TW	PM												
83.4			5	SS	2												
15.1	End of Borehole Bedrock  * WATER LEVEL NOT ESTABLISHED																

RECORD OF BOREHOLE No 2

W O 77-50165 LOCATION Sta. 11+42 o/s 7' RT. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
99.9	Bridge Deck																
0.0	Water Level																
96.2																	
93.9	Creek Bottom																
6.0	Organic Clay						90										
83.2																	
16.7	Clay to Silty Clay						80										
71.7																	
28.2	End of Cone Test Bedrock																

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 0.5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 3

8

WO 77-50165 LOCATION Sta. 11+33 o/s 7' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
99.8	Bridge Deck															
0.0	Water Level															
96.2																
3.6																
92.8	Creek Bottom															
7.0																
	Organic Clay						90									
83.1																
16.7							80									
	Clay to Silty Clay															
69.3							70									
30.5	End of Cone Test Bedrock															

# RECORD OF BOREHOLE No 4

WO 77-50165 LOCATION Sta. 11+25 o/s 7' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
99.8	Bridge Deck															
0.0	Water Level															
96.2																
3.6																
92.8	Creek Bottom															
7.0																
	Organic Clay						90									
82.9																
16.9							80									
	Clay to Silty Clay															
66.3							70									
33.5	End of Cone Test Bedrock															

# RECORD OF BOREHOLE No 5

9

W O 77-50165 LOCATION Sta. 10+77 o/s 25' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Washboring N Casing and Cone Test COMPILED BY G.P.  
DATUM Assumed DATE September 30, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100 200 300 400 500					
96.5	Ground Level													
0.0	Dark Grey Organic Clay Soft to Very Soft		1	SS	2		90		+ 5.0		o		88	OM 6.37%
			2	SS	2									
			3	TW	PM									
			4	TW	PM									
82.0														
14.5	Grey Clay to Silty Clay Soft		5	TW	PM		80		+ 22		o		98	
			6	TW	PM				+ 4.5		o		100.5	
							70		+ 6					
									+ 10					
62.5			7	SS	1									
34.0	End of Borehole Sand and Gravel						60							
55.0														
41.5	End of Cone Test Bedrock													


# RECORD OF BOREHOLE No 6

W O 77-50165 LOCATION Sta. 10+49 o/s 20' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE Sept. 29, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100 200 300 400 500					
97.9	Ground Level													
0.0	Probable Organic Clay						90							
79.9							80							
18.0	End of Cone Test Bedrock													

## RECORD OF BOREHOLE No 7

10

WO 77-50165 LOCATION Sta. 11+54 o/s 7' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S. 

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
99.9	Bridge Deck												
0.0													
96.2	Water Level												
3.7													
93.9	Creek Bottom												
6.0													
	Organic Clay						90	Under Weight of Hammer					
83.7													
16.2							80						
	Clay to Silty Clay												
75.1								25/9"					
24.8	End of Cone Test Bedrock							Hammer Bouncing					

## RECORD OF BOREHOLE No 8

W O 77-50165 LOCATION Sta. 11+62 o/s 7' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>		
								SHEAR STRENGTH					
								○ UNCONFINED + FIELD VANE					
								● QUICK TRIAXIAL x LAB VANE					
100.0	Bridge Deck												
0.0	Water Level												
96.2													
3.8													
93.0	Creek Bottom												
7.0													
	Organic Clay						90	Under Weight of Hammer					
83.9													
16.1													
	Clay to Silty Clay						80						
77.0													
23.0	End of Cone Test Bedrock							20/0" Hammer Bouncing					

+3, x5: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 9

11

W O 77-50165 LOCATION Sta. 10+24 o/s 10' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
98.5	Ground Level																GR SA SI CL
0.0	Probable Organic Clay																
89.4							90										
9.1	End of Cone Test Bedrock																

# RECORD OF BOREHOLE No 10

W O 77-50165 LOCATION Sta. 10+37 o/s 14' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
98.2	Ground Level																GR SA SI CL
0.0	Probable Organic Clay																
78.7							80										
19.5	End of Cone Test Bedrock																

