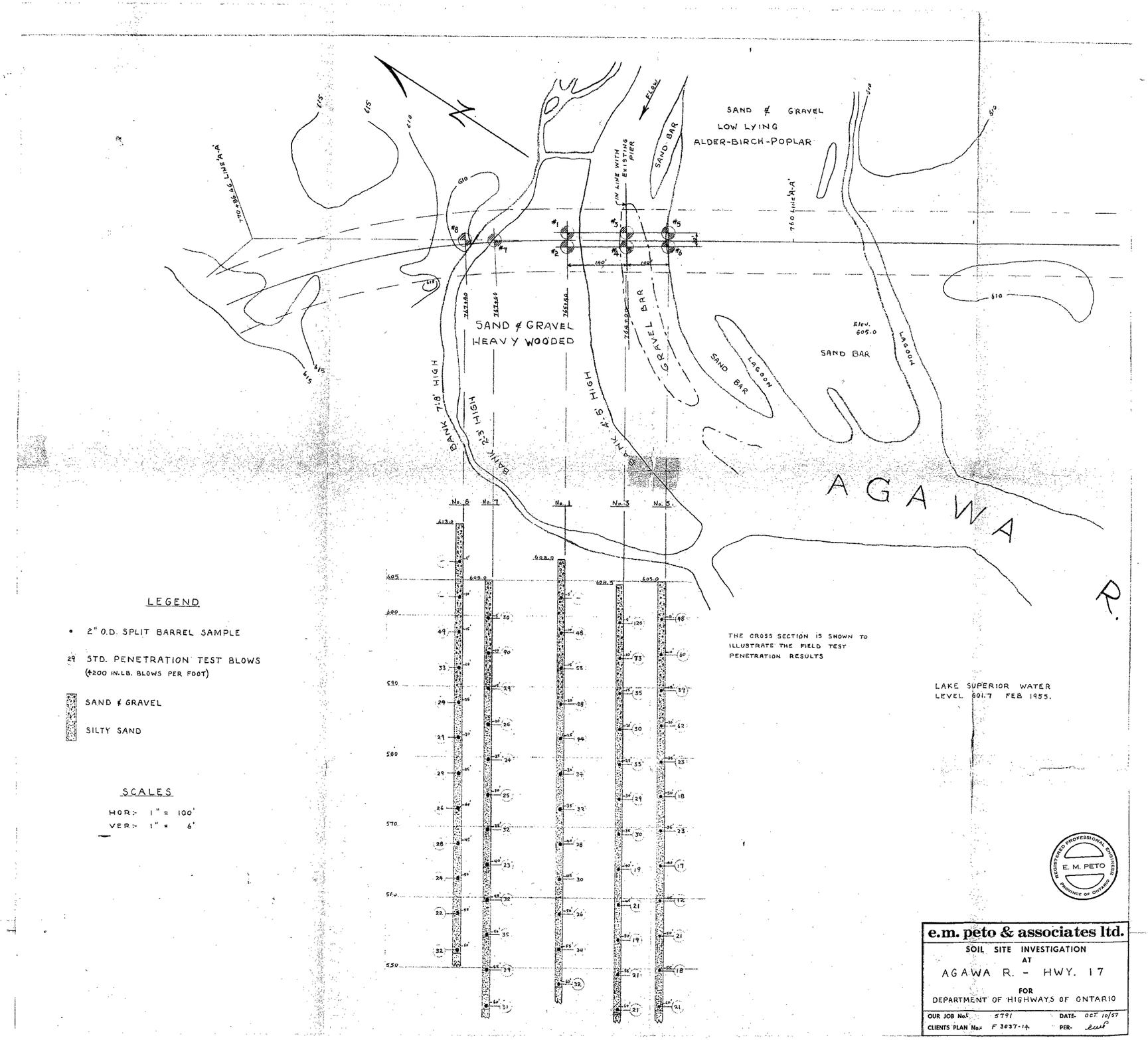
57-F-234C
W.P. 956-57
HWY. # 17
AGAWA RIVER



LEGEND

- 2" O.D. SPLIT BARREL SAMPLE
- 29 STD. PENETRATION TEST BLOWS (+200 IN.LB. BLOWS PER FOOT)
- SAND & GRAVEL
- SILTY SAND

SCALES

HOR:- 1" = 100'
VER:- 1" = 6'

THE CROSS SECTION IS SHOWN TO ILLUSTRATE THE FIELD TEST PENETRATION RESULTS

LAKE SUPERIOR WATER LEVEL 601.7 FEB 1955.

REGISTERED PROFESSIONAL ENGINEER
E. M. PETO
PROVINCE OF ONTARIO

e.m. peto & associates ltd.

