

**DOMINION SOIL INVESTIGATION LIMITED**

CONSULTING SOIL & FOUNDATION ENGINEERS

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REPORT ON SUBSURFACE INVESTIGATION,
PROPOSED REPLACEMENT OF BRIDGE NO. 0022,
WILMOT TOWNSHIP ROAD NO. 7,
NEW HAMBURG, ONTARIO.

Geocres # 40P7-54
NO. 2006-11007

Reference No. 76-1-K1

March 1976

Prepared for:

The Township of Wilmot,
c/o W.E. Kelley & Associates Limited,
13 Spetz Street,
Kitchener, Ontario.

Distribution:

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STRUCTURE SITE No. 33-113



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1.0 INTRODUCTION

This report describes the results of a subsurface investigation carried out at the site of the replacement of Bridge No. 0022 on Township Road 7 in the Township of Wilmot near the Town of New Hamburg, Ontario.

Authorization to proceed with the work was received in a letter dated January 8, 1976 from Mr. W.E. Kelley, P. Eng., of W.E. Kelley & Associates Limited, Consulting Engineers for the project.

The purpose of the investigation was to disclose the subsurface conditions of the site of the proposed new bridge and make recommendations for the design and construction of the foundations for the proposed structure.

2.0 METHOD OF INVESTIGATION

The field work consisted of 2 exploratory boreholes put down at the locations shown on Drawing No. 1 of this report. The boreholes were advanced to the sampling depths using a continuous flight hollow stem power auger and samples of the subsoil were recovered at 2½ and 5 foot intervals in depth in each of the boreholes to a maximum depth of 35 feet. The samples recovered were returned to our laboratory for visual and tactile examination.



Elevations have been referred to a benchmark provided by the Consulting Engineers. The benchmark used was the outside edge of the north curb at the center-line of the existing structure and it was assigned an assumed elevation of 100.0 feet referenced to local datum.

3.0 THE SITE

The site is located at the crossing of Wilmot Creek and Township Road No. 7 in the Township of Wilmot. The area is part of the westerly limit of the Physiographic Region known as the Stratford Clay Plain and the creek meanders across a wide flat valley and has cut a narrow 'U' shaped channel within the valley floor.

Drainage in the area appears to be quite good but there is evidence of some minor flooding associated with the creek.

4.0 SUBSOIL CONDITIONS

Very uniform subsoil conditions were encountered in the two boreholes done at this site. Details of the subsurface conditions encountered in each borehole are given on the individual borehole logs of Enclosures 2 & 3 and may be



summarized briefly as follows.

- (i) FILL - Beneath the surficial deposit of sand and gravel fill 18 inches thick, compact to dense dark brown silt fill was encountered. The fill contained pieces of wood and extended to a maximum depth of 10.5 feet which is equivalent to Elevation 90₊.
- (ii) CLAYEY SILT - Beneath the fill, hard brown to grey clayey silt till was encountered extending to Elevation 77± (22 feet). The till contained embedded fine gravel and 'N' values within the till ranged from 25 to over 100 blows per foot.
- (iii) SAND & SILT - Beneath the till, dense to very dense grey fine sand and silt was encountered. There was a trace of gravel in layers and both boreholes were terminated within this stratum. 'N' values ranged from 46 to over 100 blows per foot.



5.0 GROUNDWATER CONDITIONS

The free surface of the groundwater table was encountered at Elevation 94, 6 feet below present ground surface which is approximately the same level as the water in Wilmot Creek at the time of the investigation.



6.0 DISCUSSION

The proposed bridge will have a span of approximately 30 feet and the proposed bridge deck will be approximately 6 feet above the water level in the creek where the water is 3 feet deep. The proposed footing elevation is 86.5 feet which is 5 feet below streambed and approximately 14 feet below the existing bridge deck.

6.1 Bearing Capacity & Settlement

The footings at Elevation 86.5 will be founded on hard clayey silt till and a safe net bearing pressure of 5 T.S.F. may be used for the design of the foundations. The clayey silt till should be cleaned by hand for the final few inches to minimize disturbance and it is anticipated that at this depth the footings will be below the anticipated depth of scour and frost.

The expected settlement is less than one inch and will occur slowly with application of load. Differential settlement between the two equally loaded abutments is expected to be minimal.

It is suggested that footings not be founded deeper than Elevation 84 as the underlying sand layer appears to be under



some artesian pressure and could cause problems if deeper penetration was contemplated.

6.2 Excavation & Dewatering

The excavation will be approximately 8 feet below the ground-water table and creek level and it will be necessary to enclose the excavations for the abutments in tight sheeting. Tight sheeting need only penetrate 3 feet into the clayey silt till which is impervious and this will provide an adequate cut off to the flow of water. It is essential that the silt till be kept free of water during construction. The sides of the excavation should be sloped back to 45° in the upper fill layers though they can be almost vertical in the silt till provided there is adequate shoring.

6.3 Backfilling & Sliding

The structure should be designed to resist sliding and a factor of safety of 1.5 is recommended. The coefficient of friction between the silt till and concrete is 0.45 can be used for the design and should it be necessary to generate more lateral resistance than is provided by friction, a key will be necessary below the footing to mobilize the passive restraint of soil.



