BA 1081

S7082

REPORT

TO

R. C. DUNN AND ASSOCIATES LTD.

ON

SOIL INVESTIGATION

PROPOSED OXBOW CREEK BRIDGE

TOWNSHIP OF LOBO, ONTARIO

Distribution:

5 copies - R. C. Dunn and Associates Ltd.,
London, Ontario.

10 copies - Department of Highways, Ontario,
Downsview, Ontario.

2 copies - Geocon Ltd,
Rexdale, Ontario.

June 20th, 1960

GEOCON

GEOCON LTD

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TELEPHONE UN 6-7632

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TEL. CH. 4-8041

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VANCOUVER 5, B.C.
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401 14-105
GEOCON No.

Rexdale, Ontario,
July 26th, 1960.

Department of Highways, Ontario,
Downsview, Ontario.

Attention: Mr. L. G. Soderman, P. Eng.,
Principal Foundations Engineer.

Re: Our Report No. S-7082,
Soil Investigation,
Proposed Bridge,
Lobo Township.

Dear Sirs:

We have been advised by the Township of Lobo through R. C. Dunn and Associates that the official local name for the stream at the above site is "Oxbow Creek", not "Springer Creek" as noted on the Topographical Map issued by the Department of National Defence.

In accordance with their request, we have added "Oxbow Creek" to the cover of our letter report and are enclosing 10 copies of the revised cover to replace the existing covers now in your possession. Please destroy the old covers.

We regret this inconvenience to you.

Yours very truly,

GEOCON LTD

[illegible]

[illegible]
Senior Soils Engineer.

[illegible]

/cls.

BA1081

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section.

June 30, 1960.
CONSULTANTS REPORT

Attention: Mr. S. McCombie.

Re: Report #S 7082 by Geocon, Limited to R. C. Dunn and Associates, Limited on Soil Investigation -- Proposed Lobo Township Bridge Near London, Ontario. District No. 2.

Attached hereto, is the above mentioned foundation report, which you will find self-explanatory.

For your information and files.

for L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.

/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
A. Gater
W. L. Fraser
J. Roy
A. Watt

Foundations Office
Gen. Files.

S7082

REPORT

TO

R. C. DUNN AND ASSOCIATES LTD.

ON

SOIL INVESTIGATION

PROPOSED LOBO TOWNSHIP BRIDGE

NEAR LONDON ONTARIO

Distribution:

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HEAD OFFICE
180 VALLÉE ST., MONTREAL 18, QUEBEC
TELEPHONE UN. 6-7632

DISTRICT OFFICES
14 HAAS ROAD
REXDALE, TORONTO, ON
TEL. CH. 4-8641

1425 WEST PENDER ST.
VANCOUVER 5, B.C.
TEL. MU. 1-8926

Rexdale, Ontario,
June 20th, 1960.

R. C. Dunn and Associates Ltd.,
Consulting Engineers,
410 Third Street,
London, Ontario.

Attention: Mr. N. M. Warner, P. Eng.

Re: Soil Investigation,
Proposed Lobo Township Bridge,
Near London, Ontario.

Dear Sirs:

This letter reports the results of the above investigation carried out in accordance with your letter of authorization dated May 4th, 1960. The object of the investigation was to determine and interpret the subsoil conditions at the above site, as they affect the design of foundations for the proposed bridge structure.

PROCEDURE

The field work was commenced on May 17th, 1960 and completed on May 18th, 1960. A total of 2 boreholes was put down using a mobile power auger. A dynamic penetration test was carried out from the bottom of each boring. Several attempts had to be made to put down borehole 2 due to the presence of boulders near ground surface. The location of the borings, together with the inferred soil stratigraphy, are shown on Drawing S7082-1, attached to this report. A detailed log of each boring is given on the Office Reports on Soil Exploration in Appendix I.

PROCEDURE (continued)

The testing of the soil samples was carried out in the Toronto Soil Mechanics Laboratory of Geocon Ltd and the results are plotted on the Office Reports and on the Figure in Appendix II. The soil samples remaining after testing will be stored until December 1st, 1960, at which time you will be contacted for instructions regarding their disposal.

The elevations at the site are referred to the north-east corner of the north abutment girder seat of the existing bridge. This bench mark has been assumed to have an elevation of 100.

SOIL CONDITIONS

The principal soil strata encountered by the borings are as follows:

Loose Dark Brown and Grey Sandy Silt

A layer of dark brown and grey sandy silt, about 3 feet in thickness, was encountered at ground surface in borehole 1. The sandy silt layer contains organic matter throughout its depth.

