



**FEASIBILITY FOUNDATION INVESTIGATION AND DESIGN  
REPORT 1 – GEOGRAPHICAL TOWNSHIP OF TILBURY EAST/NORTH  
for  
HIGHWAY 401 – CHATHAM-KENT  
FROM 0.9 KM EAST OF ESSEX COUNTY ROAD 42  
EASTERLY 66.1 KM TO THE ELGIN COUNTY BOUNDARY  
AGREEMENT NUMBER 3004-E-0001  
GWP NO. 80-00-00  
for  
MCCORMICK RANKIN CORPORATION**

PETO MacCALLUM LTD.  
165 CARTWRIGHT AVENUE  
TORONTO, ONTARIO  
M6A 1V5  
Phone: (416) 785-5110  
Fax: (416) 785-5120  
Email: [Toronto@petomaccallum.com](mailto:Toronto@petomaccallum.com)

**Distribution:**

- 5 cc: McCormick Rankin Corporation for  
distribution to MTO Project Manager  
+ 1 digital copy (PDF format)
- 1 cc: McCormick Rankin Corporation for  
distribution to MTO Pavements and  
Foundations Section + 1 digital copy (PDF format)  
+ 1 digital copy of Drawing (AutoCAD)
- 2 cc: McCormick Rankin Corporation  
+ 1 digital copy (PDF format)
- 1 cc: PML Toronto

PML Ref.: 05TF060-1  
Index No.: 112FIDR  
GEOCRES No.: 40J8-46  
January 29, 2010



## TABLE OF CONTENTS

1. INTRODUCTION .....	1
2. SITE DESCRIPTION .....	2
3. INVESTIGATION PROCEDURES .....	3
4. LITERATURE REVIEW.....	4
4.1 Inferred Subsurface Conditions .....	4
4.2 Inferred Structure Foundations.....	7
5. SITE RECONNAISSANCE .....	8
6. DISCUSSION AND RECOMMENDATIONS .....	10
6.1 General .....	10
6.1.1 Structure Foundations .....	11
6.1.2 Embankment Stability .....	13
6.1.3 Embankment Settlement .....	14
6.1.4 Construction Considerations.....	15
6.1.5 Advantages and Disadvantages of Alternate Configurations .....	16
6.2 Preferred Alternative Considerations.....	18
6.3 Foundation Investigation Areas For Detail Design .....	19
7. CLOSURE.....	21

Table 1-1 – List of Reference Documents

Table 1-2 – Water Well Records Summary (Tilbury East and North Townships)

Figure 1-1 – Key Map

Drawings 1-1 to 1-4 – Site Plan

Drawings P1-1 to P1-4 – Preferred Option

Appendix A – Site Photographs 1-1 to 1-38

Photographs 1-1 to 1-4	– Tilbury Creek Bridge No. 2
Photographs 1-5 to 1-10	– Queen Street Overpass
Photographs 1-11, 1-12	– Malott Division Drain Culvert
Photographs 1-13 to 1-16	– Little Baptiste Creek Drain Bridges



- Photographs 1-17 to 1-20     – Baptiste Creek Bridges
- Photographs 1-21 to 1-28     – Queen's Line Interchange
- Photographs 1-29, 1-30        – Sinclair Drain Culvert
- Photographs 1-31 to 1-34     – McDougall Drain Bridges
- Photographs 1-35 to 1-38     – Government Drain No. 1 Bridges

#### Appendix B – Previous Soil Data and Record of Boreholes

- (1) Contract Drawings for WP 160-58 (Tilbury Creek Bridge No. 2 EBL and WBL)
- (2) Foundation Investigation Report for WP 160-58 (Tilbury Creek Bridge No. 2 EBL and WBL)
- (3) Contract Drawings for WP 161-58 (Queen Street Overpass)
- (4) Foundation Investigation Report for WP 161-58 (Queen Street Overpass)
- (5) Contract Drawings for WP 162-58 (Little Baptiste Creek Bridge)
- (6) Foundation Investigation Report for WP 162-58 (Little Baptiste Creek Crossing)
- (7) Contract Drawings for WP 164-58 (Baptiste Creek Bridges)
- (8) Foundation Investigation Report for WP 164-58 (Baptiste Creek Crossing)
- (9) Contract Drawings for WP 165-58 (Queen's Line Underpass)
- (10) Foundation Investigation Report for WP 165-58 (Queens Line Underpass)
- (11) Contract Drawings for WP 9-59 (McDougall Drain Bridges)
- (12) Foundation Investigation Report for WP 9-59 (McDougall Drain Bridges)
- (13) Contract Drawings for WP 10-59 (Government Drain No. 1 Bridges)
- (14) Foundation Investigation Report for WP 10-59 and 69-59 (Government Drain No. 1 Bridges and Merlin Road Underpass)
- (15) Foundation Investigation Report for WP 89-67-00 (Government Drain No. 1 Bridge at Highway 2, North of Highway 401)
- (16) Contract Drawings for Contract No. 78-55 (General data only - no additional soil data)
- (17) Contract Drawings for Contract No. 97-43 (General data only - no additional soil data)

