

63-F-241 M

MOORE & SOMBRA
T.L.

BLACK CREEK

TOWNSHIP

BRIDGE #9

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Materials and Research Section,
Room 107, Lab. Bldg.
DOWNSVIEW.

FROM: G. C. E. Burkhardt,

DATE: February 10, 1964.

OUR FILE REF.

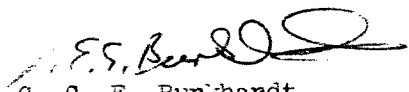
IN REPLY TO

SUBJECT: County of Lambton
Township Bridge #9 over Black Creek
on Townline between Twp's. of Sombra and Moore
Structure Site No. 15-191
Our File No. BA 1744

Attached please find one (1) copy of the
Foundation Report, by E. M. Peto Associates Limited,
and one (1) copy of the Preliminary Plan for your
comments.

We would appreciate it very much, if we could
have your comments on or before February 20, 1964.

GCEB/im


G. C. E. Burkhardt,
for K. L. Kleinsteinber,
Municipal Bridge Liaison Engineer.

c.c. J. Walter

*Filed foundation logical choice
No comment
By phone Feb 11, 1964 GCEB
A. Stermac*

P.B. 1774

E. M. PETO ASSOCIATES LIMITED

1287 Caledonia Road,
Toronto 19, Ontario.

Our Job Number 63229

789 - 1126.

11th December 1963.

The County of Lambton,
c/o J. A. Monteith & Associates Ltd.,
Consulting Engineers,
P. O. Box 579,
Petrolia, Ontario.

63 E-241 M

Gentlemen,

County Bridge #9, Black Creek
Moore and Sombra Township Line
County of Lambton

We have pleasure in submitting four copies of our Report
Number 63229 on the subsoil investigation for the above Project. One
additional copy has been forwarded directly to Mr. O. van Deurs,
Lambton County Engineer.

The investigation has indicated that, within the probable
economic spread footing foundation depth, the allowable net bearing
capacity of subsoil does not exceed 1.5 tons/sq. ft, and that the settlements
might be quite important even under this loading. In contrast, the con-

PAGE TWO

ditions can be regarded as excellent for supporting the proposed bridge on a pile foundation. Sound shale bedrock commences near elevation 550.2, which is approximately 51 ft below the existing grade.

While we consider the report to be complete within your terms of reference, we would gladly provide additional assistance should you wish to discuss further any aspects of this investigation.

Yours very truly,

E. M. PETO ASSOCIATES . ETD.

A handwritten signature in dark ink, appearing to read 'E. M. Peto', written in a cursive style.

E. M. Peto, P. Eng.

RK/ap

THE COUNTY OF LAMBTON

C/O J. A. MONTEITH & ASSOCIATES LTD.
CONSULTING ENGINEERS.

COUNTY BRIDGE #9, BLACK CREEK
MOORE and SOMBRA TOWNSHIP LINE
COUNTY OF LAMBTON

E. M. PETO ASSOCIATES LTD.

1287 Caledonia Road,
Toronto 19, Ontario

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BOREHOLE LOGS

SITE PLAN

PROFILE

A. INTRODUCTION

The work described in this report was authorized verbally by Mr. G. Ingram, P. Eng., of J. A. Monteith & Associates Ltd., Consulting Engineers,

A new bridge is to be constructed over the Black Creek, in connection with the proposed improvement of a county road on the Moore and Sombra Townships line. The present course of the Black Creek is to be diverted, and the proposed relative positions of the present and new creek beds and bridges are indicated on the enclosed site plan.

According to preliminary information, the new bridge will have a single span of approximately 100 ft and will be located about 150 ft west of the existing structure.

B. GENERAL INFORMATION

1. The site is located just west of the crossing of Black Creek, on the line between the Townships of Moore (Lot 3, Conc. I) and Township of Sombra (Lot 28, Conc. XV).