From resistance to auger penetration it is estimated that the relative density of the sandy silt is loose.

Compact Brown Silty Sand and Gravel with Boulders

A stratum of brown silty sand and gravel with cobbles and boulders, was encountered at ground surface in borehole 2. The thickness of the stratum at the boring location is about 7 feet. The individual grain sizes are generally subrounded to subangular in shape.

SOIL CONDITIONS (continued)

Compact Brown Silty Sand and Gravel with Boulders (cont'd)

One standard penetration test, carried out in this stratum between the boulders, gave an "N" value of about 15 blows per foot indicating that the relative density of the stratum is generally compact.

Very Dense Grey Silty and Sandy Till

Underlying the sandy silt in borehole 1 and the silty sand and gravel in borehole 2 a stratum of grey silty and sandy till was encountered. The thickness of the stratum is about 5 feet in borehole 1. In borehole 2, it was penetrated to a maximum depth of about 7 feet. The stratum is generally comprised of subrounded to subangular sand and gravel sizes in a grey silt matrix.

Two grain size distribution curves obtained from typical samples of the till are shown on Figure 1 in Appendix II. These indicate that the stratum contains about 5 to 24 percent gravel sizes, 22 to 30 percent sand sizes, 38 to 56 percent silt sizes and 8 to 17 percent clay sizes.

Two moisture content determinations on samples from the stratum gave values of about 8 and 9 percent.

Based on the results of the standard and dynamic penetration tests, the relative density of the till is estimated to be very dense.

SOIL CONDITIONS (continued)

Very Dense Grey-Brown Silt

A stratum of grey-brown silt, with some pebble gravel sizes dispersed throughout, was encountered below the silty and sandy till in borehole 1. The thickness of the stratum at the boring location is about 14 feet.

Two grain size distribution curves, obtained from typical samples of the stratum, are shown on Figure 1 in Appendix II. These indicate that the stratum contains about 70 to 74 percent silt sizes, with 13 to 15 percent fine sand sizes and 11 to 17 percent clay sizes.

Three natural moisture content determinations on samples from the stratum gave values ranging between 10 and 12 percent. A wet unit weight determination on a sample of the silt gave a value of about 147 pounds per cubic foot.

One unconfined compression test carried out on a typical sample from the stratum gave a shear strength of about 5300 pounds per square foot.

Standard penetration tests carried out in the stratum gave "N" values ranging from 74 blows per foot to greater than 100 blows per foot. Based on these values it is estimated that the relative density of the stratum is very dense.

Dense to Very Dense Grey Silty and Sandy Till

Below the grey-brown silt in borehole 1 a stratum of grey silty and sandy till, which was penetrated for a depth of about

SOIL CONDITIONS (continued)

Dense to Very Dense Grey Silty and Sandy Till (continued)

8 feet, was encountered. This material is essentially similar to the upper till stratum, but contains a higher percentage of sand sizes with depth.

Two standard penetration tests carried out in the stratum gave "N" values of 38 blows per foot and greater than 100 blows per foot. These values together with the results of a dynamic penetration test indicate that the relative density of the stratum is dense to very dense.

WATER CONDITIONS

During the period of the investigation the groundwater level in the boreholes was within a foot of creek level. The creek water level was at about elevation 91.

DISCUSSION

General:

The site of the investigation was at the existing bridge over Spring Creek on the road between Concession I and Concession II, at Lot 9, in the Township of Lobo.

It is proposed to replace the existing County Bridge at this location by a single span structure. No specific details of the proposed structure are available at this time, but it is known that it will probably be of the rigid frame type.

DISCUSSION (continued)

General: (continued)

It is understood that it is proposed to found the structure on spread or strip footings, about 4 feet below river bottom, at elevation 80. It is further understood that this depth of penetration below river bottom is for the purpose of preventing possible river scour beneath the footings.

At elevation 80 there is a stratum of very dense grey-brown silt and a stratum of very dense grey silty and sandy till in boreholes 1 and 2, respectively. Spread or strip footings may be founded at this elevation under an allowable net bearing pressure of 5000 pounds per square foot. This value is based on the results of the standard penetration tests carried out in the silt and till strata. However, due to the fact that the footing excavations would be carried down to about 10 feet below groundwater level, there would be a tendency for heave of the base of the excavations resulting from upward water seepage pressures. This would result in a reduction of the relative density of the silt below the base of the excavation. In order to eliminate this possibility, it is recommended that the excavation be sheeted to a minimum depth of penetration of 5 feet below footing elevation.

