S6673

REPORT

TO

DEPARTMENT OF HIGHWAYS, ONTARIO

ON

SOIL CONDITIONS AND FOUNDATIONS

PROPOSED MONTREAL RIVER BRIDGE

HIGHWAY 11

LATCHFORD ONTARIO

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Rexdale, Ontario,
June 2nd, 1958.

58-F-310 C

Department of Highways, Ontario,
Parliament Buildings,
Toronto 2, Ontario.

Attention: Mr. A. M. Toye, P. Eng.,
Bridge Engineer.

Re: Site Investigation,
Proposed Montreal River Bridge,
Highway 11,
Latchford, Ontario.

Dear Sirs:

This letter reports the results of the above investigation carried out in accordance with our proposal dated May 2nd, 1958 and accepted on May 5th, 1958. The object of this investigation was to determine and interpret the subsoil conditions at the above site, as they affect the design of foundations for the proposed bridge.

The site of the proposed bridge on the Montreal River is located south of Latchford, Ontario and between the existing conservation dam and Ontario Northland Railway bridge. The ground level at the site varies from a minimum elevation of about 895 at the river bed to a maximum elevation of about 930 on the south bank of the river. The width of the river at the site is approximately 205 feet. From available geological information, it is known that, at the site, sands, gravels and boulders in the river channel and boulder till elsewhere overlie bedrock. Bedrock is Precambrian siliceous shale of the Cobalt series.

The field work was commenced on May 8th and completed on May 15th, 1958. Four exploratory boreholes were put down to depths between 23 feet and 32 feet. A shallow test pit was put down on the north bank of the river

to check the soil conditions. The locations of the borings and the test pit together with the inferred soil stratigraphy are shown on Drawing S6673-1 attached at the rear of this report. Detailed logs of each borehole are given on the Office Reports on Soil Exploration in Appendix I.

The soil and rock samples obtained will be stored until December 1st, 1958 and will then be destroyed unless further instructions are received.

The locations of the borings were obtained from a site plan No. 1714-T-1 supplied by the Foundation of Canada Engineering Corporation Limited. Elevations are Geodetic and were obtained by reference to water level readings at the conservation dam.

SOIL CONDITIONS

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

Peat

A layer of dark brown peat, about 1 foot in thickness, was generally found to cover the area around test pit 5.

Fill

A layer of sand, gravel and boulder fill, about 3 feet in thickness, was encountered at ground surface in borehole 4, put down on the south bank of the river and adjacent to the existing band stand. The relative density of the fill layer is estimated from the resistance to core drilling and core recovery to be compact to dense.

Boulders

The river bed consists of boulders, the upper surface of which is irregular and varies from about 3 feet below water level, to about water

SOIL CONDITIONS (continued)

Boulders (continued)

level. The thickness of the boulder stratum as encountered in boreholes 1, 2 and 3, varies from about 4 to 12 feet. The boulders range in size to a maximum of about 6 feet and are of assorted geological origin. In borehole 2, located in the relatively calm portion of the river channel, some sand and gravel sizes were encountered among the boulders.

From observation of the gaps between boulders and from the core recovery, it is estimated that the upper portion of the boulder stratum is of loose relative density. The relative density of the remainder of the stratum is estimated to be compact.

Boulder Clay Till

Beneath the peat in test pit 5, the fill in borehole 4 and the boulders in borehole 3, a stratum of boulders in a matrix of grey-brown clay till was encountered. Due to the presence of the numerous boulders, it was very difficult to estimate the relative density of the clay till, but based on the core recovery, it is estimated to be dense.

Bedrock

Underlying the boulder till in boreholes 3 and 4 and the boulders in boreholes 1 and 2, bedrock was encountered. Bedrock is a sound dark grey siliceous shale of the Cobalt series separated by occasional thin bands of arkose. The shale is laminated by thin alternating bands of dark grey and dull red. The upper 1 to 5 feet of the shale has been subjected to weathering resulting in a somewhat fragmental and broken structure, occasionally resulting in poor rock core recovery. Bedrock was proved by diamond drilling for up to 25 feet in borehole 1.