SOIL SITE INVESTIGATION
AT
AGAWA R. - HWY. 17
FOR
DEPARTMENT OF HIGHWAYS OF ONTARIO

OUR JOB No.:	5791	DATE:	OCT. 10/57
CLIENTS PLAN No.:	F 3037-14	PER:	EMP

Mr. A. M. Toye, — March 18, 1959.

Bridge Engineer — Agawa River Crossings, Hwy. #17, TCH, Dist. #18, W.P. 950-57, BW 113

J.D.Harris, Bridge Hydrology Section

The original recommendation made by the Bridge Hydrology Section with regard to the Agawa River crossings was for two bridges of 250' and 50' span respectively. This was subsequently altered to one bridge of 300' span, on account of the unusually high cost of substructures at this site.

The Bridge Design, submitted by Messrs. A.M.Lount and Associates, called for a 375' single span, and a hydrologic report was later supplied by the Consultant giving the considerations on which this size of opening was based.

Several assumptions made in the report are open to question, and the more important of these discussed below.

1) Characteristics of the Watershed

The report states that the non-centricity of the river to the watershed results in rapid access of runoff from a large portion of the watershed. In actual fact, the area having rapid access is less than 4% of the total, and the overall elongated shape of the catchment is conducive to a relatively slow runoff. The general slope of the main channel, after omitting vertical falls, is about average for the region.

2) Flood Elevations

A high water level of 610.00 is quoted in the report, and is also shown on the bridge layout drawings with a date of March 21, 1955. This elevation is a purely hypothetical one making allowance for possible ice jams at the river mouth, and the date on the drawing probably refers to that of a letter from Blind River Division concerning water levels, and is not of any particular flood. The highest known flood for 25 years is reported to be 608.2, and occurred on 23/24 April 1957. Thus the flow of 29,400 cfs at elevation 610.00 quoted by the Consultants can (as stated in their report) be discounted completely.

3) Flood Frequency for Design

The Consultants' design is based on a flood frequency of 5 years. For a bridge of this size and importance, a design flow of at least 25 to 30 years' recurrence is used both by this Department and by most other bridge authorities. A frequency of 5 years would be used only for a temporary culvert on a very minor highway, if at all.

THIS DOCUMENT MAY APPEAR AS MULTI-FEED ON FILM.

4) Comparison with Other Rivers:

The report compares the Agawa with other rivers in various parts of the U.S.A., having runoffs of up to 125 and 613 cfs per square miles. Such comparisons seem unreasonable, as the runoffs for catchments of similar area in Northern Ontario range between 12 and 18 cfs per square mile.

5) Design Flow:

The precipitation records on which the Consultants' calculations appear to be based are those of various Summer storms of short duration, occurring at Sault Ste. Marie.

The use of this type of record appears to have little justification; inspection of records covering a long period for Montreal River, which is adjacent to the Agawa, shows that the peak annual flood has never resulted from a Summer storm, and is invariably due to the Spring thaw, possibly augmented by rainfall.

Moreover, it must be pointed out that the Sault Ste. Marie records quoted would be of use only for Municipal Design on comparatively small watersheds.

The unit hydrograph prepared by the Consultants is based on 1" of runoff occurring in a storm of 17 hours' duration. It is estimated that under actual maximum conditions of Spring thaw, these figures should be nearer 2.21" runoff occurring in 62 hours. A flood caused by a storm of the magnitude of Hurricane Audrey would give about 2.78" of runoff in 50 hours, although such a storm is unlikely in this area, and would have a theoretical frequency approaching 100 years.

The design flow as derived from the hydrograph is 15,000 cfs, which the Consultant estimates is the value of a 5 year flood.

The magnitude of a 25 year design flow has been calculated by the Bridge Hydrology Section using a variety of methods, the range of results being consistently between 9,800 to 11,500 cfs.

The provision of a single bridge, instead of the two structures originally recommended will increase the flow in the main channel by about 20%, giving a corresponding increase of velocity and a slight rise of water level. The undisturbed channel velocity may approach 6.0 fps, but will be variable due to fluctuations in the levels of Lake Superior. At the time of the 1957 flood, the lake level is estimated to have been about 6" below normal, and the peak velocities were therefore somewhat above normal. Other factors affecting water levels and velocities at the site are changes in the gravel bar at the mouth of the river, and the occurrence of ice jams. The minimum soffit elevation of 615.0 recommended earlier by this Section is considered sufficient for all normal contingencies.

The velocity through the bridge for a 25 year flood may range up to 7.0 fps., depending on the variable conditions mentioned above.

