

Mr. A. M. Tove, Bridge Engineer

February 8, 1961.

Bridge Division.

FOUNDATION INVESTIGATION REPORT

Materials & Research Section.

To R.C. Dunn & Associates, Ltd.  
by Geecon, Ltd.

Attention: Mr. K. Kleinsteinber,  
Municipal Bridge Liaison Engr.

Re: Proposed County of Middlesex Bridges,  
Big Munday Creek and Eisdon Drain  
Near London, Ontario.

Attached, we are forwarding to you, two copies  
of the above-mentioned report for your information. A review  
of this report by this Section has not been undertaken, but  
will be done when the preliminary design drawings are  
submitted.

62-5F-2834

L. G. Goderman,  
PRINCIPAL FOUNDATION ENGR.  
Per:

AGB/Wkf  
Encls.

(L. G. Stermac,  
SUPERVISING FOUNDATION ENGR.)

cc: Messrs. W. L. Fraser  
J. Roy

Foundations Office ✓  
Gen. Files.



ONTARIO

DEPARTMENT OF HIGHWAYS

Bridge Division.

Memo to Mr. A. Stermac, Date February 19, 1962.  
Principal Foundation Eng.,  
Materials & Research Section, Subject County of Middlesex,  
Room 107, Lab. Bldg., DOWNSVIEW Thorndale Bridge  
From G. C. E. Burkhardt Twp. of W. Missouri  
Cons. III, Lots 15-16

We are enclosing, herewith, a copy of the  
Foundation Report by Geocon and a copy of the plans  
for your comments.

KLK/ea

K. L. Kleinsteinber,  
Municipal Bridge Liaison Engineer.

*[Faint handwritten notes and signature]*

S7176  
REPORT  
TO  
COUNTY OF MIDDLESEX  
ON  
SOIL CONDITIONS AND FOUNDATIONS  
PROPOSED COUNTY OF MIDDLESEX BRIDGES  
BIG MUNDAY CREEK AND RISDON DRAIN  
NEAR LONDON ONTARIO

Distribution:

- 4 copies - County of Middlesex,  
London, Ontario.
- 10 copies - Department of Highways, Ontario,  
Downsview, Ontario.
- 2 copies - Geoccon Ltd,  
Rexdale, Ontario.

**GEOCON**

# GEOCON LTD

## HEAD OFFICE

180 VALLÉE ST., MONTREAL 12, QUEBEC

TELEPHONE UN. 6-7633

## DISTRICT OFFICES

14 HAAS ROAD  
REXDALE, TORONTO, ONT.  
TEL. CH. 4-8641

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

Rexdale, Ontario,  
February 2nd, 1961.

County of Middlesex,  
County Buildings,  
London, Ontario.

Attention: Mr. T. Collings, P. Eng.,  
Assistant County Engineer.

Re: Soil Investigation,  
Proposed County of Middlesex Bridges,  
Big Munday Creek and Risdon Drain,  
Near London, Ontario.

Dear Sirs:

This letter reports the results of the above investigation carried out in accordance with your verbal instructions given on January 12th, 1961. The object of the investigation was to determine and interpret the subsoil conditions at the above sites, as they affect the design of foundations for the proposed bridges.

### PROCEDURE

The field work was commenced on January 18th, 1961 and completed on January 20th, 1961. One borehole with an accompanying dynamic penetration test was put down on the creek bank at each site. At the Big Munday Creek site, an additional dynamic penetration test was put down in the creek bed from the top of the east side of the existing bridge. The borings were put down using mobile power auger equipment.

County of Middlesex,  
February 2nd, 1961,  
Page 2.

PROCEDURE (continued)

The locations of the borings put down at the Big Munday Creek site, together with a section of the inferred soil stratigraphy, are shown on Drawing S7178A-1 attached to this report. The location of the boring put down at the Risdon Drain site is shown on Drawing S7178B-1 attached. A detailed log of each boring is given on the Office Reports on Soil Exploration in Appendix I.

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. The soil samples remaining after testing will be stored until August 1st, 1961, at which time you will be contacted for instructions regarding their disposal.

The elevations at each site were obtained from local bench marks established by the County of Middlesex Engineering Department. At the Big Munday Creek site, the elevations were referred to the top of the east curb of the existing bridge, which has an elevation of 79.5, local datum. At the Risdon Drain site, the bench mark, which has an assumed elevation of 100.00, consisted of a nail in a hydro pole located near the south west corner of the existing bridge.

The two bridge sites are discussed separately below:

BIG MUNDAY CREEK BRIDGE

SITE

The site of the investigation is at an existing bridge over Big Munday Creek, a tributary of the Thames River. The existing bridge is situated on County Road 9, about 3 miles south of Melbourne, between Lot 1, Concession III of Ekfrid Township and Lot 1, Concession III of Caradoc Township.

The general topography of the area is flat. At the site under investigation the creek flows along the bottom of a valley which is about 40 feet below the general elevation of the surrounding countryside.

SOIL CONDITIONS

Stiff to Very Stiff Silty Clay

In borehole 1, which was put down on the north bank of the creek, a stratum of silty clay extending to the full depth of exploration of 41 feet was encountered. Soundings and probings in the creek bed, put down through the ice, and the results of dynamic penetration test 2 confirm the continuity of the stratum and indicate that the silty clay directly underlies the creek bottom. The stratum, as encountered in borehole 1, is grey in colour, except in the upper 10 feet where it is grey brown, probably as a result of weathering and oxidation. In the upper 2 to 3 feet of the silty clay some organic matter in the form of grass roots was encountered. The stratum which is composed of homogeneous silty clay with no visible structure contains occasional subrounded to subangular gravel ranging from about 1/8 to 1/2 inch in size.