**Feasibility Foundation Investigation and Design  
Report 1 – Geographical Township of Tilbury East/North**  
for  
Highway 401 – Chatham-Kent  
From 0.9 Km East of Essex County Road 42  
Easterly 66.1 Km to the Elgin County Boundary  
Agreement Number 3004-E-0001  
GWP No. 80-00-00

---

**1. INTRODUCTION**

This report presents the results of the foundation feasibility study carried out for the proposed widening of the Highway 401 section through the Geographical Township of Tilbury East/North, County of Kent. The study is being carried out for McCormick Rankin Corporation (MRC) on behalf of the Ministry of Transportation of Ontario (MTO).

MTO plans to widen the Highway 401 section extending from 0.9 km east of Essex County Road 42 easterly 66.1 km to the Elgin County Boundary from four to six lanes. Feasibility studies are required for the foundations of the existing bridge structures and structural culverts (span larger than 3.0 m) between the study limits. The freeway section traverses five geographical townships and the reporting was separated into five reports designated as follows:

- Report 1 – Geographical Township of Tilbury East/North
- Report 2 – Geographical Township of Raleigh
- Report 3 – Geographical Township of Harwich
- Report 4 – Geographical Township of Howard
- Report 5 – Geographical Township of Orford

This report concerns the Highway 401 section through the Geographical Township of Tilbury East/North which extends between the west limit of the project within the Township of Tilbury North and the boundary with the Township of Raleigh on the east for some 12.4 km. A key map for this section of the Highway 401 is highlighted in Figure 1-1.

Within the limits of Tilbury East/North Township, there is one underpass bridge structure for one interchange, two overpass structures, ten bridges and two structural culverts that are described in the following section.





All dimensions in this report are provided in metres except where indicated.

## 2. SITE DESCRIPTION

The Highway 401 through the Geographical Township of Tilbury East/North is currently a four-lane freeway.

The following table lists the MTO site numbers, locations and types of structures and structural culverts along this section of Highway 401.

### LIST OF STRUCTURES

Structure Name	Site No.	Station (*)	Type
Tilbury Creek Bridge No. 2 EBL	6-50/1	~16+244	Concrete Rigid Frame
Tilbury Creek Bridge No. 2 WBL	6-50/2	~16+244	Concrete Rigid Frame
Queen Street Overpass EBL	6-51/1	10+000.0	Concrete Rigid Frame
Queen Street Overpass WBL	6-51/2	10+000.0	Concrete Rigid Frame
Malott Div. Drain Culvert	13-398-C	10+436.3	Conc. Open Footing (4.80 by 2.30 by 20.7)
Little Baptiste Creek Bridge EBL	13-187/1	~11+766	Concrete Rigid Frame
Little Baptiste Creek Bridge WBL	13-187/2	~11+766	Concrete Rigid Frame
Baptiste Creek Bridge EBL	13-188/1	~14+237	Concrete Rigid Frame
Baptiste Creek Bridge WBL	13-188/2	~14+237	Concrete Rigid Frame
Queen's Line Underpass	13-189	14+802.2	4-span steel girder interchange structure
Sinclair Drain Culvert	13-399-C	17+262.5	Conc. Open Footing (3.65 by 1.83 by 60.1)
McDougall Drain Bridge EBL	13-190/2	~19+130	Concrete Rigid Frame
McDougall Drain Bridge WBL	13-190/1	~19+130	Concrete Rigid Frame
Government Drain No. 1 Bridge EBL	13-55/1	~20+965	Concrete Rigid Frame
Government Drain No. 1 Bridge WBL	13-55/2	~20+965	Concrete Rigid Frame

Notes: Culvert sizes taken from RFP documents as Span by Width by Length in metres.

(\*) – The chainage refers to Tilbury East Township except for Tilbury Creek Bridge No. 2 which refer to Tilbury North Township. All chainages should be considered approximate.



The typical topography abutting the highway corridor within the Geographical Township of Tilbury East/North is typically flat or shows a gentle undulation. In general, the highway grades are considered flat varying only about 1 m (inferred elevations 179 to 180) at the underpass and bridge locations. Within the highway section of the Queen Street Overpass in Tilbury the highway grade rise for the approach embankments and the grade at the crest of the overpass crossing is about 6 to 7 m higher than the grades at the nearest structure locations.

The main land use is agricultural and the typical vegetation beyond the highway corridor comprises mostly of farming crops. Isolated stands of trees are also present along the highway corridor and some of the drainage ditches. The roadside ditches are typically covered with grasses. Scattered farm residences and facilities are located near Highway 401. Within Tilbury, there are residential and industrial/commercial land uses on properties bordering the Highway 401 corridor to the north and south and off Queen Street and other local municipal roads.

