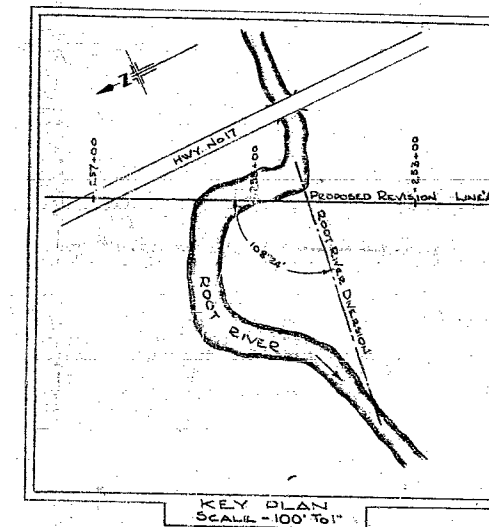
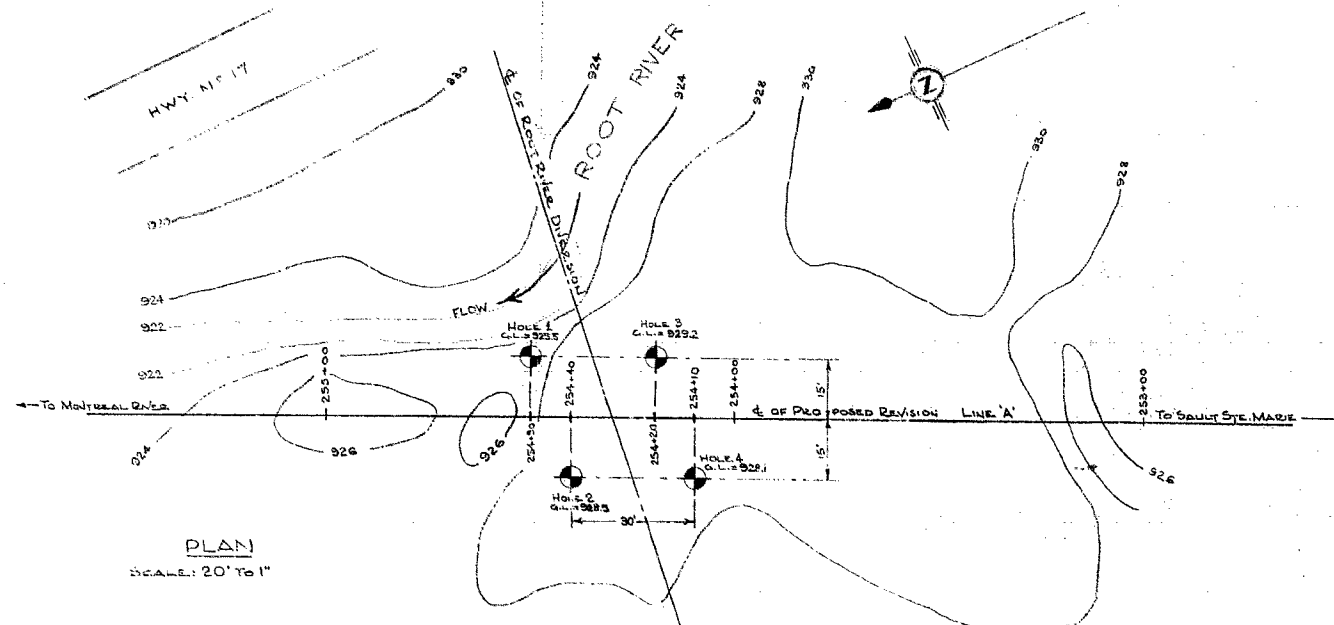
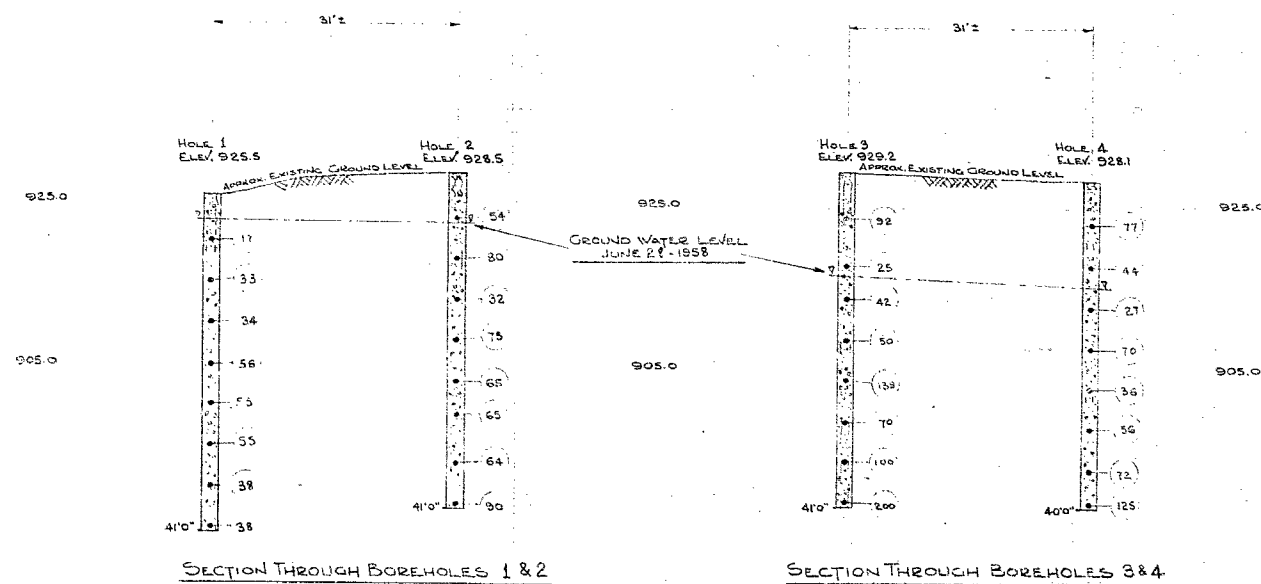


