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DIST. 11 REGION

W.P. No. 132-82-02

CONT. No. 85-53

W. O. No.

STR. SITE No. 44-130

HWY. No. 518

LOCATION Magnetawan River

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 85-53



Ministry of  
Transportation and  
Communications

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Note: For purpose of the contract, this report supersedes all other foundation reports prepared by or for the Ministry in connection with the above-noted project.

# EXPLANATION OF TERMS USED IN REPORT

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**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 (R Q D), 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
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
$E$	kPa	MODULUS OF LINEAR DEFORMATION
$G$	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	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
$C_\alpha$	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
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_f$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

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

For  
Magnetawan River Structure  
Geog. Twp. Proudfoot, Dist. Parry Sound  
Lot 19, Conc. 4  
Sec. Hwy. #518, Line 'A'  
W.P. 132-82-02; Site 44-1253-130  
District #11, Huntsville

### INTRODUCTION

This report contains the results of the foundation investigations carried out at the aforementioned site in two stages: from 83 06 07 to 83 06 16, and from 84 10 15 to 85 10 18. The fieldwork consisted of eight sampled boreholes and four dynamic cone penetration tests. The borings were advanced by continuous flight auger machines mounted on muskeg vehicles equipped with 83 mm (I.D.) hollow stem augers and by conventional diamond drilling equipment adapted for soil sampling purposes, using NX and BX size casings.

### SITE DESCRIPTION

The site is located some 13 km east of Kearny at the crossing of Sec. Hwy. #518, Line 'A' and Magnetawan River. The River, at this area meanders and has changed course in the past. This is evidenced by the visible oxbow lakes. The terrain in the immediate vicinity of the proposed structure is flat, wet and marshy with light bush cover. The river channel is about 19 m wide at El.340 and approx. 2m deep. At the proposed crossing, Magnetawan River flows in a westerly direction.

### SUBSURFACE CONDITIONS

#### General

The subsoil at this location was found to consist of a surficial deposit of sand mixed with organics, followed by a peat zone which is underlain by a deep stratum, consisting of sandy silt to silty sand with traces of clay. It is pointed out, however, that due to the meandering

nature of the river the character and the extent of the surficial deposits may vary at other locations. The boundaries of the different strata encountered at the boring locations together with the obtained field and laboratory test results are shown on the Record of Borehole Sheets contained in the Appendix of this report. The stratigraphical profiles shown on Drawing No. 2 of the contract documents are based on the second investigation. This drawing also shows the locations and elevations of the borings. A description of the different strata encountered is given below.

#### Sand

This stratum was encountered in all the borings but #4 immediately below ground level for a maximum depth of about 1.8 m. The material consists mainly of sand with varying degrees of organic content. The denseness may be described as very loose to loose.

#### Peat

With the exception of B.H. #302 and #304 an organic deposit (peat) was intersected at every boring location either below the ground surface (BH#4) or below the above described sand zone. The maximum thickness encountered is about 6.4 m. Reference should be made to the Record of Borehole Sheets for lower boundary elevations at a particular boring location. The material in the deposit consists mainly of decayed and undecayed organic substances. Sand and organic silt layers were also discovered. The organic content is as high as 45.9%. The natural moisture content ranges from 30% to 280%. The consistency in general is very soft. Almost no resistance was encountered to standard penetration tests.

### ORGANIC SILT

In boreholes No. 302 and 304 an organic silt deposit was encountered below the sand with organics stratum. The thickness ranges from 1.6 m to 2.3 m. In general, the consistency is very soft. The natural moisture content is in excess of 40%.

### Sandy Silt to Silty Sand

This stratum was found to underlie the peat layer at every borehole location. The lower boundary was not determined since the borings were terminated within this deposit at various levels. The maximum depth by sampling is about 30.5 m (El. 310  $\pm$ ) in BH#1. Dynamic cone penetration test advanced from the bottom of borehole #3, penetrated to El. 302, some 38 m below ground level. The material in the deposit consists of sands and silts in varying proportions and also with trace of clay. The results of the grain-size analysis performed on selected samples are plotted in envelope form on Figure #1 of the Appendix. The natural moisture content ranges from 17% to 30%.

Standard penetration tests, carried out within the deposit, gave 'N' values from 3 to 59 blows per 30 cm. Based on these values, the overall deposit may be classified as very loose to very dense.

### Groundwater Conditions

The following groundwater levels were observed during the field investigation:

BH #1	El. 339.5;	0.8 m below ground level
BH #2	El. 339.3;	0.4 m "
BH #3	El. 338.8;	1.3 m "
BH #4	El. 339.5;	0.7 m "
BH #301	El. 339.2;	1.3 m "
BH #302	El. 339.4;	0.9 m "
BH #303	El. 339.5	0.7 m "
BH #304	El. 339.2	1.0 m "

No artesian water conditions were encountered.



*P. Payer*  
 P. Payer, P. Eng.  
 Foundations Engineer

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A P P E N D I X

# RECORD OF BOREHOLE No 1

METRIC

W P 132-82-02 LOCATION Sta. 15 + 807.8 12.0m Lt & Hwy 518 Line 'A' ORIGINATED BY CM  
 DIST 11 HWY 518 BOREHOLE TYPE Washbore; Nx, Bx Casings & Cone Test COMPILED BY PP  
 DATUM Geodetic DATE 83 06 07 to 09 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
340.3	Ground Level											
0.0	Sand and Organics Loose		1	SS	5		340					0 86 12 2
338.9			2	SS	5		338					
1.4	Peat Soft		3	SS	14		336					0 84 15 1
337.7			4	SS	8		334					
2.6			5	SS	7		332					0 48 51 1
	Sandy Silt to Silty Sand trace of clay		6	SS	6		330					
			7	SS	9		328					0 89 (11)
			8	SS	16		326					
	Loose to Very Dense		9	SS	15		324					
			10	SS	9		322					0 78 21 1
			11	SS	12		320					
			12	SS	22		318					0 1 95 4
			13	SS	37		316					
			14	SS	38		314					
			15	SS	44		312					0 68 29 3
			16	SS	59							
	Silt		17	SS	16							
			18	SS	26							
			19	SS	53							
309.8												
30.5	End of Borehole											

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 2

METRIC

W P 132-82-02 LOCATION Sta; 15 + 823.0 13.1 m Lr C Hwy 518 Line 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Cont. Flight Auger (H.S.) and Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 09 and 10 CHECKED BY *SC*

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 (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
339.7	Ground Level												
337.9	Sand traces of organics Very Loose		1	SS	2								
1.8	Peat and Organic Silt with sand		2	SS	5								
			3	SS	4								
			4	SS	3								
	Very Soft to Soft		5	SS	1								
334.8			6	SS	11								
4.9	Sandy Silt to Silty Sand trace of clay		7	SS	9								
			8	SS	14								
	Loose to Compact		9	SS	25								
328.6			10	SS	19								
11.1	End of Borehole												
323.2													
16.5	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 3

METRIC

W P 132-82-02 LOCATION Sta; 15 + 783.2 14.8 m Li Q Hwy 518 LINE 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Cont. Flight Auger, Washboring & Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 14 to 16 CHECKED BY 10

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	SHEAR STRENGTH						
340.1	Ground Level														GR SA SI CL
0.0	Sand traces of silt and clay Very Loose		1	SS	3										0 95 (5)
338.3	Peat Very Soft		2	SS	1	46 cm								Om 3.3%	
335.2			3	SS	2									Om 2.3%	
4.9			4	SS	4										0 60 39 1
			5	SS	12										
	Sandy Silt		6	SS	22										
	to		7	SS	13										
	Silty Sand		8	SS	12										
			9	SS	15										
			10	SS	11										0 84 (11)
			11	SS	13										
	Very Loose		12	SS	13										
	to														
	Dense		13	SS	21										
			14	SS	29										
			15	SS	26										0 22 74 4
			16	SS	35										
312.2			17	SS	12										0 59 40 1
27.9	End of Borehole														
310.1															

OFFICE REPORT ON SOIL EXPLORATION

Cont

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 4										METRIC			
W P 132-82-02		LOCATION Sta: 15 + 766.9 15.5 m Lt G Hwy 518 Line 'A'				ORIGINATED BY CM							
DIST 11 HWY 518		BOREHOLE TYPE Cont. Flight Auger and Cone Test				COMPILED BY PP							
DATUM Geodetic		DATE 83 06 13				CHECKED BY							
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					
340.2	Ground Level												
0.0	Peat and Organic Silt  Occasional Sand Layers  Very Soft		1	SS	3								
			2	SS	2								
			3	SS	1	46 cm							
			4	SS	1	46 cm							
			5	SS	1	46 cm							
			6	SS	1	45 cm							
			7	SS	2	15 cm							
333.8	Sandy Silt to Silty Sand  Occasional Silt Layers trace of clay  Loose to Dense		8	SS	1	15 cm							
6.4			9	SS	33								
328.8			10	SS	10								
11.4	End of Borehole												
319.5													
20.7	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 301										METRIC				
W P 132-82-02		LOCATION Sta. 15 + 776.0; 4.1 m RT C Hwy. 518 Line 'A'		ORIGINATED BY BR										
DIST 11 HWY 518		BOREHOLE TYPE Hollow Stem, Washboring, Dynamic Cone		COMPILED BY BR										
DATUM Geodetic		DATE 84 10 15 & 84 10 16		CHECKED BY										
ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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
			NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%) 20 40 60					
340.5	Ground Level													
0.0	Sand some silt traces of organics Very Loose		1	SS	1		340						0m 1.3%	
339.0			2	SS	2								0m 3%	
1.5	Peat and Organic Silt Very Soft to Stiff		3	SS	2		338						0m 1.4%	
337.0			4	SS	11								0m 0.1%	
3.5			5	SS	10		336							0 72 27 1
	Sandy Silt to Silty Sand trace of clay		6	SS	3		334							
			7	SS	2		332							
	Very Loose to Compact		8	SS	3		330							0 54 45 1
			9	SS	5		328							
			10	SS	26		326							0 5 93 2
	Silt		11	SS	11		324							
			12	SS	5		322							
			13	SS	12		320							
315.2							318							
25.3	End of Borehole Start Cone Test						316							17 62 (21)
310.3							314							
30.2							312							

OFFICE REPORT ON SOIL EXPLORATION

Cont

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 301 Cont										METRIC			
W P 132-82-02		LOCATION Sta. 15 + 776.0; 4.1 m RTG Hwy. 518 Line 'A'				ORIGINATED BY BR							
DIST 11 HWY 518		BOREHOLE TYPE Hollow Stem, Washboring, Dynamic Cone				COMPILED BY BR							
DATUM Geodetic		DATE 84 10 15 & 84 10 16				CHECKED BY <i>[Signature]</i>							
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					
310.3													GR SA SI CL
30.2													
303.6													
36.9	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 302

METRIC

W P 132-82-02 LOCATION Sta. 15 + 776.0; 3.6 m LT Q Hwy. 518 Line 'A' ORIGINATED BY BR  
 DIST 11 HWY 518 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BR  
 DATUM Geodetic DATE 84 10 17 CHECKED BY BR

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					
340.3	Ground Level															
0.0	Sand with Organics Very Loose		1	SS	3											0 85 14 1
338.8			2	SS	2											
1.5	Organic Silt Very Soft		3	SS	11											
336.5			4	SS	3											
3.8			5	SS	8											Om 1.4%
	Sandy Silt to Silty Sand trace of clay		6	SS	18											Om 0.2%
	Very Loose to Compact		7	SS	11											Om 0.1%
332.2			8	SS	9											Om 0.4%
8.1	End of Borehole															0 44 55 1

OFFICE REPORT ON SOIL EXPLORATION

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 303										METRIC			
W P 132-82-02		LOCATION Sta. 15 + 805.0; 3.2 m RT Q Hwy. 518 Line 'A'				ORIGINATED BY BR							
DIST 11 HWY 518		BOREHOLE TYPE Hollow Stem Auger				COMPILED BY BR							
DATUM Geodetic		DATE 84 10 17 & 84 10 18				CHECKED BY <i>10</i>							
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					
340.2	Ground Level												
0.0	Sand with Organics Loose		1	SS	6								
338.7			2	SS	2								
1.5	Peat and Organic Silt Soft to Stiff		3	SS	6								
			4	SS	11								
336.4			5	SS	3								
3.8			6	SS	3								
	Sandy Silt to Silty Sand		7	SS	3								
			8	SS	3								
	Very Loose to Compact		9	SS	7								
			10	SS	15								
	Silt		11	SS	10								
321.4	End of Borehole												
321.0	Start Cone Test												
19.2													
317.0	End of Cone Test												
23.2													

RECORD OF BOREHOLE No 304										METRIC		
W P 132-82-02		LOCATION Sta. 15 + 806.0; 3.4 m LT Q Hwy. 518 Line 'A'		ORIGINATED BY BR								
DIST 11 HWY 518		BOREHOLE TYPE Hollow Stem Auger		COMPILED BY BR								
DATUM Geodetic		DATE 84 10 18		CHECKED BY								
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					
340.2	Ground Level											
0.0	Sand with Organics Very Loose		1	SS	4						0m	
339.0											1.5%	
1.2	Sand and Organic Silt Very Loose		2	SS	2						0m	
337.4											0.5%	
2.8	Sandy Silt to Silty Sand trace of clay Very Loose to Compact		4	SS	8						0m	
			5	SS	12						0.3%	
335.2			6	SS	3						0.1%	
5.0	End of Borehole											0 67 32 1

OFFICE REPORT ON SOIL EXPLORATION



ENGINEERING MATERIALS OFFICE  
PAVEMENT & FOUNDATION DESIGN SECTION

WP 132-82-01

DIST 11

HWY 518

STR SITE 44-130

Magnetawan River Structure

DISTRIBUTION

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D.J. Armatage (2)  
K. Bassi  
B.J. Giroux  
R. Hore  
L. Argo (cover only)  
T.J. Kovich (cover only)  
Files

*4 additional Boreholes  
to be added*

FOUNDATION INVESTIGATION REPORT  
For  
Magnetawan River Structure  
Geog. Twp. Proudfoot, Dist. Parry Sound  
Lot 19, Conc. 4  
Sec. Hwy. #518, Line 'A'  
W.P. 132-82-01; Site 44-130  
District #11, Huntsville

INTRODUCTION:

This report contains the results of a foundation investigation carried out at the aforementioned site during the period of 83 06 07 and 83 06 16. The fieldwork consisted of four sampled and four dynamic cone penetration tests adjacent to each borings. The borings were advanced by a continuous flight auger machine mounted on a muskeg vehicle equipped with 83 mm (I.D.) hollow stem augers and by conventional diamond drilling equipment adapted for soil sampling purposes, using NX and BX size casings.