# RECORD OF BOREHOLE No 11

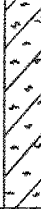


W O 77-50165 LOCATION Sta. 10+56 o/s 17' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
97.2	Ground Level																GR SA SI CL
0.0	Probable Organic Clay																
82.0							80										
15.2	Probable Clay to Silty Clay																
75.5																	
21.7	End of Cone Test Bedrock																

## RECORD OF BOREHOLE No 12





12

WO 77-50165 LOCATION Sta. 10+65 o/s 19' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
96.5	Ground Level													GR SA SI CL
0.0	Probable Organic Clay						90							
82.0														
14.5	Probable Clay to Silty Clay						80							
64.0							70							
32.5	End of Cone Test Bedrock							30/4"	Hammer Bouncing					

## RECORD OF BOREHOLE No 13


WO 77-50165 LOCATION Sta. 10+81 o/s 23' Rt. & Twp Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.






SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
								SHEAR STRENGTH						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
96.3	Ground Level													
0.0	Organic Clay						90							
82.0							80							
14.5	Clay to Silty Clay						70							
62.5							60							
33.8	Sand and Gravel													
55.7														
40.6	End of Cone Test Bedrock							25/1"	Hammer Bouncing					

+3, x5: Numbers refer to 20  
Sensitivity 15 ± 5 (%) STRAIN AT FAILURE  
10

## RECORD OF BOREHOLE No 14

13

WO 77-50165 LOCATION Sta. 10+90 o/s 24' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S. 

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	W <sub>p</sub>	W			W <sub>L</sub>
								WATER CONTENT (%)						
96.2	Ground Level													
0.0	Organic Clay													
82.0														
14.2	Clay to Silty Clay													
62.5														
33.7	Sand and Gravel													
57.7														
38.5	End of Cone Test Bedrock							25/0"						
								Hammer Bouncing						

## RECORD OF BOREHOLE No 15

W O 77-50165 LOCATION Sta. 11+46 o/s 7' Lt. & Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Washboring N Casing COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S. *JP*

[illegible]

+3, x5: Numbers refer to Sensitivity

ENGINEERING MATERIALS OFFICE  
SOIL MECHANICS SECTION

W O 77-50165

DIST 13

HWY Loc.

STR SITE 46-211

Daoust Creek Bridge  
Township of Bigwood

DISTRIBUTION

J.C. McAllister (2)  
W.J. Peck  
S. McCombie  
J.M. Bernhardt (2)

E. Van Beilen  
G.A. Wrong  
B.J. Giroux  
R.S. Pillar

R. Hore

L. Argo )  
J. Anderson ) cover only  
G. Sloan )

Files ✓

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	77-12-15	12/8
TUBES	77-12-15	12/8
ROCK CORES	77-12-15	12/8

FOUNDATION INVESTIGATION REPORT  
For  
Daoust Creek Bridge  
Township of Bigwood  
W.O. 77-50165, Site 46-211  
Local Road, District 13, North Bay

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INTRODUCTION

This report contains the results of the foundation investigation for the above project. Fieldwork consisted of 3 sampled boreholes and 13 dynamic cone penetration tests advanced during the period September 27, 1977 to October 4, 1977 employing a skid mounted diamond drill.

Locations and elevations of the borings, as well as an inferred subsoil stratigraphy, are shown in Drawing No. 7750165-A.

SITE DESCRIPTION

The site is located some 3.5 miles west of Hwy. 69 where the Township Road between the first and second Concession of Bigwood Township crosses Daoust Creek.

Clearings in the poplar and spruce forest have been created along this concession road in many places. However, these marginal farms are being abandoned with the fields returning to scrub brush.

Rock ridges running north south outcrop at frequent intervals creating sharp crests in the road. Daoust Creek also flows north south with its path being controlled by the parallel rock ridges. It is generally broad, marshy, and slow flowing with beaver dams creating long narrow interconnecting ponds.

Existing at the crossing is a four span timber structure with an effective opening of 56 feet. It shows considerable deterioration. The deck planking is rotten and has a number of holes where planks have broken. It remains in service due to longitudinal planking placed over the deck in the area of the wheel tracks. The upper portion of the timber piles have deteriorated with piles starting to crush and disintegrate where the bridge timbers rest on them.



