

GEOCRES No. 31M-12DIST. 14 REGION W.P. No. CONT. No. MUNICIPALW. O. No. 70-11096STR. SITE No. 47-168HWY. No. LOCATION PONTLEROY STRUCTURETWP. HILLIARDNo of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

MEMORANDUM

31 M-12

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Office,
Admin. Bldg.

FROM: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

ATTENTION: Mr. S. McCombie

DATE: March 15, 1971

☐ OUR FILE REF.

IN REPLY TO

MAR 19 1971

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Pontleroy Structure, Site 47-168
Site 47-168 - Twp. of Billiard
Concs. IV & V, Lot 9
District No. 14 (New Liskeard)
W.O. 70-11096 -- W.P. (N11)

Enclosed, please find our complete foundation investigation report for the above mentioned project.

We believe that the factual data and recommendations contained in the report will prove adequate for your design purposes. Should additional information be required, please contact this Office.

AGS/MdeF
Attach.

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. B. R. Davis
F. G. Allen
D. W. Farren
K. L. Kleinsteinber
H. McArthur
T. A. Sharpe
J. C. McAllister (2)
E. R. Saint
B. J. Giroux
B. A. Singh
Foundations Files ✓
Gen. Files

TABLE OF CONTENTS

1. INTRODUCTION.
 2. SUBSOIL.
 3. RECOMMENDATIONS.
 4. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Pontleroy Structure, Site 47-168
Site 47-168 - Twp. of Hilliard
Concs. IV & V, Lot 9
District No. 14 (New Liskeard)
W.O. 70-11096 -- W.P. (Nil)

1. INTRODUCTION:

A request for a foundation investigation at the above mentioned site was requested by Mr. T. A. Sharpe, District Engineer, New Liskeard, via Local Purchase Order M-196551, dated October 9, 1970. The work was subsequently carried out by the Foundation Section.

This report contains the results of the field and laboratory investigations, together with recommendations pertaining to the foundation design for the proposed new bridge.

2. SUBSOIL:

Two sampled boreholes and four dynamic cone penetration tests were carried out at the site of the proposed structure. These borings revealed an extensive deposit of varved clay having a consistency ranging from soft to stiff. The deepest borehole was advanced to elev. -9.8, which was 93 ft. below ground level. The varved clay deposit consists of 1/8 inch to 2-inch layers of clay, silty clay, and clayey silt. The average undrained shear strength of the subsoil as determined from field vane tests, was found to be about 450 p.s.f. on the south side of the river, and about 650 p.s.f. on the north side. The natural moisture content ranges from about 30% to about 75%, and the bulk density from about 106 p.c.f. to about 120 p.c.f.

Groundwater level in sampled boreholes was found to be at elev. 75.0 \pm some 6 feet above river level.

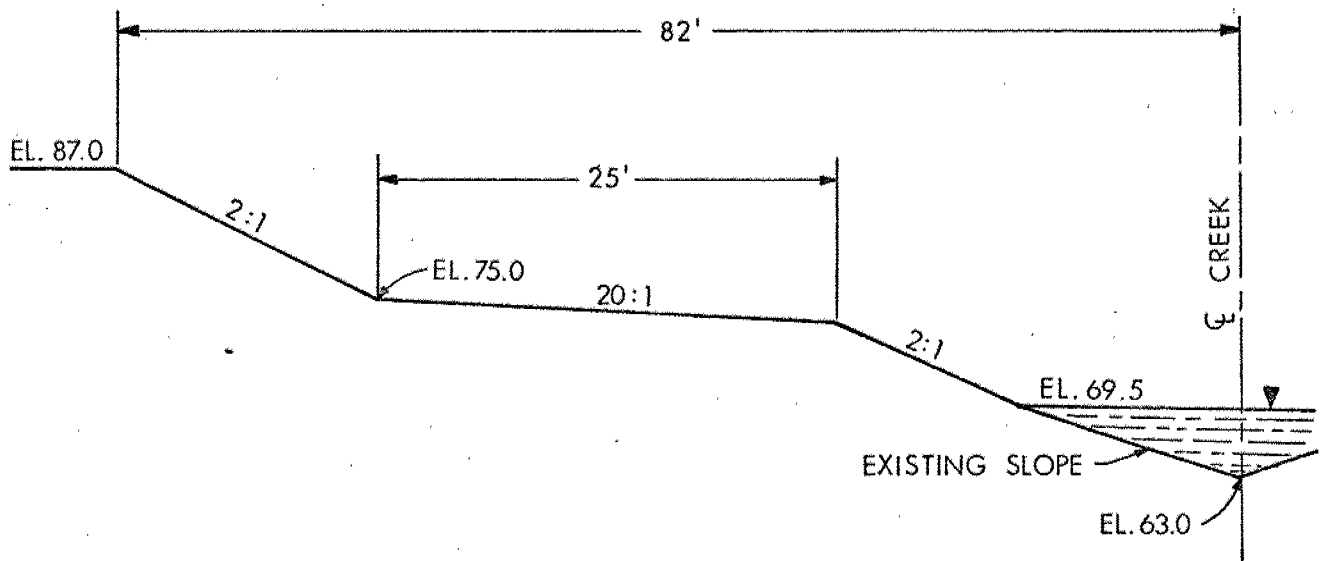
2. SUBSOIL: (cont'd.) ...

Results of field and laboratory tests are shown on the Record of Borehole sheets and on Figs. 1, 2, and 3 of the Appendix. The estimated stratigraphical profile and borehole locations are shown on Drawing No. 70-11096A.

3. RECOMMENDATIONS:

The existing structure at this site consists of a 116-ft. timber bent bridge spanning the approximately 50-ft. wide Pontleroy Creek. It is now proposed to construct a Bailey bridge at the same location on the same centre-line, Line 'A'. The new profile grade will be approximately the same as the existing grade, which means that the height of the bridge approaches will be about 24 ft. above the stream bed.

In order to determine the shape and gradient of approach slopes necessary to achieve a safety factor commensurate with present-day standards, stability analyses, in terms of total stresses, were carried out by means of an electronic computer. The results of these analyses showed that 25-ft. benches would be required and trimming of existing slopes, as shown below.



Recommended Slopes

Half Section Along \varnothing Line 'A' (Other half similar)
(N.T.S.)

3. RECOMMENDATIONS: (cont'd.) ...

The side slopes of the cut sections necessary to form the benches and flattened slopes should be sloped at 3 horizontal to 1 vertical.

The proposed structure may be supported on No. 14 timber piles, creosoted to prevent decay. The lengths of piles will be dependent on the design capacity required, and may be calculated as follows:

$$Q = 0.35 L \quad \text{where} \quad \begin{array}{l} Q = \text{Safe Load, in tons/pile} \\ \text{and} \quad L = \text{Embedded Length, in ft.} \end{array}$$

The embedded length should not be less than 25 ft.

Slopes should be protected with rip-rap against erosion according to hydrological requirements.

4. MISCELLANEOUS:

The field work for this project was carried out during the period November 3 - 6, 1970.

Equipment used was owned and operated by Dominion Soil Investigation Ltd. under the supervision of Mr. P. Payer, Project Foundation Engineer, who also prepared this report.

The report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

March, 1971

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-11096(R)

LOCATION Sta. 3 + 47 24' Lt. Line 'A'