WATER CONDITIONS

During the time of the investigation, the river water level varied between elevation 900.3 and 900.8.

DISCUSSION

It is understood that the proposed bridge is to be either a two-span through truss steel structure with a pier located in the middle of the river or a single span steel structure. The proposed location of the bridge is as shown on Drawing S6673-1. The exact details of the bridge structure are at present not known, but the boreholes were located by the Foundation of Canada Engineering Corporation Limited so that a multi-span structure may be studied.

For the pier and abutment foundations, it is considered that the boulder stratum is not a suitable bearing stratum due to its erratic and loose relative density. It is therefore recommended that the pier and abutment foundations be carried to the sound portion of the bedrock, ranging from about elevation 892 to 883 as shown on Drawing S6673-1, and that the weathered and fragmental upper portion of the bedrock be removed. It is further recommended that an inspection of the bedrock be made following excavation to ensure that it is in a sound condition. An allowable bearing pressure of 20 tons per square foot may be used for design of foundations resting on the sound portion of the bedrock.

Prior to the construction of approach embankments, it is recommended that all peat and topsoil be removed. The boulder till is suitable for the construction of embankments and based on the soil conditions encountered in this investigation, it is considered that for embankment design an angle of internal friction of 40 degrees and a wet unit weight of 130 pounds per cubic foot may be used. For example, an embankment about 20 feet in height with side slopes of 1 vertical to 1½ horizontal would have an adequate factor of safety for overall stability. It is further recommended that the face of the embankment be protected by rip rap to prevent scour in the river.

We believe that this letter report gives all the information necessary to enable you to proceed with the design of the proposed bridge. If however, we can be of any further assistance, please do not hesitate to contact us.

Yours very truly,

GEOCON LTD

V. Milligan per J. L. S.

VM/dw
S6673

V. Milligan, P. Eng.,
District 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

Appx. I

CONTRACT S6273 BORING # ______ DATUM GEODETIC CASING BX & AXT

BORING DATE MAY 10, 1955 REPORT DATE MAY 21, 1955 COMPILED BY M.W. CHECKED BY V.L.S.

SAMPLER HAMMER WT. — LBS. DROP — 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

SOIL PROFILE / SAMPLES

WATER CONTENT W% ○ NAT. LW PW

DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
900.6		WATER LEVEL							
1.6		RIVER BOTTOM		900					
		BOULDERS			RECOVERY 15%	LOST	RC BX	1	—
891.6 / 9.0		WEATHERED SILICEOUS SHALE BEDROCK		890	RECOVERY 47%	LOST	RC AXT	2	—
886.6 / 14.0					RECOVERY 75%	GOOD	RC AXT	3	—
		SOUND DARK GREY SILICEOUS SHALE BEDROCK		880	RECOVERY 100%	GOOD	RC AXT	4	—
					RECOVERY 100%	GOOD	RC AXT	5	—
874.6 / 26.0		END OF HOLE		870					

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OFFICE REPORT ON SOIL EXPLORATION

APPEX. I

CONTRACT 56273 BORING # 2 DATUM GEODETIC CASING BX & AXT

BORING DATE MAY 10, 1955 REPORT DATE MAY 21, 1955 COMPILED BY M.M. CHECKED BY J.L.S.

SAMPLER HAMMER WT — LBS DROP — 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

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- γ - WET UNIT WEIGHT
- K - PERMEABILITY
- C - CONSOLIDATION
- WL - WATER LEVEL IN CASING
- WT - WATER TABLE IN SOIL

SOIL PROFILE					WATER CONTENT W % (O NAT, Lw, Pw) / DYNAMIC PENETRATION TEST BLOWS PER FOOT	OTHER TESTS	SAMPLES			
ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE			CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
260.1		WATER LEVEL		260						
1.0		RIVER BOTTOM								
		BOULDERS WITH SOME SAND AND GRAVEL				RECOVERY 3%		R.C. BX	1	—
				255		RECOVERY 100%		R.C. BX	2	—
254.7 / 6.0		WEATHERED SILICEOUS SHALE BEDROCK								
252.[illegible] / 7.[illegible]						RECOVERY [illegible]%		R.C. AXT	3	—
				250						
		SOUND DARK GREY SILICEOUS SHALE BEDROCK				RECOVERY 57%		R.C. AXT	4	—
						RECOVERY 100%		R.C. AXT	5	—
248.5 / 11.6				245		RECOVERY 92%		R.C. AXT	6	—
		END OF HOLE								