The ground slopes up gently to the east of the stream so that the road dips slightly to allow relief flow during periods of high water. To the west a rock ridge, which outcrops for a considerable distance along the creek, creates a much steeper slope.

## SUBSURFACE CONDITIONS

### General

This area is characterized by shallow overburden with ridges of bedrock outcropping at frequent intervals. At this site a pocket of soil fills a valley in the bedrock. The upper 15 feet of this soil consists of dark grey organic clay. Beneath this is a deposit of soft sensitive grey clay. In most of the area these deposits rest directly on the bedrock. However, in the area of deepest subsoil a layer of 6 to 8 feet of sand and gravel was found overlying the bedrock.

Reference should be made to the Record of Borehole Sheets found in the Appendix of this report which show the boundaries between different soil types and which contain a summary of all field and laboratory tests performed. More detailed descriptions of the soil types encountered are given below.

### Organic Clay

This deposit has a maximum thickness of about 15 feet. It is soft to very soft and contains a trace of fine gravel in the upper portion. Physical properties of the deposit are listed below.

Undrained Shear Strength	- 200 to 400 psf
Organic Content	- 6%
Moisture Content	- 30% to 142%
Liquid Limit	- 62 to 133
Plastic Limit	- 25 to 40
Unit Weight	- 82 to 88 pcf
Sensitivity	- 4 to 5

### Clay to Silty Clay

This deposit lies under the organic clay and is a soft sensitive clay to silty clay. The maximum thickness penetrated was 19 feet with the lower portion of the deposit showing an increasing silt content. Physical properties of the deposit are listed below.

Undrained Shear Strength	- 250 to 400 psf
Moisture Content	- 30% to 70%
Liquid Limit	- 29 to 57

Plastic Limit	- 17 to 21
Unit Weight	- 100 pcf
Sensitivity	- 5 to 22

#### Bedrock

Bedrock at the structure site is a hard granitic gneiss dipping to the east at an angle of 15 degrees.

#### Groundwater

Due to the relatively impervious nature of the subsoil, groundwater levels in the boreholes generally did not stabilize during the period of the fieldwork. It may be assumed, however, that the groundwater level is the same as or slightly higher than that of the creek. In any case no dewatering problems should be encountered due to the relatively impervious nature of the subsoil.

## DISCUSSION AND RECOMMENDATIONS

### Discussion

The soft to very soft nature of the subsoil at this site rules out the possibility of a large grade raise as this would require extensive berms, thereby lengthening the structure and greatly increasing its cost. Similarly, the possibility of a large structural pipe on the present stream alignment is eliminated due to the deep deposit of soft soil.

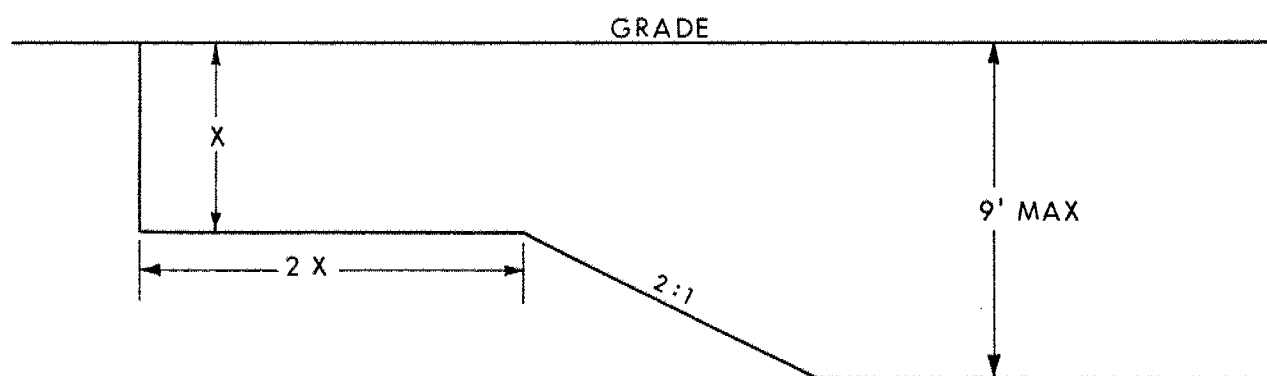
### Recommendations

It is recommended that a new timber tressel structure be built supported on timber piles driven to bedrock with design loads of up to 25 tons per pile.