ORIGINATED BY PP

W.P. Nil

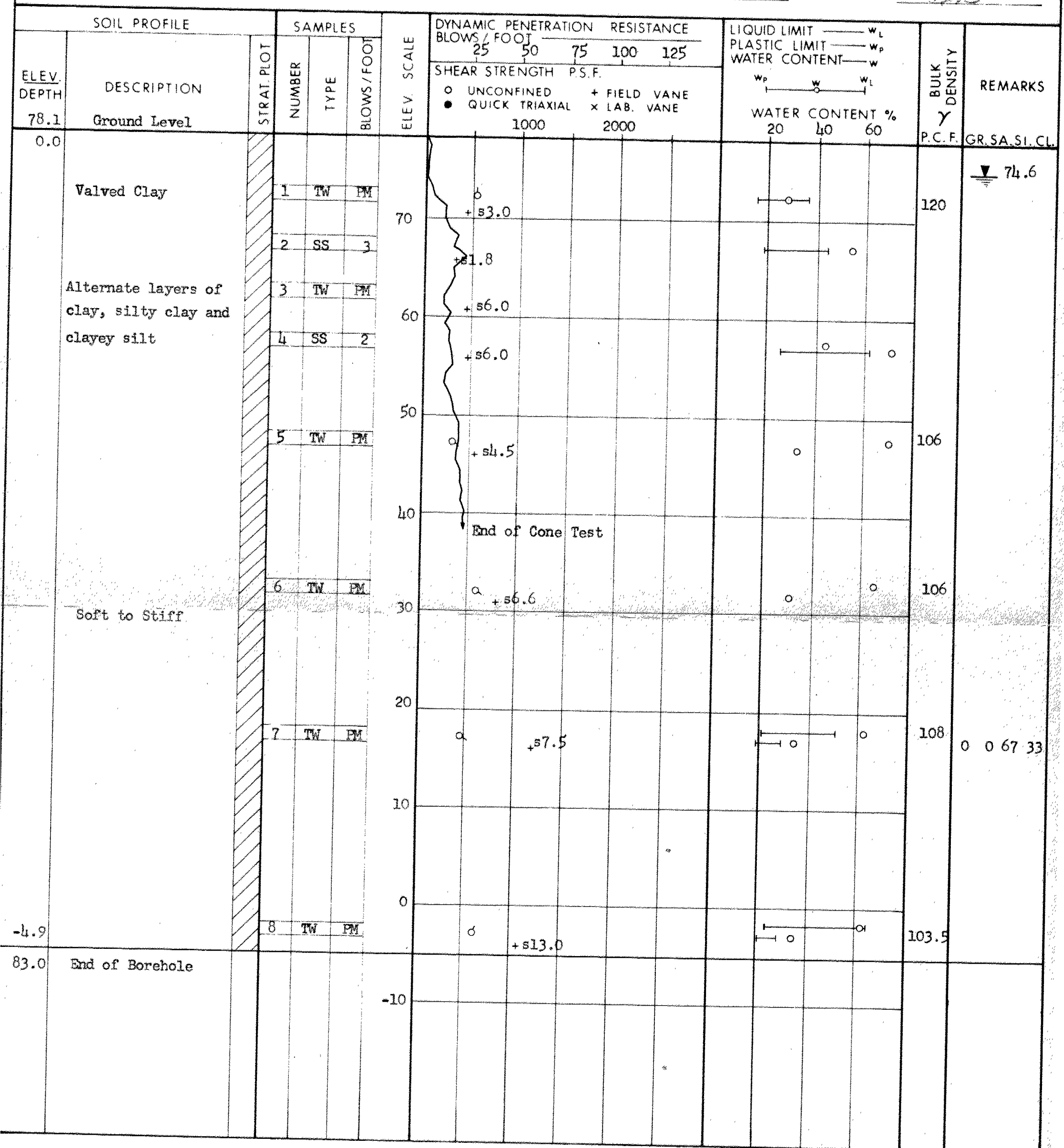
BORING DATE November 3 & 4, 1970

COMPILED BY PP

DATUM Assumed

BOREHOLE TYPE Cont. Flight Auger & Washbore

CHECKED BY



Site 29

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-11096(R)

LOCATION Sta. 2 + 26 17' Rt. Line A

ORIGINATED BY PP

W.P. Nil

BORING DATE November 4 & 5, 1970

COMPILED BY PP

DATUM Assumed

BOREHOLE TYPE Washbore - NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 20 40 60
							25	50	75	100	125	UNCONFINED ○ QUICK TRIAXIAL		+ FIELD VANE x LAB. VANE			
83.2	Ground Level																
0.0	Varved Clay Alternate layers of clay, silty clay & clayey silt Soft to Stiff		1	TW	PM	80									118	▽74.2	
			2	TW	PM	70											118
			3	TW	PM	60											103
			4	TW	PM	50											107.5
			5	TW	PM	40											107
			6	TW	PM	30											108
			7	TW	PM	20											110
			8	TW	PM	10											107.5
			9	TW	PM	0											102
-9.8			End of Borehole		10	TW	PM	-10									
93.0																	

20
10-5 % STRAIN AT FAILURE
10

Site 29

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 70-11096 (R) LOCATION Sta. 2 + 63 6' Lt. Line A ORIGINATED BY PP
W.P. N11 BORING DATE November 6, 1970 COMPILED BY PP
DATUM Assumed BOREHOLE TYPE Cone Test Only CHECKED BY HL

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	PLASTIC LIMIT — w_p	WATER CONTENT — w	WATER CONTENT %		
68.7	Water Level														
66.5	Ground Level														
2.2	Probable Varved Clay														
26.5															
42.2	End of Cone Test														

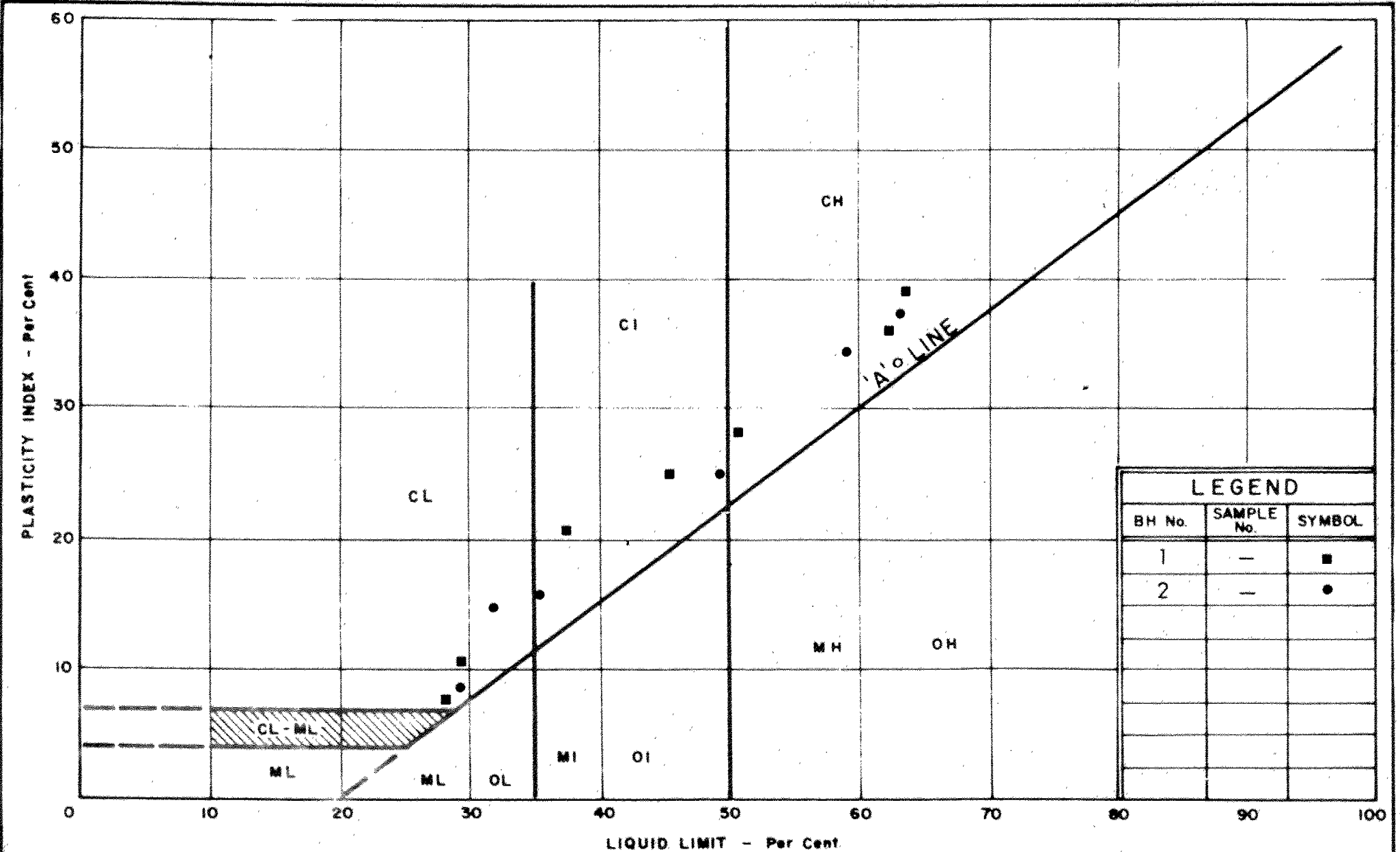
DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-11096(R) LOCATION Sta. 3 + 07 6' Rt. Line A ORIGINATED BY PP
W.P. Nil BORING DATE November 6, 1970 COMPILED BY PP
DATUM Assumed BOREHOLE TYPE Cone Test Only CHECKED BY HL

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	25	50	75	100	125	PLASTIC LIMIT — w_p	WATER CONTENT — w		
69.4	Ground Level															
0.0	Probable Varved Clay															
26.4																
43.0	End of Cone Test															