58-F-283C  
W.P. 907-57  
Hwy. #17  
ROOT RIVER  
#2 CROSSING



- NOTE:
- 1) NO WATER IN RIVER... AUG., 1957.
  - 2) RIVER VERY LOW AND OCCUPYING ONLY HALF OF RIVER BED.  
WATER LEVEL 923.0... JUNE, 1958.
  - 3) HIGH WATER LEVEL = 926.6



<b>e.m. peto &amp; associates ltd.</b>	
SOIL SITE INVESTIGATION AT	
HWY. 17 - ROOT RIVER CROSSING No. 2 FOR	
DEPARTMENT OF HIGHWAYS OF ONTARIO	
OUR JOB No. 5868	DATE JULY 3-58
CLIENTS PLAN No. E-5367-1	PER C.T.

**e. m. peto associates ltd.**

YOUR REFERENCE:- **W. P. 907-57**  
OUR REFERENCE:- **5868**

**850 roselawn avenue,  
TORONTO, ONTARIO.  
RUssell 1-4955.**

**7th July, 1958.**

*58-F-283 C*

**Mr. A. M. Toye,  
Chief Bridge Engineer,  
Department of Highways of Ontario,  
280, Davenport Road,  
TORONTO.  
Ontario.**

**For the attention of Mr. J. C. McAllister, P. Eng.**

**Dear Sir,**

**Soil Site Investigation  
Proposed Highway 17 - Root River # 2 Crossing**

We refer to your letter dated 27th May, 1958, and have pleasure in forwarding herewith four (4) copies of our report on the soil and foundation conditions at this site.

The soil conditions at this site are reasonably straightforward and hence do not present any abnormal foundation problem, rather they lend themselves to the consideration of alternative types of structure, the choice of which will probably rest more on economic factors than site or soil conditions. We have considered these aspects in the soils report, and here we have summarized our findings and recommendations for your consideration.