Natural drainage of the lands located along the highway is generally poor in view of the flat terrain. The highway crosses several creeks, including the Tilbury Creek, Little Baptiste Creek and Baptiste Creek and man-made drains that were constructed to enhance the natural drainage of the farmland and lower the perched groundwater that is typically encountered at depths close the ground surface along this section of the highway corridor.

The MTO design frost depth for the Geographical Townships of Tilbury East and North is 1.2 m.

### **3. INVESTIGATION PROCEDURES**

The foundation feasibility analysis for this report was based primarily on a review of existing data and literature. The data comprised five geological maps and literature, three physiographic maps, seventeen previous MTO construction contract documents and foundation investigation reports and four groundwater data documents, including 25 water well records. Other sources of documents were also used such as mosaics of aerial photographs, base maps and topographic maps. Table 1-1 provides a list of the reference documents reviewed for this study.



A large number of the reference documents were in poor condition prior to scanning by MTO. The inferred data referred in this report was double-checked where possible. Chainages are approximate unless clearly provided on the reference documents. The majority of elevations and dimensions were converted to the metric system from imperial units. All dimensions and elevations provided in this report should be verified during detail design.

A summary of the stratigraphy encountered in the water wells is provided on the attached Table 1-1 and details of the measured groundwater levels and encountered bedrock levels in the wells were included on the attached Site Plans, Drawings 1-1 to 1-4. The water levels are in general conformance with the MOE water level maps for the Essex/Chatham/Kent areas.

A site reconnaissance visit was also carried out at each of the bridge structures and culverts. Representative photographs showing relevant natural features and geomorphology are included in Appendix A.

Subsurface field explorations were not carried out for this report. Copies of the previous records of boreholes and associated location plans relevant to the existing structures that were available at the time of the investigation were included in Appendix B.

#### **4. LITERATURE REVIEW**

##### **4.1 Inferred Subsurface Conditions**

The reviewed geological and physiographic maps and literature indicated that Highway 401 through the Geographical Township of Tilbury East/North was constructed over the St. Clair Clay Plain deposits which occur over the western area of Kent County and extend over the Essex and Lambton Counties to the west and north, respectively. The St. Clair Clay Plain consists of a flat and relatively deep deposit of typically very stiff clayey silt and silty clay till deposits.

The bedrock underlying the Highway 401 alignment through the Geographical Township of Tilbury East/North comprises mostly of the black bituminous shale of the Kettle Point Formation containing locally grey shale and shale with limestone bands of the Hamilton Formation.



The following tables provide a simplified summary of the site conditions that were previously encountered or inferred at the location of the underpasses, overpasses, bridge structures and structural culverts within the Geographical Township of Tilbury East/North.

For the structures where previous reports were not prepared or were not available, the subsurface conditions were assumed to be similar to those encountered or inferred for the adjacent structures.

#### SUMMARIZED INFERRED/ASSUMED SUBSURFACE CONDITIONS

Structure Name	Soil Cover Levels (*)		Bedrock (**)		Groundwater (***)	
	Clayey Silt, Silty Clay (Till)	Silt, Sand	Depth (m)	Elev.	Depth (m)	Elev.
Tilbury Creek Bridge No. 2 EBL	Hard to very stiff to 10 m depth; soft to stiff below. Termination depth: 10.7 to 36.3 m (elev. 139.5 to 165.8)	Interbedded compact layers within till Depths from 25.3 m (elev. 150.5) to termination	27.1 to 39.0	137.8 to 149.5	Perched: 1.8 to 2.4 Regional: 3.7 to 4.9	Perched: 174.1 to 175.0 Regional: 171.9 to 173.1
Tilbury Creek Bridge No. 2 WBL						
Queen Street Overpass EBL	Hard to very stiff to 4 m depth; firm to stiff below. Termination depth: 7.5 to 14.2 m (elev. 162.7 to 169.3)	—	27.1 to 39.0	137.9 to 149.5	Perched: 1.8 to 2.4 Regional: 3.7 to 4.9	Perched: 174.1 to 175.0 Regional: 171.9 to 173.1
Queen Street Overpass WBL						
Malott Div. Drain Culvert						
Little Baptiste Creek Bridge EBL	Hard to very stiff to 6 m depth; soft to stiff below. Termination depth: 8.1 to 36.9 m (elev. 140.7 to 170.0)	Dense (layer) Depth 37.2 m (elev. 140.3) (in one borehole)	35.7 to >37.2	<140.3 to 140.8	Perched: 3.4 to 3.8 Regional: 5.5 to 12.2	Perched: 174.4 to 174.7 Regional: 165.4 to 171.0
Little Baptiste Creek Bridge WBL						
Baptiste Creek Bridge EBL	Hard to very stiff to 12 m depth; firm to stiff below. Termination depth: 15.5 to 30.8 m (elev. 147.0 to 162.4)	—	34.9 to 39.0	141.0 to 143.2	Perched: 0.9 to 3.7 Regional: 9.1 to 13.1	Perched: 176.3 to 177.2 Regional: 164.9 to 168.9
Baptiste Creek Bridge WBL						
Queen's Line Underpass	Hard to very stiff to 9 m depth; firm to stiff below. Termination depth: 15.2 to 35.1 m (elev. 142.9 to 162.9)		34.9 to 39.0	141.0 to 143.2	Perched: 0.9 Regional: 9.1 to 13.1	Perched: 177.2 Regional: 164.9 to 168.9