SITE DESCRIPTION

The site is located some 13 km east of Kearny at the crossing of Sec. Hwy. #518, Line 'A' and Magnetawan River. The river, at this area meanders and has changed course in the past. This is evidenced by the visible oxbow lakes. The terrain in the immediate vicinity of the proposed structure is flat, wet and marshy with light bush cover. The river channel is about 19 m wide at El.340 and approx. 2 m deep. At the proposed crossing, Magnetawan River flows in a westerly direction.

SUBSURFACE CONDITIONS

General

The subsoil at this location was found to consist of a surficial deposit of sand mixed with organics, followed by a peat zone which is underlain by a deep stratum, consisting of sandy silt to silty sand with traces of clay. It is pointed out, however, that due to the meandering nature of the river the character and the extent of the surficial deposits may vary at other locations. The boundaries of the different strata encountered at the boring locations together with the obtained field and laboratory test results are shown on the Record of Borehole Sheets contained in the Appendix of this report. A stratigraphical profile is shown on Drawing No. 1328201-A. This drawing also shows the locations and elevations of the borings. A description of the different strata encountered is given below.

### Sand

This stratum was encountered in Boreholes #1, #2 and #3 immediately below ground level for a maximum distance of about 1.8 m. The material consists mainly of sand with varying degrees of organic content. The denseness may be described as very loose to loose.

### Peat

An organic deposit (peat) was intersected at every boring location either below the ground surface (BH#4) or below the above described sand zone. The maximum thickness encountered is about 6.4 m. Reference should be made to the Record of Borehole Sheets for lower boundary elevations at a particular boring location. The material in the deposit consists mainly of decayed and undecayed organic substances. Sand and organic silt layers were also discovered. The organic content is as high as 45.9%. The natural moisture content ranges from 30% to 280%. The consistency in general is very soft. Almost no resistance was encountered to standard penetration tests.

### Sandy Silt to Silty Sand

This stratum was found to underlie the peat layer at every borehole location. The lower boundary was not determined since the borings were terminated within this deposit at various levels. The maximum depth by sampling is about 30.5 m (El. 310±) in BH#1. Dynamic cone penetration test advanced from the bottom of a sampled borehole (BH#3), penetrated to El. 302, some 38 m below ground level. The material in the deposit consists of sands and silts in varying proportions and also with trace of clay. The results of the grain-size analyses performed on selected samples are plotted in envelope form on Figure #1 of the Appendix. The natural moisture content ranges from 17% to 25%.

Standard penetration tests, carried out within the deposit, gave 'N' values from 4 to 59 blows per 30 cm. Based on these values, the overall deposit may be classified as very loose to very dense.

### Groundwater Conditions

The following groundwater levels were observed during the field investigation:

BH #1	El. 339.5;	0.8 m below ground level
BH #2	El. 339.3;	0.4 m below ground level
BH #3	El. 338.8;	1.3 m below ground level
BH #4	El. 339.5;	0.7 m below ground level

No artesian water conditions were encountered.

## DISCUSSION AND RECOMMENDATIONS

### General

It is proposed to realign Sec. Hwy. #518 at this location. In order to cross the Magnetawan River with the new alignment a structure will be required. At the present time, two types of structures are being considered by the regional structural section:

- a) Single span beam type structure with grade in the order of El. 343.5 at Sta. 15+813.5
- b) Multi span composite timber/concrete deck with grade in the order of El. 342.5 at Sta. 15+813.5

The original ground is at El. 340±, while the river bed is at El. 338±.

### Structure Foundations

In view of the encountered subsoil conditions, it is recommended that the future structure (Scheme [a] or [b]) be founded on steel 'H' piles driven some 30 m in the original ground. For HP 310 x 79 steel 'H' piles, a design load of 625 kN is recommended. For the purposes of the O.H.B.D.C., the following design values are recommended:

Factored capacity at U.L.S.	875 kN
Capacity at S.L.S. Type II	625 kN

The piles should be driven in accordance with MTC standards SS 103-10 or SS 103-11. The driving energy of the hammer should not be less than 40,000 kJ/blow. An ultimate capacity of 1875 kN is required.

Earth pressure should be computed as per subsection 6.6.1.2.2 of the Code. For the granular backfill, a non-yielding foundation condition should be assumed, in which case a value of  $K_0=0.43$  is recommended.

The pile caps should have a minimum of 1.8 m earth cover for frost protection requirements.

The pile caps should be formed 'in the dry'. Therefore, a dewatering scheme will be required if the pile caps are formed below the prevailing groundwater level.



### Approach Embankments

The borings have indicated the presence of up to 6.4 m thick of very soft organic deposit. It is recommended that this deposit be removed to its full vertical and horizontal extent within the construction area for a minimum distance of about 16 m beyond the abutments. The exact dimensions (vertical and horizontal) of the organic material along the remainder of the proposed embankment will be determined by the Regional Geotechnical Section, and a specific treatment specified by them.

The sub-excavated area should be backfilled with non-cohesive material. Non-cohesive material should also be used for a minimum height of 1 m above the observed high water level for the approach embankments.

The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles may have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 75 mm. The embankments should be constructed with 2:1 forward and side slopes if earth fill is used, and 1-1/4:1 slopes for rockfill.

The encountered subsoil is highly scourable. It is therefore recommended that the river bed be provided with rip-rap for a minimum distance of 50 m upstream and about 25 m downstream. The existing river banks and the future approaches should be protected against erosion by rip-rap for a minimum distance of 1 m over the high water level.

### MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of Mr. C. McLorg, Student Specialist Engineering. The equipment used was owned and operated by Atcost Soil Drilling Inc. This report was written by Mr. P. Payer and reviewed by Mr. K. G. Selby.



*P. Payer*

P. Payer, P. Eng.  
Foundations Engineer

*K. G. Selby*

K. G. Selby, P. Eng.  
Senior Foundations Engineer

A P P E N D I X



Ministry of  
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# RECORD OF BOREHOLE No 1

METRIC

W P 132-82-01 LOCATION Sta. 15 + 814.4 1.8 m Rt Sec. Hwy. 518 Line 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Washbore; Nx, Bx Casings & Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 07 to 09 CHECKED BY 10

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 (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
340.3	Ground Level										
0.0	Sand and Organics		1	SS	5						0 86 12 2
338.9	Loose		2	SS	5						
1.4	Peat										
337.7	Soft		3	SS	14						
2.6	Sandy Silt		4	SS	8						0 84 15 1
	to		5	SS	7						
	Silty Sand		6	SS	6						
	trace of clay		7	SS	9						0 48 51 1
			8	SS	16						
			9	SS	15						
	Loose		10	SS	9						0 89 (11)
	to		11	SS	12						
	Very Dense		12	SS	22						
			13	SS	37						0 78 21 1
			14	SS	38						
			15	SS	44						
			16	SS	59						0 1 95 4
	Silt		17	SS	16						
			18	SS	26						
			19	SS	53						0 68 29 3
309.8											
30.5	End of Borehole										

+3, x5: Numbers refer to  
Sensitivity

20  
15 ÷ 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 2

METRIC

W P 132-82-01 LOCATION Sta; 15 + 829.6 Q Sec. Hwy. 518 Line 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Cont. Flight Auger (H.S.) and Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 09 and 10 CHECKED BY *PP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				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	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>		
339.7	Ground Level												
0.0	Sand traces of organics Very Loose		1	SS	2								
337.9			2	SS	5		338					0m 1.3%	
1.8	Peat and Organic Silt with sand		3	SS	4							0m 8.8%	
	Very Soft to Soft		4	SS	3		336					0m 4.7%	
334.8			5	SS	1							0m 1.9%	
4.9	Sandy Silt to Silty Sand trace of clay		6	SS	11		334						
	Loose to Compact		7	SS	9								
			8	SS	14		332						0 94 (6)
			9	SS	25		330						
328.6	End of Borehole		10	SS	19								0 96 (4)
11.1							328						
							326						
							324						
323.2	End of Cone Test												
16.5													

OFFICE REPORT ON SOIL EXPLORATION



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# RECORD OF BOREHOLE No 3

METRIC

W P 132-82-01 LOCATION Sta; 15 + 789.7 G Sec. Hwy. 518 Line 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Cont. Flight Auger, Washboring & Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 14 to 16 CHECKED BY 10

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 (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES							
340.1	Ground Level											
0.0	Sand traces of silt and clay Very Loose		1	SS	3							0 95 (5)
338.3			2	SS	1						Om 3.3%	
1.8			3	SS	2						Om 2.3%	
335.2			4	SS	4							0 60 39 1
4.9			5	SS	12							
			6	SS	22							
			7	SS	13							
			8	SS	12							
			9	SS	15							
			10	SS	11							0 84 (11)
			11	SS	13							
			12	SS	13							
			13	SS	21							
			14	SS	29							
			15	SS	26							0 22 74 4
			16	SS	35							
312.2			17	SS	12							0 59 40 1
27.9	End of Borehole											
310.1												
30.0												

Cont

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



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# RECORD OF BOREHOLE No 3 Cont

METRIC

W P 132-82-01 LOCATION Sta; 15 + 789.7 @ Sec. Hwy. 518 Line 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Cont. Flight Auger, Washboring & Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 14 to 16 CHECKED BY LL

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>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
310.1	Cont'd											
30.0												
302.0												
38.1	End of Cone Test											

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

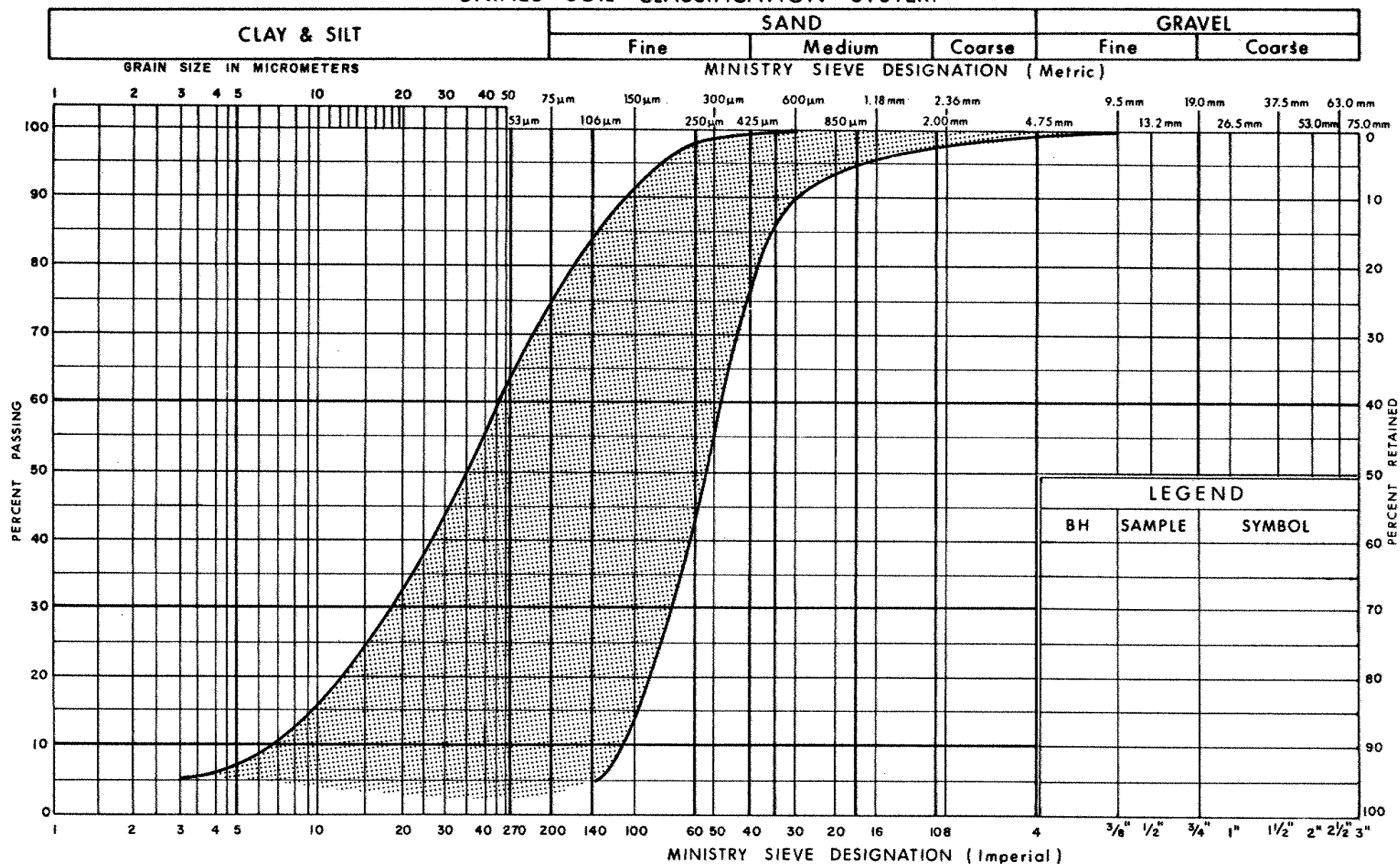
## METRIC

W P 132-82-01 LOCATION Sta: 15 + 773.4 C Sec. Hwy. 528 Line 'A' ORIGINATED BY CM  
DIST 11 HWY 518 BOREHOLE TYPE Cont. Flight Auger and Cone Test COMPILED BY PP  
DATUM Geodetic DATE 83 06 13 CHECKED BY [Signature]

[illegible]

+3, x5; Numbers refer to Sensitivity

## UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION  
SANDY SILT TO SILTY SAND

FIG No 1

W P 132-82-01



## 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

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

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{v0}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_f$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	kN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	kN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	kN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