The proposed new centreline of the stream is shifted to the east of the existing centreline. This will place the west abutment in the present stream channel and the east abutment over the existing east approach which consists of rock fill. No problems should be encountered driving piles in the existing stream bed. However, where piles are to be driven in the area of the existing approaches, all rock fill should be excavated and replaced by compacted granular before the piles are driven. It is estimated that this rock fill may extend to as deep as 10 feet.

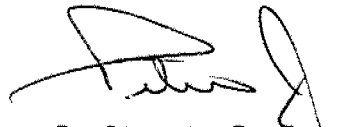
Care should be exercised in driving the timber piles as they approach bedrock as they will split if driven after they contact bedrock.

The grade raise should be limited to 2 feet with hydrologic requirements met through relief flow east of the structure if possible. The suggested profile for the approaches is shown in the figure below.

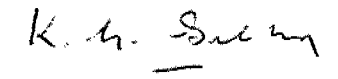


NOTE: X must not exceed 5'

As an alternative a series of small pipes (6 foot diameter) may be considered for this crossing.

  
P. Stuart, P. Eng.  
Project Engineer



  
K.G. Selby, P. Eng.  
Supervising Engineer

KGS/PS/gs  
December, 1977

## APPENDIX

## RECORD OF BOREHOLE No 1

W O 77-50165 LOCATION Sta. 11+88 o/s 18' RT. Ø Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Washboring N Casing and Cone Test COMPILED BY G.P.  
 DATUM Assumed DATE Sept. 27, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
98.5	Ground Level													
0.0	Dark Grey Organic Clay  Soft to Very Soft		1	SS	2	18"	90						Om 6.14%	
			2	SS	3									
			3	SS	1/									
			4	TW	PM									
83.4			5	SS	2									
15.1	End of Borehole Bedrock													
	* WATER LEVEL NOT ESTABLISHED													

## RECORD OF BOREHOLE No 2

W O 77-50165 LOCATION Sta. 11+42 o/s 7' Rt. Ø Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
99.9	Bridge Deck													
0.0	Water Level													
3.7	Creek Bottom													
93.9														
6.0	Organic Clay						90							
83.2														
16.7	Clay to Silty Clay						80							
71.7														
28.2	End of Cone Test Bedrock													

+3, x5 : Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

## RECORD OF BOREHOLE No 3

WO 77-50165 LOCATION Sta. 11+33 o/s 7' Rt. of Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
99.8	Bridge Deck																
0.0																	
96.2	Water Level																
3.6																	
92.8	Creek Bottom																
7.0																	
	Organic Clay						90										
83.1																	
16.7							80										
	Clay to Silty Clay																
69.3							70										
30.5	End of Cone Test Bedrock																

## RECORD OF BOREHOLE No 4

WO 77-50165 LOCATION Sta. 11+25 o/s 7' Rt. of Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
99.8	Bridge Deck																
0.0																	
96.2	Water Level																
3.6																	
92.8	Creek Bottom																
7.0							90										
	Organic Clay																
82.9							80										
16.9																	
	Clay to Silty Clay																
66.3							70										
33.5	End of Cone Test Bedrock																

## RECORD OF BOREHOLE No 5

W O 77-50165 LOCATION Sta. 10+77 o/s 25' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Washboring N Casing and Cone Test COMPILED BY G.P.  
 DATUM Assumed DATE September 30, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100 200 300 400 500					
96.5	Ground Level													
0.0	Dark Grey Organic Clay Soft to Very Soft		1	SS	2									
			2	SS	2									
			3	TW	PM		90		+ 5.0				88	OM 6.37%
			4	TW	PM				+ 4.6				87.5	
82.0														
14.5	Grey Clay to Silty Clay Soft		5	TW	PM		80		+ 2.2				98	
			6	TW	PM				+ 4.5				100.5	
							70		+ 6					
									+ 10					
62.5			7	SS	1									
34.0	End of Borehole Sand and Gravel						60							
55.0														
41.5	End of Cone Test Bedrock													