As an alternate scheme, it is suggested that it may be more economical to found the abutment footings for the proposed bridge about 2 feet below the surface of the very dense silty to sandy till stratum which was encountered at about elevations 90 and 85 in boreholes 1 and 2, respectively. Considering the abutment footings to be at the boring locations, the foundation elevations would be at about 88 and 83

DISCUSSION (continued)

General: (continued)

for the north and south abutments, respectively. At these elevations an allowable net bearing pressure of 5000 pounds per square foot may be used in design.

Under the allowable bearing pressure of 5000 pounds per square foot and assuming the footings to have a width of approximately 5 feet, the total consolidation settlement of the bridge structure is estimated to be negligible and will take place largely during construction.

As the recommended footing elevations are below the ground-water level, the excavations will have to be sheeted to prevent inflow of water from the upper loose sandy silt and compact sand and gravel deposits. For protection against river scour beneath the abutment footings, the toe of the sheeting should be driven, about 4 feet below river bottom, to elevation 80 and left in place.

The sheeting should be of the interlocking steel sheet type in order to ensure driving it through the sand and gravel with boulders stratum, which was encountered at ground surface in borehole 2.

A thin layer of lean concrete should be laid down immediately the excavation is down to grade to prevent softening of the till.

We believe that this letter report, which was written by N.R. McCammon and checked by J.L. Seychuk, contains the information necessary for the foundation design of the proposed bridge structure. However, should you have any further questions, please do not hesitate to contact us.

Yours very truly,

GEOCON LTD

N. R. McCammon.

NRMcC/dw
S7082

N. R. McCammon, P. Eng.,
Soils Engineer.

APPENDIX I

OFFICE REPORTS ON SOIL EXPLORATION

EXPLANATION OF THE FORM "OFFICE REPORT ON SOIL EXPLORATION"

The object of this form is to enable a comprehensive study of the soil to be made by combining on one sheet all of the information obtained from the boring. An explanation of the various columns of the report follows.

ELEVATION AND DEPTH

This column gives the elevation and depth of boundaries between the various soil strata. The elevation is referred to the datum shown in the general heading.

WATER CONDITIONS

In this column the water level in the casing at the time of boring or the water table in the ground, determined by a series of observations in a piezometer or standpipe, is indicated to scale by a horizontal line with the symbol W.L. or W.T. above the line. A notation of any complicated groundwater conditions will be made in this column.

DESCRIPTION

A description of the soil, using standard terminology, is contained in this column. The consistency of cohesive soils and the relative density of non-cohesive soils are described by the following terms:

Consistency	U-Strength Tons/sq. ft.
Very soft	0.03 to 0.25
Soft	0.25 to 0.5
Firm	0.5 to 1.0
Stiff	1.0 to 2.0
Very stiff	2.0 to 4.0
Hard	over 4.0

Relative Density	Standard Penetration Resistance, Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

STRATIGRAPHIC PLOT

The stratigraphic plot follows the standard symbols of the National Research Council, Canada.

ELEVATION SCALE

The information in all columns is plotted to a true elevation scale which is shown in this column.

GRAPHS

The main body of the report forms a graph which is used to plot to correct elevation the important soil properties which are obtained through field and laboratory tests. The scales and symbols for the plotting are shown at the head of the column.

OTHER TESTS

In this column are shown, by symbol, the other field or laboratory tests which have been performed on the soil and for which the results have not been plotted on the above graph.

SAMPLES

The first three columns describe the condition, type and number of each sample obtained from the boring. The location and extent of each sample is plotted to scale.

In the last column is shown the penetration resistance in blows of 4200 inch-pounds required to drive one foot of the sampler into the ground. When a 2 inch Drive Sampler is used the result obtained is termed the "Standard Penetration Resistance".

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OFFICE REPORT ON SOIL EXPLORATION

CONTRACT S7082 BORING # 1 DATUM LOCAL CASING —

BORING DATE MAY 18, 1960 REPORT DATE JUNE 2, 1960 COMPILED BY J.A CHECKED BY M.M.L

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN · LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS

V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

Appendix I
Borehole 1

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT 57082 BORING # 1 DATUM LOCAL CASING —

BORING DATE MAY 18, 1960 REPORT DATE JUNE 2, 1960 COMPILED BY J.A. CHECKED BY M.M.B.