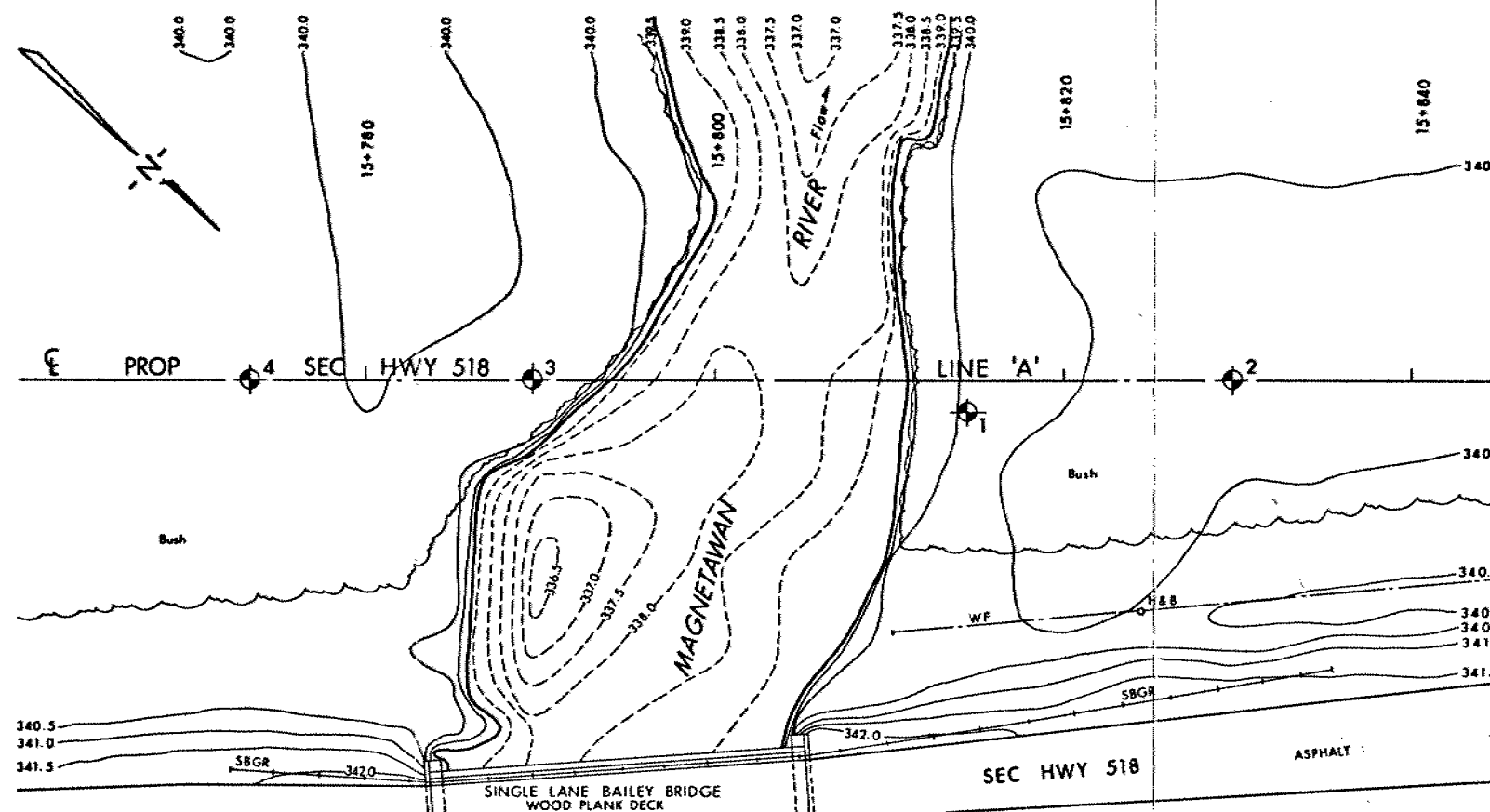
**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN IN STRAIGHT  
IN KILOMETRES + METRES

CONT No  
WP No 132-82-01

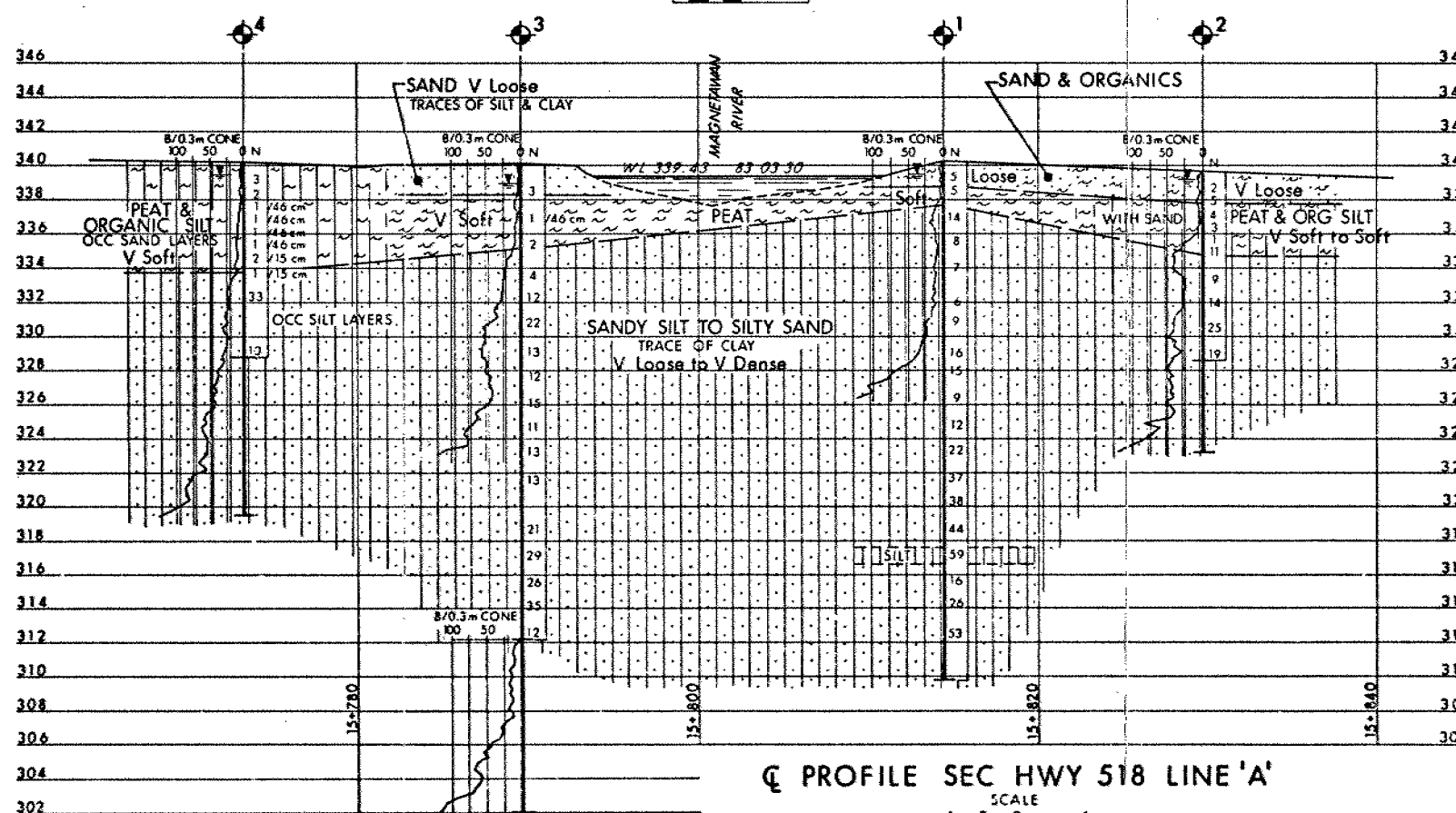
MAGNETAWAN RIVER

BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PLAN  
SCALE  
4m 2 0 4m



PROFILE SEC HWY 518 LINE 'A'

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 83 06

No	ELEVATION	STATION	OFFSET
1	340.3	15+814.4	1.8 m RT
2	339.7	15+829.6	€
3	340.1	15+789.7	€
4	340.2	15+773.4	€

NOTE

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the 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.

DATE	BY	DESCRIPTION
83 09 22	PP	CHECKED
83 09 22	SO	CHECKED
83 09 22	PP	DATE
83 09 22	SO	DATE

Geocres No 31E-96

HWY No	SEC 518 LINE 'A'	DIST	11
STANDARD PP	CHECKED	DATE	83 09 22
DRAWN SO	CHECKED	DATE	83 09 22
DATE	83 09 22	SITE	44-130
DATE	83 09 22	DWG	1328201-A

REF NO E-9020-1 83 05



## METRIC

**DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN**

DIST. NO 11 HWY. 518

CONT No  
WP No 132-82-02

MAGNETAWAN RIVER BRIDGE  
FOOTINGS

**SHEET**

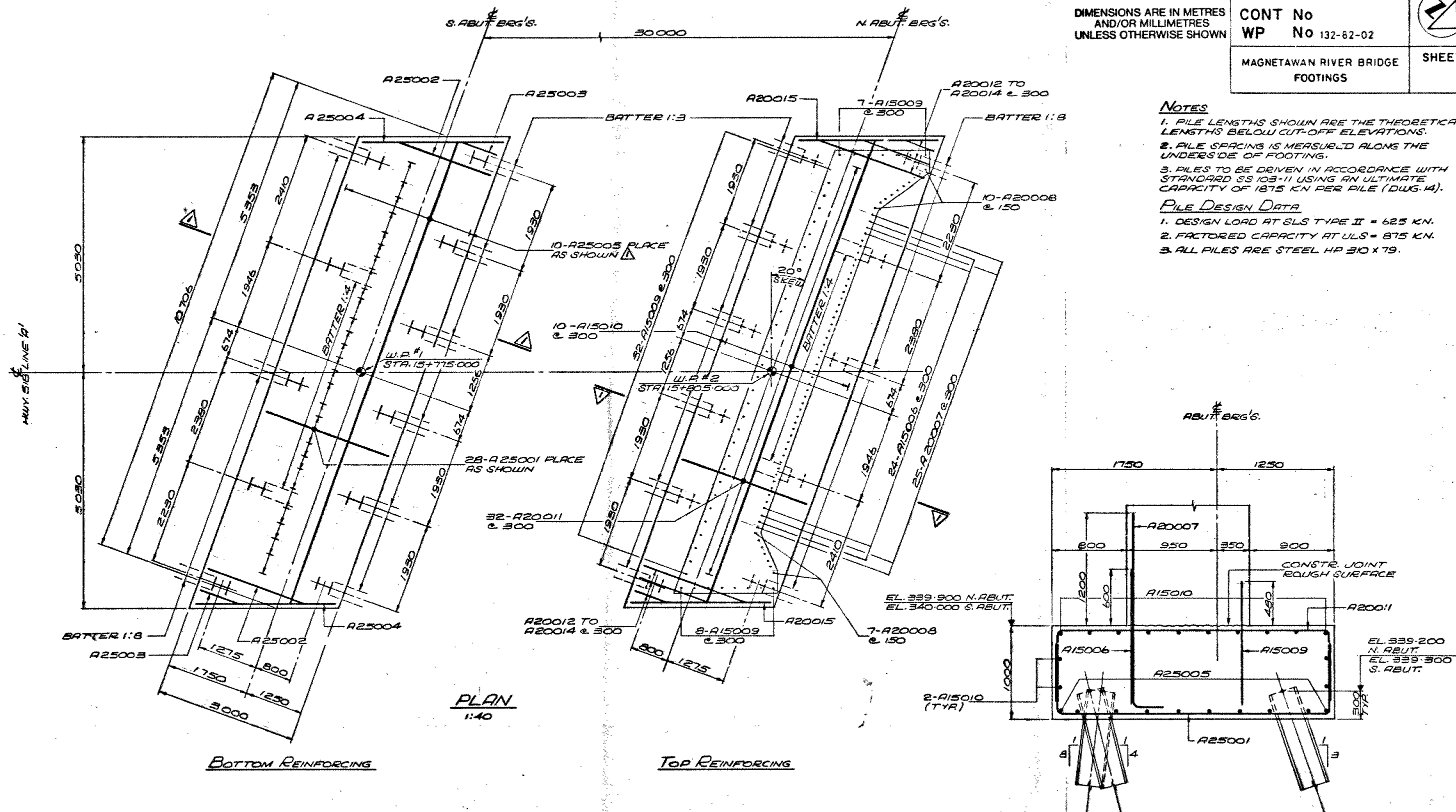


NOTES

- NOTES**
1. PILE LENGTHS SHOWN ARE THE THEORETICAL LENGTHS BELOW CUT-OFF ELEVATIONS.
  2. PILE SPACING IS MEASURED ALONG THE UNDERSIDE OF FOOTING.
  3. PILES TO BE DRIVEN IN ACCORDANCE WITH STANDARD SS 103-11 USING AN ULTIMATE CAPACITY OF 1875 KN PER PILE (DWG. 14).

### PILE DESIGN DATA

1. DESIGN LOAD AT SLS TYPE II = 625 KN.
2. FACTORED CAPACITY AT ULS = 875 KN.
3. ALL PILES ARE STEEL HP 310 x 79.



PILE DATA				
LOCATION	ROW	BATTER	QUANTITY	LENGTH
SOUTH ABUT.	FRONT	3:1	6	30.750
	BACK	4:1	2	30.000
		8:1	3	29.500
NORTH ABUT.	FRONT	3:1	6	30.750
	BACK	4:1	2	30.000
		8:1	3	29.250

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

[illegible]



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Transportation and  
Communications  
Ontario