B. GENERAL INFORMATION - Cont'd

2. Two test holes were performed, in the approximate locations of the abutments of the new bridge. The positions were chosen and indicated to our drilling foreman by Mr. G. Ingram, P. Eng., who also supplied us with Geodetic elevations at the borehole locations.

The elevations are entered on the borehole logs and drawing, and are referred to a bench mark of elevation 608.4, taken at centre line of the existing bridge immediately to the east of the site.

3. Test hole 1 was put down to bedrock, which was proved by 10 ft of diamond drilling.

Test hole 2 encountered refusal at a similar depth as the bedrock surface in test hole 1, but the rock in this case was not proved by diamond drilling on the instruction of Mr. G. Ingram, issued directly to our drilling foreman.

4. The field work was performed by our drilling unit #6, between 18th and 21st November 1963. Our standard drilling and sampling procedures were followed.

5. In view of the probable adoption of a pile foundation for the proposed bridge, the laboratory testing of soil samples, apart from natural water content measurements, was restricted to four unconfined compression tests with volumetric analyses and two Atterberg limit tests.

C. SOIL CONDITIONS

Details of soil conditions encountered in the test holes are described on the borehole logs, while a simplified subsoil profile, in the form of a section through the test holes, is presented on the appended drawing. The distribution of water content and standard penetration resistance with depth is plotted on Fig. 1, on which results of Atterberg limit tests and unconfined compression tests are also included.

The main characteristics of the subsoil, with regard to bridge foundation design, are the occurrence of a stratum of firm to soft clay between the average elevations 589 and 556, and the presence of a hard shale bedrock near elevation 550.

The clay stratum can be regarded as consisting of two parts, the uppermost^{of} which, down to the approximate elevation 573.5 contains silt and numerous pebbles, while below this level the clay is less silty and contains few pebbles. The water content in the lower layers is higher than in the upper zone.

Between the elevations 585 and 575, the undrained shear strength of the clay ranged from 1380 to 1620 lb/sq. ft, the average of the four unconfined compression tests being 1460 lb/sq. ft.

In test hole 1, the clay stratum, was covered by an 11.6 ft thick deposit of very desiccated fissured silt with some fine sand and organic matter. In test hole 2, similar material extended to a depth of 7.2 ft and was followed by a 6.5 ft thick deposit of soft

C. SOIL CONDITIONS - Cont'd

organic silt with layers of gravel. The gravel was a source of ground water seepage.

A layer of stiff clay with sand, grits and silt pockets, approximately 5 ft thick, intervenes between the soft clay deposit and the shale bedrock, and the lower portions of this layer contain a considerable quantity of broken shale.

D. GROUND WATER CONDITIONS

The only source of water seepage encountered in the test holes was the gravel seam, encountered in test hole 2 between the depths of 10 and 13.7 ft. The gravel probably carried water from the creek, but its absence in test hole 1 suggests that it is localized and does not form an extensive stratum.

Very slow seepage of ground water occurred in the very dense layers immediately above the bedrock. At all remaining depths, no free water was encountered.

E. CONCLUSIONS and RECOMMENDATIONS

If the bridge were to be supported on spread footings, the foundations would probably be located between elevations 585 and 580. Within this depth, for a factor of safety of three against shear failure, the allowable bearing capacity would be not higher than 1.5 ton/sq. ft. This value is probably rather low for an economical spread footing foundation design. Moreover, the subsoil below such footings would be subject to settlements. Because of the improbability that the bridge would be supported on footing foundations, consolidation characteristics of subsoil were not studied. However, from our experience with similar materials, it can be judged that the settlements would be quite important.

In contrast to the unfavourable characteristics of subsoil with respect to a spread footings, the conditions for a pile foundation are excellent at this site. Hard shale bedrock was encountered in test hole 1 at elevation 550.2 and was found to be in a sound state. Consequently, it is recommended that the bridge be supported on piles, which can carry a high load, determined by the manufacturer's specifications for the condition of support on sound shale bedrock.