1. There are no distinctive soil strata at this site, rather the soil is a grey brown heterogeneous, fine to coarse sand, occasionally with silt binder and rock fragments. It is dense to very dense, with isolated compact layers. The penetration test results obtained at hole # 1 were consistently lower than those occurring at the other three holes. The wet density of the sand can be assumed to be 130 lbs/cu. ft.

2. It is to be expected that ground water conditions will be influenced by the nearby river, particularly since the subsoil is a granular material. However, the effect of the river is more pronounced at holes # 1 and 2, which are closer to it than holes # 3 and 4. The percolation of the water into the cased holes was either very slow or negligible. This may be due to (i) relatively impermeable silt strata or (ii) subsurface water bearing strata helping to drain the ground water away from the site. Having in mind the dry season regime of this river we incline to the latter explanation as being the more likely.

3. We are of the opinion, that subject to hydraulic requirements and economic considerations, this site lends itself to either a box culvert or a small bridge. In the case of the former, cut-off walls will need to be incorporated at both the upstream and downstream aprons; whilst in the case of the latter anti scour protection to the abutments, extending to a depth of approximately 10 to 12 feet below river bed, is considered necessary, particularly during periods of Spring flood, having due regard to the hydraulic gradient prevailing along this section of the river.

4. Bridge abutments should be founded on shallow spread footings, and placed at an elevation compatible with frost penetration requirements.

The safe allowable bearing capacities for this type of footing are:-

(a) Footings 4 feet wide - 2.2 tons/sq.ft.

(b) Footings 10 feet wide - 1.8 tons/sq.ft.

Bearing values for intermediate size footings may be interpolated between these limiting load intensities. Settlement under these recommended loadings would be less than one inch.

covering letter

for **Mr. A. M. Teye,  
Chief Bridge Engineer.**

Sheet No.

**3.**

5. Ground water seepage can be expected in any excavation below river level on this site. However, at the South end of the proposed crossing, in test holes # 3 and 4 the ground water levels were approximately 6 to 8 feet below river water level. Accordingly, excavation down to this depth in this area, particularly during extended dry periods, may not encounter water. In the event that it is considered necessary to excavate below this depth, the soil below this level is sufficiently permeable to lend itself to the well point process for lowering the water table temporarily.

In conclusion we believe we have dealt with all the points of particular note arising from this investigation, but should you consider some matter requires further elucidation we shall be pleased if you will call on our services.

Yours very truly,

**E. M. PETO ASSOCIATES LTD.**



**E. M. Peto, P. Eng.**

MM:pf

e. m. peto associates ltd., 850 roselawn avenue, Toronto 10, Ontario

Job No. 5868

Client's Ref. No.

Date 7th July, 1958.

Report on  
**SOIL SITE INVESTIGATION**  
at  
**PROPOSED HIGHWAY 17 - ROOT RIVER # 2 CROSSING**  
**W.P. 997 - 57**

for  
**DEPARTMENT OF HIGHWAYS OF ONTARIO.**

**INTRODUCTION**

We were retained, by letter dated May 27th, 1958, from Mr. J. C. McAllister, to carry out a soil investigation at the above site. We were also issued a copy of D. H. O. plan E-3367-1, on which four (4) suggested borehole locations were shown.

**PROGRAMME OF WORK**

- June 21st, 1958: Equipment moved to site from Root River # 1 crossing.
- June 23rd, 1958: Field work commenced.
- June 28th, 1958: Field work completed. Crew and equipment moved to site of Root River # 3 crossing.

SUPER IMPOSED DOCUMENT MAY  
APPEAR AS MULTI-FEED ON FILM

### GENERAL INFORMATION

1. Our standard sampling procedures were followed during the performance of this work. These are described in Appendix I.

2. The four test holes were terminated at the 40 feet depth approximately, in a very dense sand stratum. Bedrock was not encountered at any of the test holes.