Scour: The Bridge Hydrology Section has made approximate scour calculations which show that the maximum depth of scour will probably not

exceed 8' during any flood likely to occur within the lifetime of the bridge. Under present conditions, the point of maximum scour is towards the north bank of the river, but in the future, it can be expected to approach the north abutment.

Scour protection, such as steel sheet piling, is therefore recommended to a depth of 30' at the north abutment, and at least 15' at the south abutment.

Riprap on north river bank: Any protective work on the main channel should consist of large boulders, particularly at and below the confluence with the secondary channel.

As a further check on the D.H.O. calculations, details of the A.C. & H.B. railway bridge near Canyon have just been obtained from the Company. This bridge is about 10 miles upstream from the proposed crossing, and is not accessible from any highway.

The original structure was a trestle bridge 234' long with an effective opening of about 200'. This was replaced in recent years by a 180' bridge, which in the 1957 flood is reported to have had the girders partially submerged. The effective waterway area of the bridge is estimated to be 1650 square feet compared with the Hydrology Section's recommendation of 1700 square feet. These figures compare very well when the difference in watersheds and channel characteristics at the two sites is taken into account.

Conclusions:

The Hydrology Report prepared by the Consultants to justify a 375' span is based on a number of unreasonable assumptions, and is therefore unreliable.

The original recommendation of a 300' total opening made by the D.H.O. Bridge Hydrology section, has been checked and rechecked by a variety of methods, and appears perfectly adequate and economical.

Our recommended waterway area agrees very closely with that of the existing A.C. & H.B. railway bridge upstream.

The recommended minimum soffit elevation of 615.0 is adequate.

Scour protection should be provided to a depth of 30' at the north abutment and at least 15' at the South abutment.

Any rip-rap provided for bank protection should be of large-sized boulders.

J.B.Harris
for B. Wilkie
Bridge Hydrology Engr.

JDH/r

SUPER IMPOSED DOCUMENT MAY
APPEAR AS MULTI-FEED ON FILM.

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

Job No. 5791 Client's Ref. No. Date October 10/57

57-F-234C
W.P. 956-57

Report on

BORY SITE INVESTIGATION

on

AGAWA RIVER BRIDGE

HIGHWAY 17

for

DEPARTMENT OF HIGHWAYS OF ONTARIO.

TERMS OF REFERENCE:

It was proposed that 8 test holes should be driven at the site of the proposed new bridge on Highway 17 crossing the Agawa River. Six of the test holes were to be located at the suggested locations of the bridge piers crossing the main river course, with 2 additional test holes to be performed on the centre line at opposite edges of the smaller tributary to the main river to the North of the main bridge.

Each test hole was to be driven to determine the strata encountered, the densities or allowable bearing values of these strata, and the depth to bedrock if refusal should be encountered. Any construction difficulties which might be anticipated during the bridge construction were to be noted.

METHOD OF OPERATIONS:

This investigation was carried out by our number 3 unit, a Sullivan "12" skid mounted diamond drill rig, which was moved into the river crossing site from Agawa Beach on August 1st, and 2nd, 1957. The field work was completed by September 5th, 1957.

Each test hole was performed by driving and cleaning BX drill casing, sampling ahead of the casing at 5 ft. intervals with a 2" standard split barrel sampler. The standard penetration test results were recorded when sampling, these being the number of blows of a 140 lbs. hammer falling 30" required to drive the sampling tube a distance of one foot. Below the 61 ft. depth, wash samples only were recovered and the test holes were carried down only to locate bedrock if within the 100 ft. depth and to determine if any loose or very loose conditions existed to that depth.

METHOD OF OPERATIONS: (Cont'd)

All samples recovered were returned to our laboratory in Toronto and examined in detail. These samples will be retained for a further period of 30 days, and will be destroyed at the end of that time unless we are otherwise notified. Since no cohesive stratum was encountered, no undisturbed or Shelby tube samples were recovered.

OBSERVATIONS:

The test hole locations with their ground elevations were supplied to our field crew by the D.H.O. staff based at Agawa. The locations are shown on the site plan attached at the rear of this report. The results obtained at each test hole are shown on the borehole logs attached at the rear of this report. A cross-sectional view through test holes 8, 7, 1, 3, and 5 has been shown to a grossly exaggerated vertical scale so that the basic information and the variation in the field penetration test results may be compared more easily.

SOIL CONDITIONS:

Similarly to many of the rivers in this part of Ontario, the subsoil is granular, with varying gradations of sand and fine gravel. As may be expected so close to a mouth of a river discharging into Lake Superior, there is no well defined pattern of stratification; there is also no clearly established pattern for densities, although there is some uniformity at depth in some of the test holes.