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OFFICE REPORT ON SOIL EXPLORATION

APPEX-I

CONTRACT 56673 BORING # B DATUM GEODETIC CASING BX & AXT

BORING DATE MAY 14, 1958 REPORT DATE MAY 21, 1958 COMPILED BY MW CHECKED BY JLS

SAMPLER HAMMER WT. — LBS. DROP — INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4300 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 CASE
- WT - WATER TABLE IN SOIL

SOIL PROFILE						SAMPLES			
ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	% THRU #100	ELEVATION SCALE	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
630.3 0.0		WATER LEVEL		640					
1.5		RIVER BOTTOM BOULDERS							
625.3 5.0		BOULDERS IN MATRIX OF CLAY TILL							
623.8 6.5		WEATHERED SILTSTONE SHALE BEDROCK		630	RECOVERY 100%		RC AXT	1	
622.3 8.0					RECOVERY 95%		RC AXT	2	
620.8 9.5					RECOVERY 95%		RC AXT	3	
619.3 11.0		SOUND DARK GREY SILICEOUS SHALE BEDROCK		620	RECOVERY 100%		RC AXT	4	
					RECOVERY 95%		RC AXT	5	
617.3 24.0		END OF HOLE		610					

WATER CONTENT W% ○ NAT □ LW △ PW

DYNAMIC PENETRATION TEST BLOWS PER FOOT

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OFFICE REPORT ON SOIL EXPLORATION

APPEX. I

CONTRACT 52673 BORING # 4 & TP.5 DATUM GEODETIC CASING BX & AXT
BORING DATE MAY 15, 1958 REPORT DATE MAY 21, 1958 COMPILED BY M.W. CHECKED BY JLS
SAMPLER HAMMER WT. —— LBS. DROP —— 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

SOIL PROFILE

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION	OTHER TESTS	SAMPLE TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
908.0 / 0.0		GROUND LEVEL				
		SAND GRAVEL AND BOULDER TILL	RECOVERY 60%	RC BX & AXT	1	—
905.0 / 3.0		BOULDERS IN MATRIX OF CLAY TILL	RECOVERY 19%	RC AXT	2	—
			RECOVERY 17%	RC AXT	3	—
		WEATHERED SILICEOUS SHALE BEDROCK	RECOVERY 80%	RC AXT	4	—
895.0 / 13.0		SOUND DARK GREY SILICEOUS SHALE BEDROCK	RECOVERY 45%	RC AXT	5	—
			RECOVERY 76%	RC AXT	6	—
884.7 / 23.3		END OF HOLE				

WATER CONTENT W% ○ NAT LW PW

DYNAMIC PENETRATION TEST BLOWS PER FOOT

ELEVATION SCALE: 910, 900, 890, 880

ELEVN. DEPTH	WATER CONDITIONS	DESCRIPTION
905.0		GROUND LEVEL
904.0 / 1.0		PEAT
2.0		END OF TEST PIT - BOULDERS IN MATRIX OF CLAY TILL