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

- A.S. - AUGER SAMPLE
- S.T. - SLOTTED TUBE
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- F.S. - FOIL SAMPLE
- S.O. - SLEEVE-OPEN
- S.F. - SLEEVE-FOOT VALVE
- T.O. - THIN WALLED OPEN
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- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

LEVN. EPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
92.8		GROUND LEVEL		
0.0		LOOSE DARK BROWN AND GREY SANDY SILT		
89.9				90
2.9		VERY DENSE GREY SILTY AND SANDY TILL		
84.8				85
8.0	W.L. @ EL. 91.7 - MAY 18, 1960	VERY DENSE GREY-BROWN SILT		80
				75
70.8				
22.0				70
		DENSE TO VERY DENSE GREY SILTY AND SANDY TILL		65
62.8				
30.0		END OF HOLE PROBABLY DENSE TO VERY DENSE SANDY TILL		60
59.7				
33.1		END OF PEN. TEST		55

SHEAR STRENGTH IN LBS./SQ. FT — ● UNCONFINED

2000 4000 6000 8000

WATER CONTENT W% — O NAT. □ Lw △ Pw

10 20 30 40 50

DYNAMIC PENETRATION TEST BLOWS PER FOOT

20 40 60 80 100

55 BLOWS FOR LAST INCH

OTHER TESTS	SAMPLES CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
M		2"D.O.	1	72
M γ=147		D.O.	2	>100
M		D.O.	3	>100
		D.O.	4	74
		D.O.	5	>100
		D.O.	6	38

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT S7082 BORING # 2 DATUM LOCAL CASING —

BORING DATE MAY 18, 1962 REPORT DATE JUNE 8, 1962 COMPILED BY J.A. CHECKED BY M.M.G.

SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

ABBREVIATIONS

V - IN-SITU VANE TEST
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Qc - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
γ - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

Appendix I
Borehole 2

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT S7082 BORING # 2 DATUM LOCAL CASING —
BORING DATE MAY 13, 1960 REPORT DATE JUNE 2, 1960 COMPILED BY J.A. CHECKED BY A.M.C.
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SAMPLE TYPES

A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE
F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
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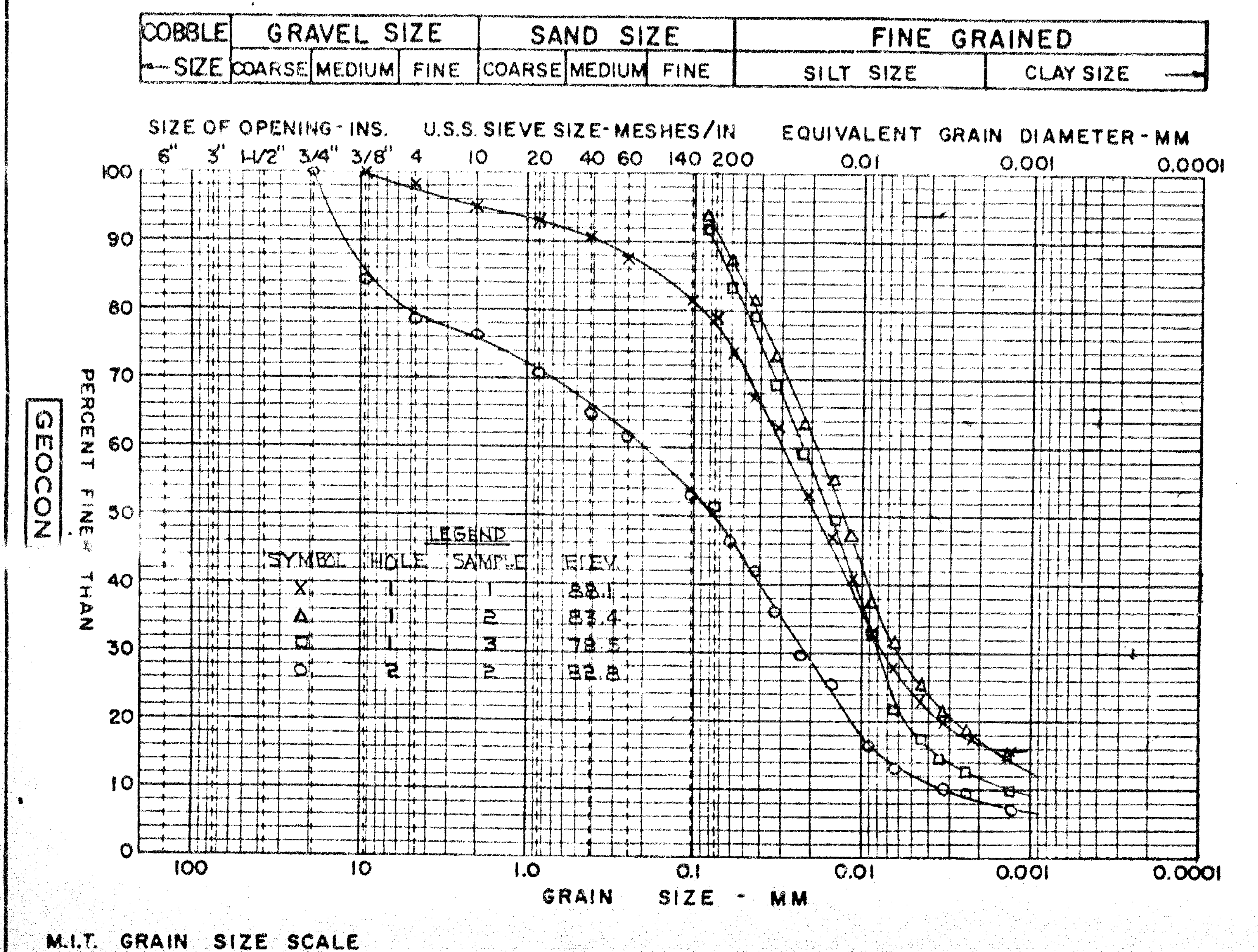
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE							SAMPLES			
LEVN. EPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W% ○ NAT. □ Lw △ Pw (10 20 30 40 50) DYNAMIC PENETRATION TEST BLOWS PER FOOT (20 40 60 80 100)	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
92.3 0.0		GROUND LEVEL								
	W.L. @ EL. 90.4 - MAY 18, 1960	COMPACT BROWN SILTY SAND AND GRAVEL WITH BOULDERS		90				2" D.O.	1	15
85.1 7.2		VERY DENSE GREY SILTY AND SANDY TILL		85	○	M		A.S.	2	—
78.3 14.0		END OF HOLE		80				A.S.	3	—
				75	PENETRATION TEST = 13'-0" TO 14'-4" = 186 BLOWS					