BIG MUNDAY CREEK BRIDGE

SOIL CONDITIONS (continued)

Stiff to Very Stiff Silty Clay (continued)

Two Atterberg limit determinations on samples of the silty clay gave liquid limits of about 36 and 37 and plasticity indices of 17 and 19 at corresponding natural moisture contents of about 21 percent. These results indicate that the clay is of low to medium plasticity and of low compressibility.

Two wet unit weight determinations on samples from the stratum gave values of 131 and 132 pounds per cubic foot.

Two quick triaxial compression tests performed on samples of the silty clay obtained from elevations 51 to 40 gave shear strengths of 1690 and 1800 pounds per cubic foot. Standard penetration tests carried out in the stratum gave "N" values ranging from 11 to 28 blows per foot with an average value of about 21 blows per foot. Based on the results of the strength tests, together with the results of the standard and dynamic penetration tests, the consistency of the stratum is stiff to very stiff.

WATER CONDITIONS

A water level observation pipe was installed in the completed borehole and a reading taken next day indicated that the borehole was dry. The ice level in the creek during the period of the investigation was at about elevation 61.

BIG MUDAY CREEK BRIDGE

DISCUSSION

It is proposed to replace the existing bridge at this location by two rectangular rigid reinforced concrete culverts forming an integral structure. Each culvert would be about 100 feet in length with a span of about 14 feet. About 10 feet of fill is to be placed on top of the proposed structure.

It is understood that it is proposed to found the proposed structure on strip footings, about 4 to 5 feet below creek bottom, at elevation 51.0. It is further understood that this depth of penetration below creek bottom is for the purpose of preventing possible scour beneath the footings.

The stratum of stiff to very stiff silty clay, which was encountered at the site, is considered a suitable bearing stratum for the founding of the proposed structure. It is thus recommended that the culvert bridge be founded on strip footings, at elevation 51.0, as planned.

Based on the estimated consistency from the "U" values and the triaxial tests, which gave shear strengths of 1690 and 1800 pounds per square foot, a net allowable bearing pressure of 2 tons per square foot may be used for design purposes.

Under the allowable loading and assuming footings of the width which will be required, the total settlement of the structure, due to consolidation of the silty clay, should not exceed 1/2 inch. This should be within tolerable limits for the proposed structure.



County of Middlesex,  
February 2nd, 1961,  
Page 6.

#### BIG MINDAY CREEK BRIDGE

#### DISCUSSION (continued)

Due to the relatively low permeability of the silty clay, groundwater inflow into footing excavations should be small and should be readily controlled by pumping from sumps.

A thin layer of concrete should be laid down immediately footing excavations are down to grade to prevent softening of the silty clay.

#### RISDON DRAIN BRIDGE NO. 145

#### SITE

The site is about 1 mile east of Bryanston on County Road 26 at the existing bridge over Risdon Drain in Lot 6, between Concessions XI and XII of the Township of London, Middlesex County. Risdon Drain is a constructed drainage channel about 10 feet wide at the base. The side slopes are about 1 on 1, and the channel is about 10 feet deep. The general topography of the area is flat.

At the time of the investigation there was no flow of water in the drain, but about 6 inches of ice was present on the bed.

#### SOIL CONDITIONS

##### Compact to Very Dense Silty Till

Borehole 1, put down to a depth of 29 feet on the south east bank of the existing drain, encountered a stratum of silty till

RISDON DRAIN BRIDGE NO. 145

SOIL CONDITIONS (continued)

Compact to Very Dense Silty Till (continued)

throughout. The stratum is grey brown in colour, except in the upper 5 to 6 feet where it is brown probably as a result of weathering and oxidation. The upper few feet of the stratum contained some grass roots. Samples of the stratum are composed predominantly of silt, with some sand and subangular gravel sizes up to 1/2 inch. Some clay sizes are also present.

Standard penetration tests carried out in the stratum gave "N" values ranging from 27 blows per foot near the surface to greater than 54 blows per foot below elevation 93. Based on these results, together with the results of the dynamic penetration test, the stratum is compact near the surface and becomes very dense with depth.

WATER CONDITIONS

The borehole was dry immediately after completion. It is known from local information that wells in the immediate area extending to depths of 30 to 35 feet are completely dry. At the time of the investigation the ice level in the stream was at about elevation 94.

DISCUSSION

It is proposed to replace the existing County Bridge at this location by a single span skew structure about 40 feet in length and 30

RISDON DRAIN BRIDGE NO. 145

DISCUSSION (continued)

feet wide. No specific details of the proposed structure are available, but it is known that it will probably be of the rigid frame type.

It is understood that it is proposed to found the structure on spread or strip footings, at about 4 feet below the drain bottom, at elevation 90. It is further understood that this depth of penetration below the channel bed is for the purpose of preventing possible scour beneath the footings.

The stratum of compact to very dense silty till which was encountered at the site, is a suitable bearing stratum for the founding of the proposed structure. It is thus recommended that the bridge be founded on spread or strip footings, at elevation 90, as planned.

