#68-F-229 M

TWP. RD. #8

WILMOT CREEK

SITE #33-112

BA. 2910
Site 33-112

PETO ASSOCIATES LIMITED

SOIL FOUNDATION INVESTIGATION
BRIDGE OVER WILMOT CREEK ON TOWNSHIP ROAD #8 (SITE 33-112) NEW HAMBURG, ONTARIO

for 68-F-229M

TOWNSHIP OF WILMOT
c/o McCARGAR AND HACHBORN LIMITED

Distribution:
4 cc Client
1 cc File

JOB NO. 68-F193

OCTOBER, 1968

PETO ASSOCIATES LTD.
CONSULTING SOIL ENGINEERS
1287 Caledonia Rd. Toronto 19 · Ontario · Phone: (416) 789-1126

JOB NO. 68-F193 October 18, 1968.

Township of Wilmot,
c/o McCargar and Hachborn Limited,
Consulting Engineers,
546 Belmont Avenue West,
P.O. Box 368,
Kitchener, Ontario.

Attention: Mr. E. G. Hachborn, P. Eng.

Dear Sir:

Re: Soil Foundation Investigation
Bridge over Wilmot Creek on Township
Road #8 (Site 33-112)
New Hamburg, Ontario.

In accordance with your letter of authority a soil foundation, consisting of two boreholes drilled to about 26 ft. below grade, was performed at this site.

It is proposed to replace the existing structure with a 20 to 25 ft. span by 8 ft. high concrete box culvert, either of rigid frame or a simple prestressed slab.

The boreholes were located as shown on the accompanying site plan, see Figure 1 and were drilled with a 3½ inch diameter power operated flight auger, using "H" casing to 15 ft. in borehole #1 only.

The testholes were located by our technician, who also recorded the ground elevations. These were referred to a local T.B.M. set up by the Consulting Engineer; this was a nail and flag in root of tree, west of existing bridge, north side of road, station 2+46, with assumed elevation 100.0.

The laboratory work was limited to determining the in situ water contents as an aid to uniformity and classification of the soils, as well as an indication of ground water conditions.

The main stratum underlying the site and the one in which is formed the creek bed, is a brown to brownish grey clayey silt to clayey sand till. This stratum arises at 8 and 7 ft. below grade in holes 1 and 2 respectively and both testholes were terminated in it at 26 ft. 6 ins. below grade. It was very stiff to stiff with depth, the average "N" value being 17 within a spread ranging from 8 to 20. The average water content was 12% and the soil was saturated. Covering this stratum, the material consisted of a mixed fill of sandy gravel, topsoil, silty clay and silt with some fragments of decomposed wood. The fill layer was in a loose to compact condition with "N" values ranging between 5 and 10 with an average value of 7. It was generally in a moist condition with a tendency for water content to increase with depth especially in hole #1 where organic material was found.

Seepage was encountered above 8 ft. in hole #1 where the final equilibrium was obtained at 6 ft. 6 ins. below grade. In hole #2, the main seepage zone occurred in the clayey sand till at a depth of about 4 to 5 ft. below the upper boundary of the till when the borehole had been advanced to a depth of 12 ft. and was uncased. Here, equilibrium water level was not established, the water level rising from 12 ft. 2 ins. to 11 ft. 9 ins. in 5 minutes. The creek water was at elevation 94.4 and this compares with the equilibrium water level in hole #1 at elevation 94.2.

The proposed structure will be supported by the main stratum of clayey silt to clayey sand till. The types of structure considered for this site could be either a rigid frame concrete box type of culvert or a rigid frame on strip footings with an open bottom.

The latter type whilst requiring footings founded below the stream bed and therefore deeper excavation, has the advantage of permitting the stream bed to be lowered at a later date.

Whichever type of structure is adopted, there will be a ground water control problem which is common to both types. This concerns the method adopted to divert the creek in order to enable excavation to be performed to reach the top of the till stratum.

The fill cover over the till is fairly loose, the depth is limited, and the borings do not indicate the presence of boulders, therefore, timber sheeting, braced and driven a nominal depth into the till should prove effective in cutting off the flow from the creek for the open bottom type of structure. However, borehole #2 indicated a seepage layer between 11 and 12 ft. in the till, corresponding to elevation 89.0 and it may be necessary to drive the sheeting below this elevation to cut off the seepage.

In the case of the complete box type of structure, this problem does not arise since the slab will correspond to the present creek bed level at elevation ±93.0. Here, diversion of the creek flow will be the main construction problem relating to ground water control.

At elevation 91.0, assumed to correspond approximately with the excavation grade for the complete box type of structure, the allowable net bearing value is 4.0 k.s.p. and hence ground support is not a problem.