APPENDIX II

FIGURE - LABORATORY TESTING



GRAIN SIZE DISTRIBUTION

APPENDIX II
FIGURE 1
PROJECT S7082

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40I 14 - 105

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _____ DIST. 2

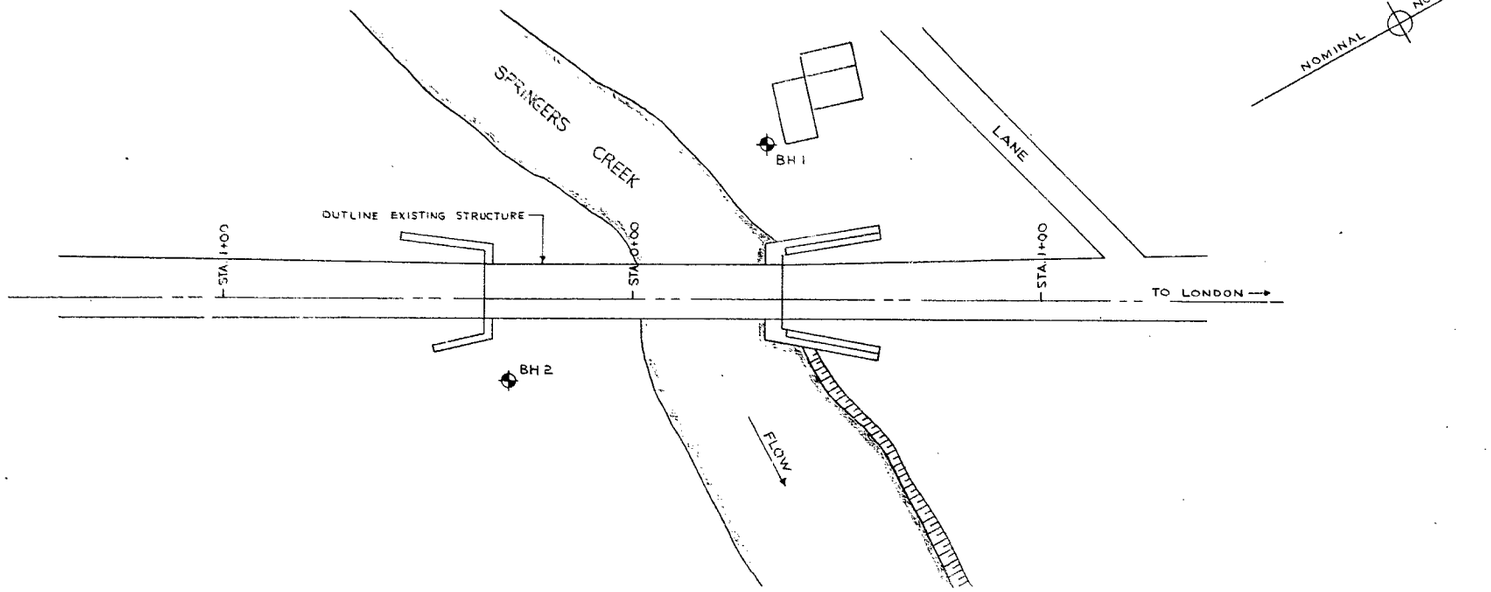
LOCATION PROP. OXBOW CREEK BR.
NEAR LONDON