Based on the standard penetration resistances obtained in the stratum below elevation 90, which gave "N" values in excess of 50 blows per foot, together with the results of the dynamic penetration test, a net allowable bearing pressure of up to 3 tons per square foot may be used for design purposes.

Under the above allowable loading and assuming footings of the width that would be required, the total consolidation settlement of the bridge structure is estimated to be very small and it would take place largely during construction.

RISDON DRAIN BRIDGE NO. 145

DISCUSSION (continued)

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APPENDIX I

OFFICE REPORTS ON SOIL EXPLORATION

GEOCON

# 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.	Relative Density	Standard Penetration Resistance Blows ft.
Very soft	0.03 to 0.25	Very loose	0 to 4
Soft	0.25 to 0.5	Loose	4 to 10
Fin.	0.5 to 1.0	Compact	10 to 30
Stiff	1.0 to 2.0	Dense	30 to 50
Very stiff	2.0 to 4.0	Very dense	over 50
Hard	over 4.0		

## 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".

# GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT S7172A BORING # 1 AND PEN # 11.2 DATUM LOCAL CASING -  
 BORING DATE JAN 18 1961 REPORT DATE JAN 19 1961 COMPILED BY M.V. CHECKED BY -  
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS ENERGY)

### SAMPLE CONDITION



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

### SAMPLE TYPES

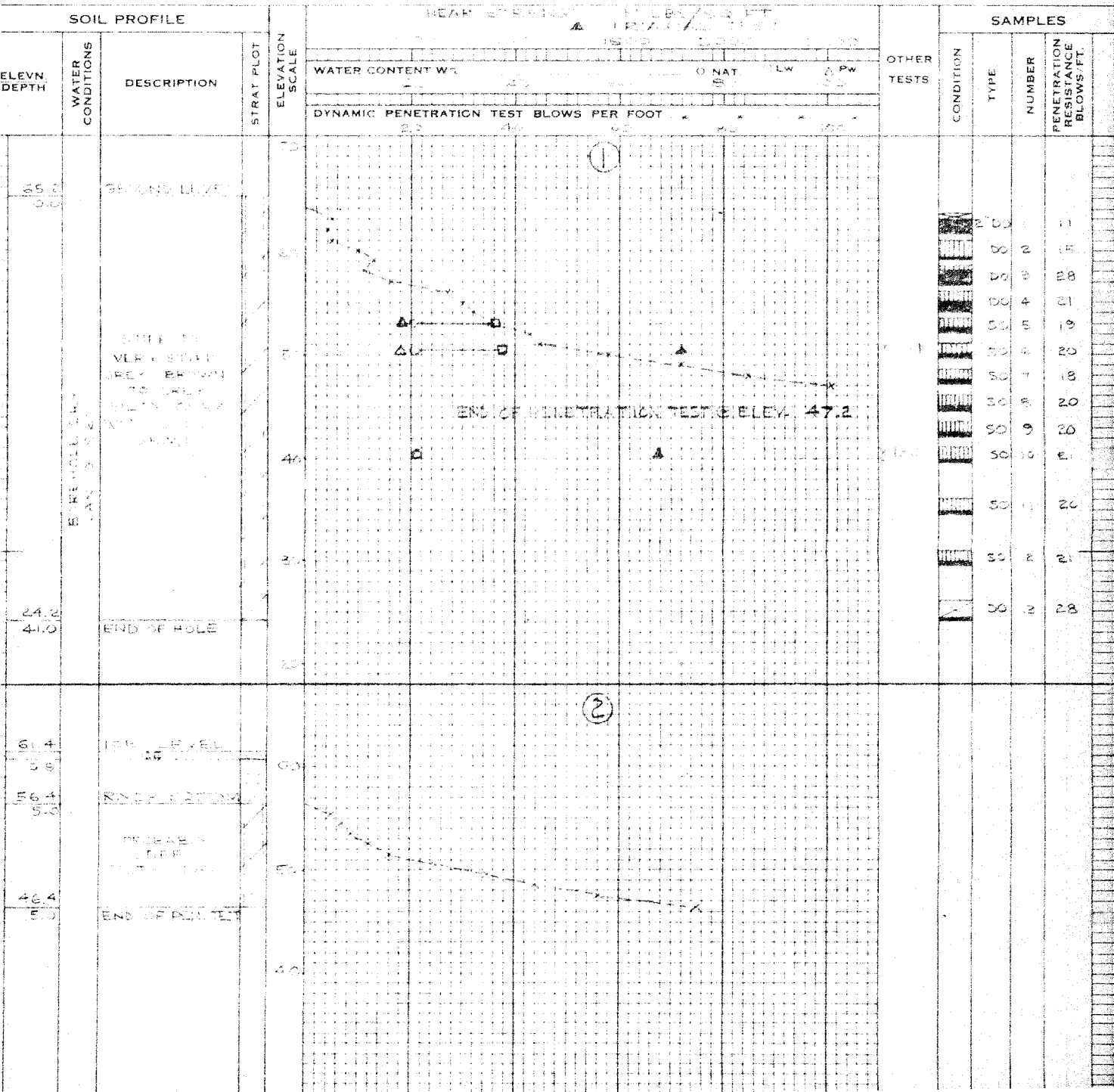
F.S. - FOIL SAMPLE  
 S.O. - SLEEVE-OPEN  
 S.F. - SLEEVE-FOOT VALVE  
 T.O. - THIN WALLED OPEN  
 R.C. - ROCK CORE