### SUMMARIZED INFERRED/ASSUMED SUBSURFACE CONDITIONS

Structure Name	Soil Cover Levels (*)		Bedrock (**)		Groundwater (***)	
	Clayey Silt, Silty Clay (Till)	Silt, Sand	Depth (m)	Elev.	Depth (m)	Elev.
Sinclair Drain Culvert	Hard to very stiff to 7 m depth; firm to stiff below. Termination depth: 6.7 to 11.3 m (elev. 167.9 to 172.2)	–	>29.0 to 36.6	<141.5 to <147.8	Perched: 1.5 Regional: 11.0	Perched: 176.3 Regional: 165.8
McDougall Drain Bridge EBL						
McDougall Drain Bridge WBL						
Government Drain No. 1 Bridge EBL	Hard to very stiff to 8 m depth; firm to stiff below. Depth: 6.7 to 22.9 m (elev. 155.5 to 170.7)	Dense (layers) From 22.9 (elev. 155.5) to 28.1 to 28.2 m (elev. 150.3)	27.1 to 29.6	148.8 to 151.3	Perched: 0.3 to 1.2 Regional: 10.7	Perched: 177.2 to 177.7 Regional: 167.1
Government Drain No. 1 Bridge WBL						

Notes: (\*) From borehole data. Levels indicated are inferred depths and elevations of the bottom of the soil units. Topsoil and fill units were disregarded.  
(\*\*) From records of boreholes and water wells.  
(\*\*\*) Groundwater levels were based on records of boreholes and water wells (circa 1950 to 1970).

Depths of topsoil and fill encountered during previous subsurface investigations were disregarded because present conditions will likely differ from those recorded. The records of some of the boreholes indicated the emanation of natural gas during the drilling.

The typical soil stratigraphy encountered in the previous investigations at all of the structure sites comprises cohesive deposits of silty clay, clayey silt till/silty clay till. These cohesive soils are typically desiccated to depths varying from 4 to 12 m showing very stiff to hard consistencies, decreasing with depth. Below the desiccated zones, the native clayey soils exhibit firm to stiff or soft to stiff consistencies.

Discontinuous layers of compact silty sand are interbedded within the clayey soils from variable depths ranging from 22.9 m (elevation 155.5) at the Government Drain No. 1 site to 25.3 m (elevation 150.5) at the Tilbury Creek Bridge No. 2 site. A localized deposit of sand was also encountered at the Little Baptiste Creek bridges site from 36.9 to 37.2 m, where the borehole was terminated.



Based on borehole and well records, the bedrock underlying the Highway 401 sites was typically encountered or inferred at variable depths ranging between 27.1 and 39.0 m. The bedrock surface was found at a variable range of levels from elevations 137.8 to 151.3.

Perched groundwater was found or inferred at depths ranging from 0.3 to 3.8 m depths in the boreholes and well records. The regional groundwater was found or inferred between 3.7 and 13.1 m depths. The present groundwater conditions may vary from those recorded during the geotechnical investigations and well drilling in the 1950 to 1970s.

#### 4.2 Inferred Structure Foundations

Based on the construction drawings reviewed, the foundations of the abutments and piers of the underpass structures and drain bridges were founded on spread footings. The following table summarizes the foundation type and founding levels that were indicated for the spread footings on this report section.

**BRIDGE STRUCTURE - EXISTING FOUNDATIONS**

Structure	Abutments			Piers		
	Type	Elevation		Type	Elevation	
		Top Footing	Bottom Footing		Top Footing	Bottom Footing
Tilbury Creek Bridge No. 2 EBL and WBL	Spread Footings	172.2	171.3	N/A	N/A	N/A
Queen Street Overpass EBL and WBL	Spread Footings	175.9	175.0	Spread Footings	175.9	175.0
Little Baptiste Creek Bridge EBL and WBL	Spread Footings	173.9	173.0	N/A	N/A	N/A
Baptiste Creek Bridge EBL and WBL	Spread Footings	174.1	173.4	N/A	N/A	N/A
Queen's Line Underpass	Spread Footings	177.4	176.4	Spread Footings	177.4	176.4
McDougall Drain Bridge EBL and WBL	Spread Footings	176.2	175.1	N/A	N/A	N/A
Government Drain No. 1 Bridge EBL and WBL	Spread Footings	174.7	173.7	N/A	N/A	N/A

Note: Elevations were taken from reference contract drawings for top of spread footings. Base of footing levels were inferred from the thickness of the footings on the drawings.