The fill encountered at this site is generally not suitable for re-use behind the walls as free draining material is essential to avoid a build-up of hydrostatic pressure behind the wall. It is suggested that Granular 'B' (M.T.C. Specification 1010) which is free draining, be used as backfill and that each of the abutments be fitted with a through-drain, surrounded by filter material which will adequately drain the backfill.

6.4 Statement of Limitation

The conclusions and recommendations in this report are based on information determined at the borehole locations and on geological data of a general nature which may be available for the area investigated.

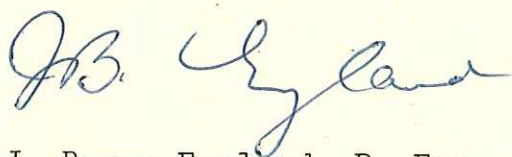
Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the boreholes and conditions may become apparent during construction which could not be anticipated or detected by the soil investigation.

We recommend that a geotechnical engineer or other designated inspector from this company should be called upon to visit

every excavation or other type of earthwork associated with this project where the soil is required to support load. The inspector should be given ample opportunity to verify that the conditions encountered by the construction are similar to those described in the report, and to confirm that the conclusions and recommendations of the report are not invalidated by new information that may have come to light during construction. If such confirmation cannot be given, the foundation design should be reviewed with respect to the new information.

In cases where the foregoing recommendation is not followed, the company's responsibility is limited to interpreting accurately the information encountered at the boreholes.

DOMINION SOIL INVESTIGATION LIMITED.



J. Byron England, P. Eng.,
Kitchener-Waterloo Branch Manager

JBE*di

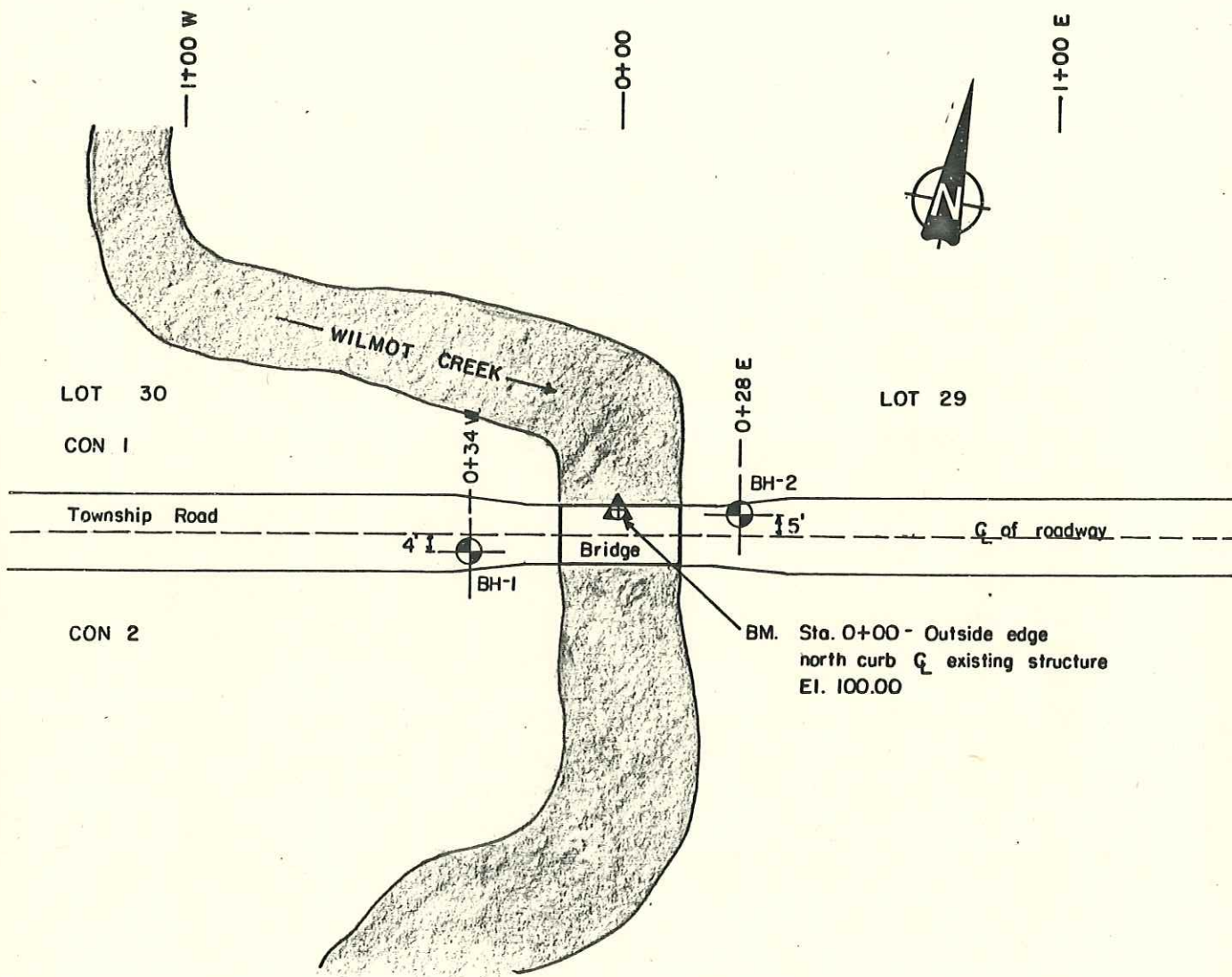


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Our Ref. No. 76-1-K1

Dwg No. 1

Prep. By KM



BOREHOLE LOCATION PLAN

SCALE: 1" = 40'