LEGEND		
BH No.	SAMPLE No.	SYMBOL
1	—	■
2	—	●



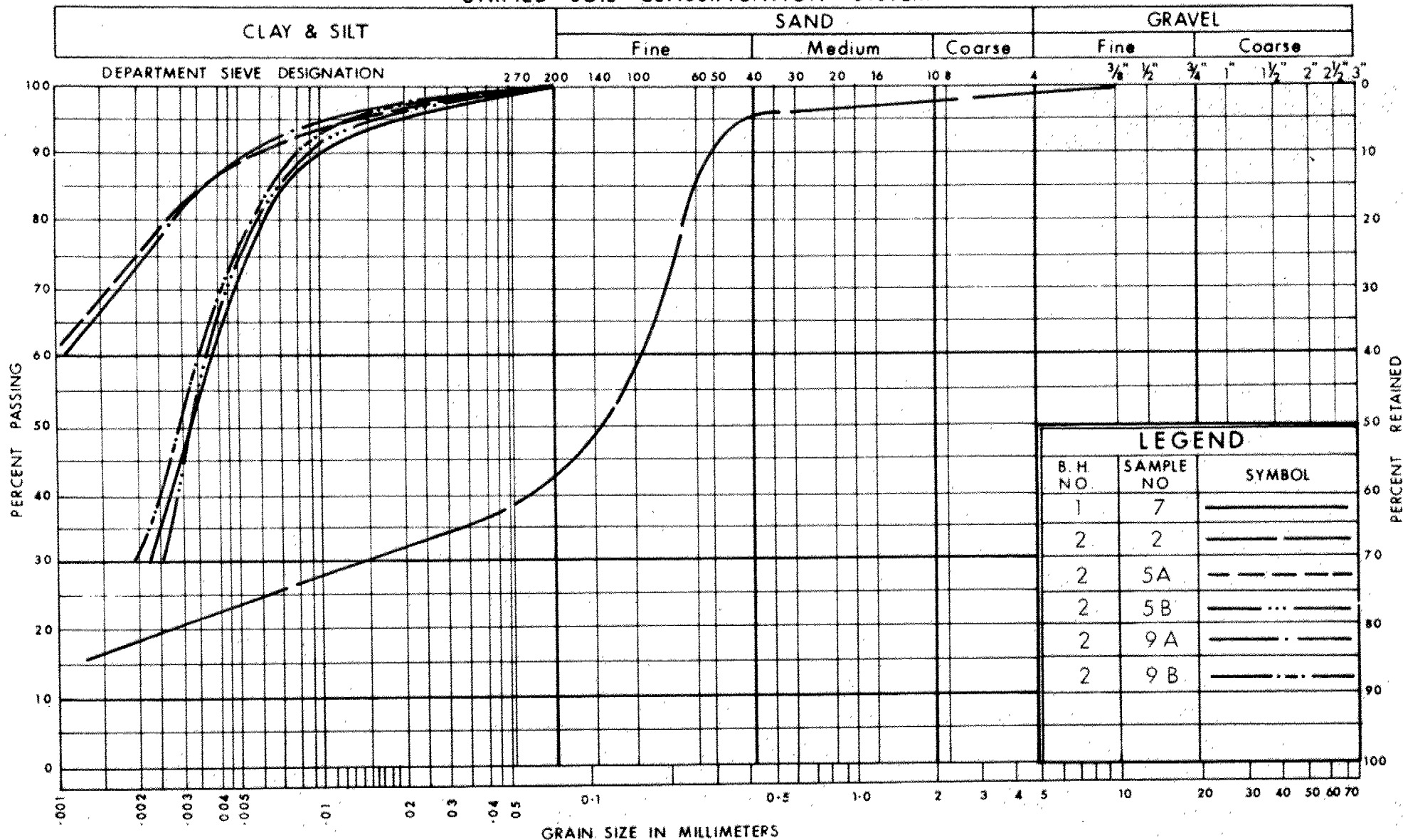
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART
VARVED CLAY

Site 29

WP No. NIL
JOB No. 70-11096 (R)
FIG. NO. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
VARVED CLAY

Site 29

W.P. No. NIL

JOB No. 70-11096 (R)

FIG. NO. 2

SHEAR STRENGTH VS ELEVATION

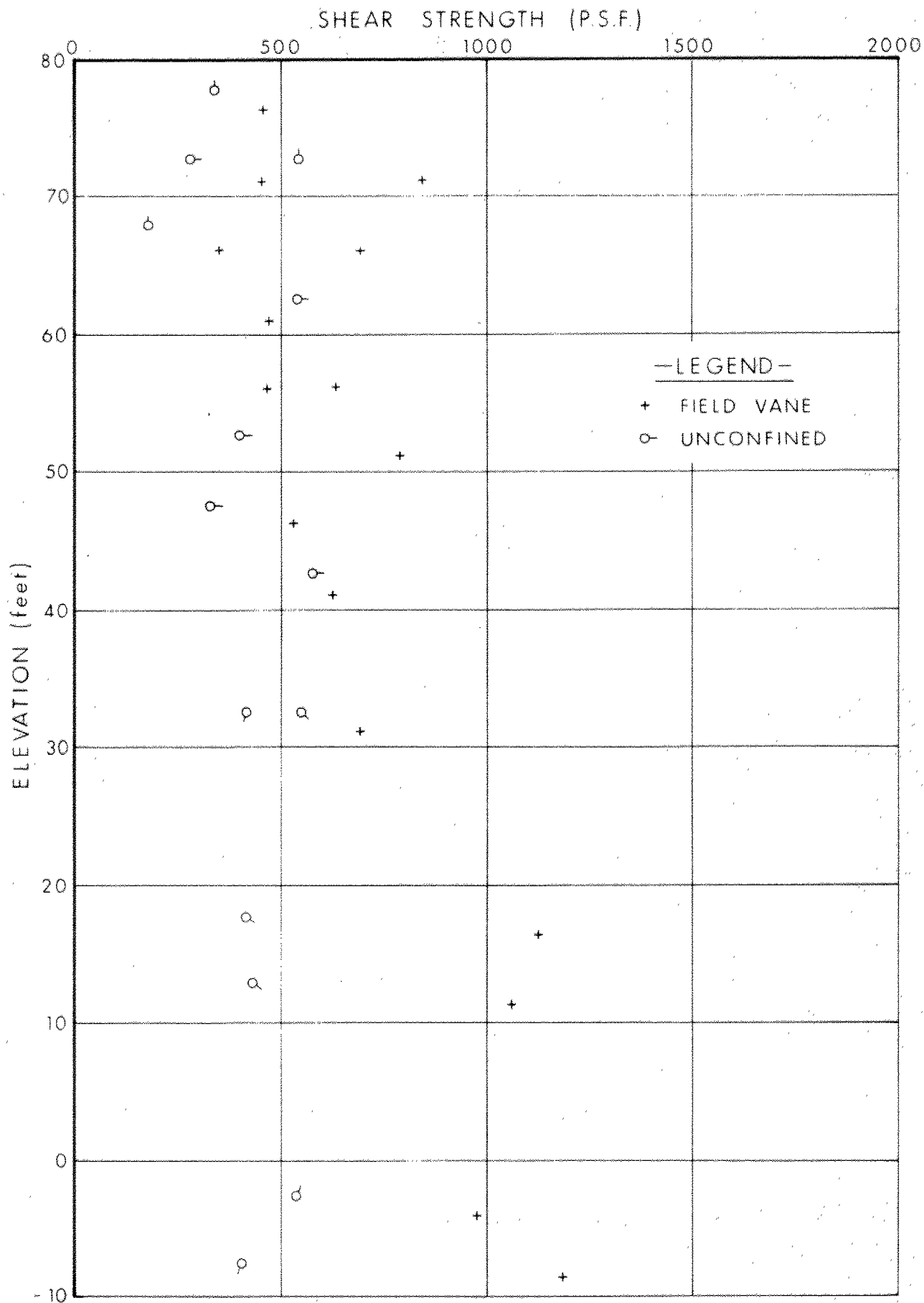


FIG. NO. 3

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
C_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