The construction of the spread footing foundation for the Baptiste Creek, McDougall Drain and Government Drain No. 1 Bridges involved the installation of sheet pile walls, according to their respective contract drawings. The sheet piles were extended along the front (channel side) of the abutment footings at the three bridge sites and also along the front of the retaining wall between the abutments at the Baptiste Creek and Government Drain No. 1 sites.

The culverts over 3 m span being assessed are of the concrete frame open footing type. It is inferred that the culvert footings were founded on the native clayey deposits about 1.2 m below the grade of the channel for frost protection.

## **5. SITE RECONNAISSANCE**

The site reconnaissance of the structures within this geographical township was carried out on January 26 and 27 and on June 28, 2006. Thirty-eight relevant photographs of the structure and culvert sites are presented in Appendix A for reference. The following notes were compiled.

- In general, the site visits confirmed that the structures and culverts are located on generally flat to gently undulating terrain of the St. Clair Clay Plain (photographs 1-1, 1-2, 1-4, 1-6 to 1-8, 1-13, 1-16, 1-19, 1-21, 1-23 to 1-29, 1-33 to 1-35 and 1-38).
- The visual inspection of the overpass and underpass structure foundations did not reveal signs of distress such as settlements or other distortion (photographs 1-5, 1-9 and 1-21).
- The roadside ditches and median were typically covered with grass. Wet ground occurs locally at toe of embankment slopes and in the roadside ditches at the overpass and underpass locations (photographs 1-6, 1-10, 1-23, 1-24, 1-26 and 1-27).
- It was judged that the overpass, underpass and bridge approach embankments and interchange ramp embankments are currently stable and without visible settlements. No major signs of distress such as erosion or sliding of the approach embankments were noted (photographs 1-2, 1-6, 1-8, 1-10, 1-19 to 1-21, 1-23 to 1-28 and 1-38).
- Localized distress of the concrete revetment of the west foreslope at the Queen's Line underpass was noted (photograph 1-22) possibly due to repeated frost action.



- The channels of the creeks and drains at and under bridges were locally narrowed by soils eroding or sloughing off the earth banks (photographs 1-14, 1-15, 1-17, 1-18, 1-20, 1-31 to 1-33 and 1-37).
- Localized channel bank erosion was noted at the Little Baptiste Creek Bridges and Sinclair Drain culvert sites (photographs 1-14 and 1-30).
- Effective erosion control measures using concrete revetment were noted at Tilbury Creek Bridge No. 2 site (photographs 1-2 to 1-4).
- A system of water flow control is being used in the roadside ditches located at creek and drain bridges to contain run-off waters in the drain channels (photographs 1-13, 1-31, 1-35 and 1-38).
- Significant water flow was noted from the weep holes of the drain bridge abutments (photographs 1-9 and 1-36)
- Swampy ground was not noted within or near the structures or culverts within the alignment. However, some areas were wet possibly due to poor drainage on the relatively flat terrain (photograph 1-26).
- The exit and on-ramps of the Queen's Line interchange were constructed over terrain that is typically flat and free of swampy soils (photographs 1-24 to 1-28).
- Lines of hydro poles are located immediately south of the Queen's Line underpass (photograph 1-23).





## **6. DISCUSSION AND RECOMMENDATIONS**

### **6.1 General**

The MTO is currently planning to widen Highway 401 through the County of Kent from four to six lanes of traffic. This report pertains to the section through the Geographical Township of Tilbury East/North. It is understood that the two widening alternatives being currently considered essentially comprise the following:

1. Adding one lane to the inside of the westbound and eastbound lanes
2. Adding one lane to the outside of the westbound and eastbound lanes

It is envisaged that Alternative 1 will require filling of the median ditch and construction of a barrier along the centreline of the median. Existing culvert and underpass structures would not require foundation modifications. The Queen Street overpass structures, the Tilbury Creek bridges No. 2, Little Baptiste and Baptiste Creek bridges, McDougall Drain and Government Drain No. 1 bridges will require widening to the inside.

At the Queen's Line interchange, removal of the existing ramps and providing a Parclo A interchange configuration at the opposite quadrants of the existing ramps without altering the existing underpass is proposed.

In addition, closing of both Jeanette's Creek Road and McKinlay Road to the N/S-W entrance ramp / E-N/S ramp exit ramp and N/S-E entrance ramp / E-N/S exit ramp, respectively, to avoid traffic entering/existing midway within the interchange ramps is considered. Extension of the Baptiste Creek Bridges to accommodate future Highway 401 lanes, and W-N/S and N-W ramp lanes are considered.