# RECORD OF BOREHOLE No 304

METRIC

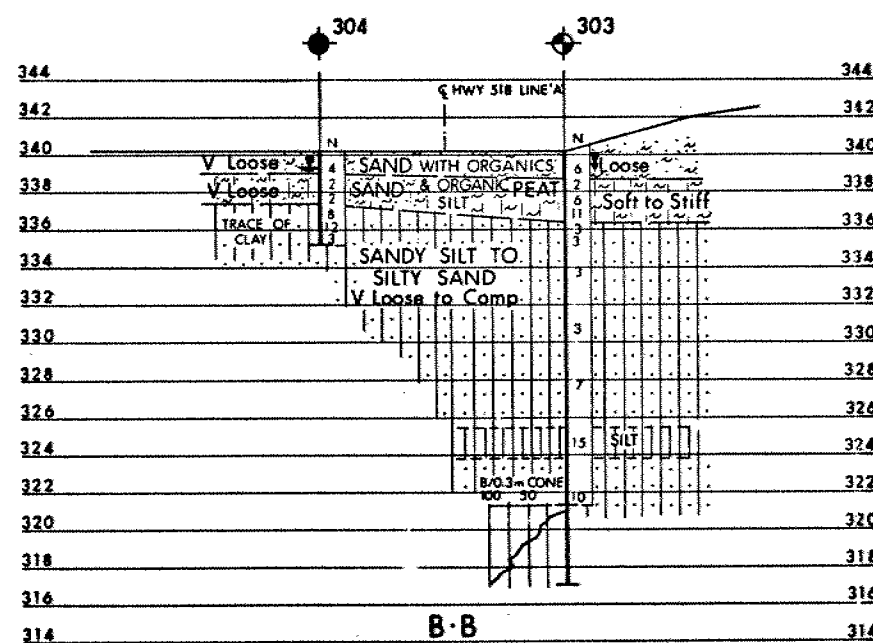
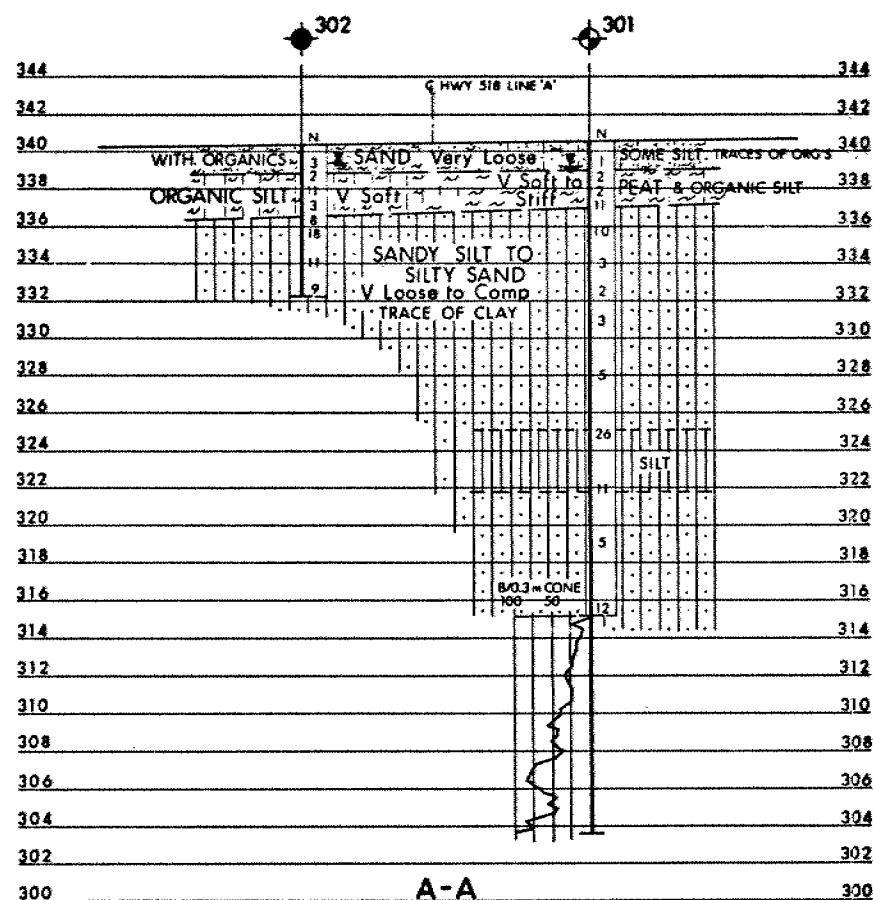
W P 132-82-02 LOCATION Sta. 15 + 806.0; 3.4 m LT Q Hwy. 518 Line 'A' ORIGINATED BY BR  
DIST 11 HWY 518 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BR  
DATUM Geodetic DATE 84 10 18 CHECKED BY [Signature]

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					
340.2	Ground Level															
0.0	Sand with Organics		1	SS	4										On	
339.0	Very Loose		2	SS	2										1.5%	
1.2	Sand and Organic Silt		3	SS	2										On	
337.4	Very Loose		4	SS	8										0.5%	
2.8	Sandy Silt to Silty Sand		5	SS	12										On	
	trace of clay		6	SS	3										0.3%	
335.2	Very Loose														On	
	to Compact														0.1%	
5.0	End of Borehole															0 67 32 1

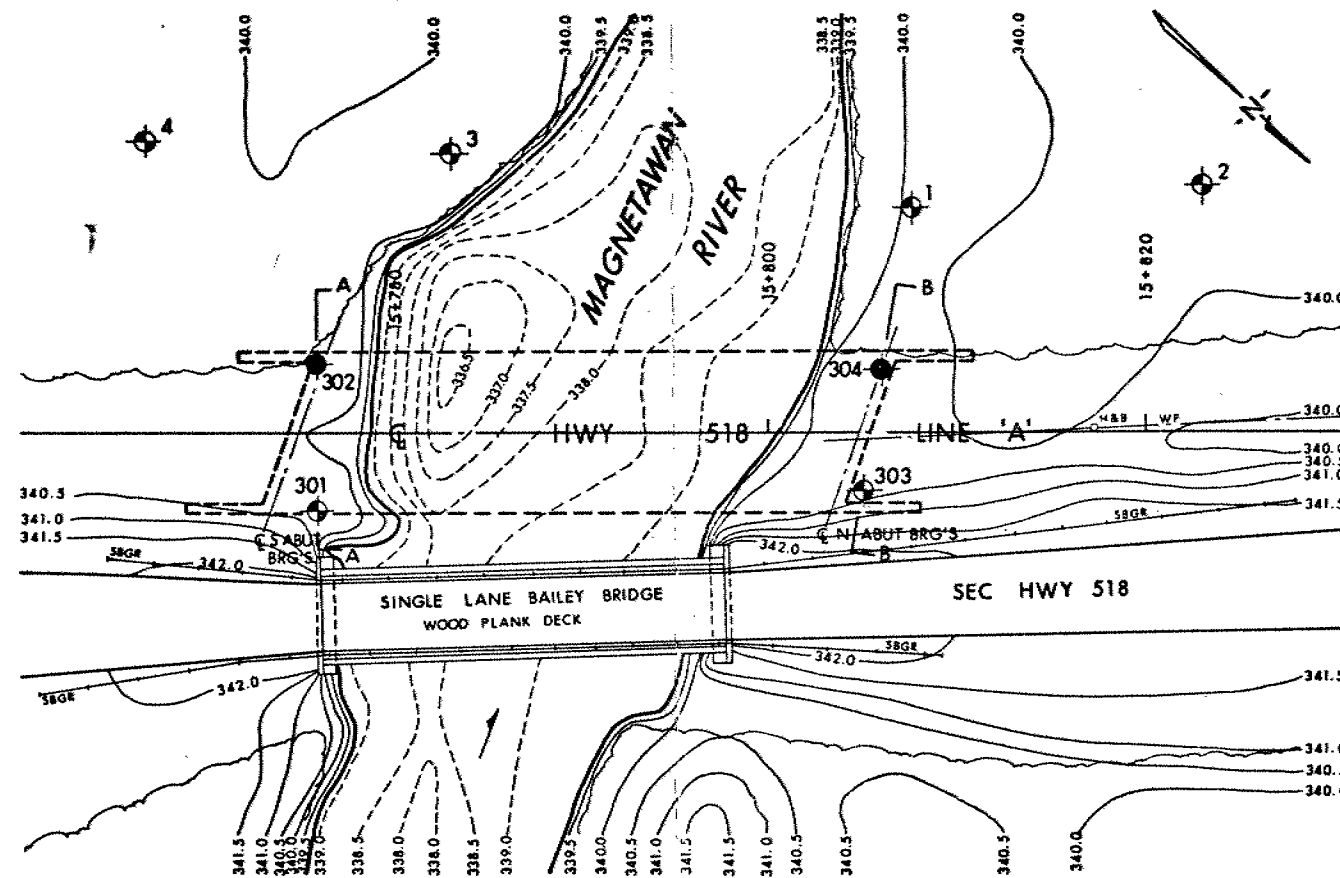
OFFICE REPORT ON SOIL EXPLORATION

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

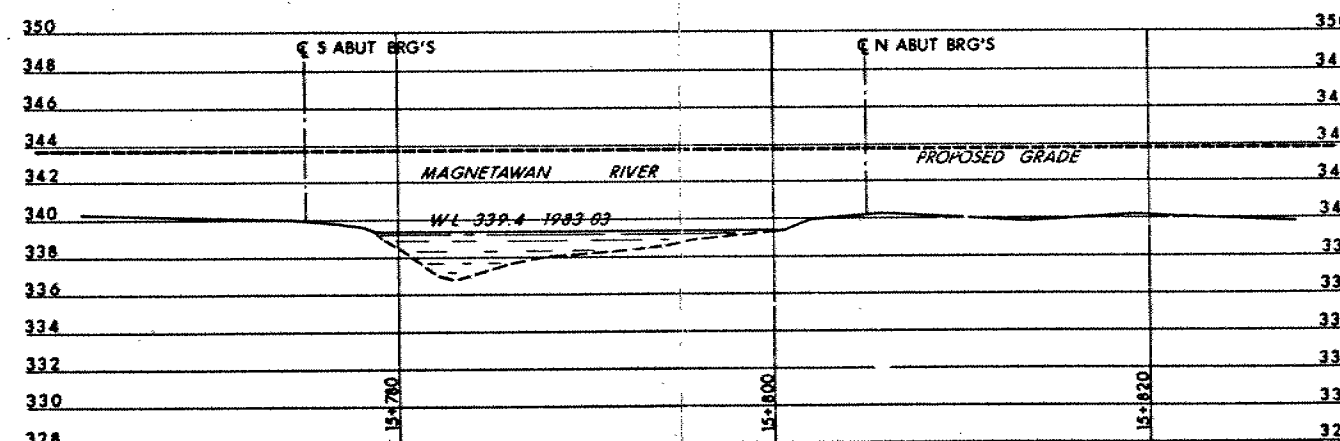
20  
15  
10  
5 (%) STRAIN AT FAILURE



SECTIONS  
SCALE  
4m 2 0 4m Vert  
2m 1 0 2m Hor



PLAN  
SCALE  
4m 2 0 4m



PROFILE HWY 518 LINE 'A'  
SCALE  
4m 2 0 4m

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

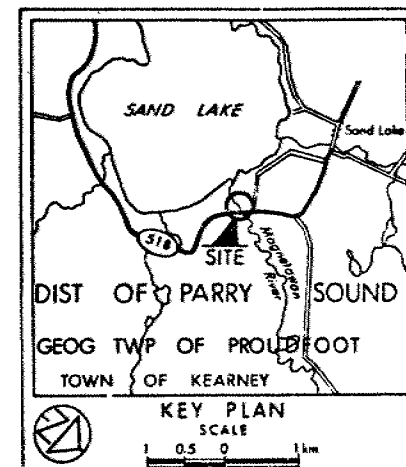
CONT No  
WP No 132-82-02

MAGNETAWAN RIVER

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



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 84-10

No	ELEVATION	STATION	OFFSET
301	340.5	15+776.0	4.1 m RT
302	340.3	15+776.0	3.6 m LT
303	340.2	15+805.0	3.2 m RT
304	340.2	15+806.0	3.4 m LT
1	340.3	15+807.8	12.0 m LT
2	339.7	15+823.0	13.1 m LT
3	340.1	15+783.2	14.8 m LT
4	340.2	15+766.9	15.5 m LT

FOR INFORMATION  
ONLY SEE RECORD  
OF BOREHOLE  
FOR SOIL  
DESCRIPTION

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.

DATE	BY	DESCRIPTION
84-12-04	DATE	84-12-04
84-12-04	DATE	84-12-04
84-12-04	DATE	84-12-04

# RECORD OF BOREHOLE No 301

METRIC

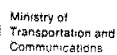
W P 132-82-02 LOCATION Sta. 15 + 776.0; 4.1 m RT & Hwy. 518 Line 'A' ORIGINATED BY BR  
DIST 11 HWY 518 BOREHOLE TYPE Hollow Stem, Washboring, Dynamic Cone COMPILED BY BR  
DATUM Geodetic DATE 84 10 15 & 84 10 16 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
340.5	Ground Level													
0.0	Sand some silt traces of organics Very Loose		1	SS	1		340							
339.0			2	SS	2									
1.5	Peat and Organic Silt Very Soft to Stiff		3	SS	2		338							
337.0			4	SS	11									
3.5			5	SS	10		336							
	Sandy Silt to Silty Sand trace of clay		6	SS	3		334							
			7	SS	2									
	Very Loose to Compact		8	SS	3		332							
			9	SS	5		330							
			10	SS	26		328							
	Silt		11	SS	11		326							
			12	SS	5		324							
			13	SS	12		322							
315.2							320							
25.3	End of Borehole Start Cone Test						318							
310.3							316							
30.2							314							
							312							

Cont

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

20  
15 5 (%) STRAIN AT FAILURE  
10



## METRIC

W P 132-82-02 LOCATION Sta. 15 + 776.0; 4.1 m RTG Hwy. 518 Line 'A' ORIGINATED BY BR  
DIST 11 HWY 518 BOREHOLE TYPE Hollow Stem, Washboring, Dynamic Cone COMPILED BY BR  
DATUM Geodetic DATE 84 10 15 & 84 10 16 CHECKED BY 10

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					
310.3							310						GR SA SI CL
30.2							308						
							306						
303.6							304						
36.9	End of Cone Test												

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

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 302

METRIC

W P 132-82-02 LOCATION Sta. 15 + 776.0; 3.6 m LT & Hwy. 518 Line 'A' ORIGINATED BY BR  
DIST 11 HWY 518 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BR  
DATUM Geodetic DATE 84 10 17 CHECKED BY *BR*

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		
340.3	Ground Level													
0.0	Sand with Organics		1	SS	3		340							0 85 14 1
338.8	Very Loose		2	SS	2									
1.5	Organic Silt		3	SS	11		338							
336.5	Very Soft		4	SS	3									
3.8			5	SS	8		336							Om 1.4%
	Sandy Silt to Silty Sand		6	SS	18									Om 0.2%
	trace of clay													Om 0.1%
	Very Loose to Compact		7	SS	11		334							Om 0.4%
332.2			8	SS	9									0 44 55 1
8.1	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\div$  5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 303

METRIC

W P 132-82-02 LOCATION Sta. 15 + 805.0; 3.2 m RT Q Hwy. 518 Line 'A' ORIGINATED BY BR  
DIST 11 HWY 518 BOREHOLE TYPE Hollow Stem Auger COMPILED BY BR  
DATUM Geodetic DATE 84 10 17 & 84 10 18 CHECKED BY *BR*

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	WATER CONTENT (%) 20 40 60					
340.2	Ground Level													
0.0	Sand with Organics Loose		1	SS	6									
1.5	Peat and Organic Silt Soft to Stiff		2	SS	2									
			3	SS	6									
336.4			4	SS	11									
3.8			5	SS	3									
			6	SS	3									
	Sandy Silt to Silty Sand		7	SS	3									
	Very Loose to Compact		8	SS	3									
			9	SS	7									
	Silt		10	SS	15									
321.4			11	SS	10									
321.0	End of Borehole													
19.2	Start Cone Test													
317.0														
23.2	End of Cone Test													

OFFICE REPORT ON SOIL EXPLORATION

# memorandum



To: K. Williams  
Head  
Planning & Design Section  
Northern Region

Date: May 14, 1985

Attn: D. Chretien

From: Structural Section  
Northern Region

WP 132-82-01 Site 44-130  
Magnetewan River  
Secondary Road 518  
District 11 - Huntsville

Following are Structural minutes of Regional Technical Review held earlier today.