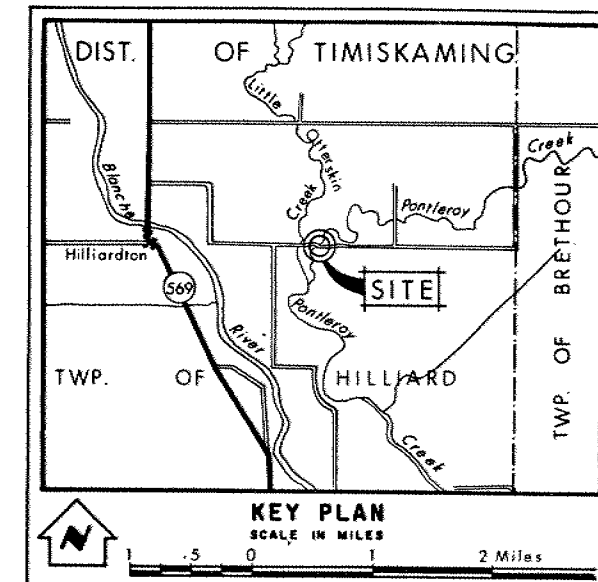
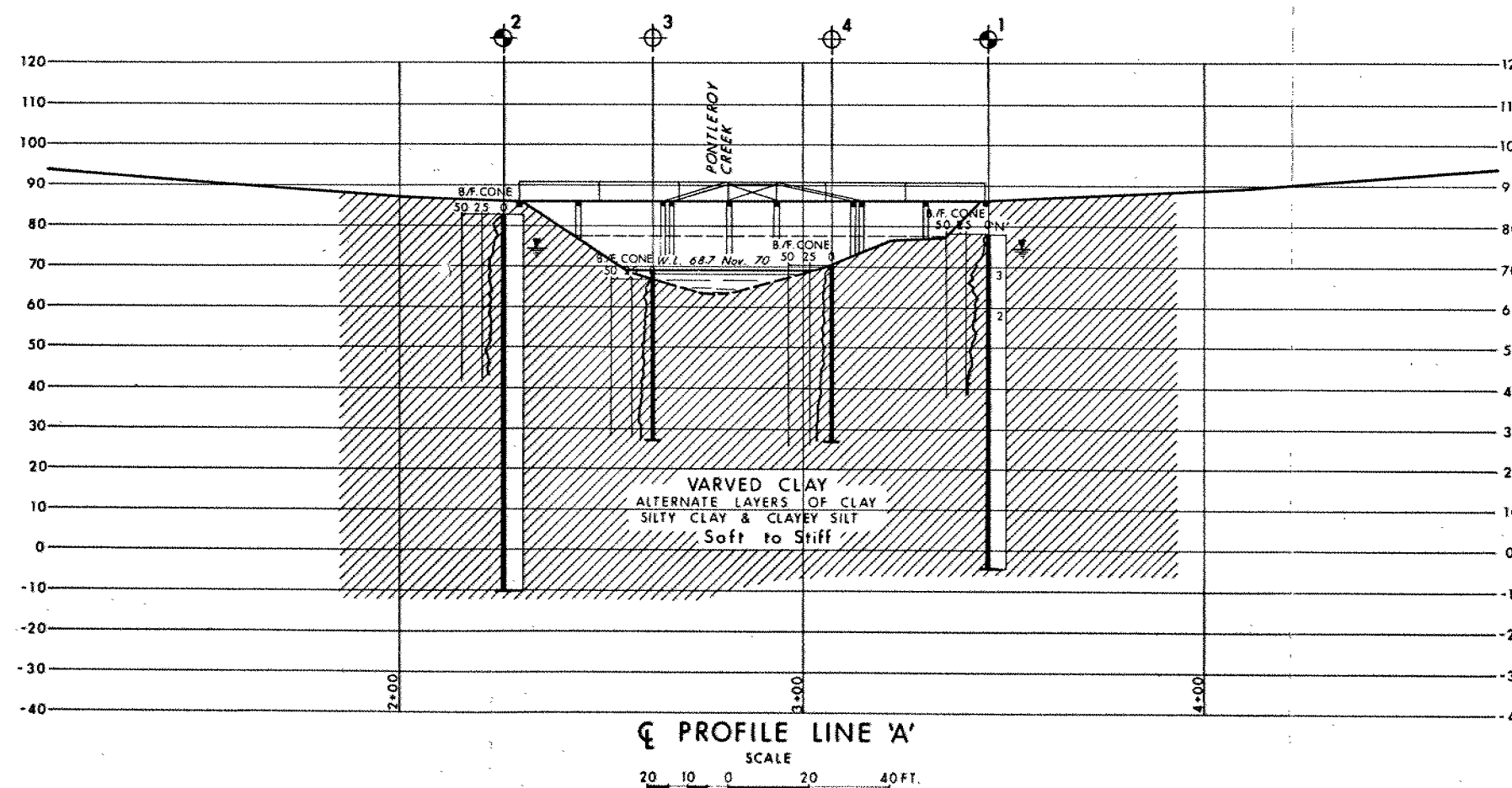
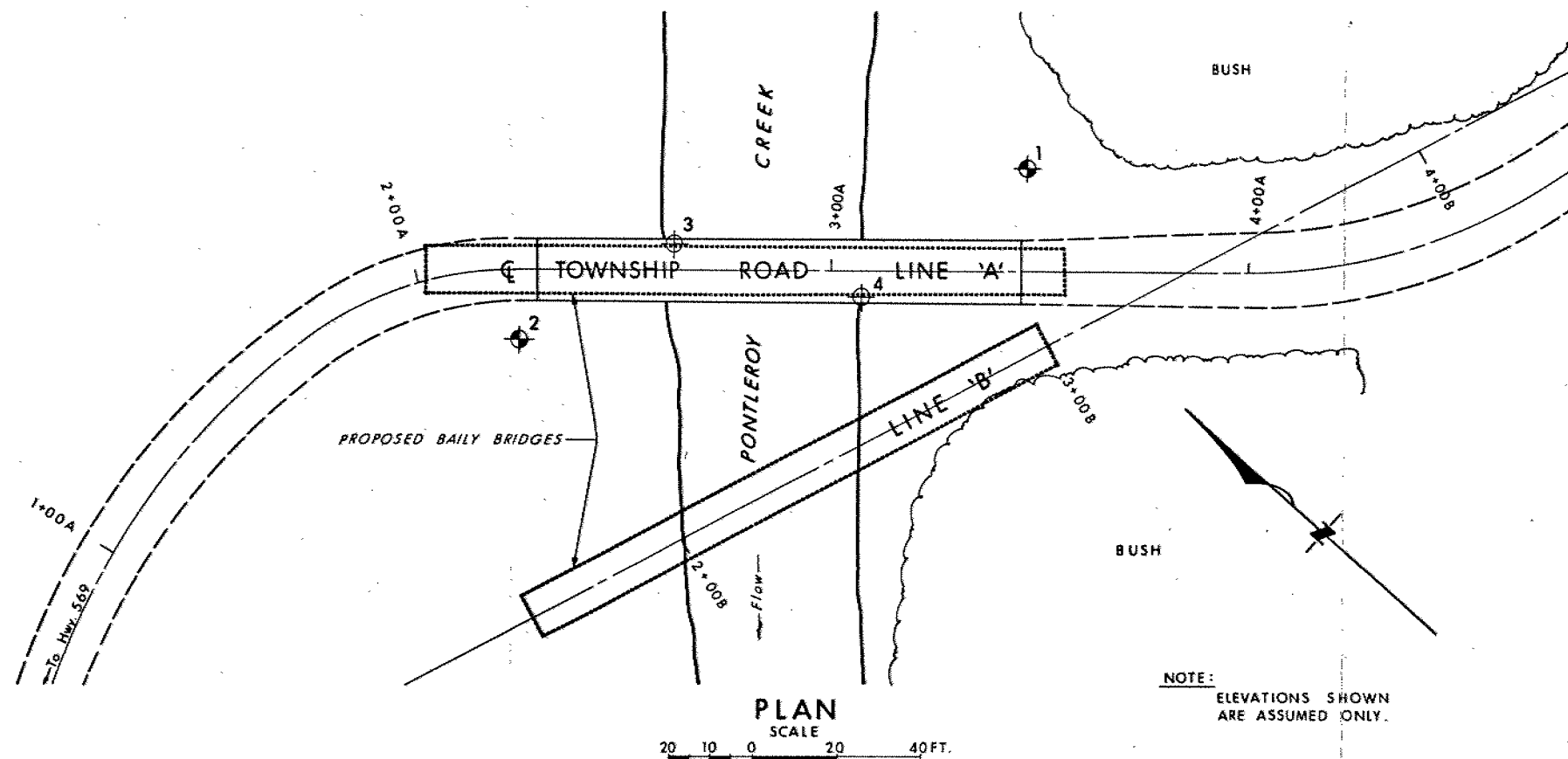
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation, Nov. 1970		

NO.	ELEVATION	STATION	OFFSET
1	78.1	3+47'A	24' LT.
2	83.2	2+26'A	17' RT.
3	68.7	2+63'A	6' LT.
4	69.4	3+07'A	6' RT.

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

PONTLEROY CREEK

KING'S HIGHWAY NO. TOWNSHIP ROAD DIST. NO. 14
Dist. of TIMISKAMING
TWP. HILLIARD LOT 9 CON. IV & V

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. P.P.	CHECKED	W.P. NO. NIL	M.B.T. DRAWING NO.
DRAWN	CHECKED	JOB NO. 70-11096 (R)	70-11096A
DATE Jan. 18, 1971	SITE NO.	BRIDGE DRAWING NO.	
APPROVED <i>A.B. Thomas</i>	CONT. NO.		

PONTLEROY CREEK (4)

JAN 11 71 70-11096

RUN DATE JAN 11, 1971

SLICES	X-INIT.	Y-INIT.	DELX	DELY	TANG.	R.L.	INCR.	NO. R	TENSION CRACK	NO. PTS.%-X<	NO. PTS.%&X<	CUT-OFF%-X<	CUT-OFF%&X<
25	50	-50	5.0	6.0	20.0		5.0	8	6.00	1	5	-100.0	120.0

X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD
-100.00	0.0	24.00	12.00	54.00	12.00	66.00	18.00	90.00	24.00	120.00	24.00		

SECTIONAL DETAILS				
SECTION	X COORD	SOIL TYPE	Y COORD	WATER TABLE
1	-100.00	1	0.0	18.00
1		2	18.00	
2	120.00	1	0.0	18.00
2		2	18.00	

SOIL PROPERTIES				
SOIL TYPE	COHESION	PHI	BULK DENSITY	SUBMERGED DENSITY
1	500.	0.0	110.0	48.0
2	500.	0.0	48.0	48.0

CRITICAL CIRCLE

RADIUS	XC	YC	F. OF S.
99.00	35.00	-44.00	1.354
105.00	35.00	-50.00	1.355
93.00	35.00	-38.00	1.356
99.00	30.00	-44.00	1.358
105.00	30.00	-50.00	1.359
111.00	35.00	-56.00	1.360
93.00	30.00	-38.00	1.361
87.00	35.00	-32.00	1.361
99.00	40.00	-44.00	1.361
105.00	40.00	-50.00	1.362

THIS JOB COMPLETED. RUNNING DATE JAN 11, 1971 TIME ELAPSED # 46 SECONDS

PONTLEROY CREEK (3)

JAN 11 71 70-11096

RUN DATE JAN 11, 1971

SLICES	X-INIT.	Y-INIT.	DELX	DELY	TANG. R.L.	INCR.	NO. R	TENSION CRACK	NO. PTS.%-X<	NO. PTS.%&X<	CUT-OFF%-X<	CUT-OFF%&X<
25	50	-50	5.0	6.0	20.0	5.0	8	6.00	1	5	-100.0	120.0

X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD
-100.00	0.0	24.00	12.00	54.00	12.00	66.00	18.00	90.00	24.00	120.00	24.00

SECTIONAL DETAILS				
SECTION	X COORD	SOIL TYPE	Y COORD	WATER TABLE
1	-100.00	1	0.0	18.00
1		2	18.00	
2	120.00	1	0.0	18.00
2		2	18.00	

SOIL PROPERTIES				
SOIL TYPE	COHESION	PHI	BULK DENSITY	SUBMERGED DENSITY
1	400.	0.0	110.0	48.0
2	400.	0.0	48.0	48.0

CRITICAL CIRCLE

RADIUS	XC	YC	F. OF S.
99.00	35.00	-44.00	1.083
105.00	35.00	-50.00	1.084
93.00	35.00	-38.00	1.085
99.00	30.00	-44.00	1.086
105.00	30.00	-50.00	1.087
111.00	35.00	-56.00	1.088
93.00	30.00	-38.00	1.089
87.00	35.00	-32.00	1.089
99.00	40.00	-44.00	1.089
105.00	40.00	-50.00	1.090