For the open bottom type of culvert with strip footings, the assumed footing grade is ±88.0 to provide about 5 ft. of cover below existing creek bed. At this depth, the allowable net bearing value is 6.0 k.s.f. Granular "B" or sand cushion quality material to the D.H.O. specification is recommended as the backfill between the culvert and the road subgrade. This should be transitioned in accordance with the D.H.O. Standard D.D.809 using sand cushion or Granular "B".

In the creek bed for the open bottom type of structure, it is recommended that the backfill up to the original surface of the till stratum is made with weak concrete to prevent possible scour.

In conclusion, it is our opinion that the open bottom type of culvert should prove effective and is suitable for the ground conditions revealed by the boreholes, without any long term settlement problem.

Yours very truly,

PETO ASSOCIATES LTD.

CFF/jc

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

LIST OF ABBREVIATIONS

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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.	DENSENESS	'N' BLOWS / FT.
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		

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

A.P.L. ABOUT PLASTIC LIMIT

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		

PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 1

CONSULTING SOIL ENGINEERS

JOB NO. 68F193 JOB NAME Bridge over Milmot Creek TECHNICIAN DM

BORING DATE Oct. 11/68 CLIENT Township of Milmot ENGINEER CFF

GROUND ELEV. 100.7 BOREHOLE TYPE 3¼" Auger with "H" Casing to 15 ft. TYPED BY JC

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT
100.7	FILL. Brown sandy gravel, loose to compact, moist				
2'6" 98.2	Fill, silt and topsoil, silty clay, sand seams loose, moist to wet, some decomposed wood		1	SS	10
			2	SS	5
8'0"			3	SS	8
92.7	Brown grey clayey silt to clayey sand till very stiff to stiff saturated and more silty greyer below 20'		4	SS	18
			55	AS	
	more clayey at 25 ft.		6	SS	20
			7	SS	16
26'0" 74.7	Borehole terminated at 26'0"		8	SS	8

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT _____ W_L
PLASTIC LIMIT _____ W_P
WATER CONTENT _____ W

W_P W W_L
WATER CONTENT % 10 20 30

REMARKS

510 final water level 6'6"

Seepage above 8'

PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 2

CONSULTING SOIL ENGINEERS

JOB NO. 68F193 JOB NAME Bridge over Wilmot Creek TECHNICIAN DM

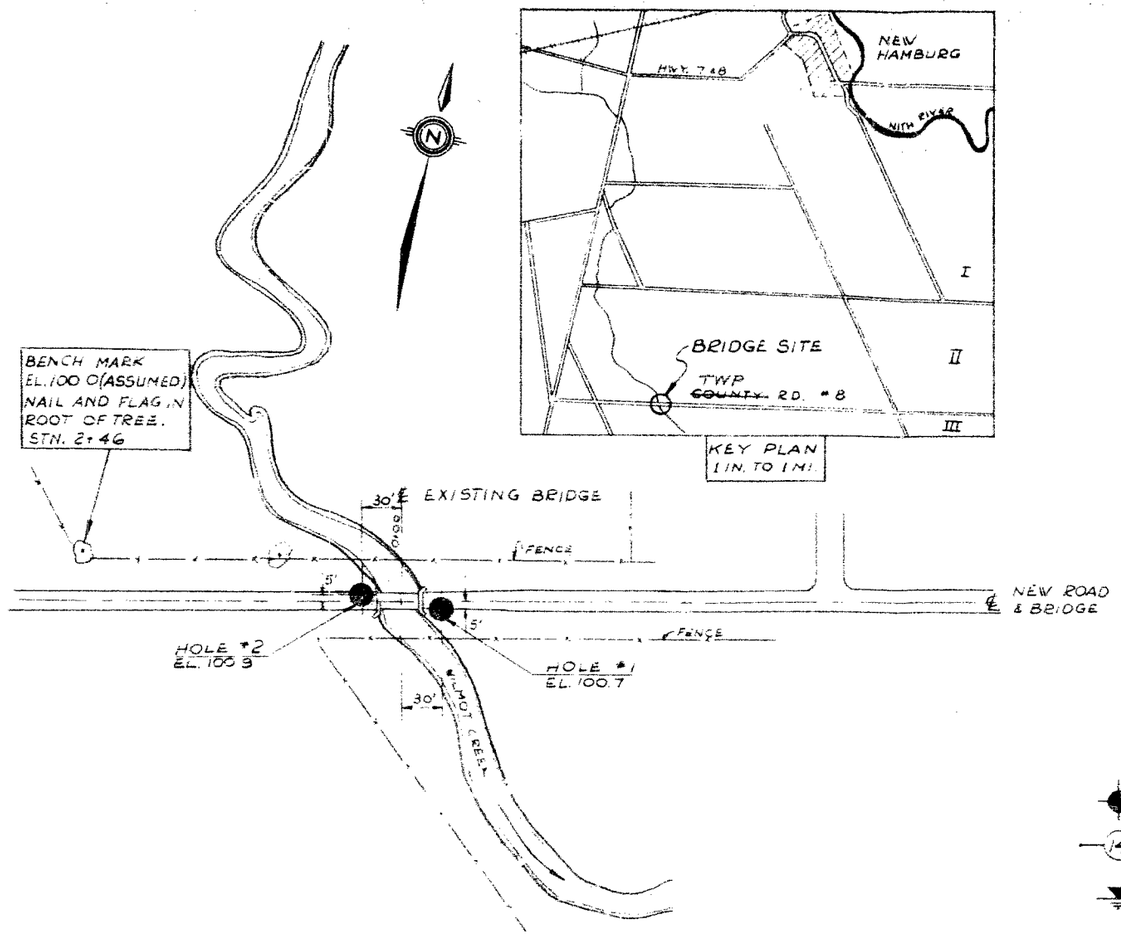
BORING DATE Oct. 11/68 CLIENT Township of Wilmot ENGINEER CPF