Generally there exists a grey brown coarse sand and multicoloured fine gravel to a depth varying between elevation 585 and 590. This stratum is in all cases at least dense, and in some cases is very dense. Some of the field penetration test results are grossly high, probably due to interference from larger pieces of gravel.

Below the sand and gravel stratum, there exists a deep bed of grey sand which is generally coarse to medium at a higher elevation, increasing in fineness generally with depth. As may be seen from the borehole logs there are minor variations with small quantities of silt and in some cases clay, usually at considerable depth. There are also some organic traces in some of the samples obtained from considerable depth. The field penetration test results are quite variable. We have attached a brief graph showing the penetration test results against the depth for each test hole.

SOIL CONDITIONS: (Cont'd)

The test results have been corrected for the saturated or wet condition in the fine sand strata. The results generally indicate a compact to dense condition with some unusually high results at odd intervals as at test hole 6 at the 55 and 60 ft. depths, (although these results are very much down graded due to the very fine sand material) and as at the 25 ft. depth in test hole 1.

WATER CONDITIONS:

As might be anticipated, all of the test holes were wet everywhere below approximately elevation 601 which corresponded roughly to the stream elevation. There is little doubt that water exists throughout this site below the present stream surface level.

CONCLUSIONS:

1. Suitable bearing capacities near the surface on this site are not a problem. Even assuming the poorest general average standard penetration test results of 30 blows per foot, bearing values of 3.9 tons per square foot for footings 4 ft. wide or less decreasing to 2.8 tons per square foot for footings 10 foot wide or more are obtainable in the course sand and fine gravel deposit which exists above elevation 590.

2. Should you wish for some reason to carry your footings at lower depth in the generally coarse to medium sand it would be wise to reduce the above values somewhat to a value of approximately 3 tons per square foot for footings 4 feet wide or less and decreasing to about 2.2 tons per square foot for footings 10 foot wide or more. For footings between 4 ft. and 10 ft. in width, the bearing values are approximately proportional. We have assumed that the footings in no case will be carried below elevation 585.

3. It is apparent from visual examination of the site that scour beneath your pier footings could ultimately be a problem at this site. It appears that there is a possibility of flood variations under severe conditions of as much as 6 to 8 ft. at this crossing. However, it is unlikely that the normal flood level exceeds 4 to 5 ft. under average conditions. Scour protection should therefore be provided for at a depth of between 15 and 20 ft. below surface. We must point out that it will be most difficult driving sheet piling through the gravel deposits at this site.

CONCLUSIONS: (Cont'd)

4. While it might be possible to carry your piers and abutments on pile bents in order to avoid the necessity of driving sheeting, to a depth of 15 feet to 20 feet, the use of piles for bearing capacity is unnecessary. It would be difficult to drive displacement piles through this gravel bed.

5. It can be anticipated that de-watering will be required in any excavation at this site where the excavation is carried below the present stream level. Unlimited quantities of water can be anticipated.

E. M. PETO ASSOCIATES LTD.

EMP:sb

E. M. Peto, P. Eng.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Agawa River - Hwy. 17 | Job No.: 5791 | Borehole No.: 1

Client: Dept. of Highways of Ont. | Casing: BX | Boring Date: Aug. 24th - 26th to 31st 1957.

Datum: D.H.O. | Compiled By: E.M.P. | Checked By: M.L.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

ABBREVIATIONS

- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0"					
			5'0"					
Very coarse sand and fine gravel.	Grey-Brown.				1	W.S.	—	
			10'0"					
Coarse sand and gravel to 1-1/2" dia.	Grey-Brown	Dense			2	S.S.	48	Wet.
			15'0"					
Medium to coarse sand and gravel, minor silt content.	Brown	Very dense			3	S.S.	53	Wet
			20'0"					
Medium to coarse sand.	Grey-Brown	Dense			4	S.S.	38	Saturated.
			25'0"					
As above	As above.	Dense			5	S.S.	44	Saturated.
			30'0"					
Coarse and some medium sand.	Grey-Brown.	Dense			6	S.S.	34	Wet
			35'0"					
As above.	As above.	Compact to Dense.			7	S.S.	32	Wet
			40'0"					
Medium sand.	Grey	Compact to Dense			8	S.S.	28	Very moist.
			45'0"					
As above.	Grey	Compact to Dense.			9	S.S.	30	Very moist.
			50'0"					
As above.	Grey	Compact			10	S.S.	26	Very moist.
			55'0"					
Medium and some fine sand	Grey	Compact			11	S.S.	24	Very moist.
			60'0"					
Fine to medium sand.	Grey	Compact to Dense.			12	S.S.	32	Very moist.
			65'0"					
			70'0"					
Fine sand some orgenic traces.	Grey	–			13	W.S.	—	
			75'0"					
			80'0"					
Silty fine to very fine sand.	Grey	–			14	W.S.	—	
			85'0"					
			90'0"					
As above.	Grey	–			15	W.S.	—	
			95'0"					
			100'0"					
As above.	Grey	–			16	W.S.	—	
					HOLE TERMINATED.			