3. Detailed individual borehole logs are attached, together with a site plan showing the borehole locations. All elevations are referred to Geodetic datum, and were obtained from a D. H. O. benchmark which is a nail and washer in the top of a 0.4 feet ash stump 8 feet right of station 252 + 10. The elevation of this benchmark was taken to be 930.06 feet.

### SITE AND GEOLOGY

The topography at the site is gently rolling to hilly, and the Root River, which has not yet cut any appreciable valley, follows a tortuous course. The river adjacent to the proposed channel diversion at the time of our investigation in June, 1958, was about 10 feet wide, 2 to 3 feet deep, and flowing at a medium velocity. Random outcrops of rock occur in the area.

### SOIL CONDITIONS

There are no distinctive soil strata at this site. The only soil type encountered at all four holes to the depths investigated was a heterogeneous fine to coarse sand with occasional silt binder and rock fragments. However, the medium to coarse size sand particles predominate, and generally the colour is grey-brown. All samples from below the depth of 15 feet were either wet or saturated; this condition may have been due to the wash water used in driving and cleaning the casing.

SOIL CONDITIONS (contd.)

The sand is dense to very dense, although there are isolated layers which are only compact. Standard penetration test results ranged from a low of 17 blows per foot to a high of 200 blows per foot. These results followed no particular pattern, and were considerably scattered. However, it should be noted that the results obtained at test hole # 1 were consistently lower than those occurring at the other holes.

The wet density of this sand for design purposes may be taken to be 130 p. c. f.

WATER CONDITIONS

The ground water conditions at this site are influenced by the adjacent river, but this influence appears to be greater at holes # 1 and 2, which are closest to the river.

At the time of the investigation the river water level at the site was approximately at elevation 923. 0. Ground surface levels at the four test holes range from 925. 5 to 929. 2.

It was noted, as the field work progressed, that the percolation of water into cased holes was either very slow or negligible. This may be attributed to relatively impermeable silt strata or silt dykes not detected in sampling, but a more likely explanation is that there are subsurface water-bearing gravelly strata helping to drain the ground water from this site.

At this time the difference in river water level between Root River crossing # 2 and Root River crossing # 1 was 123 feet. During August, 1957, Root River at the site of crossing # 2 completely dried up on the surface, while the river flow continued at minimum summer level at crossing # 1. This occurrence substantiates our opinion that there is a considerable subsurface drainage from this site.



### CONCLUSIONS AND RECOMMENDATIONS

1. The site, subject to hydraulic requirements, is admirably suited to the construction of a box culvert. The low unit bearing pressure induced by such a structure can be easily accommodated by this soil. Vertical cut-off walls or sheet-piling must be incorporated at both upstream and downstream aprons.

2. Alternatively, a bridge of relatively short span may be used. The abutments should be founded on spread footings at shallow depth, compatible with adequate protection against frost penetration. The maximum recorded flood rise is 3.6 feet. Despite the relatively high soil densities close to ground surface, the fairly rapid fall of approximately 1 foot in 55 feet along this stretch of river indicates a potential scour problem at any point of constriction during Spring flood. Accordingly scour protection for the bridge abutments placed at the water's edge must be considered essential for a depth of approximately 10 to 12 feet.

3. The safe allowable bearing capacities for shallow spread footings are:-

(a) Footings 4 feet wide - 2.2 tons/sq.ft.

(b) Footings 10 feet wide - 1.8 tons/sq.ft.

Values for intermediate size footings are approximately proportional.

4. Settlements under the above recommended loadings would be less than one inch.

5. Ground water seepage may be expected in any excavations below river level on this site. However, test holes # 3 and 4 at the South end of the proposed crossing indicated ground water levels approximately 6 to 8 feet below the river water level, and excavation to this depth in this area, particularly during extended dry periods, may not encounter any water.

CONCLUSIONS AND RECOMMENDATIONS (contd.)

6. If deeper excavation is necessary, the soil conditions are suitable for the installation of well-points if it is considered necessary to lower the water table level temporarily.