## RECORD OF BOREHOLE No 6

W O 77-50165 LOCATION Sta. 10+49 o/s 20' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE Sept. 29, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100 200 300 400 500					
97.9	Ground Level													
0.0	Probable Organic Clay													
							90							
79.9														
18.0	End of Cone Test Bedrock						80		25.0"					
									Hammer Bouncing					



## RECORD OF BOREHOLE No 7

WO 77-50165 LOCATION Sta. 11+54 o/s 7' Rt. 0 Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S. *P.J.S.*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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							
								SHEAR STRENGTH							
99.9	Bridge Deck														
0.0															
96.2	Water Level														
3.7															
93.9	Creek Bottom														
6.0															
	Organic Clay						90								
83.7															
16.2							80								
	Clay to Silty Clay														
75.1															
24.8	End of Cone Test Bedrock														

## RECORD OF BOREHOLE No 8

WO 77-50165 LOCATION Sta. 11+62 o/s 7' Rt. 0 Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 3, 1977 CHECKED BY P.J.S. *P.J.S.*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100			W <sub>p</sub>
								SHEAR STRENGTH		WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE							
								● QUICK TRIAXIAL x LAB VANE							
100.0	Bridge Deck														
0.0															
96.2	Water Level														
3.8															
93.0	Creek Bottom														
7.0	Organic Clay						90	Under Weight of Hammer							
83.9															
16.1	Clay to Silty Clay						80								
77.0								20/0"							
23.0	End of Cone Test Bedrock							Hammer Bouncing							

## RECORD OF BOREHOLE No 9

W O 77-50165 LOCATION Sta. 10+24 o/s 10' Rt. 0 Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

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 <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
98.5	Ground Level										
0.0	Probable Organic Clay										
89.4							90	30/1"			
9.1	End of Cone Test Bedrock										

## RECORD OF BOREHOLE No 10

W O 77-50165 LOCATION Sta. 10+37 o/s 14' Rt. 0 Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

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 <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
98.2	Ground Level										
0.0	Probable Organic Clay						90				
78.7							80	25/0"			
19.5	End of Cone Test Bedrock							Hammer Bouncing			

## RECORD OF BOREHOLE No 11

W O 77-50165 LOCATION Sta. 10+56 o/s 17' Rt. 0 Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

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 <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
97.2	Ground Level										
0.0	Probable Organic Clay						90				
82.0											
15.2	Probable Clay to Silty Clay						80				
75.5								25/0"			
21.7	End of Cone Test Bedrock							Hammer Bouncing			

## RECORD OF BOREHOLE No 12

W O 77-50165 LOCATION Sta. 10+65 o/s 19' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W <sub>p</sub>	W	W <sub>L</sub>		
96.5	Ground Level													
0.0	Probable Organic Clay						90							
82.0							80							
14.5	Probable Clay to Silty Clay						70							
64.0														
32.5	End of Cone Test Bedrock													

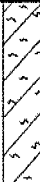
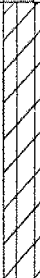


## RECORD OF BOREHOLE No 13

W O 77-50165 LOCATION Sta. 10+81 o/s 23' Rt. & Twp. Rd. ORIGINATED BY P.J.S.  
 DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
 DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W <sub>p</sub>	W	W <sub>L</sub>		
96.3	Ground Level													
0.0	Organic Clay						90							
82.0							80							
14.5	Clay to Silty Clay						70							
62.5							60							
33.8	Sand and Gravel													
55.7														
40.6	End of Cone Test Bedrock													

## RECORD OF BOREHOLE No 14

W O 77-50165 LOCATION Sta. 10+90 o/s 24' Rt. 6 Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Cone Penetration Test COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>			WATER CONTENT (%)
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
96.2	Ground Level													
0.0	Organic Clay						90							
82.0							80							
14.2	Clay to Silty Clay						70							
62.5							60							
33.7	Sand and Gravel						25/0"							
57.7														
38.5	End of Cone Test Bedrock						Hammer Bouncing							

## RECORD OF BOREHOLE No 15

W O 77-50165 LOCATION Sta. 11+46 o/s 7' Lt. of Twp. Rd. ORIGINATED BY P.J.S.  
DIST 13 HWY Local BOREHOLE TYPE Washboring N Casing COMPILED BY G.P.  
DATUM Assumed DATE October 4, 1977 CHECKED BY P.J.S.