The driving of piles would be easy down to an approximate elevation 556. Below this level, the resistance to driving will increase and become very high in the broken shale layers apparently present near elevation 554. In order to overcome the resistance without damaging the piles, it is recommended to reinforce the pile tips.

E. CONCLUSIONS and RECOMMENDATIONS - Cont'd

The piles should not be overdriven after refusal has been reached, in order not to shatter the bedrock.

2. Excavations and Embankments

According to data obtained from the two test holes, the material above approximate elevation 587.7 to 590.4 will consist mostly of a weathered silt with some fine sand, which must be regarded as susceptible to frost heave and, if it is used in reconstruction of the embankments, the pavements should be protected with a granular cushion. At a greater depth, the excavated subsoil will be mostly a silty clay with grits and pebbles, and will probably be recovered at a water content of between 24% and 26%, which is a little wetter than the plastic limit. In this condition, the clay could be regarded as suitable for use as backfill in reconstructed embankments and behind bridge abutments, although imported granular fill may prove more advantageous for the latter purpose.

Organic silt layers may also be present within the depth of excavation, and this material should be rejected and not used in the embankments.

Report prepared by:

R. Kulesza

R. Kulesza, P. Eng.

E. M. PETO ASSOCIATES LTD.

C. F. Freeman

C. F. Freeman, P. Eng.
Chief Engineer.

RK/AP

Our Job Number 63229

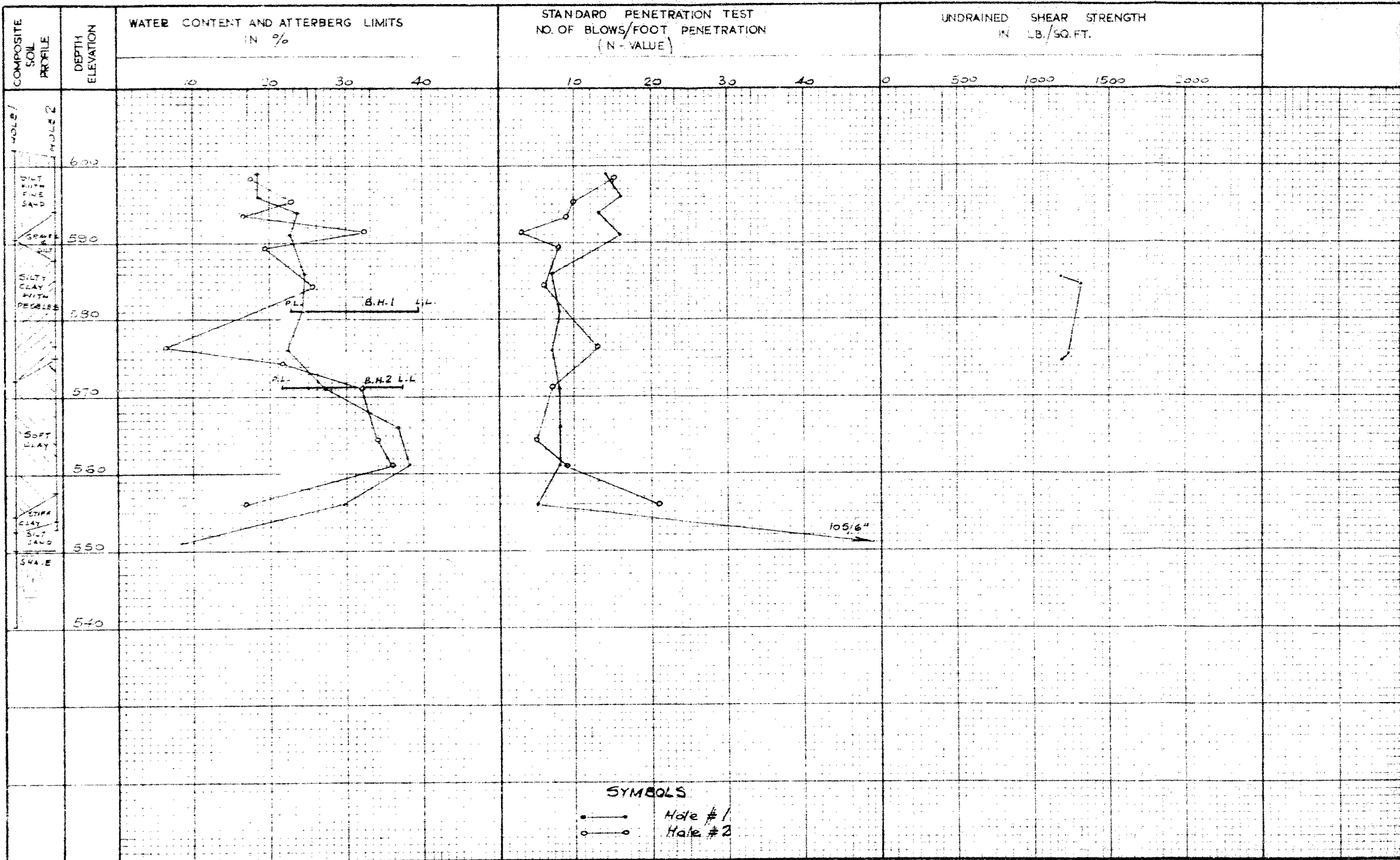
11th December 1963.