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Agawa River - Hwy. 17 | Job No.: 5791 | Borehole No.: 2

Client: Dept. of Highways of Ont. | Casing: BX | Boring Date: Aug. 20 - 21, 23rd, 1957

Datum: D.H.O. | Compiled By: E.M.P. | Checked By: M.M.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

ABBREVIATIONS

- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0"					
			608.0					
			5'0"					
Coarse sand and firm to coarse gravel.	Grey-Brown	Very dense	10'0"		1	S.S.	90	Very moist.
As above with some medium sand.	As above.	Very dense	15'0"		2	S.S.	87	Very moist.
Coarse sand, pebbles.	Grey-Brown	Very dense	20'0"		3	S.S.	52	Very moist.
As above, but more grits and pebbles.	As above.	Dense	25'0"		4	S.S.	33	Very moist.
Medium and coarse sand, odd stone.	Grey-Brown	Dense	30'0"		5	S.S.	34	Very moist.
Coarse sand, pebbles to 1-1/2" dia.	Grey-Brown.	Compact to Dense.	35'0"		6	S.S.	28	Very moist.
Medium and some coarse sand.	Brown-Grey	Compact	40'0"		7	S.S.	23	Saturated.
As above.	As above.	Compact	45'0"		8	S.S.	26	Saturated.
As above.	As above.	Compact to Dense.	50'0"		9	S.S.	28	Wet.
Medium sand, some coarse sand and pebbles.	Grey	Compact	55'0"		10	S.S.	24	Saturated.
Medium sand.	Grey	Compact	60'0"		11	S.S.	23	Very moist.
Fine sand.	Grey	Dense	65'0"		12	S.S.	33	Very moist.
As above.	Grey	-	70'0"		13	W.S.	—	
Very fine silty sand, organic traces.	Grey	-	75'0"		14	W.S.	—	
As above.	Grey	-	85'0"		15	W.S.	—	
As above.	Grey	-	95'0"		16	W.S.	—	
			100'0"					HOLE TERMINATED.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE — TORONTO, ONTARIO

BOREHOLE LOG

Job Name: [illegible] River - Hwy. 17 | Job No.: [illegible] | Borehole No.: 3

Client: Department of Highways of Ont. | Casing: HW | Boring Date: Oct. 2 - 26, '62

Datum: [illegible] | Compiled By: [illegible] | Checked By: [illegible]

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

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- W.L. WATER LEVEL IN CASING
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SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0" 604.5					
Coarse sand and gravel to at least 3" diameter	Grey-Brown	Very dense	5'0"		1	[illegible]	120	Wet
Coarse sand and multi-coloured gravel	Brown	Very dense	10'0"		2	[illegible]	73	Wet
Coarse sand and fine gravel, multi-coloured	Grey-brown	Dense	15'0"		3	[illegible]	35	Wet
Coarse sand	Grey-Brown	Compact to Dense	20'0"		4	S.S.	30	Wet
Coarse sand some medium sand.	Grey-Brown	Dense	25'0"		5	S.S.	33	Wet
Medium sand.	Grey	Compact to Dense	30'0"		6	S.S.	29	Wet
Medium some fine sand.	Grey	Compact to Dense	35'0"		7	S.S.	30	Wet
Fine Sand.	Grey	Compact	40'0"		8	S.S.	22 (19)	Corrected Value Wet
As above.	Grey	Compact	45'0"		9	S.S.	27 (21)	Wet
Fine, some medium sand.	Grey	Compact	50'0"		10	S.S.	23 (19)	Wet
Fine sand, minor silt content.	Grey	Compact	55'0"		11	S.S.	26 (21)	Wet
Fine sand, minor silt content.	Grey	Compact	60'0"		12	S.S.	27 (21)	Wet
Fine sand, minor silt content.	Grey	-	65'0"		13	W.S.	-	
As above.	As above	-	70'0"		14	W.S.	-	
Silty fine sand.	Grey	-	75'0"		15	W.S.	-	
As above.	As above.	-	80'0"		16	W.S.	-	
			85'0"					
			90'0"					
			95'0"					
			100'0"					
			105'0"					Washed rods to 110'0" (No return).
			110'0"					
								HOLE TERMINATED.