THIS JOB COMPLETED. RUNNING DATE JAN 11, 1971 TIME ELAPSED # 45 SECONDS

PONTLEROY CREEK (2)

JAN 11 71 70-11096

RUN DATE JAN 11, 1971

SLICES	X-INIT.	Y-INIT.	DELX	DELY	TANG. R.L.	INCR.	NO. R	TENSION CRACK	NO. PTS.%-X<	NO. PTS.%&X<	CUT-OFF%-X<	CUT-OFF%&X<
25	50	-50	5.0	6.0	20.0	5.0	8	6.00	1	5	-100.0	120.0

X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD
-100.00	0.0	24.00	12.00	44.00	12.00	56.00	18.00	80.00	24.00	120.00	24.00

SECTIONAL DETAILS				
SECTION	X COORD	SOIL TYPE	Y COORD	WATER TABLE
1	-100.00	1	0.0	18.00
1		2	18.00	
2	120.00	1	0.0	18.00
2		2	18.00	

SOIL PROPERTIES				
SOIL TYPE	COMESION	PHI	BULK DENSITY	SUBMERGED DENSITY
1	500.	0.0	110.0	48.0
2	500.	0.0	48.0	48.0

CRITICAL CIRCLE

RADIUS	XC	YC	F. OF S.
93.00	30.00	-38.00	1.298
87.00	30.00	-32.00	1.298
99.00	30.00	-44.00	1.302
93.00	35.00	-38.00	1.303
87.00	35.00	-32.00	1.305
87.00	25.00	-32.00	1.305
81.00	30.00	-26.00	1.305
93.00	25.00	-38.00	1.305
99.00	35.00	-44.00	1.306
105.00	30.00	-50.00	1.308

THIS JOB COMPLETED. RUNNING DATE JAN 11, 1971 TIME ELAPSED # 45 SECONDS

PONTLEROY CREEK (1)

JAN 11 71 70-11096

RUN DATE JAN 11, 1971

SLICES	X-INIT.	Y-INIT.	DELX	DELY	TANG.	R.L.	INCR.	NO. P	TENSION CRACK	NO. PTS.%-X<	NO. PTS.%&X<	CUT-OFF%-X<	CUT-OFF%&X<
25	50	-50	5.0	6.0	20.0		5.0	8	6.00	1	5	-100.0	120.0

X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD	X COORD	Y COORD
-100.00	0.0	24.00	12.00	44.00	12.00	56.00	18.00	80.00	24.00	120.00	24.00

SECTIONAL DETAILS				
SECTION	X COORD	SOIL TYPE	Y COORD	WATER TABLE
1	-100.00	1	0.0	18.00
1		2	18.00	
2	120.00	1	0.0	18.00
2		2	18.00	

SOIL PROPERTIES				
SOIL TYPE	COHESION	PHI	BULK DENSITY	SUBMERGED DENSITY
1	400.	0.0	110.0	48.0
2	400.	0.0	48.0	48.0

CRITICAL CIRCLE

RADIUS	XC	YC	F. OF S.
93.00	30.00	-38.00	1.039
87.00	30.00	-32.00	1.039
99.00	30.00	-44.00	1.042
93.00	35.00	-38.00	1.042
87.00	35.00	-32.00	1.044
87.00	25.00	-32.00	1.044
81.00	30.00	-26.00	1.044
93.00	25.00	-38.00	1.044
99.00	35.00	-44.00	1.045
105.00	30.00	-50.00	1.046

THIS JOB COMPLETED. RUNNING DATE JAN 11, 1971 TIME ELAPSED # 45 SECONDS

0-11096

Safe height of embankment

$$\text{Avg. Shear strength} = 400 \text{ P.S.F.}$$

$$\text{Safe height} = \frac{4 \times 400}{120}$$

$$\approx 13 \text{ ft.}$$

16 ft

$$\text{Max}^m \text{ possible safe height} = \frac{4 \times 500}{110}$$

$$\approx 18 \text{ ft.}$$

Pile carrying capacity (F.S. = 2)

$$\text{Above elev. 40.0} = \frac{400 \times 3}{2 \times 2000} = 0.3 \text{ tons/ft length}$$

$$\text{Between elev. 40.0 \& 20.0} = \frac{700 \times 3}{2 \times 2000} = 0.5 \text{ tons/ft length}$$

$$\text{Below elev. 20.0} = \frac{1000 \times 3}{2 \times 2000} = 0.75 \text{ tons/ft length}$$