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. ONE

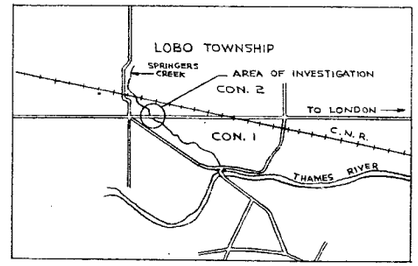
REMARKS: _____

G.I.-30 SEPT. 1976

40I14-105
GEOCRES No.



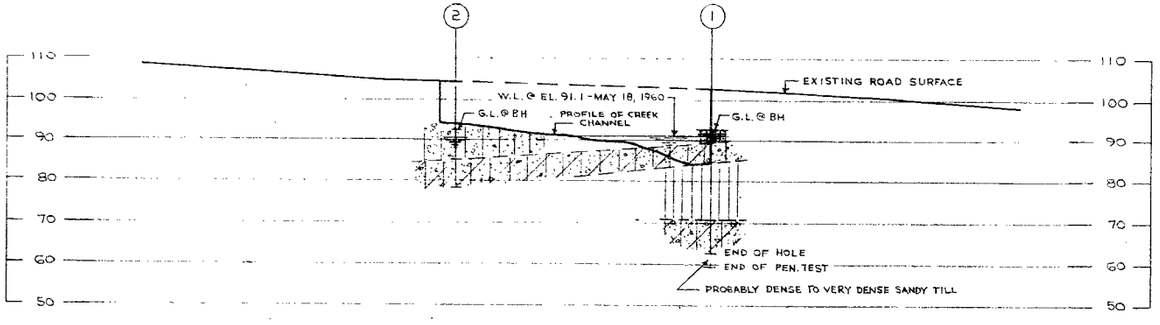
PLAN
SCALE: 1"= 20'-0"



KEY PLAN
SCALE: 1"= 0.8 MILES

LEGEND

- BOREHOLE WITH PENETRATION TEST IN PLAN
- (1) BOREHOLE AND PENETRATION TEST IN ELEVATION
- (2) BOREHOLE IN ELEVATION
- W.L. IN HOLE - MAY 18, 1960



SCHEMATIC SECTION ALONG CENTRE LINE OF ROAD
SCALE: HORIZ. & VERT. 1"= 20'-0"

STRATIGRAPHY

- LOOSE DARK BROWN AND GREY SANDY SILT
- COMPACT BROWN SILTY SAND AND GRAVEL WITH BOULDERS
- DENSE TO VERY DENSE GREY SILTY AND SANDY TILL
- VERY DENSE GREY-BROWN SILT

SPECIAL NOTE. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT BOREHOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN BOREHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

40I14-105
GEOCRES No.

REVISIONS			REFERENCE		REFERENCE	
MARK	DATE	DESCRIPTION	DWG. NO.	DESCRIPTION	DWG. NO.	DESCRIPTION
					—	PLAN AND PROFILE - LOBO TOWNSHIP BRIDGE SUPPLIED BY R.C. DUNN AND ASSOCIATES LIMITED

R. C. DUNN AND ASSOCIATES LIMITED
LONDON ONTARIO

PROPOSED LOBO TOWNSHIP BRIDGE
NEAR LONDON ONTARIO

BORING PLAN AND SOIL STRATIGRAPHY

GEOCON LTD

DATE JUNE 3, 1960 SCALE AS SHOWN

MADE	CHKD.	APPD.	No.
J.A.			S 7082 - 1