### 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



# GEOCON

## OFFICE REPORT ON SOIL EXPLORATION

CONTRACT S7173 E BORING # 1 DATUM LOCAL CASING -  
 BORING DATE JAN. 20, 1961 REPORT DATE JAN. 24, 1961 COMPILED BY M.W. CHECKED BY JH  
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

### SAMPLE CONDITION



A.S. - AUGER SAMPLE  
 S.T. - SLOTTED TUBE  
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 C - CONSOLIDATION  
 WL - WATER LEVEL IN CASIN  
 WT - WATER TABLE IN SOIL

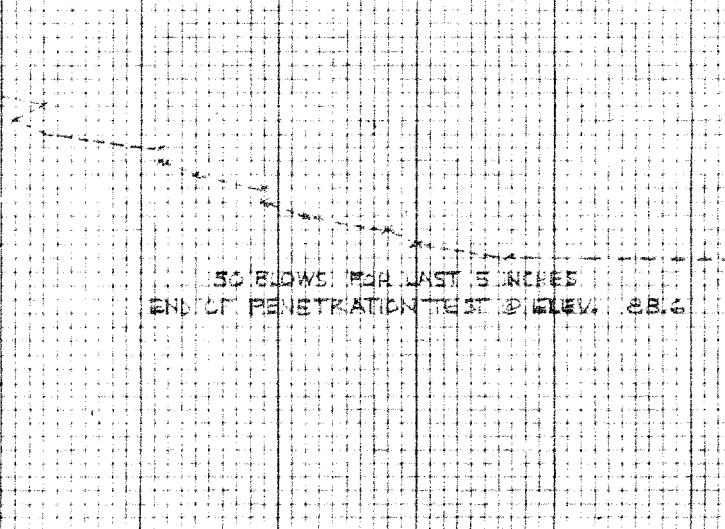
### SOIL PROFILE

ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE
101.0 0.0		GROUND LEVEL		100
72.0 29.0	BORING DRY JAN 20, 1961	CONCRETE TO VERY DENSE GREY BROWN SILTY TILL		90 80 70
		END OF HOLE		

WATER CONTENT W% NAT. PLW Pw

DYNAMIC PENETRATION TEST BLOWS PER FOOT

20 40 60 80 100

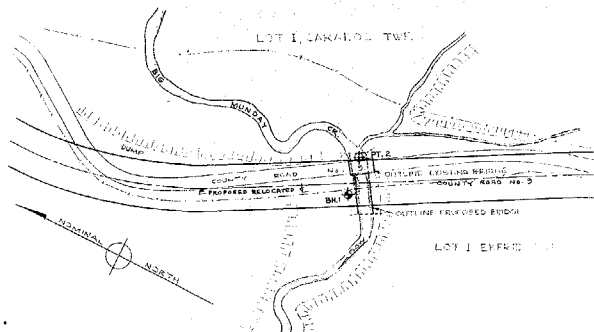


OTHER TESTS

### SAMPLES

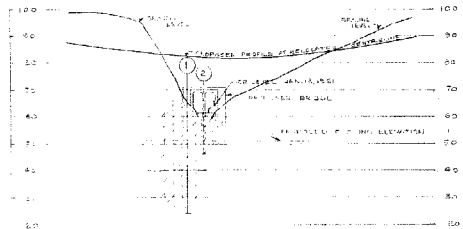
CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
		27	
	DO	2	61
	DO	3	61
	DO	4	63
	DO	5	54
	DO	6	58





PLAN

SCALE 1"=100'



SECTION A-A - RELOCATED CENTRELINE

VERT. SCALE 1"=20'



KEY PLAN

SCALE 1"=0.5 MILES (APPROX.)

# LEGEND

- BORING WITH PENETRATION TEST IN PLAN
- PENETRATION TEST IN PLAN
- BORING IN ELEVATION
- PENETRATION TEST IN ELEVATION

# STRATIGRAPHY

STIFF TO VERY STIFF GREY BROWN TO GREY SILTY CLAY WITH SOME GRAVEL

SPECIAL NOTE: DATA CONCERNING THE VARIATION OF STRATIGRAPHY HAVE BEEN OBTAINED AT BORING LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN BORING LOCATIONS HAS BEEN INFERRED FROM GEOTECHNICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

# REFERENCE

PLAN & PROFILE, BIG MUNDAY CREEK BRIDGE, COUNTY ROAD No. 3, SUPPLIED BY COUNTY OF MIDDLESEX.