SHEAR STRENGTH VS ELEVATION

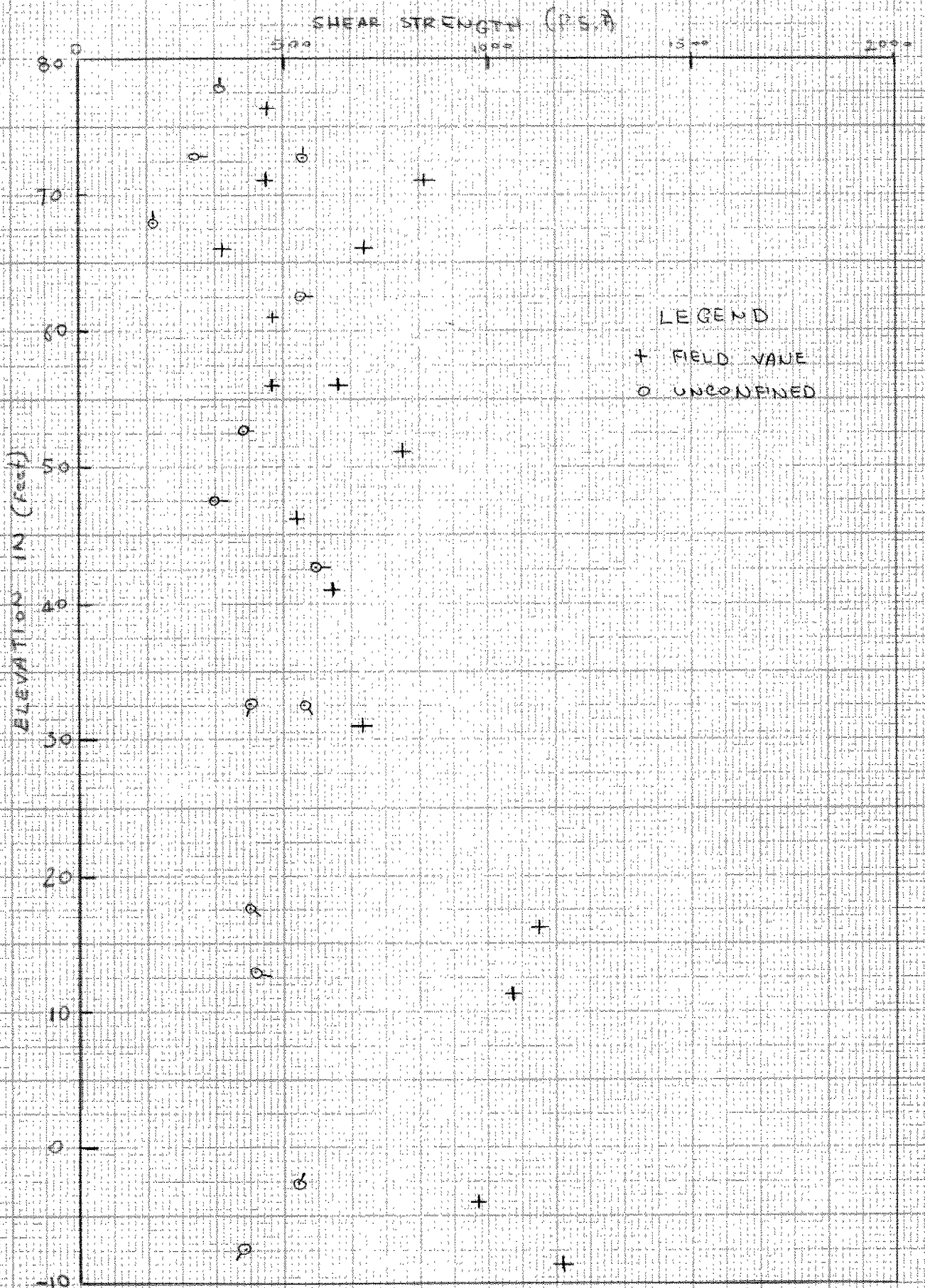
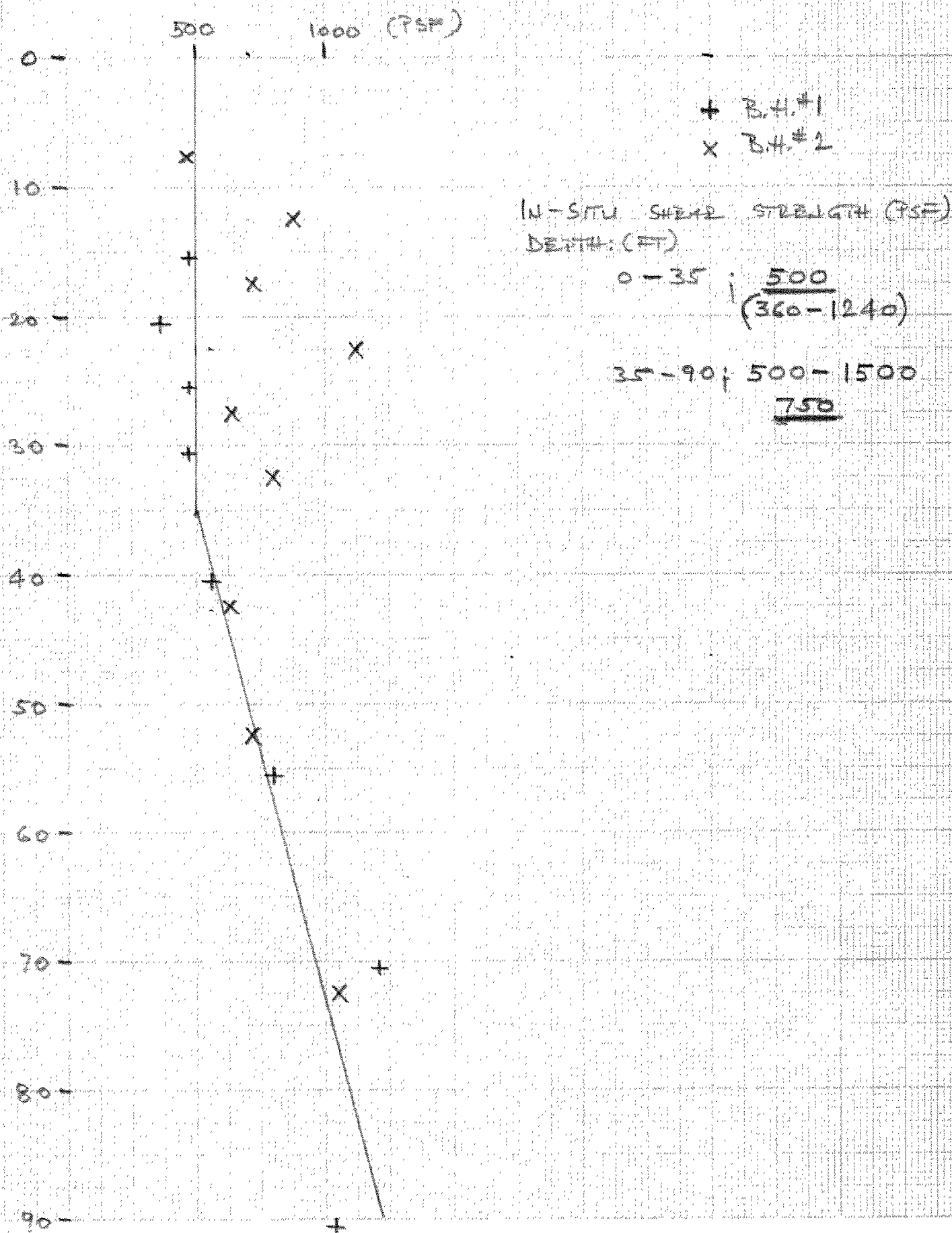
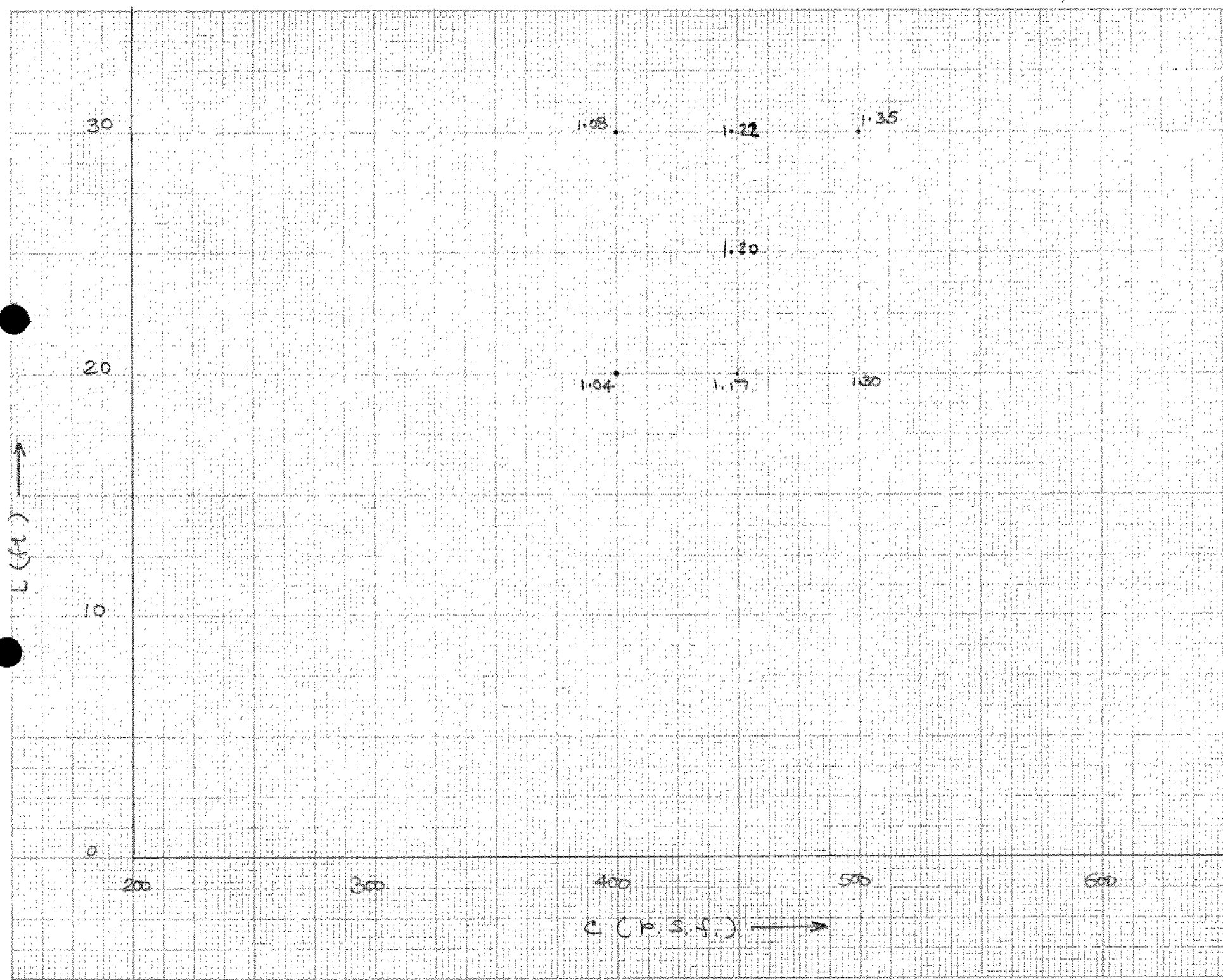


Fig. No. 3



70-11096



DESIGN LOAD

LENGTH

TYPE

12.7 TONS

52.0'

14 TIMBER

12.0 "

47.0'

20.0 "

70.0'

20.0 "

70.0'

12.2 "

41.0'

12.1 "

44.0'

12.7 " "

52.0'

14" 8"

$$L = 40 \text{ ft.}$$

11"

$$C = 500 \text{ PSF}$$

$$.92 \times 40 = 36.8 \text{ sq. ft.}$$

$$A = .46^2 \times 3.14 = .66 \text{ sq. ft.}$$

$$.92 \times 3.14 \times 40 = 115 \text{ sq. ft.}$$

$$9 \times .66 \times 500 + 115 \times 700 =$$

$$= 2950 + 80500 = 83450 \text{ lbs}$$

42.0 TONS

$$SF = 3.0 ; 14 \text{ TONS/PILE}$$

$$L = 50 \text{ ft.}$$

$$.92 \times 3.14 \times 50 = 144 \text{ sq. ft.}$$

$$9 \times .66 \times 500 + 144 \times 700 =$$

$$= 2950 + 100800 = 103750$$

52 TONS

$$52/3 = 17 \text{ TONS/PILE}$$

①

Brown Clay: 5 TO 10 FT.

LL: 35% ; PI: 14%

300 TO 2100 PSF.

VARVED CLAY:

LAYERS OF CLAY AND CLAY TO SILTY CLAY ($\frac{1}{16}$ " TO 1")
(DARK GREY) (LIGHT)

CLAY LAYERS:

LL: 65 TO 70 %

PI: 40 TO 44 %

CLAY TO SILTY CLAY:

LL: 30 %

PI: 15 %

OVER-ALL: LL: 38 TO 71% ; PI: 20 TO 45%

BULK DENSITY: 100 TO 120 PCF.