[illegible]

+3, x5: Numbers refer to Sensitivity

## EXPLANATION OF TERMS USED IN REPORT

**'N' VALUE:** AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS  $N_c$ .

**DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3):** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

**SOIL QUALITY:** SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

$S_u$ (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

**ROCK QUALITY:** 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 DRILLED IN THAT CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

### ABBREVIATIONS & SYMBOLS

#### LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG.  $\bar{C}U$  = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

#### FIELD SAMPLING

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

#### EARTH PRESSURE TERMS

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  ANGLE OF WALL FRICTION  
 $k_o$  COEFFICIENT OF EARTH PRESSURE AT REST  
 $k_A$  COEFFICIENT OF ACTIVE EARTH PRESSURE  
 $k_P$  COEFFICIENT OF PASSIVE EARTH PRESSURE  
 $i$  ANGLE OF INCLINATION OF SURCHARGE  
 $w$  SLOPE ANGLE-BACKFACE OF WALL  
 $\beta$  ANGLE OF SLOPE  
 $N_q, N_c, N_{\gamma}$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

#### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  UNIT WEIGHT OF SUBMERGED SOIL  
 $G_s$  SPECIFIC GRAVITY OF SOLIDS  
 $e$  VOIDS RATIO  
 $e_o$  INITIAL VOIDS RATIO  
 $e_{max}$   $e$  IN LOOSEST STATE  
 $e_{min}$   $e$  IN DENSEST STATE  
 $D_r$  RELATIVE DENSITY =  $\frac{e_{max} - e}{e_{max} - e_{min}}$   
 $n$  POROSITY  
 $w$  WATER CONTENT  
 $w_L$  LIQUID LIMIT  
 $w_p$  PLASTIC LIMIT  
 $w_s$  SHRINKAGE LIMIT  
 $I_p$  PLASTICITY INDEX =  $w_L - w_p$   
 $I_L$  LIQUIDITY INDEX =  $\frac{w - w_p}{I_p}$   
 $I_c$  CONSISTENCY INDEX =  $\frac{w_L - w}{I_p}$   
 $A_c$  ACTIVITY =  $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu\text{m Soil Fraction}}$   
 $O_m$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