E. M. PETO ASSOCIATES LTD.

UNCONFINED COMPRESSION TEST DATA SHEET

Borehole #	Sample #	Depth	M. C. %	Wet Density p.c.f.	Dry Density p.c.f.	Void ratio e	Job No. 63229
							u/c Shear Strength P.S.F.
1	8	16'6"-17'	22.3	129.0	105.2	0.60	1380
1	8	17'-17'6"	22.7	128.0	104.5	0.61	1620
1	12	26'6"-27'	13.7	136.5	120.5	0.42	1460
1	12	27'-27'6"	15.9	134.0	116.0	0.45	1380







GEOTECHNICAL SOIL PROPERTIES



e. m. peto associates ltd.
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO
BOREHOLE LOG

BOREHOLE LOG

Job Name County Bridge Job No. 63234 Borehole No. 1
 Client County of Loudoun Casing P.N. 6" ID Boring Date 18 & 19 Nov 64
 Elevation 202.0 Compiled By R. K. Checked By _____

SAMPLE CONDITION		SAMPLE TYPE		ABBREVIATIONS	
	UNDISTURBED	A.S.	AUGER SAMPLE	V.T.	IN SITU VANE SHEAR TEST
	FAIR	C.S.	CASING SAMPLE	M.	MOIST
		S.S.	2" STANDARD SPLIT TUBE SAMPLE	W.L.	WATER LEVEL IN CASING
		S.L.	SPLIT BARREL WITH LINERS	W.T.	GROUND WATER TABLE IN SOIL
	DISTURBED	S.T.	THIN-WALLED SHELBY TUBE SAMPLE	W.T.P.L.	WETTER THAN PLASTIC LIMIT
	LOST	W.S.	WASH SAMPLE	D.T.P.L.	DRIER THAN PLASTIC LIMIT
		R.C.	ROCK CORE	A.P.L.	ABOUT PLASTIC LIMIT

[illegible]

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

County Bridge #1

Job Name County of Landover

Job No. 00222

Borehole No. _____

Client c/o F. A. Monteith Assoc. Ltd.

Casino

Boring Data 23 & 24 Nov. 65

Elevation 601.4

Compiled By _____ 8-13

Checked By _____

SAMPLE CONDITION



UNDISTURBED



FAIR



DISTURBED



LOST

SAMPLE TYPE

A.S. AJGER SAMPLE

C.S. CASING SAMPLE

5.5. 2" STANDARD SPLIT TUBE SAMPLE.