DETAILS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Arrow River Hwy. 17 Job No. 2791 Borehole No. 4

Client Dept. of Highways of Ont. Casing BX Boring Date Sept. 6 - 8th, 1957

Datum D.H.S. Compiled By A.S.L. Checked By [illegible]

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

ABBREVIATIONS

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

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0" 604.5					
Coarse sand and silt coloured gravel to 1" size	Grey Brown	Very Loose	5'0"		1	S.S.	5	
As above	As above	Dense	10'0"		2	S.S.	47	
As above	As above	Dense to Very dense	20'0"		3	S.S.	50	
Coarse sand	Grey Brown	Compact	25'0"		4	S.S.	21	Wet
As above	As above	Compact to Dense	30'0"		5	S.S.	33	
As above.	As above	Compact	35'0"		6	S.S.	21	
Medium and some fine sand.	Grey	Compact	40'0"		7	S.S.	12	Wet
Coarse sand	Grey	Compact	45'0"		8	S.S.	24	Wet
Fine sand	Grey	Compact	50'0"		9	S.S.	21 (18)	Corrected Value Wet
As above.	As above	Compact	55'0"		10	S.S.	17 (16)	Wet
Fine sand, minor silt content	Grey	Compact	60'0"		11	S.S.	17 (16)	
Silty fine sand	Grey	Compact	65'0"		12	S.S.	17 (16)	
Silty fine sand with organic traces	Grey	-	70'0"		13	W.S.	-	
As above.	As above	-	75'0"		14	W.S.	-	
Silt, fine sand	Grey	-	80'0" 85'0" 90'0" 95'0"		15	W.S.	-	
Silty fine to very fine sand.	Grey	-	100'0"		16	W.S.	-	
								HOLE TERMINATED

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Agawa River - Hwy. 17 | Job No.: 5791 | Borehole No.: 5

Client: Dept. of Highways of Ont. | Casing: BX | Boring Date: Aug. 9 - 10th, 1957.

Datum: D.H.O. | Compiled By: E.M.P. | Checked By: M.M.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

ABBREVIATIONS

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- G.W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	Blows per foot	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0"					
			805.0					
			5'0"					
Coarse sand and gravel	Grey-Brown	Dense			1	S.S.	48	
			10'0"					
Coarse sand and fine gravel	Grey-Brown	Very Dense			2	S.S.	60	
			15'0"					
As above.	Brown	dense			3	S.S.	37	
			20'0"					
Coarse sand, some pebble gravel.	Grey-Brown	Very dense			4	S.S.	62	
			25'0"					
Coarse sand.	Grey-Brown	Compact			5	S.S.	23	Wet
			30'0"					
Fine to medium sand.	Grey	Compact			6	S.S.	18	
			35'0"					
Fine, some medium sand.	Grey	Compact			7	S.S.	23	
			40'0"					
Fine sand.	Grey	Compact			8	S.S.	18 (17)	Corrected value.
			45'0"					
As above.	Grey	Compact			9	S.S.	12	Saturated.
			50'0"					
Medium and some fine sand.	Grey	Compact			10	S.S.	27 (21)	
			55'0"					
Silty very fine sand.	Grey	Compact			11	S.S.	18	
			60'0"					
Silty very fine sand, minor clay content.	Grey	Compact			12	S.S.	27 (21)	
			65'0"					
			70'0"					
Fine sand. Some silt content.	Grey	-			13	W.S.	-	
			75'0"					
			80'0"					
Silty fine sand. Organic traces	Grey	-			14	W.S.	-	
			85'0"					
			90'0"					
As above.	Grey	-			15	W.S.	-	
			95'0"					
			100'0"					
As above.	Grey	-			16	W.S.	-	
								HOLE TERMINATED

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Agawa River - Hwy. 17 | Job No.: 5791 | Borehole No.: 6

Client: Department of Highways of Ont. | Casing: BX | Boring Date: Aug. 12 - 14th, 1957

Datum: D.H.O. | Compiled By: E.M.P. | Checked By: M.M.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