E. M. PETO ASSOCIATES LTD.

MM:pf



E.M. Peto, P. Eng.



## BOREHOLE LOG

SOIL DESCRIPTION	COLOR	Density or Consistency	Depth Elevation	Legend	Sample No. and Container	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
SILT. FINE TO MEDIUM SAND, SMALL PEBBLES, FIBROUS ORGANIC MATTER	DARK REDDISH-BROWN	PROBABLY LOOSE	0' 0" 828.5		<input checked="" type="checkbox"/> SAMPLE FROM CASING	-	-	SLIGHTLY MOIST
MEDIUM TO COARSE SAND, SOME PEBBLES.	LARK YELLOWISH-BROWN	DENSE	5' 0"		<input checked="" type="checkbox"/> S.S.	54	+	SLIGHTLY MOIST  W.L. = 6' 1" JUNE 28, 1958 NO CASING.
SILTY MEDIUM TO COARSE SAND, CONSIDERABLE FINE GRAVEL.	GREY-BROWN	VERY DENSE	10' 0"		<input checked="" type="checkbox"/> S.S.	80		WET
MEDIUM TO COARSE SAND, NUMEROUS TINY PEBBLES.	DARK GREY-BROWN	COMPACT TO DENSE	15' 0"		<input checked="" type="checkbox"/> S.S.	32		WET
AS ABOVE	"	VERY DENSE	20' 0" 808.5		<input checked="" type="checkbox"/> S.S.	75		WET
MEDIUM TO COARSE SAND, GRAVEL UP TO 1/2" SIZE.	LARK GREY-BROWN	VERY DENSE	25' 0"		<input checked="" type="checkbox"/> S.S.	65		WET
AS ABOVE	DARK GREY	VERY DENSE	30' 0"		<input checked="" type="checkbox"/> S.S.	65		SAMPLE LOST, WASH SAMPL RETAINED.
MEDIUM, SOME COARSE SAND	GREY-BROWN, REDDISH TINT	VERY DENSE	35' 0"		<input checked="" type="checkbox"/> S.S.	64		SAMPLE LOST, WASH SAMPL RETAINED.
MEDIUM TO COARSE SAND	DARK GREY-BROWN	VERY DENSE	41' 0" 827.5		<input checked="" type="checkbox"/> S.S.	90		NOTE: NO WATER IN FULLY CASED HOLE TO 30 LEFT OVERNIGHT.  HOLE TERMINATED

## BOREHOLE LOG

Checked By ..... E. M. Peto

## ABBREVIATIONS

W. T. GROUND WATER TABLE IN SOIL.

[illegible]



## APPENDIX I

### METHOD OF OPERATION

The field investigation work is carried out by means of a skid-mounted diamond drill rig.

Standard sampling procedures are followed. Casing is driven and cleaned, either by tubes or by wash water.

Samples are recovered ahead of the casing at frequent intervals, with either a 2 inch or 3 inch O.D. split barrel sampling tube, Shelby tube, or split barrel sampling tube fitted with brass liners and special sharp cutting nose.

The standard penetration test results are recorded when sampling with the regular 2 inch O.D. split barrel sampler, these being the number of blows of a 140 pound hammer falling 30 inches, required to drive the sampling tube a distance of one foot into undisturbed soil.

The Dutch cone probe test is made by driving the drill rods into the ground with a 2-1/4" - 90° cone tip. The number of 4200 inch pound blows per foot of penetration are recorded, as in the standard penetration test.

Where required, "in situ" shear strength tests are made ahead of the casing, using modified Acker vane test equipment.

Disturbed samples are visually classified in the field, sealed in sample jars, and are re-examined, and tested as necessary, in the soils laboratory. Undisturbed samples are returned to the laboratory for later examination and testing, as required.

The test holes are bailed at the end of the day and on completion. Subsequent water level readings are taken for the duration of the field work. Water pressure readings are recorded when Artesian water conditions are encountered. Moisture content samples are recovered at frequent intervals to assist in the soil classification and the interpretation of water table results.