COUNTY OF MIDDLESEX  
LONDON ONTARIO

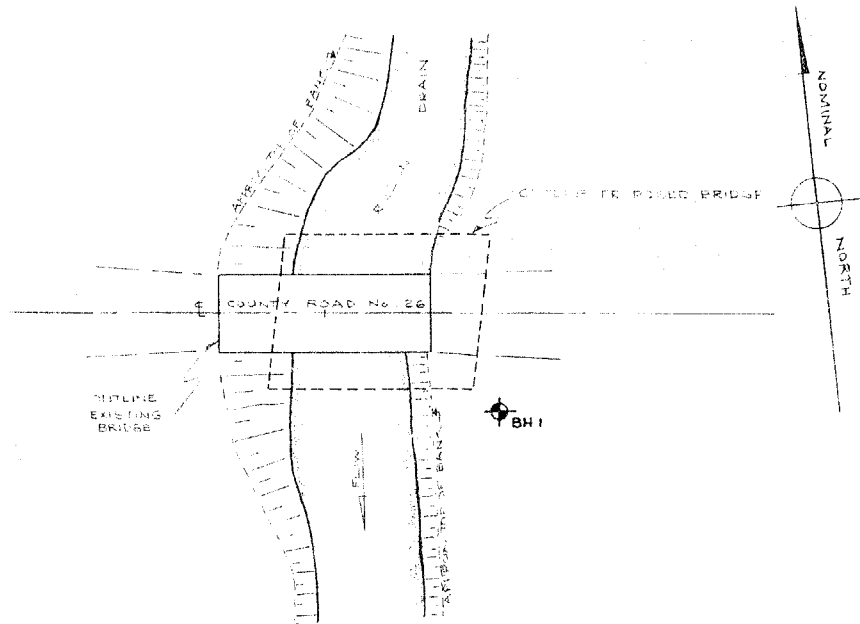
PROPOSED BRIDGE  
BIG MUNDAY CREEK

COUNTY OF MIDDLESEX  
BORING PLAN & SOIL STRATIGRAPHY

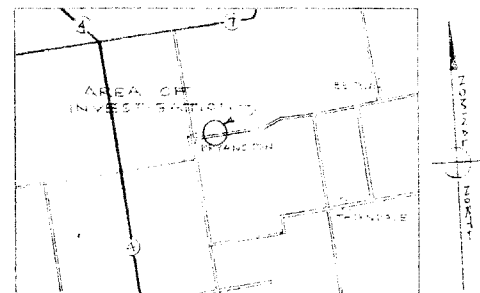
GEOCON LTD.

DATE JAN 1961 SCALE AS SHOWN

MADE BY J.V. APP. BY J.V. No. S 7178A-1



SKETCH PLAN  
Scale 1" = 20'-0"



KEY PLAN  
Scale 1" = 4 MILES (APPROX)

### LEGEND

✦ BOREHOLE WITH PENETRATION TEST IN PLAN

COUNTY OF MIDDLESEX  
TOWNSHIP OF LONG BEACH  
PROPOSED BRIDGE No. 145  
RISCON CHAIN  
BORING PLAN

GEOCON LTD.