## Bridge Drawings

Dwg 1 Change Granular "B" Type 1 to Select Subgrade material.

Forward slope of organic excavation is shown "as steep as possible," change to 1:1.

Temporary roadway protection rotated at both abutments.

Reduce east limits of bank protection to 17000 on south side and 16000 on north side to stay within ROW.

Dwg 7 Change base plates from field to shop weld.

Dwg 10 X out sections with sidewalk.

Construction of approach slabs will be staged requiring transverse bars to be lapped. Rebar schedule should be changed accordingly.

Dwg 13 Use latest revision. Dimension 'J' is face to face keeperbars.

Recommend that seal have a total rated movement capacity of 40 mm.

## Documents

Tender Item 21 Change to Removal of Structure, associated SP to read:



- a) Removal, salvage and loading of 14 reinforcing bailey panels weighing 3.7 tonnes.
- b) Removal and disposal of steel pony truss including timber decking.
- c) Removal and disposal of concrete abutments and supporting concrete piles to El. 338.0.

Tender Item 22 - Not required

Highway Engineering Standard Drawings

DD3503 - to Rev. 3

DD3930 still in use as is

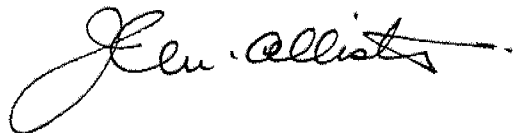
Structural Steel Shop inspection

Cost \$7500.00

Drawings of the existing 66' pony truss are not available.

The proposed excavation of peat and organic material as shown on Drawing 1 leaves a ± 3 m depth of organic under half the proposed road. This was specifically designed to accommodate maintenance of traffic on the existing road without the use of temporary roadway protection, hence the requirement for minimum 3 months preloading.

With the use of roadway protection the organic material can be fully excavated to the face of the roadway protection. Drawing 1 will be revised accordingly and the roadway protection Drawing 15 revised to accommodate the additional depth of excavation.



JCMcA:pld

J. C. McAllister

cc: B. Ruck  
A. Radkowski

# memorandum



To: Mr. K. G. Selby,  
Chief Foundations Engineer - West,  
Foundation Design Section,  
3rd floor, Central Building.

Date: 84 11 19

110 pcf.  
d = 28

SUBJECT: Magnetawan River Bridge,  
W.P. 132-82-02, Site 44-1253-130,  
Highway 518, District 11

After discussions with your office and the region regarding this project the following notes were included:

- Peat, organic and all soft material to be removed and replaced with compacted granular material for structure approach embankments. Maximum particle size in vicinity of piles 75 mm (TYP). For details see grading drawing.
- Driving shoes are not required.

If these do not meet your requirements could you inform this office.

DS/cf

*D. Sproule*

D. G. Sproule,  
Structural Project Engineer,  
Structural Office.



# memorandum



To: S. McCombie  
Structural Section  
North Bay

Date: 1984 11 21

From: Foundation Design Section  
Room 315, Central Building

RE: Magnetawan River Bridge  
W.P. 132-82-02  
Site 44-1253-130  
Hwy. 518, District 11

Further to your request, we have completed additional fieldwork for the noted structure and provide the following comments:

- 1) The additional fieldwork consisted of two additional boreholes at each of the new abutment locations along new Line 'A'. Generally, the subsurface conditions are similar to those encountered along old Line 'A' (located some 15<sup>+</sup> m south of new Line 'A') except that the maximum depth of organic material encountered was  $\pm 3.3$  m compared to  $\pm 6.4$  m along old Line 'A'. The borehole logs and the amended stratigraphical drawing will not be forwarded at this time, but will be included in the contract package.
- 2) The structure foundations can be designed in accordance with the recommendations given in the original Foundation report, dated October 4, 1983.
- 3) In the vicinity of the approaches it is recommended that the organic material be removed from the areas shown on the accompanying sketch. It will be necessary to perform this subexcavation in strips not exceeding 5 m wide at the base. Details of the excavation method are given on the sketch.

In addition to the noted subexcavation, it is recommended to preload the structure approaches for a minimum of 3 months prior to construction of the approach slabs and any paving. The embankments should be constructed with 2:1 forward and side slopes.

Additional comments regarding the approaches are given in the original foundation report.

- 4) If the abutment footings are to be formed below the prevailing groundwater level, a dewatering scheme consisting of interlocking steel sheet piles will be required. The sheet piles could then serve as roadway protection during the excavation for the abutment footings.

- 5) The size of compaction equipment utilized behind the abutments should be restricted as per current Ministry practice.

Please attach this memo to your copy of the original Foundation Report.

A handwritten signature in black ink, reading "Brian Ruck". The signature is written in a cursive style with a large, sweeping "B" and a long, horizontal stroke at the end.

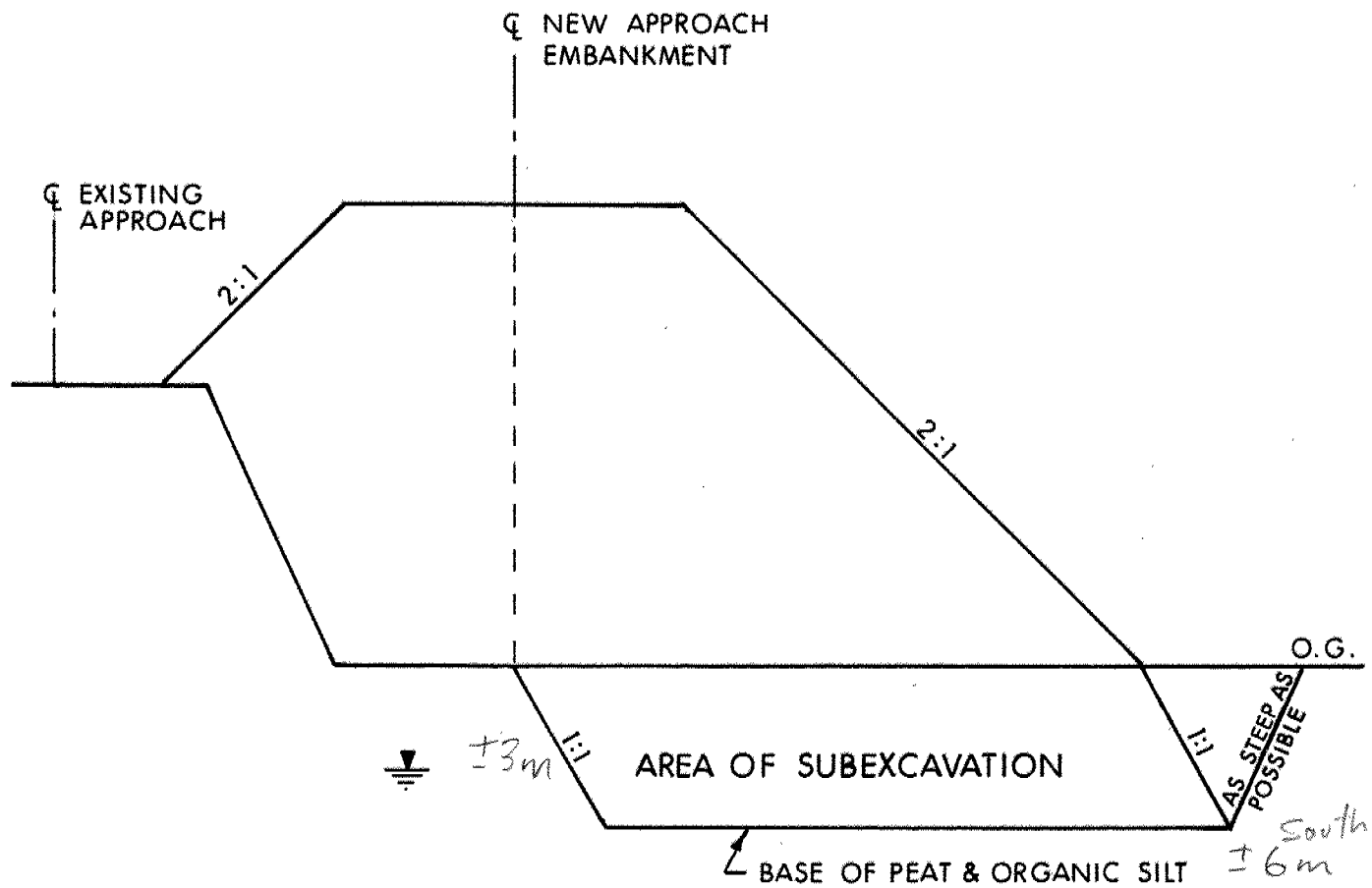
B.E. Ruck, P. Eng.  
Project Foundations Engineer

BER/mmj

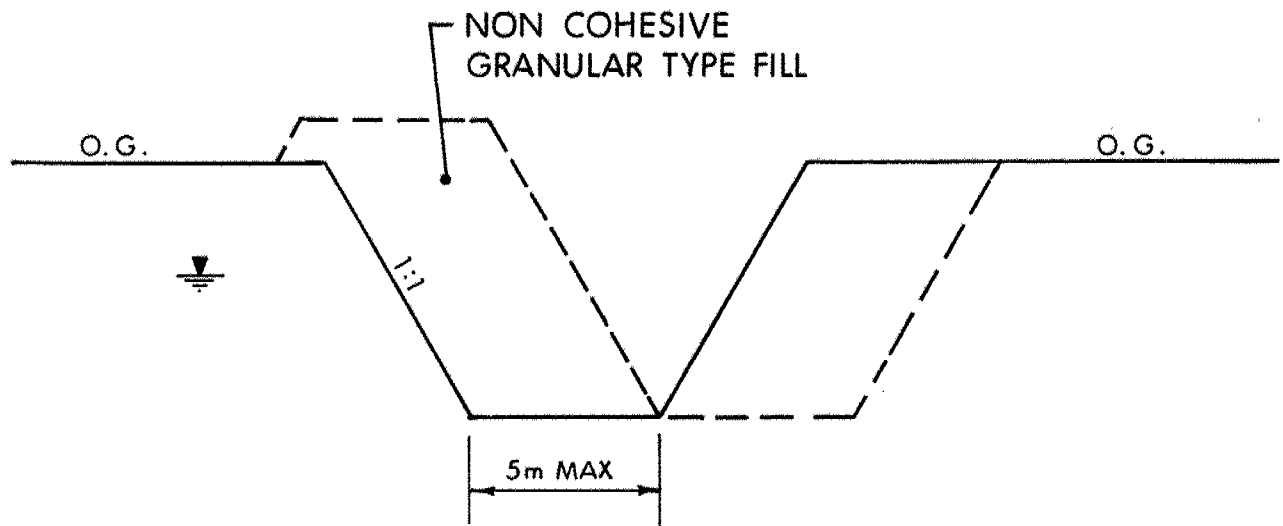
c.c. - J. McDougall  
K. Williams  
D. Barnes  
K. Bassi  
R. Hore

Attach.

# SKETCH SHOWING STRIP EXCAVATION



LONGITUDINAL SECTION  
N.T.S.



CROSS SECTION  
N.T.S.



# memorandum

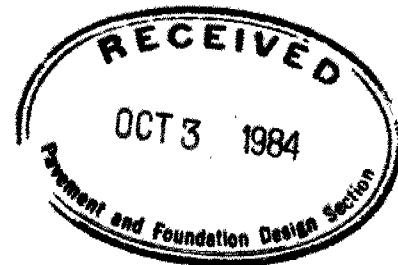
Structural Office  
4th Floor  
3501 Dufferin St.  
Downsview



To: Mr. K.G. Selby  
Chief Foundations Engineer - West  
Foundation Design Section  
3rd Floor, Central Building

Date: 1984 10 01

Re: Magnetawan River Bridge  
W.P. 132-82-02  
Site 44-1253-130  
Hwy. 518, District 11



A copy of the General Arrangement drawing (Preliminary Plan drawing - P1) was sent to you with a copy of my memo to Mr. S. McCombie dated 84 09 20. When Mr. McCombie visited my office on 84 09 26 I expressed my concern about the extent of removal of peat moss, organic and soft material in the vicinity of the bridge. The poor material would have to be removed and replaced with a sound material prior to the construction of the bridge.

As you may recall the foundations investigation was carried out for a now abandoned line (ie. old Line "A") some distance away from the existing bridge. Subsequently, the line and new bridge location were shifted much closer to the existing bridge, (also line "A"), on the basis of limited field investigation performed by the Geotechnical Section, Northern Region, which showed somewhat less poor material at the new site. During my discussion with Mr. McCombie he informed me that the Structural Section, North Bay, had requested further investigation to be carried out at the new location, however, he was not aware if the investigation had been carried out to date.

In view of the above and our concern for the stability of the structure and approaches, would you kindly advise us of your findings and recommendations as they apply to the proposed structure as shown on the preliminary plan, ie. General Arrangement drawing - P1, dated 84/09. If the additional investigation has not been carried out, would you inform us when you expect the investigation to be completed and when you would be in a position to review and comment on the proposed arrangement.

We would also appreciate having your opinion as to the stability of the temporary slope of 1½:1 cut into the existing bridge approaches as shown in Section 1 on the drawing. Traffic is to be maintained on a single lane of the existing roadway and bridge during construction of the new approaches and bridge. The design of the new bridge is currently about 50% complete.

JLK:ac

A handwritten signature in dark ink, appearing to read "J.L. Keen".  
J.L. Keen  
Design Engineer

cc: S. McCombie  
A. Radkowski  
D. Sproule

# memorandum



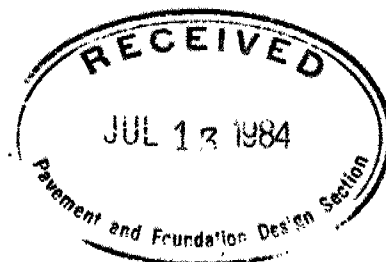
To: Mr. K.G. Selby  
Senior Foundations Engineer  
Pavement & Foundation Design Section  
3rd Floor, Central Building  
DOWNSVIEW, Ontario

Date: 1984 07 11

Attention: Mr. P. Payer

FROM: Geotechnical Section  
Northern Region

RE: W.P. 132-82-01, SEC. HWY. 518,  
MAGNETAWAN RIVER BRIDGE, 21.0 km EAST  
OF THE JCT. HWY. 11, DIST. 11, HUNTSVILLE



This memorandum is forwarded to request that the approach embankments be checked for the proposed structure at the Magnetawan River. The borings in the foundation investigation and design report indicated the presence of a very soft organic deposit up to 6.4 m thick. In our investigation it was found that this deposit extended south east with depths of muck and soft material to 4.0 m.