ABBREVIATIONS

- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	Recovered Inches per ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0" 695'0					
Coarse sand and fine gravel, multi-coloured	Brown	Compact to Dense	5'0"		1	S.S.	37	Wet
Coarse sand and fine gravel, multi-coloured	Grey-Brown	Dense	10'0"		2	S.S.	47	Wet
Coarse sand, some pebbles.	Grey-Brown	Compact	15'0"		3	S.S.	23	Wet
Coarse sand and fine gravel, multi-coloured	Grey-Brown	Dense	20'0"		4	S.S.	32	Wet
Coarse sand some medium sand.	Grey-Brown	Compact to Dense	25'0"		5	S.S.	30	Wet
Medium sand, some course sand.	Grey	Compact	30'0"		6	S.S.	26	Wet
Medium sand.	Grey	Dense	35'0"		7	S.S.	32	Wet
Fine sand.	Grey	Compact	40'0"		8	S.S.	23	Wet (19) corrected value)
Fine sand.	Grey	Dense	45'0"		9	S.S.	32 (24)	Wet
Fine sand, sulphurous Odour	Grey	Compact to Dense	50'0"		10	S.S.	30 (23)	Wet
Very fine sand, clay content.	Grey	Dense	55'0"		11	S.S.	48 (32)	Wet
Very fine sand, with some medium sand layers.	Grey	Dense	60'0"		12	S.S.	42 (29)	Wet
Very fine to fine sand in layers.	Grey	-	65'0"		13	W.S.	-	
Fine sand, some organic matter and minor clay content.	Grey	-	70'0" 75'0" 80'0"		14	W.S.	-	
As above.	Grey	-	85'0" 90'0" 95'0"		15	W.S.	-	
Minor silt and very fine sand content.	Grey	-	100'0"		16	W.S.	-	
						HOLE TERMINATED		

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Agawa River – Hwy. 17 | Job No.: 5791 | Borehole No.: 7

Client: Dept. of Highways of Ont. | Casing: HX | Boring Date: Sept. 1st, 2nd & 3rd/57

Datum: D.H.O. | Compiled By: E.M.P. | Checked By: M.M.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

ABBREVIATIONS

- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample type	Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0"					
			605.0					
			5'0"					
Coarse sand and gravel mult-coloured	Brown	Compact			1	S.S.	30	Wet
			10'0"					
As above.	Brown	Very dense			2	S.S.	90	Wet
			15'0"					
Medium to coarse sand and gravel.	Grey-Brown	Compact			3	S.S.	29	Wet
			20'0"					
Coarse sand.	Grey-Brown	Compact			4	S.S.	34	Wet
			25'0"					
Medium to coarse sand.	Grey-Brown	Compact			5	S.S.	24	Wet
			30'0"					
Medium and some coarse sand.	Grey	Compact			6	S.S.	25	Wet
			35'0"					
As above.	Grey	Dense			7	S.S.	32	Wet
			40'0"					
As above.	As above.	Compact			8	S.S.	23	Wet
			45'0"					
As above.	As above.	Dense			9	S.S.	32	Wet
			50'0"					
Fine sand.	Grey	Dense			10	S.S.	35	Wet
			55'0"					
As above.	Grey	Compact to Dense			11	S.S.	29	Wet
			60'0"					
As above.	Grey	Compact to Dense			12	S.S.	31	Wet
			65'0"					
			70'0"					
Fine sand.	Grey	-			13	W.S.	-	
			75'0"					
			80'0"					
Fine sand, minor clay content.	Grey	-			14	W.S.	-	
			85'0"					
			90'0"					
As above.	Grey	-			15	W.S.	-	
			95'0"					
			100'0"					
As above.	Grey	-			16	W.S.	-	
					HOLE TERMINATED.			

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Agawa River Bridge - Hwy. 17 | Job No.: 5791 | Borehole No.: 8

Client: Dept. of Highways of Ontario | Casing: BX | Boring Date: Sept. 4th to 7th, 1957.

Datum: D.H.O. | Compiled By: K.M.P. | Checked By: M.L.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 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