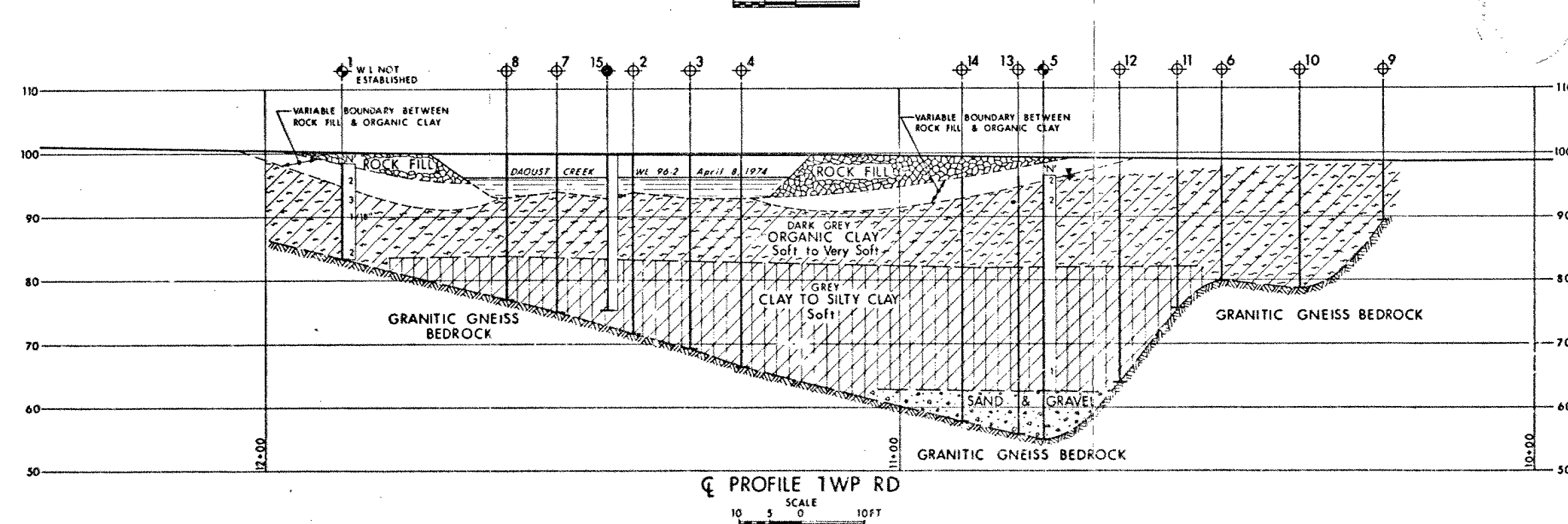
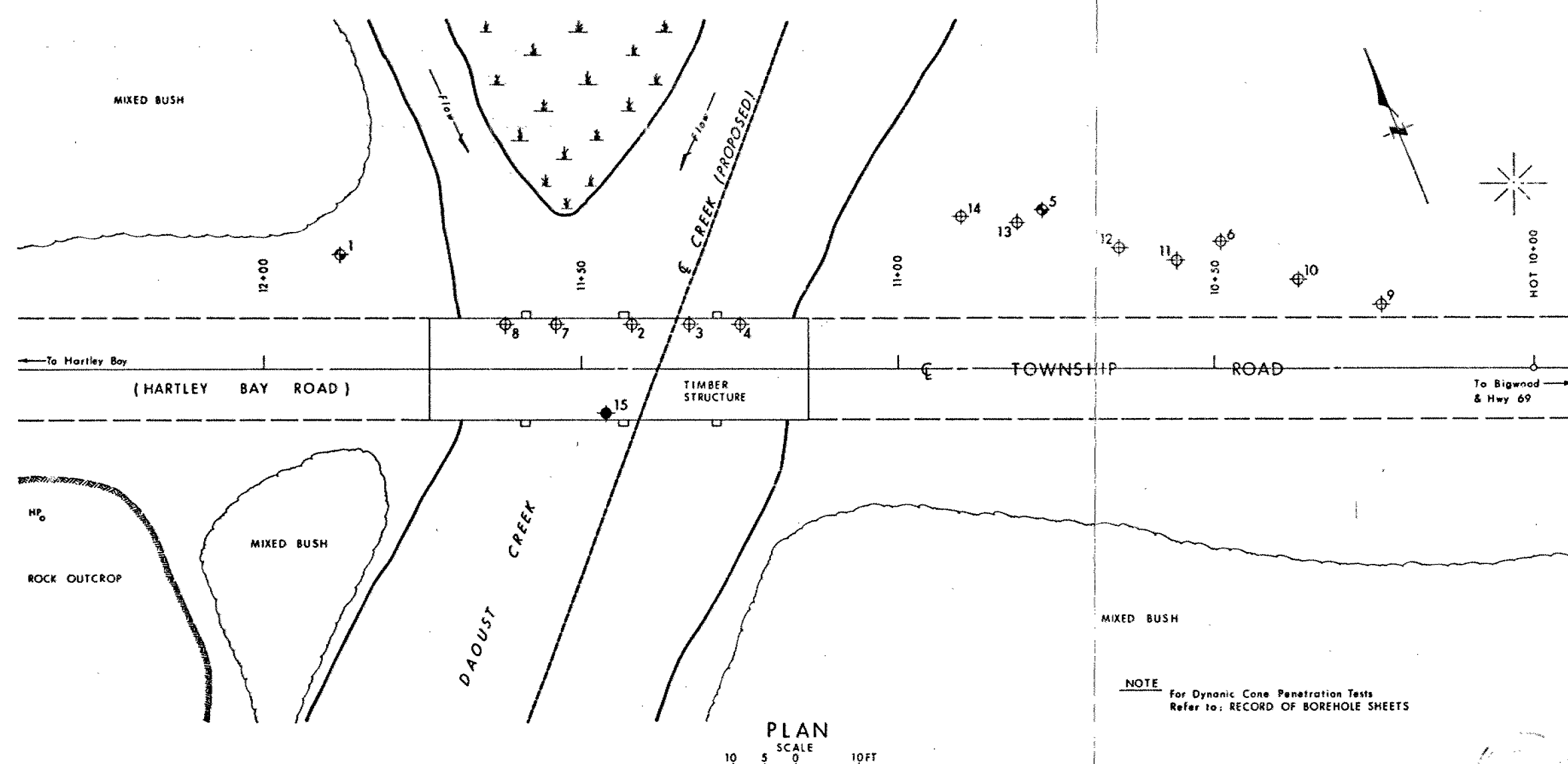
#### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  RESIDUAL SHEAR STRENGTH  
 $c$  COHESION INTERCEPT  
 $\sigma_1, \sigma_2, \sigma_3$  NORMAL PRINCIPAL STRESSES  
 $u$  PORE WATER PRESSURE  
 $u_e$  EXCESS  $u$   
 $r_u$  PORE PRESSURE RATIO  
 $q_u$  UNCONFINED COMPRESSIVE STRENGTH  
 $s_u$  UNDRAINED SHEAR STRENGTH  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  POISSON'S RATIO  
 $E$  MODULUS OF ELASTICITY  
 $G$  MODULUS OF SHEAR DEFORMATION  
 $k_s$  MODULUS OF SUBGRADE REACTION  
 $m, n$  STABILITY COEFFICIENTS  
 $A, B$  PORE PRESSURE COEFFICIENTS

#### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  COEFFICIENT OF VISCOSITY  
 $k$  COEFFICIENT OF HYDRAULIC CONDUCTIVITY  
 $k_h$   $k$  IN HORIZONTAL DIRECTION  
 $k_v$   $k$  IN VERTICAL DIRECTION  
 $m_v$  COEFFICIENT OF VOLUME CHANGE  
 $c_v$  COEFFICIENT OF CONSOLIDATION  
 $C_c$  COMPRESSION INDEX  
 $C_r$  RECOMPRESSION INDEX  
 $d$  DRAINAGE PATH DISTANCE  
 $T_v$  TIME FACTOR  
 $U$  DEGREE OF CONSOLIDATION  
 $O_r$  OVERCONSOLIDATION RATIO (OCR)

**NOTE:** EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

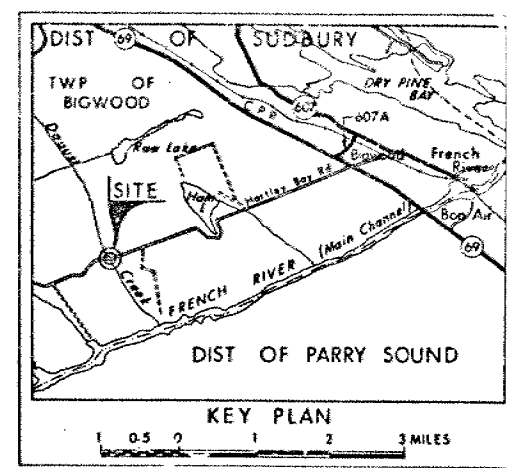


CONT No  
W O No 77-50165

DAOUST CREEK

BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- WL at time of investigation  
Sept & Oct, 1977

No	ELEVATION	STATION	OFFSET
1	98.5	11+88	18' RT
2	99.9	11+42	7' RT
3	99.8	11+34	7' RT
4	99.8	11+25	7' RT
5	96.5	10+77	25' RT
6	97.9	10+49	20' RT
7	99.9	11+54	7' RT
8	100.0	11+62	7' RT
9	98.5	10+24	10' RT
10	98.2	10+37	14' RT
11	97.2	10+56	17' RT
12	96.5	10+65	19' RT
13	96.3	10+81	23' RT
14	96.2	10+90	24' RT
15	99.9	11+46	7' LT

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

REVISIONS	DATE	BY	DESCRIPTION