Construction of Alternative 2 will likely require the modification of the existing underpass, overpasses and bridge structures or alternatively the construction of new structures. One option for modification of the existing underpass structures (Queen's Line Underpass) is to cut into the existing approach embankment foreslopes (in front of the abutments) and construct permanent



vertical retaining wall for abutment support. Widening to the outside will also require alterations to the Queen's Line interchange ramps and the extension of culverts. The alternatives for the construction of new underpass structure comprise constructing on the same alignment or on new alignment to the west or east of the existing structure.

The following sections of this report provide comments for planning purposes and an overview of the advantages and disadvantages, costs and risks/consequences of each alternate configuration from a foundation perspective.

#### 6.1.1 Structure Foundations

As indicated previously, it is envisaged that the widening alternative comprising the addition of traffic lanes to the inside will not require new foundations or modifications to existing culverts and underpass foundations, however will require modifications to the overpasses and bridges. The alternative of widening to the outside of the existing lanes will likely require new construction or alteration of the existing structures, including culvert extensions. It is noted that the underpass structure may also require replacement or widening due to a separate possible requirement to increase the current number of traffic lanes over Highway 401.

Based on the available data, the following foundation levels and geotechnical resistances for shallow and deep foundations are anticipated.

#### **PRELIMINARY REFERENCE FOUNDING LEVELS AND GEOTECHNICAL RESISTANCES <sup>(1)</sup>**

Structure site	Shallow Foundations <sup>(2)</sup>				Deep Foundations <sup>(3)</sup>			
	Founding Levels <sup>(4)</sup>		Geotechnical Resistance		Founding Levels		Geotechnical Resistance <sup>(5)</sup>	
	Depth (m)	Elev.	ULS (kPa)	SLS (kPa)	Depth (m)	Elev.	ULS (kN)	SLS (kN)
Tilbury Creek Bridge No. 2 EBL and WBL	2.4	171.3	350	200	27 to 39	138 to 149	2,000	N/A
Queen Street Overpass EBL and WBL	2.3	175.0	350	200	27 to 39	138 to 149	2,000	N/A
Little Baptiste Creek Bridge EBL and WBL	1.7	173.0	350	200	36 to >37	<140 to 141	2,000	N/A



**PRELIMINARY REFERENCE FOUNDING LEVELS AND GEOTECHNICAL RESISTANCES <sup>(1)</sup>**

Structure site	Shallow Foundations <sup>(2)</sup>				Deep Foundations <sup>(3)</sup>			
	Founding Levels <sup>(4)</sup>		Geotechnical Resistance		Founding Levels		Geotechnical Resistance <sup>(5)</sup>	
	Depth (m)	Elev.	ULS (kPa)	SLS (kPa)	Depth (m)	Elev.	ULS (kN)	SLS (kN)
Baptiste Creek Bridge EBL and WBL	1.3	173.4	350	200	35 to 39	141 to 143	2,000	N/A
Queen's Line Underpass	2.8	176.4	350	200	35 to 39	141 to 143	2,000	N/A
McDougall Drain Bridge EBL and WBL	0.8	175.1	350	200	>29 to 34	<144 to 148	2,000	N/A
Government Drain No. 1 Bridge EBL and WBL	1.0	173.7	350	200	27 to 30	149 to 151	2,000	N/A

Notes: <sup>(1)</sup> Geotechnical resistances are to be confirmed during detailed design. Factored resistance at ULS used in table.

<sup>(2)</sup> Abutments founded below the 1.2 m foundation frost depth on engineered fill may be designed for 900 kPa ULS and 350 kPa SLS for a granular pad thickness  $\geq 2.0$  m.

<sup>(3)</sup> Driven pile tips assumed to be established on the bedrock underlying the sites.

<sup>(4)</sup> Footing founding levels should match those of existing footings for widening alternatives and assumed to be minimum 1.5 m wide. Depths refer to inferred top of highway pavement levels at the underpasses or base of channel at drain bridges.

<sup>(5)</sup> Resistance for HP 310x110 piles. SLS resistance is not applicable to piles driven to refusal on unyielding bedrock.

Subject to structural analyses, the existing underpass structure foundations may be reused for new structures constructed on the same alignment (such as, the centre pier foundations). The installation of new steel H-piles will be required for construction of new integral or semi-integral bridge abutments in addition to the other design items specific to these abutment types.

Extensions of the bridge abutments at the Drain bridge locations will require excavations below the respective channel beds. These excavations will likely need to be stabilized with permanent sheet pile walls. Where the widening is to the inside at the Baptiste Creek and Government Drain No. 1 bridges, the existing sheet pile walls will likely provide adequate shoring protection.