Subsequently a line was checked closer to the existing alignment as shown on the enclosed plan. Borings in the low areas showed that depths of muck with a silty fine sand firm bottom were 1) 450 mm at Station 15 + 725 CL and 8 m Lt of CL. 2) 450 mm at Station 15 + 750 CL and 8 m Lt of CL. 3) 600 mm at Station 15 + 810 CL and 8 m Lt of CL. 4) 1.20 m at Station 15 + 850 6 m Lt of CL.

All of these are somewhat less than recorded on old line 'A', where data was collected previously. At the same time a test pit was dug with a backhoe on the south east bank. This was not successful because of sloughing after a depth of 1.8 m. Only silty fine sand was recorded to that depth. Some logs were encountered near this depth. No test pit was dug on the north west bank because of the poor access and it was deemed that the same results would be obtained.

With the equipment employed by the Geotechnical Section it is not practical to determine the presence of a peat layer below the silty sand under the approach embankments as found in the foundation investigation report. It would appear that a continuous flight auger is required for this purpose.

It is recommended that the approach embankments be checked by advancing at least one borehole on each bank. This can possibly be done in conjunction with the investigation requested for W.P. 65-79-01 on Secondary Highway 632 south of Rosseau. Please consider this in your schedule of the investigation.

EWV:tp  
Encl.

A handwritten signature in dark ink, appearing to read "E.W. Veritsky".  
E.W. Veritsky  
Pavement Design & Evaluation  
Officer

# memorandum



To: S. McCombie  
Head, Structural Section  
Northern Region  
North Bay

Date: 1983 11 18

Atten: J. McAllister

From: Foundation Design Section  
Room 315, Central Building

Re: Alignment Revision  
Magnetewan River - W.P. 132-82-01  
13.2 km E of Kearny  
Sec. Highway #518  
District #11 (Huntsville)

In the light of the alignment shift at the above location we have reviewed the Foundation Investigation Report which was prepared for the original alignment line 'A'. It is our opinion that the recommendations contained in that report concerning the structure foundations and embankment stability are valid and applicable for the revised alignment.

The Regional Geotechnical Section has indicated that the extent of the organic material is somewhat less along the new line. However, based on the information they have provided to us dated 83 10 25, it is our opinion that the full extent of the organic deposit has not been adequately defined. It will be necessary for them to carry out further fieldwork to determine the exact dimensions (horizontal and vertical) of the organic deposit which must be removed to ensure stability of the structure and approaches. We have no further comments to offer at this time.

A handwritten signature in dark ink, appearing to read "P. Payer".

P. Payer, P. Eng.  
Foundations Engineer

PP/mmj

c.c. - E.W. Veritsky

# memorandum



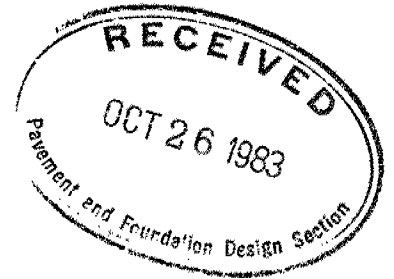
To: Mr. K. Selby  
Sr. Foundations Engineer  
Pavement & Foundation Design  
Section  
Central Building  
DOWNSVIEW

Date: 83 10 25

Attention: Mr. P. Payer

FROM: Geotechnical Section  
Northern Region

RE: WP 132-80-01, SEC HWY 518  
STRUCTURE AT MAGNETAWAN RIVER  
13.2 km EAST OF KEARNEY  
DISTRICT # 11, HUNTSVILLE



As requested, attached are copies of the log of boreholes recorded during the field investigation. These were completed along the proposed surveyed alignment and later a check was made of the existing bridge site.

A preliminary investigation was also made to check the recommended new alignment close to the existing structure. This was done because the investigation along the originally proposed alignment showed shallow organic depths on the right side. The preliminary borings indicated 1.2 m of muck on the north (low chainage) end and about 1.8 m of muck on the south end (high chainage). Our comments to the Structural Section stated that this varied to some extent from our original investigation where muck existed to a depth up to 4.0 m.

A handwritten signature in black ink, appearing to read "E. W. Veritsky".

E. W. Veritsky  
Pavement Design &  
Evaluation Officer

EWV/ap

Attach:

MEMORANDUM

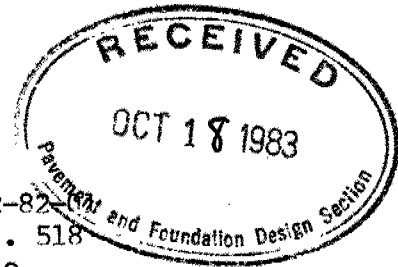
G. Wrong,  
Pavement & Foundation Design Section,  
Central Building, Room 315,  
Downsview, Ontario.

October 14, 1983

Attention: P. Payer

FROM: Engineering & Right-of-Way Office,  
Structural Section  
Northern Region.

RE: Site 44-130, W.P. 132-82  
Magnetewan River, Sec. Rd. 518  
District 11, Huntsville



Attached are two prints of the site plan for the above crossing showing the alignment revision discussed with you yesterday. Although the line has not yet been run, any further field work can be laid out from the dimensions shown.

Geotechnical has indicated that excavation of organic material is considerably lessened as the line is brought closer to the existing. I am attaching a schematic layout of the possible design of a single span structure suitable for this location.

Please carry out the necessary field work etc. to modify the foundation report.

A handwritten signature in cursive script, appearing to read "J. C. McAllister".

J. C. McAllister  
Structural Section

JCM/pg  
Encl.

# memorandum

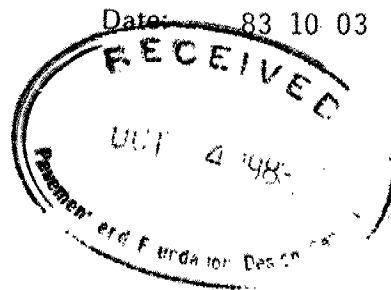


To: Mr. S. McCombie  
Head, Structural Section  
Northern Region

Attention: Mr. J. C. McAllister

FROM: Geotechnical Section  
Northern Region

RE: WP 132-82-01, SEC. HWY 518  
FROM 13.2 km E OF KEARNEY E'LY 0.1 km  
DISTRICT # 11, HUNTSVILLE



We have reviewed the data gathered during the field investigations for the above project at the Magnetawan River. On the proposed alignment a deposit of swamp was found on the approach between Stations 15+650 to 15+780 with muck and soft material to a depth of up to 4.30 m. This material would have to be excavated and backfilled with material meeting Select Subgrade Specifications.

At offset locations, especially 8.0 m south of the proposed alignment the depth of muck becomes shallow. Here depths vary from 300 to 900 mm over silty fine sand. Only at one location, Station 15+740, 8.0 m right of C/L depth of muck was 4.0 m. During a visit to the site on 1983 09 29, depth of muck at the bush line about 13 m from the new alignment indicated near 1.2 m of muck on the west approach and 1.9 m of muck on the east approach.

From this data, it is apparent that the amount of excavation can be substantially reduced on the approaches should the alignment be relocated southerly to the old alignment. The new structure should be placed as close as possible to the old one and yet use the existing structure as a detour.

The field investigation is limited using hand equipment especially when silty fine sand in a wet condition is encountered because the result is sloughing. A foundation investigation would be required at any new location chosen. It would appear that the depth of organics vary to some extent depending on the location.

EWV/ap

cc: W. Barker  
D.A.O. White  
G. A. Wrong ✓

E. W. Veritsky  
Pavement Design &  
Evaluation Officer

(843) 472-7900

# memorandum



To: Mr. S. McCombie  
Head, Structural Section  
Northern Region  
North Bay, Ontario

Date: 83 06 23

From: Pavement & Foundation Design Section  
Room 315, Central Building  
Downsview, Ontario

Re: Foundation Recommendations  
Magnetawan River Bridge  
W.P. 132-82-01  
Site: 44-130  
District #11 (Huntsville)

## Introduction

A foundation investigation consisting of four sampled boreholes accompanied by dynamic cone penetration tests was carried out for the above project. In order to expedite the structural design process, we are submitting the final foundation recommendations ahead of the formal foundation investigation report. In our opinion, the recommendations contained in this memorandum are completely adequate for your requirements and the design work can proceed without any delay. The Site Plan #9020-1 was received by the Foundation Section on 83 06 22.

## Subsurface Conditions

The main deposit in this area was found to be sandy silt to silty sand, for a minimum depth of 38 m. The relative density varies randomly from very loose to very dense. (N values: 2 to 59 blows/30cm) An organic deposit containing decayed and undecayed vegetable matter was also encountered within the main deposit at the following elevations:

East side of River: (BH #4) (BH #3)

Upper Boundary: El. 340.2 - El. 338.3

Lower Boundary: El. 333.8 - El. 335.2

West Side of River: (BH #1) (BH #2)

Upper Boundary: El. 338.9 - El. 337.9

Lower Boundary: El. 337.7 - El. 334.8

The groundwater level was found to be between El. 339.5 and El. 338.2

The River water level was at El. 339.3 on 83 06 14.

The subsoil conditions are shown on the attached sketch.

## Recommendations

### Structure Foundation

Two types of structures are being considered by the Regional Structural Section:

- a) Single span beam type structure
- b) Multi span composite timber/concrete structure

Regardless which scheme will be adapted, it is recommended that the future structure be founded on steel 'H' piles driven some 30 m in the original ground. For HP 310 x 79 steel 'H' piles, a design load of 625 Kn (70 tons) is recommended. For the purposes of the O.H.B.D.C., the following design values are recommended:

Factored capacity at U.L.S.: 875 Kn  
Capacity at S.L.S. Type II: 625 Kn

The piles should be driven in accordance with MTC standards SS103-10 or SS103-11. The driving energy of the hammer should not be less than 40,000 kJ/blow.

Earth pressure should be computed as per subsection 6.6.1.2.2 of the Code. For the granular backfill, a non-yielding foundation condition should be assumed, in which case a value of  $K_0=0.43$  is recommended.

The pile caps should have a minimum of 1.8 m earth cover for frost protection requirements.

The pile caps should be formed 'in the dry'. Therefore, a dewatering scheme will be required if the pile caps are formed below the prevailing groundwater level.

### Approach Embankments

The grade of the future structure will be between El. 342.5 and El. 343.5. The original ground is at El. 340+, while the River bed is at El. 337+.

The borings have indicated the presence of up to 6.8 m thick of very soft organic deposit. It is recommended that this deposit be removed to its full vertical and horizontal extent within the construction area for a minimum distance of about 16 m beyond the abutments. The exact dimensions (vertical and horizontal) of the organic material along the remainder of the proposed embankment will be determined by the Regional Geotechnical Section, and a specific treatment specified by them.

The sub-excavated area should be backfilled with non-cohesive material. Non-cohesive material should also be used for a minimum height of 1 m above the observed high water level for the approach embankments.




The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles may have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 75 mm. The embankments should be constructed with 2:1 forward and side slopes if earth fill is used, and 1½:1 slopes for rockfill.

The encountered subsoil is highly scourable. It is therefore recommended that the River bed be provided with rip-rap for a minimum distance of 50 m upstream and about 25 m downstream. The existing River banks and the future approaches should be protected against erosion by rip-rap for a minimum distance of 1 m over the high water level.

#### Miscellaneous

Our complete foundation investigation report will be forwarded to you in the near future after the necessary lab and drafting work is finished. If, however, additional information is required by you in the intervening time, please contact our office.