VANE TEST: 300 TO 1500 PSF

UNCONFINED: 240 TO 490 PSF

(INCREASES WITH DEPTH)

THIN LAYERS, EQUAL LIQUIDITY INDEX = HOMOGENEOUS

70-11096 (2)

Average $C = 450$ p.s.f. B.H. 1 (South)
 $C = 700$ p.s.f. B.H. 2 (North)

Height of Final slope 24'

Pile lengths required

B.H. 1 50 ft. for 15 tons -
 35 ft. for 10 tons -

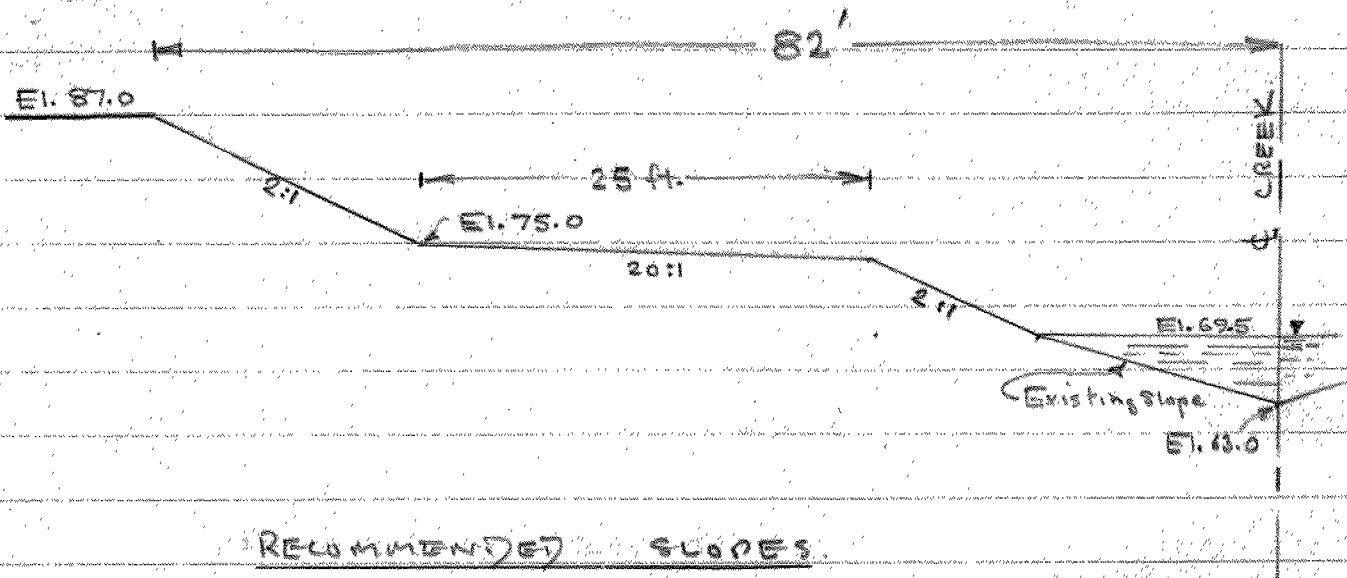
B.H. 2. 35 ft. for 15 tons
 25 ft. for 10 tons

use B.H. #2 for design
 $Q = 0.4L$

Safe Height of slope

B.H. 1 $\frac{1800}{110} = 16.4'$

2 $\frac{2900}{110} = 25.4'$



RECOMMENDED SLOPES

HALF SECTION ALONG \perp LINE 'A' (OTHER HALF SIMILAR)
(N.T.S.)

The side slopes of the cut sections necessary to form the benches and flattened slopes should be sloped at 3 horizontal to 1 vertical.

The proposed structure may be supported on No. 14 timber piles creosoted to prevent decay. The lengths of piles will be dependent on the design capacity required and may be calculated as follows:-

$$Q = 0.35 L \quad \text{where } Q = \begin{matrix} \text{in tons} \\ \text{Safe load, /pile} \end{matrix} \quad \text{and } L = \begin{matrix} \text{Embedded length} \\ \text{in ft.} \end{matrix}$$

The embedded length should not be less than 25 ft.

Slopes should be protected with rip-rap against erosion according to hydrological requirements.

FIELD BORING LOG

DRILLING CO. Dominion DATUM ELEV. 100.0 B.H. NO. 1
 DRILLER H. Brady GROUND ELEV. 78.1 JOB NO. 70-11096
 ENGINEER PP CASING SIZE NX DATE Nov. 3, 1970.

SITE LOCATION _____

HOLE LOCATION STA: 3+47; 24' LT; LINE 'A'REMARKS TWP. BRIDGEWL = 3.5' B.G.L. (Nov 6/70; 12⁰⁰ AM)

DEPTH FEET		DESCRIPTION	SAMPLE TYPE, NO. & RECOVERY	METHOD OR BLOWS & DISTANCE
FROM	TO			
0.0	5.0	Auger Hole 17 x 5" GRAY - CL - SL.		
5.0	6.5	2" SHELBY TUBE	TW #1	PM
6.5	8.0	VANE TEST: $20(12+12) \times 12" = 480 \text{ PSF}$ $20(8+8) \times 6" = 160 \text{ PSF}$	S = 3.0	
5.0	10.0	Auger Hole DAT.: SAME AS ABOVE SOME SAND AT 9'		
10.0	11.5	SPLIT SPOON: GRAY - CL - SL. V. SOFT.	SS. #2	1-1-2
11.5	13.0	VANE TEST: $20(18+18) \times 6" = 360 \text{ PSF}$ $20(10+10) \times 6" = 200 \text{ PSF}$	S = 3.6 1.8	
10.0	15.0	Auger Hole DAT.: SAME AS ABOVE		
15.0	16.5	2" SHELBY TUBE	T.W. #3	PM
16.5	18.5	VANE TEST: $20(12+12) \times 12" = 480 \text{ PSF}$ $20(4+4) \times 6" = 80 \text{ PSF}$	S = 6.0	
20.0		DRIVE NX CASING & WASH OUT DAT.: SAME AS ABOVE		
20.0	21.5	SPLIT SPOON: LAYERS OF CL - SL. thin slit - V. SOFT.	SS. #4	1-1-1

FIELD BORING LOG

DRILLING CO. <u>DOMINION</u>	DATUM ELEV. <u>100.0</u>	B.H. NO. <u>1</u>
DRILLER <u>H. BRY</u>	GROUND ELEV. <u>78.1</u>	JOB NO. <u>70-11096</u>
ENGINEER <u>FP</u>	CASING SIZE <u>NK</u>	DATE <u>NOV. 3, 1970</u>
SITE LOCATION _____		
HOLE LOCATION <u>STA: 3+47; 24' LT; LINE 'A'</u>		
REMARKS _____		

DEPTH FEET		DESCRIPTION	SAMPLE TYPE, NO. & RECOVERY	METHOD OR BLOWS & DISTANCE
FROM	TO			
21.5	23.0	VANE TEST: $20(24+24) \times 6" = 480 \text{ PSF}$ $20(4+4) \times 6" = 80 \text{ PSF}$	$S = 6.0$	
20.0	30.0	WASH AHEAD OF CASING MATERIAL: SAME AS ABOVE		
30.0	31.5	2" SHELBY TUBE	T.W. #5	PM
31.5	33.0	VANE TEST: $20(28+28) \times 6" = 560 \text{ PSF}$ $20(6+6) \times 6" = 120 \text{ PSF}$	$S = 4.5$	
30.0	45.0	WASH AHEAD OF CASING MATERIAL: SAME AS ABOVE		
45.0	46.5	2" SHELBY TUBE	T.W. #6	PM
46.5	48.0	VANE TEST: $20(20+20) \times 12" = 800 \text{ PSF}$ $20(12+12) \times 3" = 120 \text{ PSF}$	$S = 6.6$	
		END OF DAY.		
45.0	60.0	WASH AHEAD OF CASING MATERIAL: SAME AS ABOVE		
60.0	61.5	2" SHELBY TUBE	T.W. #7	PM
61.5	63.0	VANE TEST: $20(30+30) \times 12" = 1700 \text{ PSF}$ $20(8+8) \times 6" = 160 \text{ PSF}$	$S = 7.5$	
60.0	80.0	WASH AHEAD OF CASING MATERIAL: SAME AS ABOVE		

FIELD BORING LOG

DRILLING CO. Dominion DATUM ELEV. 100.0 B.H. NO. 1
DRILLER H. Feny GROUND ELEV. 78.1 JOB NO. 70-11096
ENGINEER PP CASING SIZE NX DATE Nov. 4, 1970.

SITE LOCATION

HOLE LOCATION STA: 3+47; 24' LT; LINE 'A'

REMARKS

[illegible]

FIELD BORING LOG

DRILLING CO. DOMINION DATUM ELEV. 100.0 B.H. NO. 2
 DRILLER H. ERNY GROUND ELEV. 83.2 JOB NO. 70-11096
 ENGINEER PP CASING SIZE Nx DATE Nov. 4. 1970.

SITE LOCATION _____

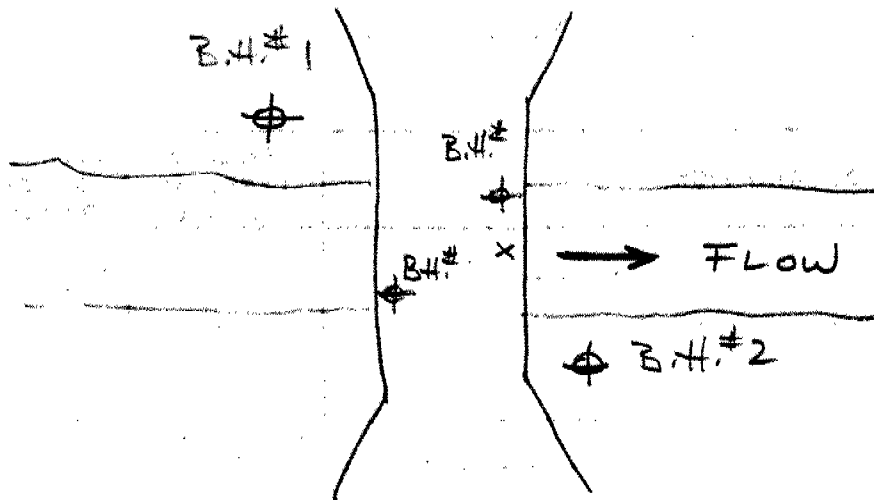
HOLE LOCATION STA: 2+26; 17' RT; LINE 'A'

REMARKS _____

WL = 9.0' B.G.L. (Nov. 6/70, 12⁰⁰ AM)