GROUND ELEV. 100.9 BOREHOLE TYPE 3½" Auger. Hole was not cased TYPED BY JC

DEPTH ELEV.	DESCRIPTION	LEGEND	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FOOT	REMARKS
	FILL. silty fine sand with grits and fine gravel, loose, moist		1	SS	6	
5'10"			2	SS	6	
7'0" 93.9	Grey brown silt FILL loose to med.clay					
	Brown to brownish grey clayey silt to clayey sand till very stiff to stiff		3	SS	8	Seepage layer from 4'6"-12' water rose as follows
			4	SS	16	
89.0	saturated		5	SS	14	After 12' sample 0 mins.12'2" 2 mins.12'0" 5 mins.11'9"
			6	SS	18	
			7	SS	20	
26'0" 74.9	more silty		8	SS	12	
	BH terminated at 26'0"					

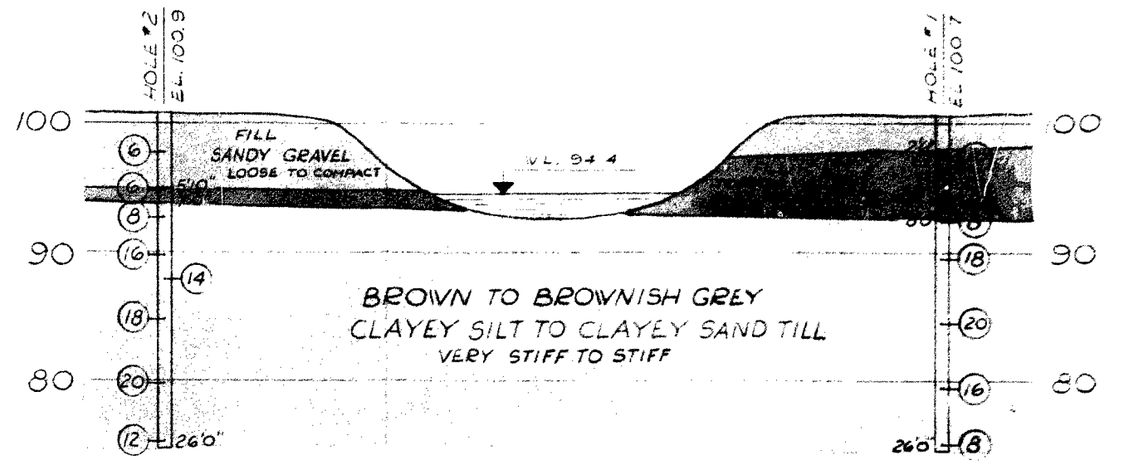
DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_p
WATER CONTENT ____ W
W_p W W_L
10 20 30
WATER CONTENT %



SITE PLAN

SCALE: 100' TO 1"



SECTION THROUGH HOLES 2 & 1

SCALE: 10' TO 1" (NATURAL)

LEGEND

- BOREHOLE
- (14) BLOWS/FOOT
- WATER LEVEL

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 these may vary from those shown between borings.

REGISTERED PROFESSIONAL ENGINEER
E. M. PETO
PROVINCE OF ONTARIO

TOWNSHIP OF WILMOT
c/o McCARGAR & HACHBORN LTD. CONSULTING ENGINEERS

BRIDGE OVER WILMOT CREEK ON TOWNSHIP ROAD #8 (SITE 33-112)

NEW HAMBURG/ONTARIO

PREPARED BY
PETO ASSOCIATES LTD.

JOB NO	DATE	DRAWN BY	CHECKED BY
68F193	OCT. 1968	K. K.	