DATE JAN 20, 61 SCALE AS SHOWN

MADE CHKD. APPD.  
M.W. [Signature] No. S 7178 B-1

# 62-F-293M

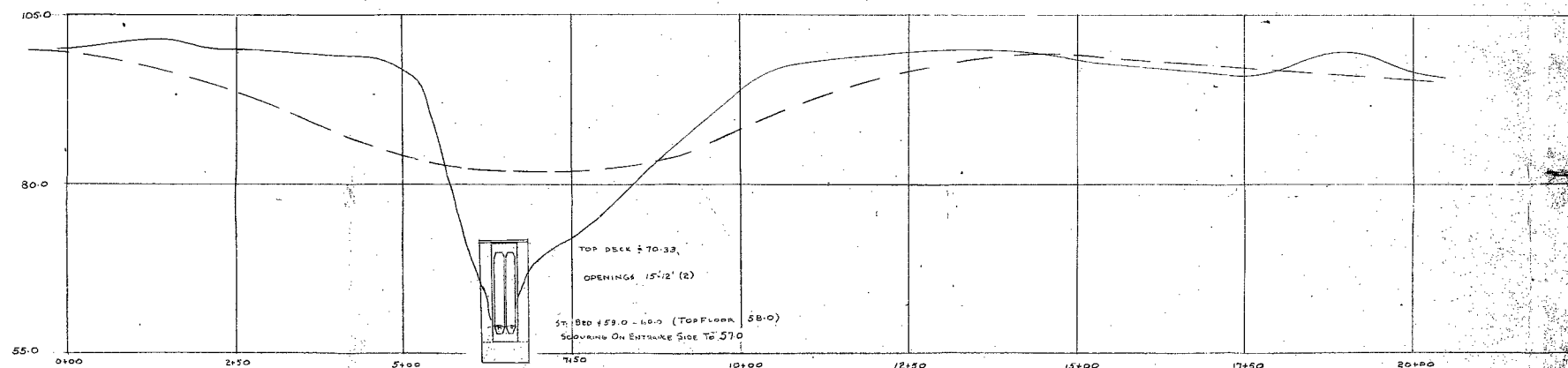
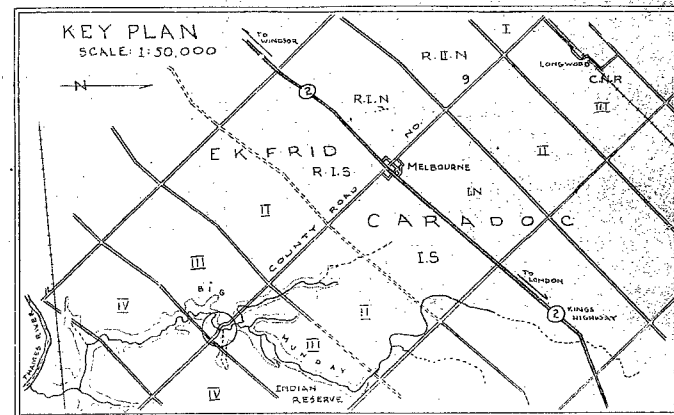
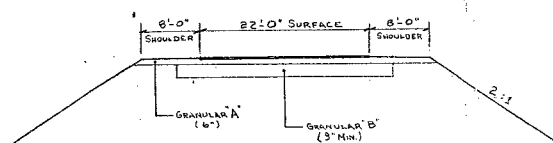
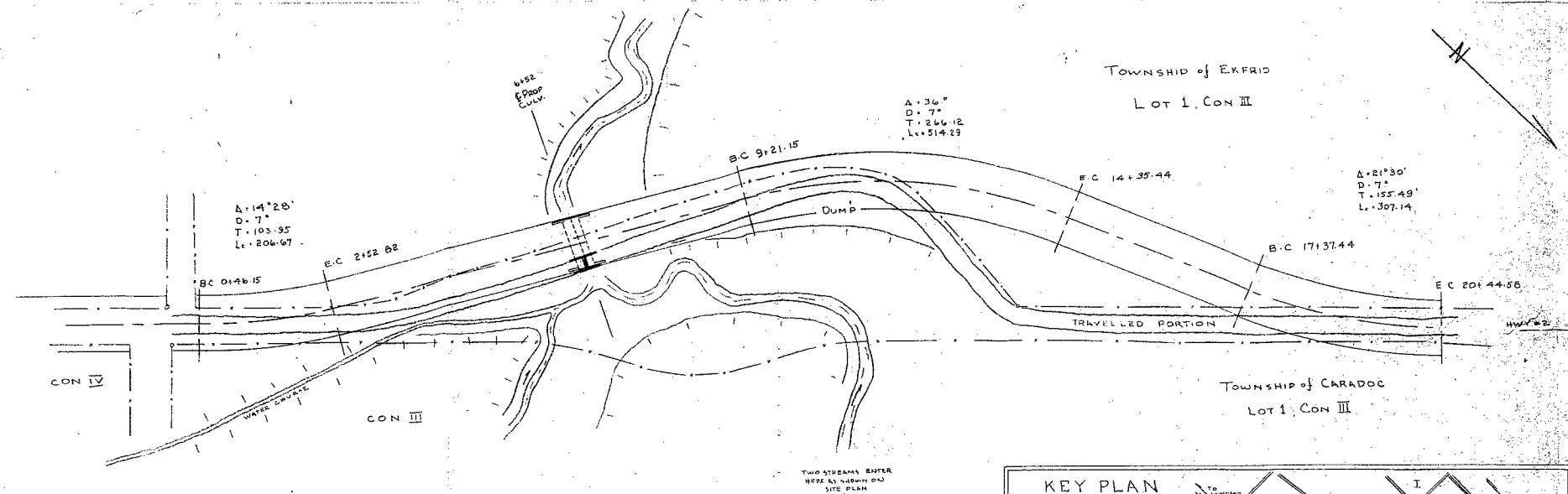
MIDDLESEX

BRIDGES

BIG MUNDAY

CREEK &

RISDON DRAIN



D A T A

1. **Special Features:** The general topography of the area is fairly flat. The topography at the site is very hilly. The creek flows through the bottom of a steep valley which is about 40' below the elevation of the surrounding countryside. (It was impracticable to relocate the culvert or divert the stream in view of the high hills so close to the structure and also due to the fact that 3 streams come together at the entrance.) The creek flows very moderately during the summer and quite rapidly during spring and flash floods. Water in winter not deep enough to create any serious ice problem.
2. **Upstream -** Structures were inaccessible by car (No. Structures)  
**Downstream -** 4.4 miles downstream the structure has an 18' span and is approximately 15' high. The creek has quite a steep gradient at this point and the water flows through it very rapidly. It is approximately 17 years old.
3. **The existing structure is approximately 10' high and 10' wide and is not large enough to drain 9 sq. miles. The scouring on the entrance side is very apparent and is approximately 1' below the streambed.**
4. **Is stream gradient liable to be lowered? No, it is 40' below the surrounding land already.**
5. **Navigation clearance required, if any: - No.**
6. **Railway clearance required, if any: - No.**
7. **Is a temporary detour required? - Yes. The structure is to be built one-half at a time. While half is being constructed, the other half will serve as a detour. Who will build it? - Contractor. Who will maintain it? - Contractor.**
8. **Information on H.W.L. is very limited as there are no dwellings in the immediate area and it is too far below the road to get an exact opinion. However, it would appear to be approximately at elevation 67.0'. L.W.L. is at elevation 62.0.**
9. **Road Design Information**

STRUCTURAL DATA

1. Net span, length and type of culvert - 25' rigid frame double box culvert (floor) with wing-walls 11' to  $\frac{1}{2}$  road.  
8' 6" long
2. Roadway width on culvert - 38' including shoulders.
3. Skew angle -  $6^{\circ}$ .
4. Total length and type of piling - Nil.
5. Approximate volume of concrete - 570 cu. yards.
6. Approximate weight of reinforcing steel - 39.1 tons
7. Drainage area - 5,300 acres.

Field Investigation made October 31st, 1960.  
By-Tom Collings,  
Survey Engineer.