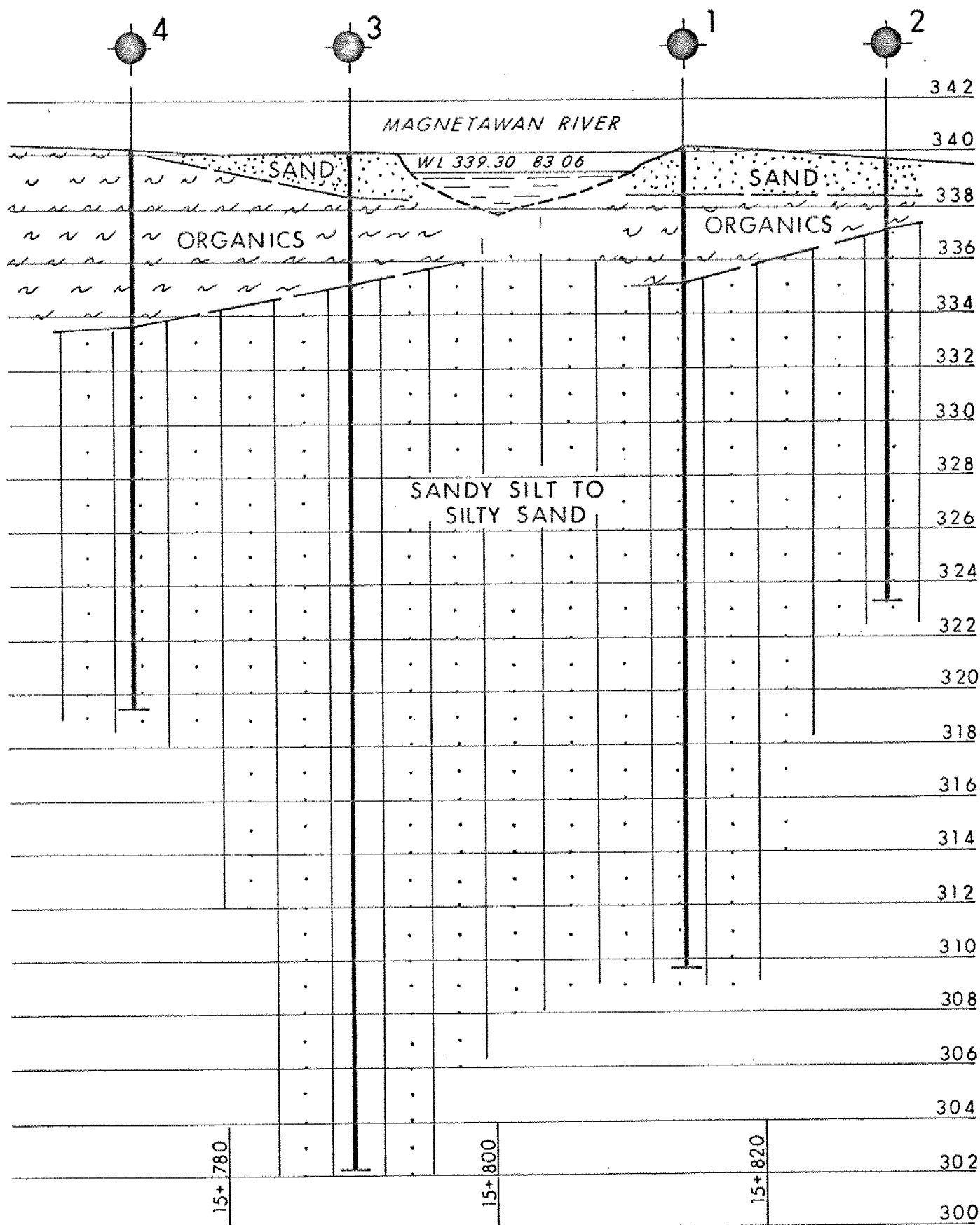
  
P. Payer, P. Eng.  
Foundations Engineer

PP:gm

cc: S. Wilson  
G. Radkowski  
L. Argo

Files

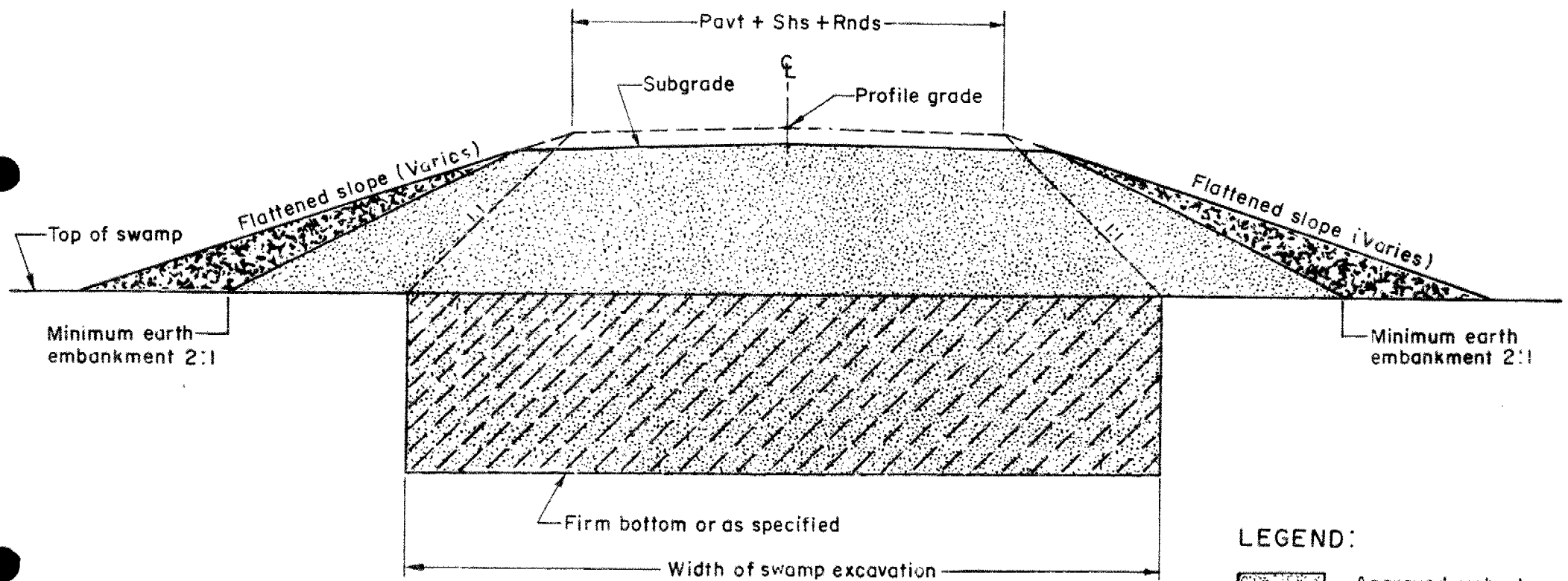
BH 1 STA 15+814.4 1.8 m RT Q ELEV 340.2  
 BH 2 STA 15+829.6 Q ELEV 339.7  
 BH 3 STA 15+789.7 Q ELEV 340.1  
 BH 4 STA 15+773.4 Q ELEV 340.2



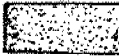


Q PROFILE SEC HWY 518 LINE 'A'

SCALE HORIZ 1:400  
 VERT 1:200

WP 138-82-01  
 MAGNETAWAN RI  
 DIST 11



#### LEGEND:

-  Approved embankment materials
-  Excavated swamp material
-  Area to be excavated & backfilled

#### NOTES:

- A This Standard to be used only where depth of swamp is 4.0 m or less and height of fill is 2.0 m or less.
- B All dimensions are in millimetres or metres unless otherwise specified.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

No DD-406

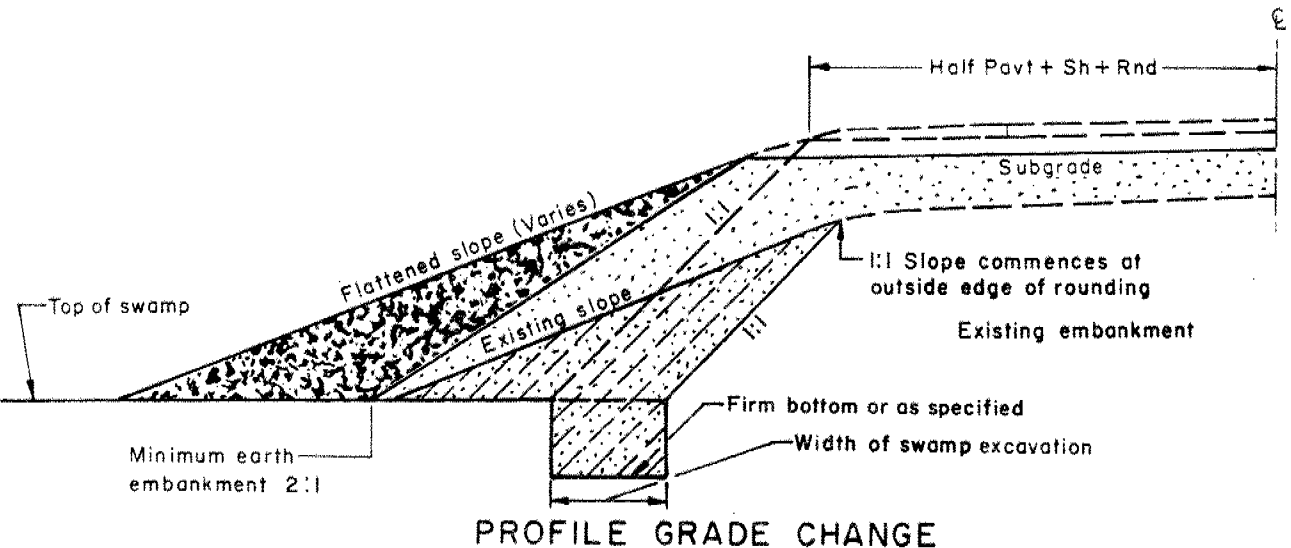
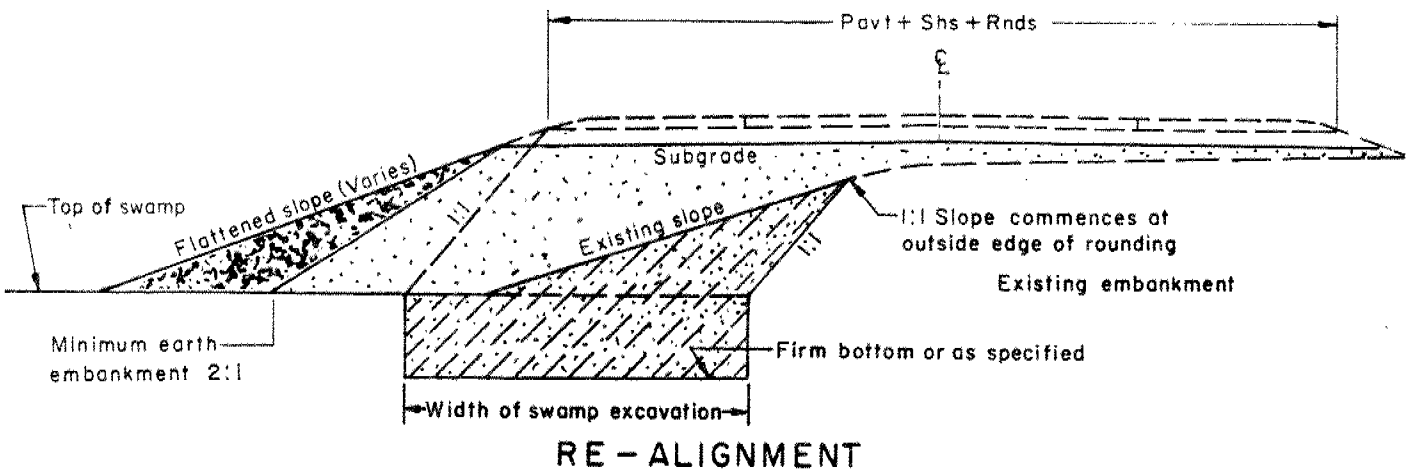
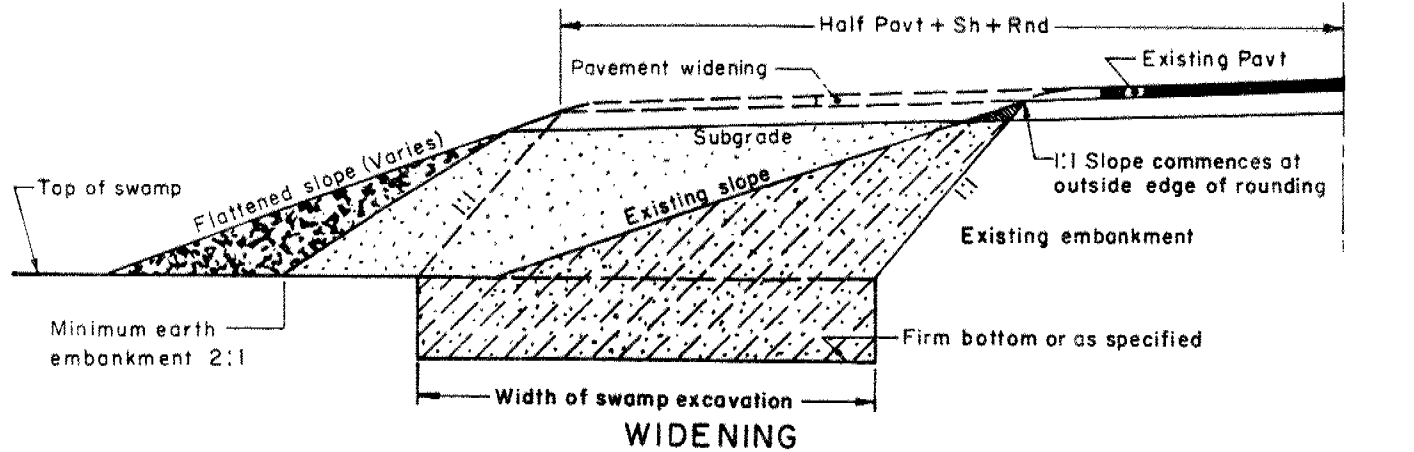
## SWAMP TREATMENT UNDER FILLS

Date 1983 04 01 Rev 2

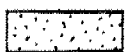
*P. L. Brown*

No DD-408-A

Date Apr 1/83 Rev

**NOTE:**

- A This Standard to be used only where depth of swamp is 13 ft or less and height of fill is 6.5 ft or less.

**LEGEND:**

Approved embankment materials



Excavated swamp material



Area to be excavated &amp; backfilled



Area to be excavated

MINISTRY OF TRANSPORTATION  
AND COMMUNICATIONS - ONTARIO

# RECONSTRUCTION SWAMP TREATMENT EXCAVATION - 1:1 SLOPES

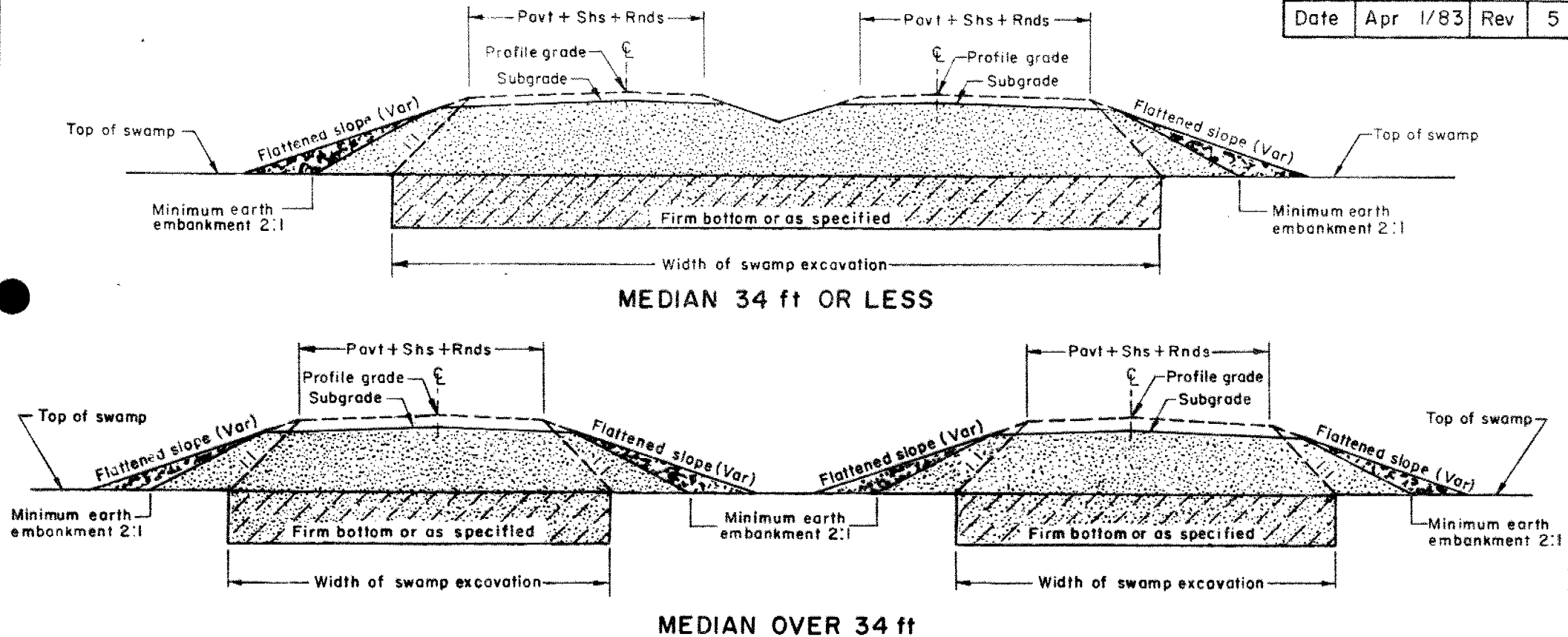
Drawn by S.S.  
 Traced by S.S.  
 Checked by E.G.  
 Passed by RAV

APPROVED

Manager Highway Design Office

No DD-407

Date Apr 1/83 Rev 5

**NOTE:**

- A This Standard to be used only where depth of swamp is 13' or less and height of fill is 6.5' or less.