S.L. SPLIT BARREL WITH LINERS

S.T. THIN-WALLED SHELBY TUBE SAMPLE

W.S. WASH SAMPLE

R.C. ROCK CORE

CO_2 , NO_x , R^{H} , COP .

ABBREVIATIONS

V.1. IN SITU VANE SHEAR TEST

M. MOIST

W.L. WATER LEVEL IN CASING

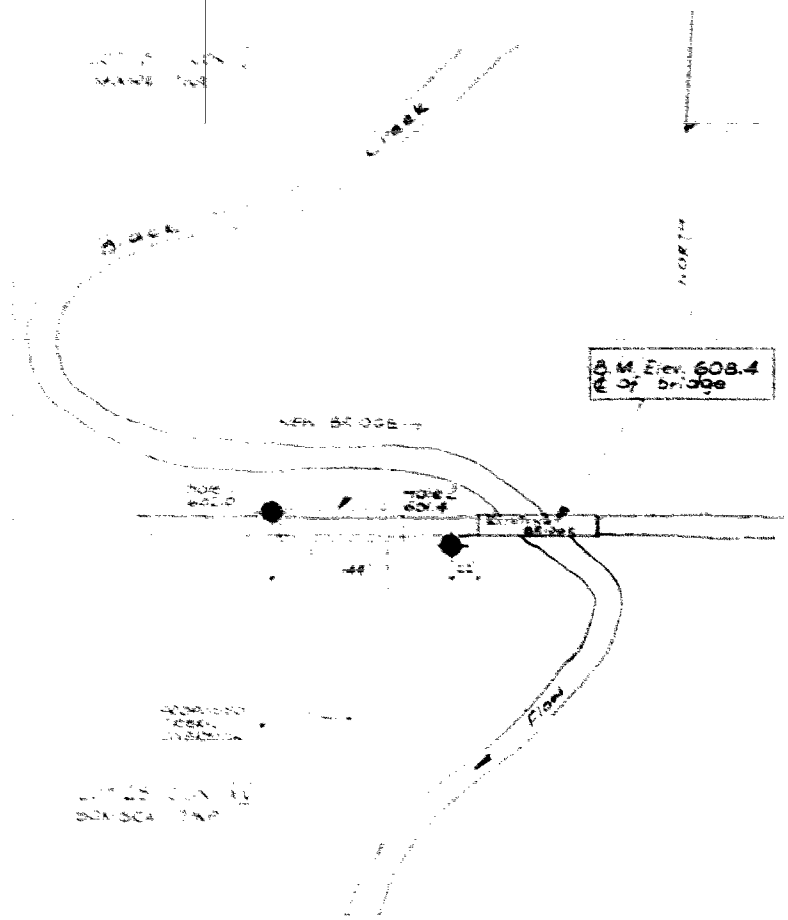
W.L. WATER LEVEL IN CASING
W.T. GROUND WATER TABLE IN SOIL

W.T.P.L. BETTER THAN PLASTIC LIMIT

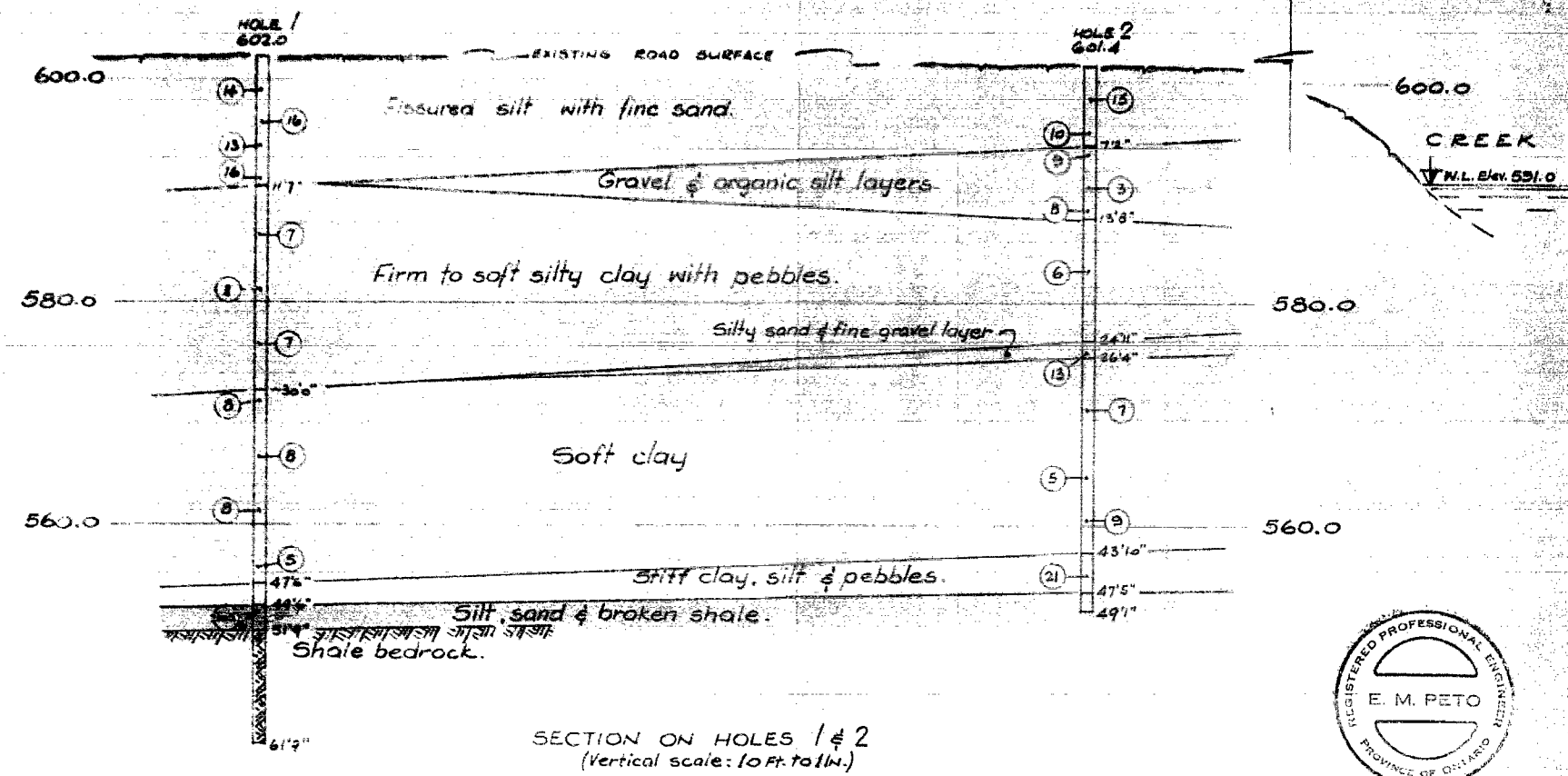
D.T.P.L. DRIER THAN PLASTIC LIMIT

A.P.L. ABOUT PLASTIC LIMIT

[illegible]



Site Plan
1" = 50.0'



LEGEND

- Testhole
- ⑤ — Blows / Foot
- ⑤ — Spt. penetration test result

NOTE

See borehole logs for complete soil details.

NOTE:

The actual soil stratification has been verified from data obtained at the borehole locations only. The inferred contacts shown are based on geological evidence and those may vary from those shown between borings.



COUNTY OF LAMBTON		
c/o J.A. MONTEITH & ASSOCIATES LTD.		
COUNTY BRIDGE NO. 9		
BLACK CREEK		
PREPARED BY		
e.m.peto associates ltd.		
JOB NO.	DATE	DRAWN BY
63729	DEC. 1963	BT