Where culvert extensions are required, it is envisaged that the extensions may be founded on the native typically stiff to hard silty clay/clayey silt/silty clay till that are inferred to exist at the founding subgrade level of the existing culverts. The extensions may be founded on the native soils and designed for preliminary geotechnical resistances of 300 kPa at ULS (factored) and 150 kPa at SLS.

#### 6.1.2 Embankment Stability

For the widening alternative comprising the addition of traffic lanes on the inside of the highway, the placement of fill on the existing median is not envisaged to cause slope instability problems.

The alternative of widening the highway to the outside the existing underpass structure will likely require replacement of the existing structure. Any new underpass structure built to the west or east of the existing alignments will require the construction of new approach embankments comprising about 6 to 7 m high fills at the abutments or widening of the existing embankments. It is envisaged that these embankments, if required, would comprise of earth fill, because rock fill is not readily available in the area of the project. The embankment subgrade typically comprises very stiff clayey silt/silty clay till. The soils are typically wet containing a relatively high perched groundwater condition.

No signs of distress such as erosion, major sloughing or sliding were noted on the existing underpass structure approach embankments. Based on the condition of these existing earth embankments, it is considered that the earth slopes will be stable at the standard earth slope configurations of 2H:1V. If rockfill is used, the stable slope configuration would be 1.25H:1V.



In general, it is considered that the existing native soils are capable of withstanding the additional loading of the new earth embankments or embankment widening, if required. The short and long-term slope stability of approach embankments on each site should be investigated during detail design.

The widening of the embankments is not expected to cause stability problems at the location of the culvert and bridge extensions in view of the relatively low additional fills (estimated 2 to 3 m high) that would be required. The faces of the inlet and outlet channels of the culverts should be cut at 3H:1V slopes to minimize erosion or sloughing of the existing sandy subgrade at the ditch line.

#### 6.1.3 Embankment Settlement

It is estimated that the settlements of new embankments constructed separately from the existing fills are expected to be significant, and in the order of 50 to 70 mm at the location of the highest fills behind the abutments. Most of the settlements are expected to occur during construction because most of the native cohesive soils are heavily preconsolidated.

Where the embankments are widened the estimated magnitude of settlements is about half those indicated for separate embankments.

The requirement for management control of the settlements should be considered during detail design. Construction of new embankments in advance of installation of new piles would minimize post-construction effects such as potential drag down forces on piles for new or widened foundations.

Settlements of the stiff to hard clayey silt/silty clay till subgrade soils at the culvert or bridge extension sites under the anticipated 2 to 3 m high new embankment platform widenings are considered to be negligible and be completed during construction. Cambers are not considered a requirement to be incorporated during construction of extensions of these culverts.



#### 6.1.4 Construction Considerations

The construction of the alternative to widen to the inside is considered to be straightforward from a foundation point of view since a new underpass structure or widening of the embankment of the existing would not be required. Widening of the Queen Street overpasses and the bridges over the drains and creeks will be required for both alternatives. Widening to the outside option will be more complex, requiring the widening of the overpass structures and embankments, creek and drain bridges as well as new or a modified underpass structure.

It is envisaged that the new underpass structure for the alternative comprising of the widening to the outside would be two-span. Where the access to the existing underpass structure is temporarily closed during construction of a new structure, the installation of the new pier and abutment foundations is expected to be straightforward. The construction of a new structure on the same alignment while maintaining through traffic on the existing structures will require shoring of the approach embankment fills (on longitudinal directions).

Excavations for the installation of new pier foundations or footing foundations for abutments on native soils will require control of the perched groundwater in particular near the creek and drain crossings where the perched water is located near the ground surface. Road protection as outlined in the SP 105S19 dated March 2005 will likely be needed for the excavations required for new piers and abutment foundations. The performance level of the protection systems should be determined during detail design.

The existing foundations may be widened to accommodate new or wider structures (if structurally feasible). Where the widening of the foundations will bear on driven piles, the new piles should comprise low displacement piles, such as HP steel sections to minimize disturbance to the existing footing subgrade. For widening of the existing foundations with deep foundations, the existing structure should be monitored during pile driving.



#### 6.1.5 Advantages and Disadvantages of Alternate Configurations

In view of the foregoing considerations the following table summarizes the advantages and disadvantages and inferred risks/consequences of each of the alternate configurations from a foundation perspective. This preliminary analysis is based on the currently planned widening of Highway 401 from four to six lanes. Other facets of the project that may need to be considered, such as future widening to eight lanes and the condition of existing underpass structures are to be addressed by others.

#### **ADVANTAGES AND DISADVANTAGES – BRIDGE STRUCTURES**

Structure Name	Widening to Inside		Widening to Outside (*)			
	Advantages	Disadvantages	New Structure on Existing Alignment		New Structure on New Alignment	
			Advantages	Disadvantages	Advantages	Disadvantages
Queen's Line Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic.	None	Use of existing embankments. Possible reuse of existing foundations	New structure required. Shoring existing approach embankments or closing traffic on bridge needed.	None	New structure and approach embankments required. Most costly.