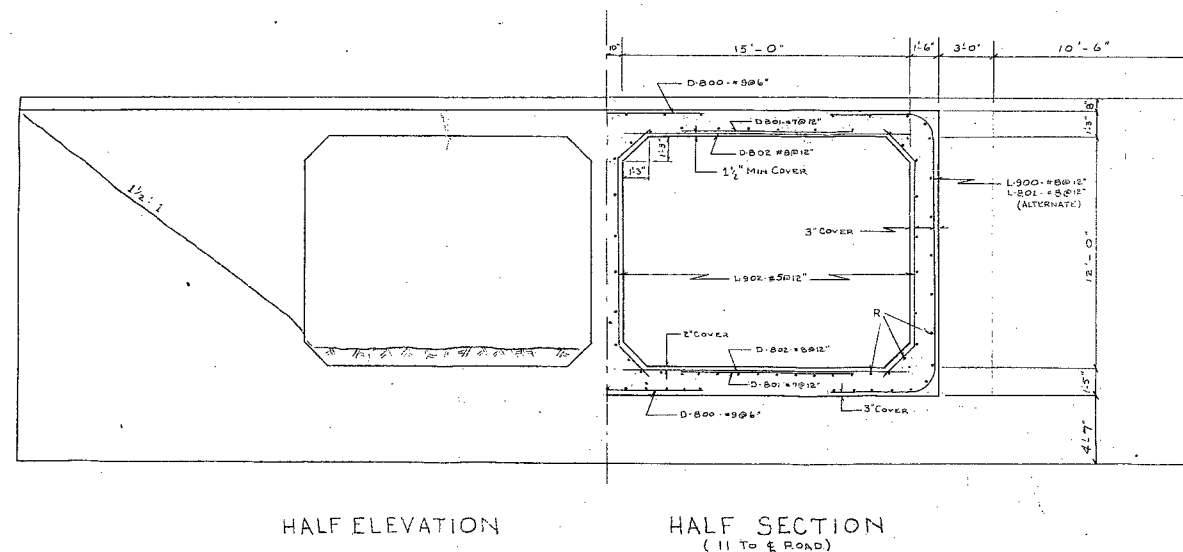
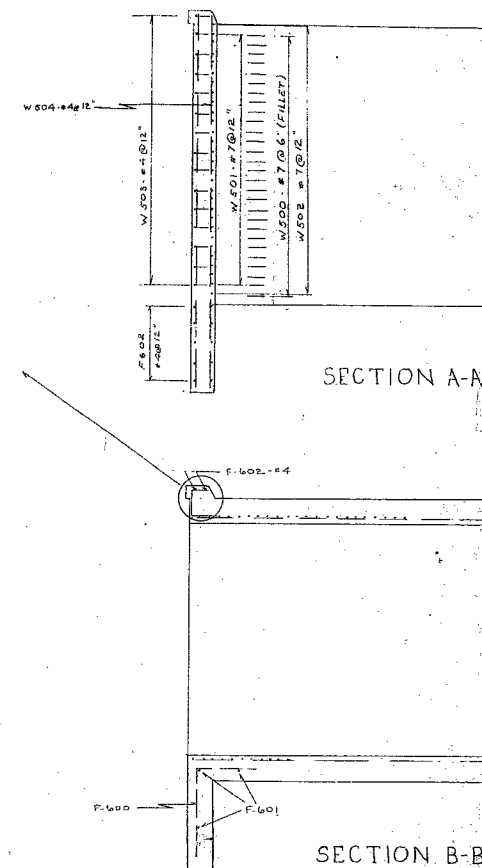
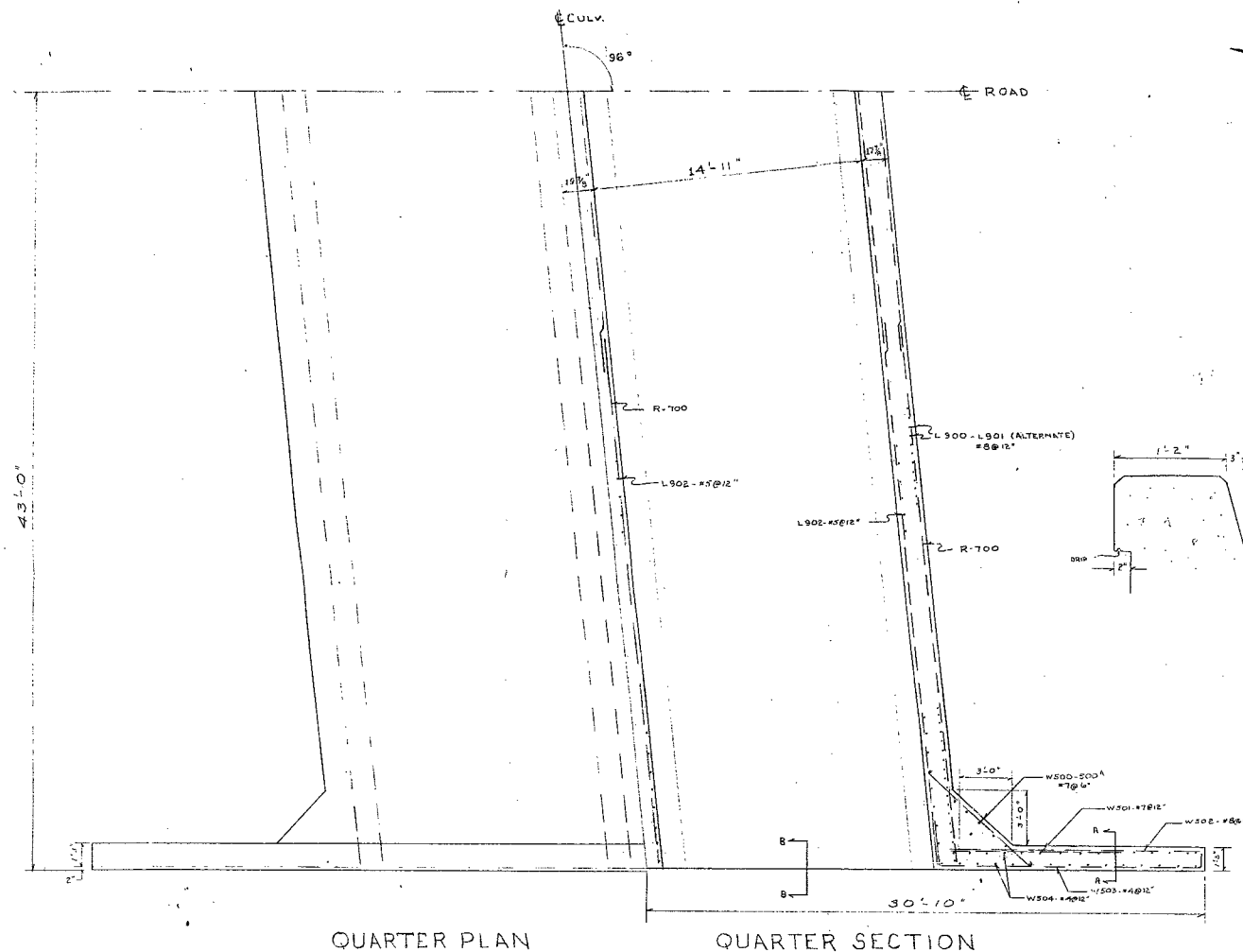
COUNTY OF MIDDLESEX