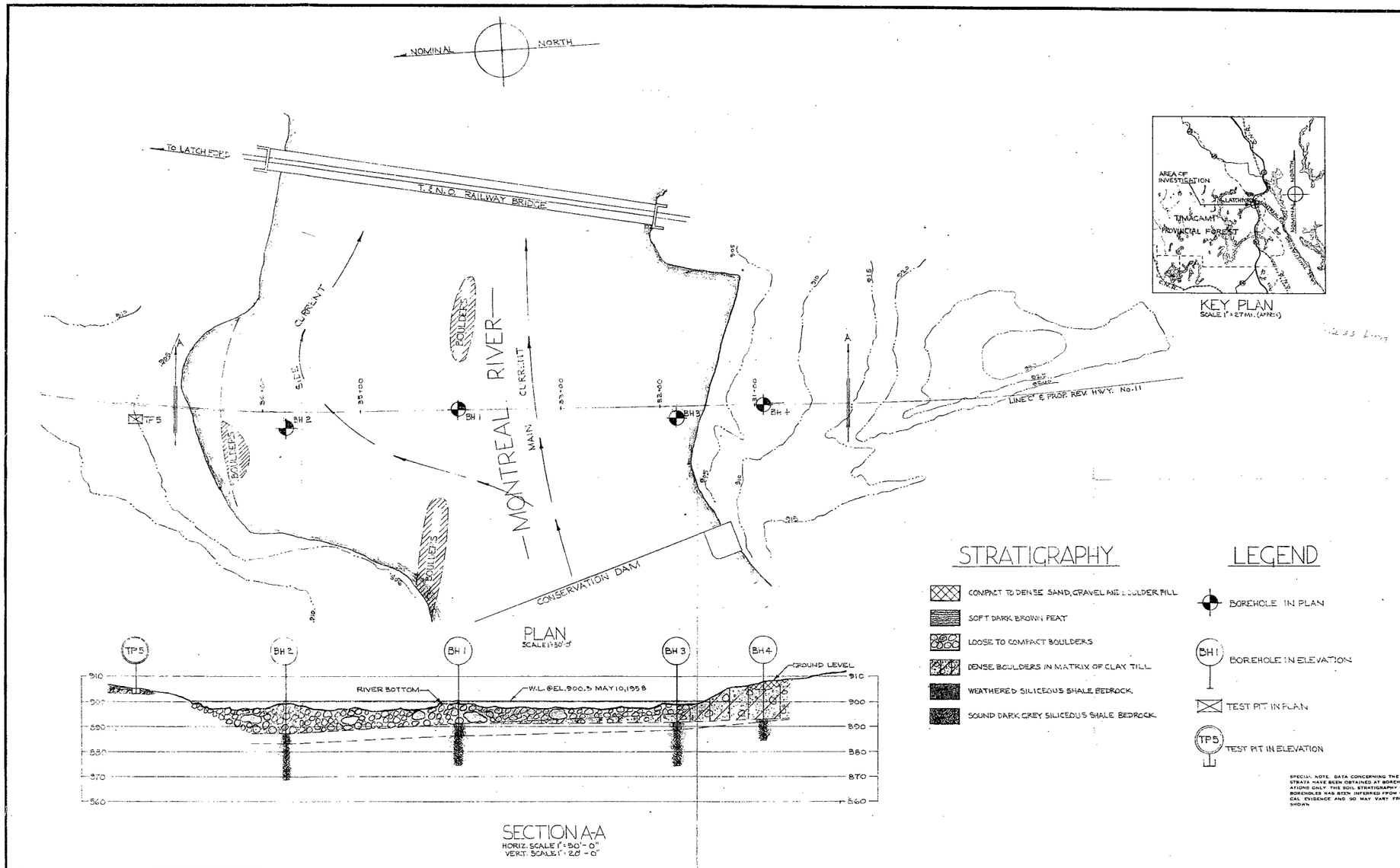
ELEVATION SCALE: 905, 900

TEST PIT

58-F-310C

HWY. # 11

MONTREAL RIVER



REVISIONS			REFERENCE		REFERENCE	
MARK	DATE	DESCRIPTION	DWG. NO.	DESCRIPTION	DWG. NO.	DESCRIPTION
					1714 - T-1	PLAN - SUPPLIED BY FOUNDATION OF CANADA ENGINEERING CORPORATION

DEPARTMENT OF HIGHWAYS, ONTARIO
TORONTO, ONTARIO
PROPOSED M[illegible] TREAL RIVER BRIDGE
HWY. 11, LATCHFO[illegible] ONTARIO
BORIN[illegible] AND SOIL STRATIGRAPHY

GEOCON LTD

DATE MAY 26, 1958 SCALE AS SHOWN

MADE	CHKD.	APPD.	No. 56673-1
MW	GS	PM	