**LEGEND:**

Approved embankment materials



Excavated swamp materials



Area to be excavated &amp; backfilled

MINISTRY OF TRANSPORTATION  
AND COMMUNICATIONS - ONTARIODIVIDED HIGHWAYS  
**SWAMP TREATMENT  
UNDER FILLS**

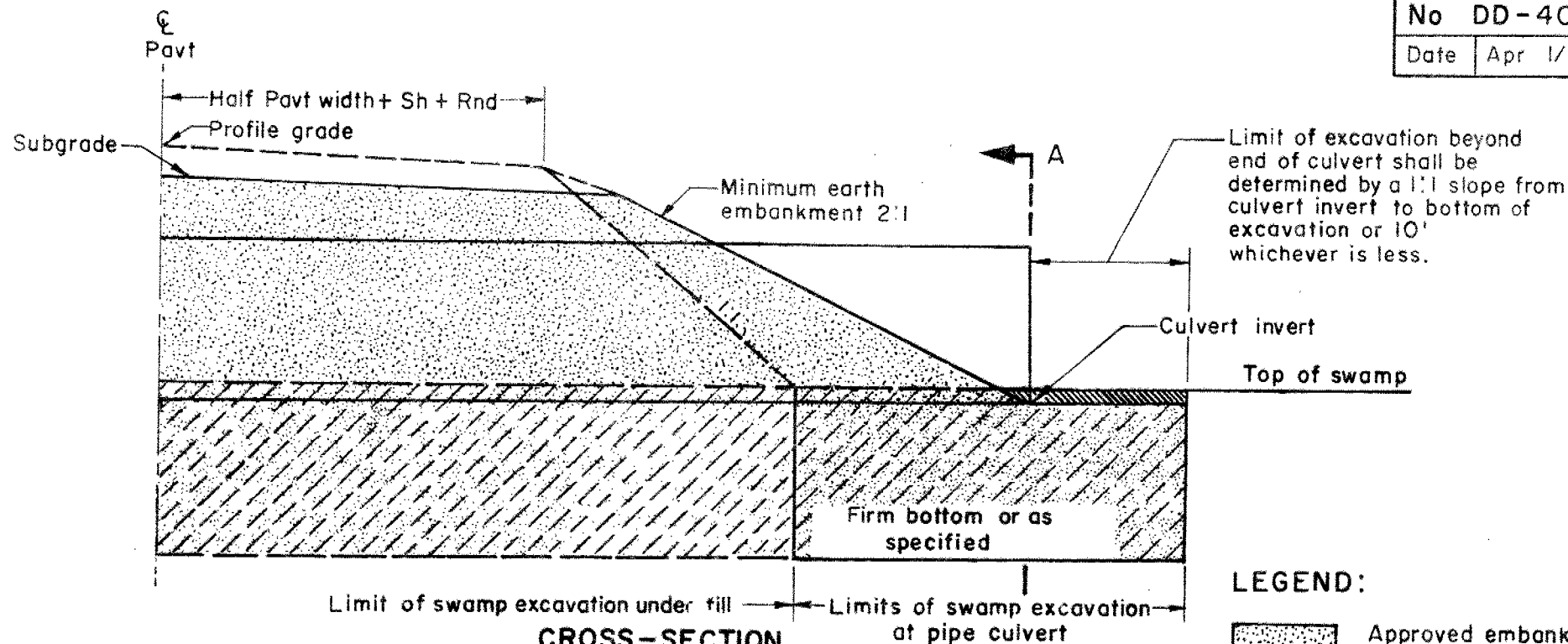
Drawn by SS  
 Traced by SS  
 Checked by E.G.  
 Passed by R.A.V.

**APPROVED**

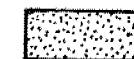
*[Signature]*  
 Manager Highway Design Office

No DD-405

Date Apr 1/83 Rev 2



## LEGEND:



Approved embankment materials



Area to be excavated and backfilled

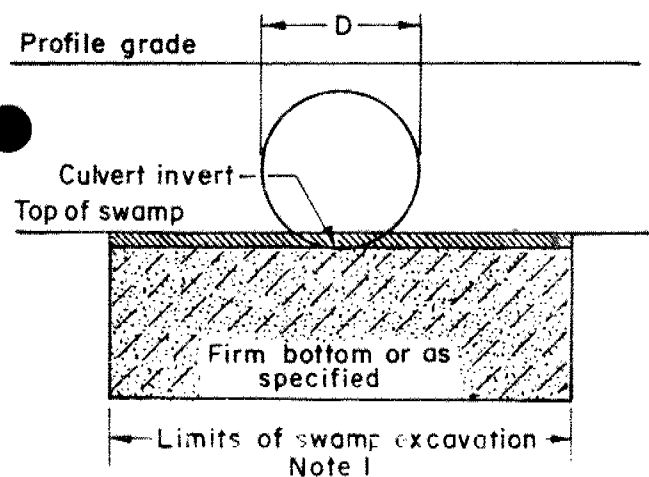


Area to be excavated

## NOTES:

1 Width of excavation shall be  $D + 3'$  for pipes  $\leq 36"$  in diameter and  $2D$  for pipes  $> 36"$  in diameter.

A This Standard to be used only where depth of swamp is 13' or less, height of fill is 6.5' or less and pipe diameter is 60" or less.

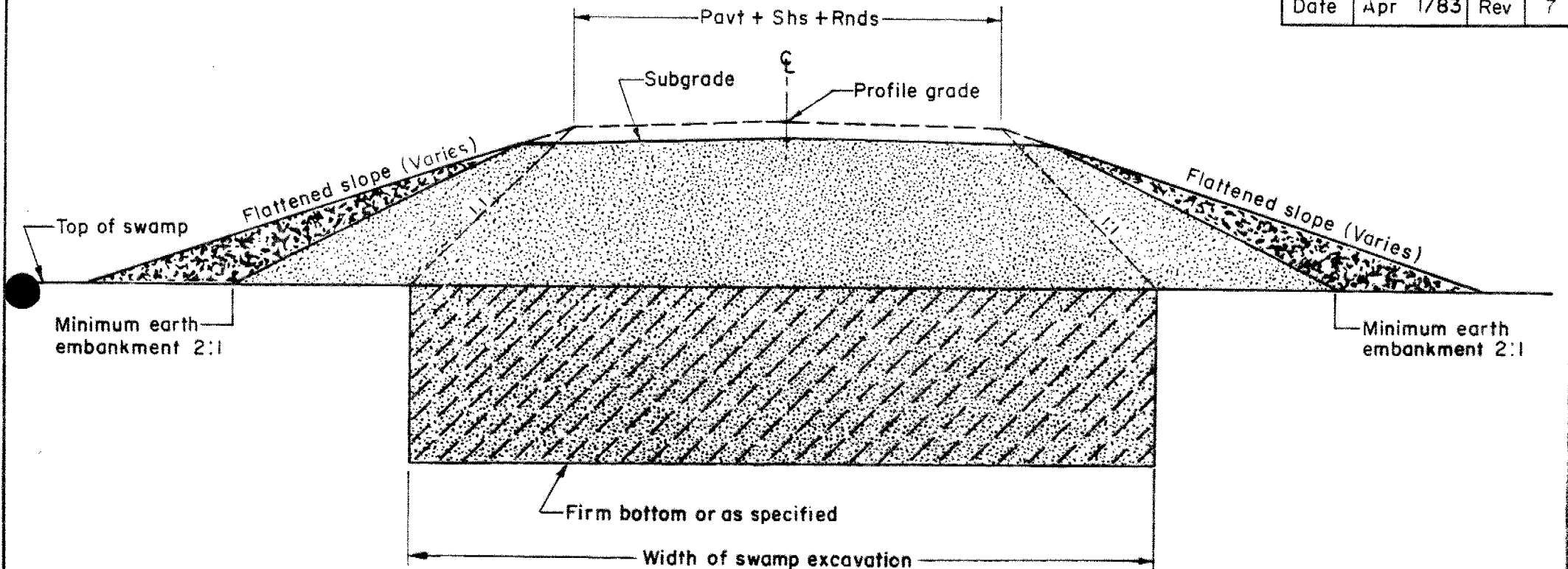
MINISTRY OF TRANSPORTATION  
AND COMMUNICATIONS - ONTARIOSWAMP TREATMENT  
AT PIPE CULVERTS

Drawn by SS  
Traced by SS  
Checked by SS

APPROVED

No DD-406




Date Apr 1/83 Rev 7



**NOTE:**

- A This Standard to be used only where depth of swamp is 13' or less and height of fill is 6.5' or less.

**LEGEND:**

-  Approved embankment materials
-  Excavated swamp materials
-  Area to be excavated & backfilled

MINISTRY OF TRANSPORTATION  
AND COMMUNICATIONS - ONTARIO

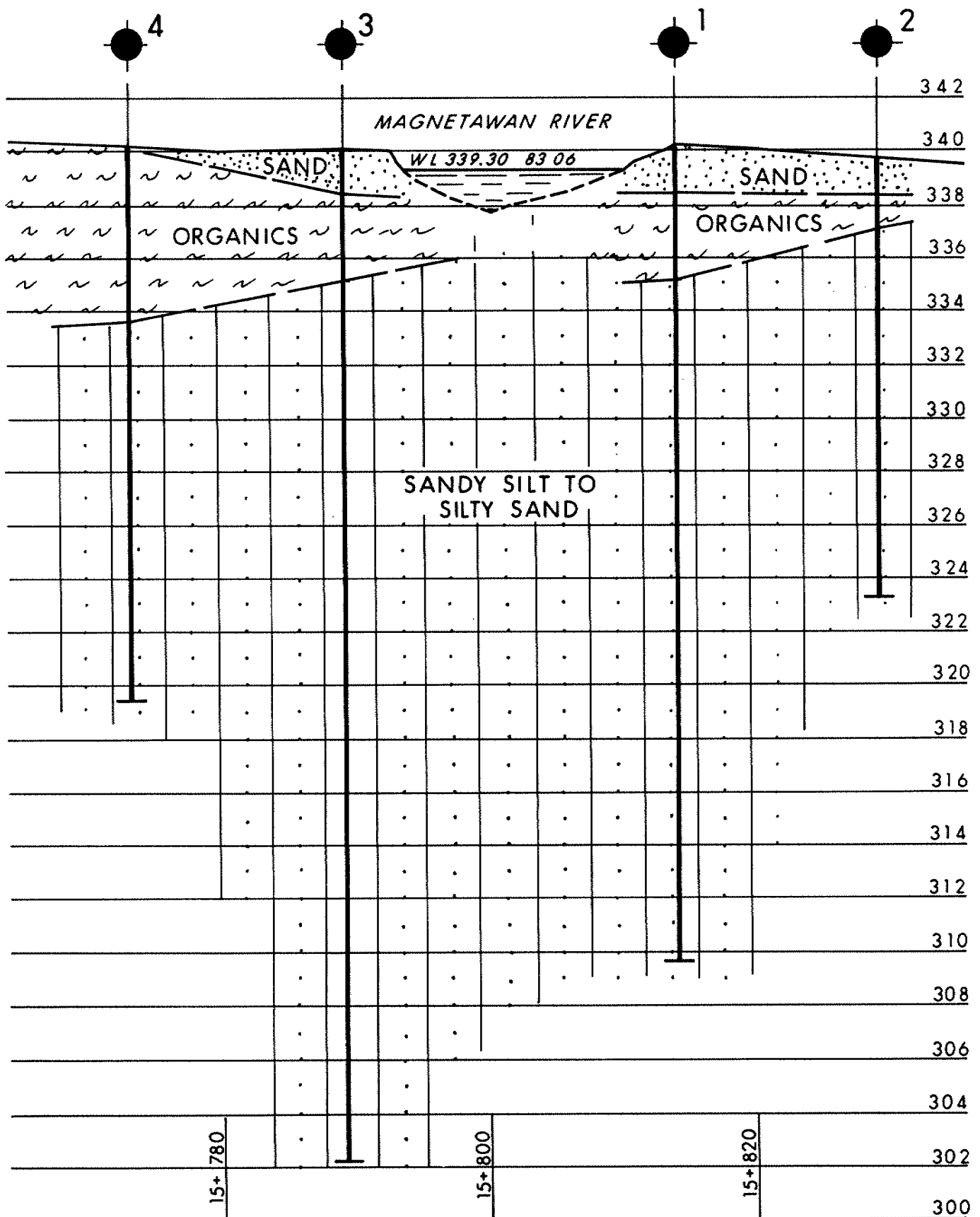
**SWAMP TREATMENT  
UNDER FILLS**

Drawn by SS  
Traced by SS  
Checked by E.G.  
Passed by R.A.V.

**APPROVED**

  
Manager Highway Design Office

BH - STA 15+814.4 1.8m RT Q L 'E' A' ELEV 340.2  
 BH 2 - STA 15+829.6 Q ELEV 339.7  
 BH 3 STA 15+789.7 Q ELEV 340.1  
 BH 4 STA 15+773.4 Q ELEV 340.2



Q PROFILE SEC HWY 518 LINE 'A'

SCALE HORIZ 1:400  
 VERT 1:200

WP 138-82-01  
 MAGNETAWAN RI  
 DIST 11



MEMORANDUM



Mr. K. Selby,  
Pavement and Foundation  
Design Section,  
Central Building,  
Downsview.

June 21, 1983

FROM: Engineering & Right-of-Way Office,  
Structural Section,  
Northern Region

RE: Site 44-130, W.P. 132-82-01,  
Magnetewan, River,  
Sec. Rd. #518, District #11, Huntsville

Attached are copies of site plan E-9020-1 and ETR plate for the above structure.

The grade cannot be finalized until the foundation report is available and the type of structure defined, however, two alternatives will be considered.

- a. Single span beam type structure with grade in the order el. 843.5 at Sta. 15+813.5.
- b. Multi span composite timber/concrete deck with grade in the order el. 842.5 at Sta. 15+813.5.

Both above use 1.5.1 riprapped forward slopes.

J. C. McAllister  
Structural Section

JCM/kn  
Attch.