PROPOSED  
CULVERT

LOT #1 CONCESSION III  
CARADOC-EKFID TOWNLINE COR.09

SCALE: As shown  
DRAWN BY: T.B.C.  
DRWG NO: 679/01/0

*Frank Brown*  
ENGINEER  
DATE: OCT 16/01



BAR LIST				DETAILS	
BAR	SIZE	NO.	LENGTH		
L-900	#8	174	23'-9"		As shown @ 12"
L-901	#8	174	26'-1"		As shown @ 12"
L-902	#5	348	14'-4"		As shown @ 12"
D-800	#9	346	10'-0"	STR	STR @ 6"
D-801	#7	348	9'-0"	STR	STR @ 12"
D-802	#8	348	15'-0"	STR	STR @ 12"
R-700	#4	378	29'-8"	STR	124 LINES of 3 @ 12" CTES FLOOR @ 12" OVERLAP
F-600	#6	76	7'-6"		@ 12"
F-601	#4	6	38'-0"		
W-500	#7	62	8'-2"	(FILET)	7" WOODS @ 6"
W-501	#7	62	8'-8"	(FILET)	7" WOODS @ 6"
W-502	#7	56	9'-0"	STR	@ 12"
W-503	#8	60	13'-9"	STR	@ 12"
W-504	#4	60	17'-8"		@ 12"
W-505	#4	120	19'-2"	STR	@ 12"
W-506	#5	24	14'-0"	STR (FILET)	@ 12"
C-400	#3	126	3'-4"		@ 12"
F-602	#4	48	31'-4"		

#### GENERAL NOTES

- Structure to be built in accordance with D.H.O. Specs. Form 9 revised March 1957, October 1959 and September 1960 and County of Middlesex Supplemental Specifications.
- Excavation for footings and floor to be finished by hand to the neat dimensions and the concrete shall be placed on undisturbed material on front, back and bottom faces.
- Excavation for footing shall be made as neat as possible but in any case shall be filled completely with footing concrete.
- Footing depth subject to revision by the Engineer.
- Allowable soil pressure - 4000 lbs. per sq. ft.
- Reinforced Concrete shall have a minimum compressive strength of 3000 psi in 28 days and a maximum slump of 3". County to design a mix on receiving samples of sand and aggregate from the successful bidder.
- Note that added addendum in County Specifications regarding the addition of an admixture containing an air entraining agent. For estimating, assume that 1 lb. of Highway Pozzolith shall be added per bag of cement.
- Maximum Size Aggregate
  - 2" in deck slabs
  - 1 1/2" in footing
  - 1" elsewhere
- Concrete cover (main reinforcing)
  - 3" in contact with earth and water
  - 1 1/2" in bottom of deck
  - 2" elsewhere
- Deck falsework shall not be struck until all back-fill has been placed and compacted behind the abutments to the satisfaction of the Engineer.
- All exposed concrete edges to have 2" chamfer unless otherwise noted.
- Construction year to appear on E. and W. end at top of Curb.
- Design Loading H 20 - S 16.
- Estimated Concrete 570 cu. yds.
- Estimated Reinforcing Steel 39 tons.

COUNTY OF MIDDLESEX	
PROPOSED CULVERT	
LOT #1, CON R.M.S. CO. RD #9	
CARADOC-EXFRID TOWNLINE	
SCALE: 1/4" = 1'	F.B.D. ARNOLD
DRAWN BY: T.M.C.	CHECKED BY: SACRA
DRWS NO: 69/14/4	DAT: DEC 22/64