DOMINION SOIL INVESTIGATION LIMITED

Prep. By KM

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURESOIL COMPONENTS AND GROUND WATER CONDITIONS

									Ground Water Level			
BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANIC	BEDROCK		Depth of Cave-in
Ø	8"	4"	3/4"	4.76mm	2.0	0.42					0.074	0.002

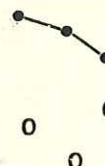
SAMPLE TYPES

AS	Auger Sample	SS	Split Spoon Sample
RC	Rock Core	TP	Piston, thin walled tube sample
%	Recovery	TW	Open, thin walled tube sample

PENETRATION RESISTANCES

DYNAMIC PENETRATION RESISTANCE : to drive a 2" Ø, 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot

STANDARD PENETRATION RESISTANCE - N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot, using a 140 lb hammer falling 30 inches

SYMBOLSOIL PROPERTIES

W%	Water content	k	Coeff. of permeability
LL %	Liquid limit	C	Shear strength
PL %	Plastic limit	φ	Angle of int. friction
γ	Natural bulk density (unit wt.)	C'	Cohesion
Qv	Coeff. of consolidation	φ'	Angle of int. friction

UNDRAINED SHEAR STRENGTH

DERIVED FROM			
TRIAXIAL	UNCONFINED	LABORATORY	FIELD
COMPRESSION TEST		VANE TEST	POCKET PENETROMETER TEST
St = sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$			

LOG OF BOREHOLE.....1.....

Enclosure No.2.....

Our Reference No. 76-1-K1
CLIENT: Township of Wilmot
PROJECT: Proposed Bridge 0022
LOCATION: Wilmot Township Rd. 7
DATUM ELEVATION: Local

DRILLING DATA
Method: Augering
Diameter: 6 1/2"
Date: February 26/76

SUBSURFACE		PROFILE	SAMPLES			PENETRATION RESISTANCE		WATER CONTENT		REMARKS
ELEVATION	DEPTH	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	Blows/Ft.	PLASTIC LIMIT	% LIQUID LIMIT	
							UNDRAINED SHEAR STRENGTH + FIELD VANE TEST • COMPRESSION TEST	W _p	W	
99.2	0	GROUND SURFACE								
97.7	1.5	SAND & GRAVEL (FILL)			1	SS	55			
	5	Dense to compact dark brown SILT (FILL)			2	SS	10			
91.2	8.0	Hard clayey			3	SS	25			
	10	brown grey SILT (TILL)			4	SS	65			
	15	embedded fine gravel			5	SS	57			
	20				6	SS	45			
76.7	22.5	Dense to very dense grey fine SAND			7	SS	46			
	30	-some gravel in layers			8	SS	>100			
63.7	35.5	END OF BOREHOLE			9	SS	>100			

VERTICAL SCALE: 1 inch to 5 ft.

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DRAWN: KM CHECKED: JBE

LOG OF BOREHOLE.....2

Our Reference No. 76-1-K1

CUT REFERENCE NO.: TOWNSHIP OF WILMOT
CLIENT: Township of Wilmot
PROJECT: Proposed Bridge 0022
LOCATION: Wilmot Township Rd. 7
DATUM ELEVATION: Local

Enclosure No.3....

DRILLING DATA
Method: Augering
Diameter: 6½"
Date: Feb 27/7

SUBSURFACE PROFILE		SYMBOL	SAMPLES	PENETRATION RESISTANCE		WATER CONTENT		REMARKS
ELEVATION Ft.	DEPTH Ft.			DESCRIPTION	UNDRAINED SHEAR STRENGTH + FIELD VANE TEST	Blows/Ft.	PLASTIC LIMIT W _p	
100.2	0	GROUND SURFACE						
98.7	1.5	SAND & GRAVEL (FILL)						
	5	Dense to loose dark brown SILT, some sand (FILL) -pieces of wood	1 SS 77		0			
	10		2 SS 6		0			
89.7	10.5	Hard grey clayey SILT (TILL)	3 SS 18		0			
	15		4 SS 28		0			
	20		5 SS 34		0			
	22		6 SS 35		0			
	25		7 SS > 100		0			
78.2	25	Very dense sandy SILT some gravel	8 SS 80		0			
70.2	30	END OF BOREHOLE						

VERTICAL SCALE: 1 inch to 5 ft.

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DRAWN: KM CHECKED: JBE