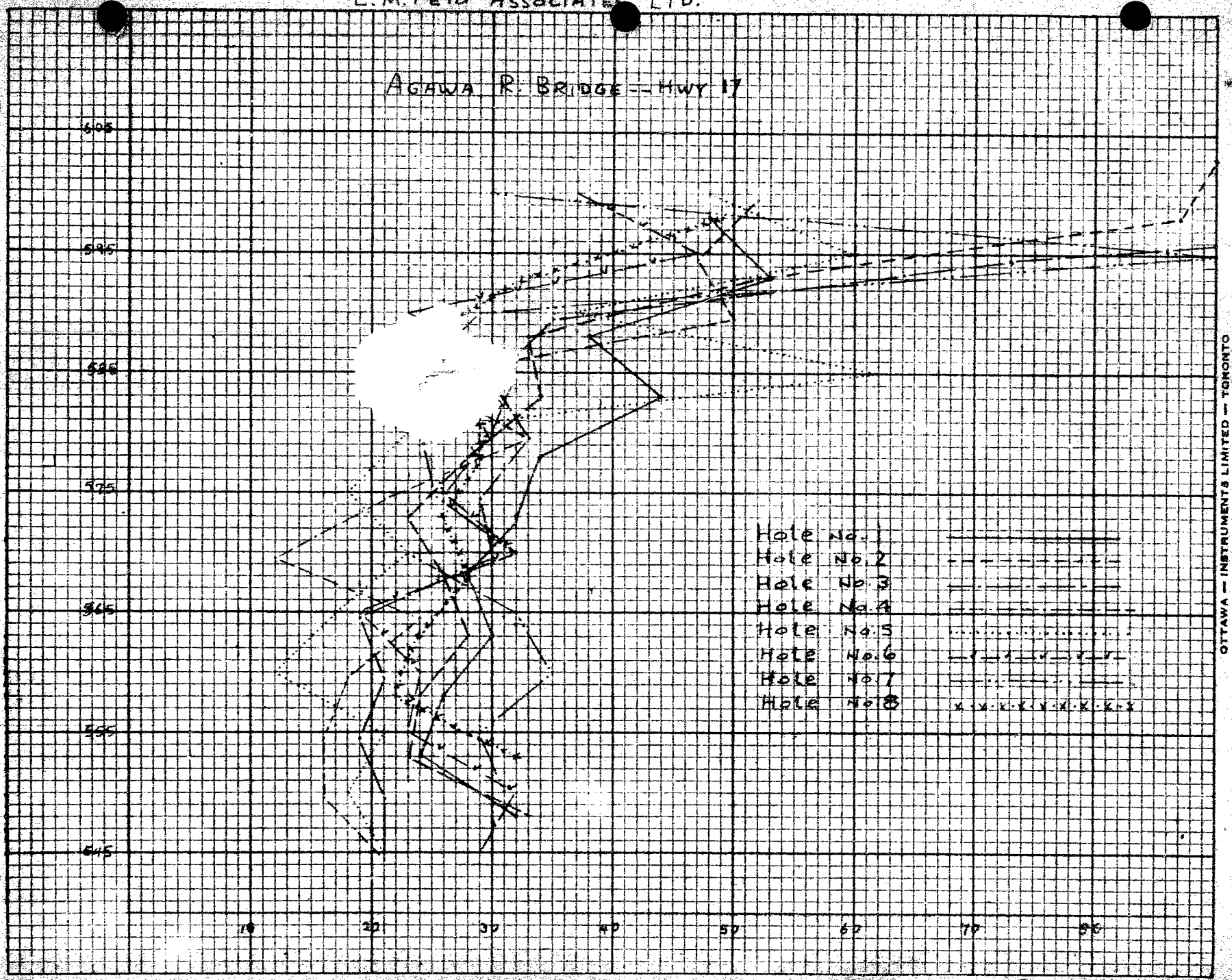
ABBREVIATIONS

- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	Standard Blows per ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0"					
			673.0					
			5'0"					
Coarse sand multi-coloured gravel.	Grey-Brown	-			1	W.S.	-	
			10'0"					
As above.	As above.	-			2	W.S.	-	W.L.
			15'0"					
Medium to coarse sand, and gravel.	Grey-Brown	Dense			3	S.S.	49	Wet
			20'0"					
As above.	As above.	Dense			4	S.S.	33	Wet
			25'0"					
Medium and coarse sand.	Grey-Brown	Compact			5	S.S.	24	Wet
			30'0"					
As above.	As above.	Compact to Dense			6	S.S.	29	Wet
			35'0"					
Medium sand.	Grey	Compact to Dense			7	S.S.	29	Wet
			40'0"					
As above.	As. above	Compact			8	S.S.	26	Wet
			45'0"					
Fine sand.	Grey	Compact			9	S.S.	28	Wet
			50'0"					
Fine sand, some medium sand.	Grey	Compact			10	S.S.	24	Wet
			55'0"					
Fine sand,	Grey	Comp			11	S.S.	22	Wet
			60'0"					
Fine sand, some medium sand.	Grey	Compact to Dense.			12	S.S.	32	Wet
			65'0"					
			70'0"					
Fine sand.	Grey	-			13	W.S.	-	
			75'0"					
			80'0"					
Fine sand, slightly silty.	Grey	-			14	W.S.	-	
			85'0"					
			90'0"					
Fine sand.	Grey	-			15	W.S.	-	
			95'0"					
			100'0"					
Fine sand, some medium sand.	Grey	-			16	W.S.	-	
					HOLE TERMINATED.			

E. M. PETO ASSOCIATES LTD.

AGAWA R. BRIDGE -- HWY 17



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