DEPTH FEET		DESCRIPTION	SAMPLE TYPE, NO. & RECOVERY	METHOD OR BLOWS & DISTANCE
FROM	TO			
0.0	5.0	DRIVE Nx CASING & WASH OUT MAT.: SOME FILL (APPR. 1-5') AND BROWN - CL. SI.		
5.0	6.5	2" SHELBY TUBE	T.W.#1	PM
6.5	8.0	VALE TEST: $20(12+12) \times 12" = 480 \text{ PSF}$ $20(4+4) \times 6" = 40 \text{ PSF}$	S = 6.0	
5.0	10.0	DRIVE Nx CASING & WASH OUT MAT.: SAME AS ABOVE - GRAY AT 7'		
10.0	11.5	2" SHELBY TUBE	T.W.#2	PM
11.5	13.0	VALE TEST: $20(44+44) \times 6" = 880 \text{ PSF}$ $20(14+14) \times 6" = 280 \text{ PSF}$	S = 3.1	
10.0	15.0	WASH AHEAD OF CASING. MAT.:		
		END OF DAY		
15.0	16.5	2" SHELBY TUBE	T.W.#3	PM
16.5	18.0	VALE TEST: $20(18+18) \times 12" = 720 \text{ PSF}$ $20(6+6) \times 6" = 120 \text{ PSF}$	S = 6.0	
15.0	20.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		

OLD BRIDGE DATA



X DISTANCE FROM OLD BRIDGE DECK LEVEL TO WATER LEVEL:

DEPTH OF WATER

FIELD BORING LOG

DRILLING CO. <u>DOMINION</u>	DATUM ELEV. <u>100.0</u>	B.H. NO. <u>2</u>
DRILLER <u>H. EDWARDS</u>	GROUND ELEV. <u>83.2</u>	JOB NO. <u>70-11096</u>
ENGINEER <u>PD</u>	CASING SIZE <u>Nx</u>	DATE <u>Nov. 5, 1970</u>
SITE LOCATION _____		
HOLE LOCATION <u>STA: 2+26; 17' 2", LINE 'A'</u>		
REMARKS _____		

DEPTH FEET		DESCRIPTION	SAMPLE TYPE, NO. & RECOVERY	METHOD OR BLOWS & DISTANCE
FROM	TO			
20.0	21.5	2" SHELBY TUBE	T.W.# 4	PM
21.5	23.0	VANE TEST: $20(28+28) \times 12" = 1120 \text{ PSF}$ $20(4+4) \times 6" = 80 \text{ PSF}$		S = 14.0
20.0	25.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		
25.0	26.5	2" SHELBY TUBE	T.W.# 5	PM
26.5	28.0	VANE TEST: $20(16+16) \times 12" = 640 \text{ PSF}$ $20(4+4) \times 6" = 80 \text{ PSF}$		S = 8.0
25.0	30.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		
30.0	31.5	2" SHELBY TUBE	T.W.# 6	PM
31.5	33.0	VANE TEST: $20(20+20) \times 12" = 800 \text{ PSF}$ $20(4+4) \times 6" = 80 \text{ PSF}$		S = 10.0
30.0	40.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		
40.0	41.5	2" SHELBY TUBE	T.W.# 7	PM
41.5	43.0	VANE TEST: $20(16+16) \times 12" = 640 \text{ PSF}$ $20(4+4) \times 6" = 80 \text{ PSF}$		S = 8.0
40.0	50.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		

FIELD BORING LOG

DRILLING CO. DOMINION DATUM ELEV. 100.0 B.H. NO. 2
 DRILLER H. ERNY GROUND ELEV. 83.2 JOB NO. 70-11096
 ENGINEER PP CASING SIZE NX DATE Nov. 5, 1970.
 SITE LOCATION _____
 HOLE LOCATION STA: 2+26; 17' 2", LINE 'A'
 REMARKS _____

DEPTH FEET		DESCRIPTION	SAMPLE TYPE, NO. & RECOVERY	METHOD OR BLOWS & DISTANCE
FROM	TO			
50.0	51.5	2" SHELBY TUBE	T.W.#8	PM
51.5	53.0	VANE TEST: $20(18+18) \times 12" = 720 \text{ PSF}$ $20(6+6) \times 6" = 20 \text{ PSF}$	S=9.0	
50.0	70.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		
70.0	71.5	2" SHELBY TUBE	T.W.#9	PM
71.5	73.0	VANE TEST: $20(26+26) \times 12" = 1040 \text{ PSF}$ $20(10+10) \times 6" = 200 \text{ PSF}$	S=5.2	
70.0	90.0	WASH AHEAD OF CASING MAT.: SAME AS ABOVE		
90.0	91.5	2" SHELBY TUBE	T.W.#10	PM
91.5	93.0	VANE TEST: $20(30+30) \times 12" = 1200 \text{ PSF}$ $20(15+15) \times 6" = 300 \text{ PSF}$	S=4.0	
		END OF BOREHOLE		
		DYNAMIC CONE PENETRATION TEST		
0.0	10.0	3-8-6-6-4-7-8-9-10-11		
10.0	20.0	15-14-15-12-15-14-12-12-11-15		
20.0	30.0	12-14-11-15-14-12-12-12-12-14		
30.0	40.0	12-14-17-19-18-15-15-17-16-16		
		END OF CONE TEST		

FIELD BORING LOG

DRILLING CO. DOMINION DATUM ELEV. 100.0 B.H. NO. 3
DRILLER H. BRY GROUND ELEV. SEE BELOW JOB NO. 70-11096
ENGINEER PP CASING SIZE — DATE Nov. 6, 1970.
SITE LOCATION _____
HOLE LOCATION STA: 2+63; 6' LT. LINE 'A'
REMARKS CONC TEST ONLY

[illegible]

FIELD BORING LOG

DRILLING CO. DOMINION DATUM ELEV. 100.0 B.H. NO. 4
DRILLER H. BENVY GROUND ELEV. SEE BELOW JOB NO. 70-11096(R)
ENGINEER PP CASING SIZE — DATE NOV. 6, 1970
SITE LOCATION STA: 3+07; 6' RT, LINE 'A'
HOLE LOCATION (AT CENTER OF BRIDGE: WL=178' BEATH=5')
REMARKS CONC TEST ONLY

DEPTH FEET		DESCRIPTION	SAMPLE TYPE, NO. & RECOVERY	METHOD OR BLOWS & DISTANCE
FROM	TO			
		0.0' ——— BRIDGE DECK LEVEL	EL: 86.4'	
		17.0' ——— GROUND LEVEL	EL: 69.4'	
		DYNAMIC CONE PENETRATION TEST		
0.0	17.0	—		
17.0	20.0	0-4-4		
20.0	30.0	4-6-5-7-6-6-6-6-7-6		
30.0	40.0	6-7-8-7-8-8-8-7-8-8		
40.0	50.0	7-10-10-10-10-10-11-10-11-11		
50.0	60.0	12-14-14-14-14-14-15-15-14-15		
		END OF CONE TEST		

10-10070

(1) CUT SLOPES ARE ALWAYS ANALYSED USING (A) TOTAL STRESS ANALYSIS (TO ENSURE STABILITY AT END OF CONSTRUCTION) AND (B) EFFECTIVE STRESS ANALYSIS (TO ENSURE LONG TERM STABILITY WHEN EQUILIBRIUM PORE PRESSURE CONDITIONS HAVE BEEN REACHED)

(2) IN THE CASE OF PONTLEEROY CREEK STRUCTURE A DIFFERENT APPROACH WAS USED. SINCE THE SLOPES WERE ON THE VERGE OF FAILURE THE VALUE OF C_u TO ACHIEVE A SAFETY FACTOR OF 1.0 WAS CALCULATED BY CARRYING OUT TOTAL STRESS ANALYSES. [IN SUCH A CASE EFFECTIVE STRESS ANALYSES AND TOTAL STRESS ANALYSES PRODUCE THE SAME SAFETY FACTOR (I.E. 1.0)] USING THE VALUE OF C_u THUS OBTAINED, THE GEOMETRY NECESSARY TO ACHIEVE A SUFFICIENT SAFETY FACTOR WAS THEN DESIGNED. THIS METHOD IS DEEMED TO BE ENTIRELY ADEQUATE SINCE THE AGE OF THE EXISTING STRUCTURE IS MORE THAN 20 YEARS.

K.L. Sullivan
March 22nd 1971

MEMORANDUM

To: A. G. Stermac,
Principle Foundations Engr.,
Downsview, Ontario.

FROM: J. T. Kernaghan,
District Municipal Engineer,
#14, New Liskeard.

ATTENTION:

DATE: October 19, 1970

OUR FILE REF.

IN REPLY TO

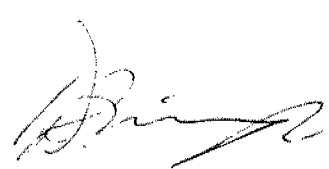
SUBJECT:

Re: Township of Hilliard,
Pontleroy Structure,
Site #47-168,
Lot 9, Conc. IV & V

In connection with Mr. J. T. Kernaghan's conversation with Mr. E. R. Saint, please find attached, plan/profile for the above noted site, also, a copy of the Township in question indicating the site location.

The purchase order number requesting the soils investigation is M-196551.

If further clarification is required, please call.



D. R. Middaugh,
Municipal Supervisor
for
J. T. Kernaghan,
District Municipal Engineer
DRM/tc
encl:
cc: E. R. Saint,
Reg. Mat'l Engr.
North Bay, Ont.

569

INGRAM

ARMSTRONG

BRETHOUR

HILLIARD

1 2 3 4 5 6 7 8 9 10 11 12

VI

V

IV

III

II

I

LITTLE OTTER

BLANCH

OTTER

RYAN

CASH

MOOSE CREEK

NO 569

S.R.

HARLEY

HILLIARD

To Hwy 11
2 MILES



THORNLOE