Notes: (\*) Assumes widening to the outside will require a new underpass structure or modifications to the existing underpass structure.



### ADVANTAGES AND DISADVANTAGES – OVERPASSES AND DRAIN BRIDGES

Structure Name	Widening to Inside		Widening to Outside (*)	
	Advantages	Disadvantages	Advantages	Disadvantages
Tilbury Creek Bridge No. 2 EBL and WBL	Widening uses existing median embankments. Least costly.	None	None	Needs widening of existing highway embankment.
Queen Street Overpass EBL and WBL	Widening uses existing median embankments. Least costly.	None	None	Widening of existing embankments required.
Little Baptiste Creek Bridge EBL and WBL	Widening uses existing median embankments. Least costly.	None	None	Needs widening of existing highway embankment. .
Baptiste Creek Bridge EBL and WBL	Widening uses existing median embankments. Additional sheet piles not required. Least costly.	None	None	Needs widening of existing highway embankment. Additional sheet piles required
McDougall Drain Bridge EBL and WBL	Widening uses existing median embankments. Least costly.			Needs widening of existing highway embankment.
Government Drain No. 1 Bridge EBL and WBL	Widening uses existing median embankments. Additional sheet piles not required. Least costly.	None	None	Needs widening of existing highway embankment. Additional sheet piles required.

Notes: (\*) Assumes widening to the outside will require a new underpass structure or modifications to the existing underpass structure.

Sheet piling was not used at the Tilbury Creek Bridges No. 2, Little Baptiste Creek Bridges and in front of the median retaining walls of the McDougall Drain Bridges.

### ADVANTAGES AND DISADVANTAGES – CULVERTS

Structure Name	Widening to Inside		Widening to Outside	
	Advantages	Disadvantages	Advantages	Disadvantages
Malott Div. Drain Culvert	Culvert extensions not required.	None	None	Culvert extensions required
Sinclair Drain Culvert	Culvert extensions not required	None	None	Culvert extensions required

Note: Use of centre section of culvert is subject to structural verification.





Since widening to the inside will not require extensions of the culverts this option will be considered less costly than the widening to outside alternative.

In general, widening to the inside will involve the least risk since shoring of the approach embankments, construction of new embankments and structures/bridges or widening of the existing embankment will not be required or will be minimized. It is noted that the structures within the Township of Tilbury East/North are EBL/WBL bridges or overpasses except the Queen's Line Underpass. Widening to the inside for the EBL/WBL structures may require excavation within the existing approach embankments between the structures at each abutment in order to drive piles and construct the pile cap or to construct shallow foundations (spread footing). Temporary shoring may be required.

## **6.2 Preferred Alternative Considerations**

From the foundation point of view the Preferred Alternative to widen Highway 401 from four to six lanes of traffic is to widen to the inside (adding traffic lanes on the median of the existing lanes). The selected alternative depended on additional considerations such as the potential future widening to eight traffic lanes that were addressed by others.

The preferred option to widen the highway to the inside would not require changes to the existing underpass. Widening the overpasses and drain bridges is feasible from the foundation point of view, given that the widening to the inside uses the existing median embankments and add limited loading to the existing subgrade soils.

At the Queen's Line interchange, it is planned to close the connections to both Jeanette's Creek Road and McKinlay Road including removal of the existing ramps. Six new ramps are considered in a Parclo A interchange configuration and the existing structure will remain intact during construction. In addition, the Baptiste Creek EBL and WBL bridges are proposed for extension to the median and outside to accommodate future Highway 401, and N-W and W-N/S ramp lanes. This widening scheme will require the installation of additional sheet piles at the toe of embankment and widening of the existing embankments at the bridge locations.



No new culverts/structures are considered around the vicinity of the Queen's Line interchange.

### **6.3 Foundation Investigation Areas For Detail Design**

The Preferred Alternative of widening Highway 401 from four to six lanes by adding traffic lanes to the inside would not require foundation investigations at the underpass and culvert structures through the Geographical Township of Tilbury East/North, unless these structures require widening or replacement due to other considerations.

Foundation investigation will be required at the locations of the outside extensions of the existing Baptiste Creek EBL and WBL bridges, located west of the existing Queen's Line underpass at approximate Sta. 14+237, which will be required to accommodate the future W-N/S and N-W ramps, respectively. Widening the bridges to the inside to provide future Highway 401 lanes will also require foundation investigations because widening of the existing decks and approach embankments are planned.

Widening of the other existing overpasses and drain bridges to the inside will also require foundation investigations.

For the Preferred Alternative, the foundation investigations for new structures that would be required for detailed design of the Highway 401 widening are listed on the following tables.



### FOUNDATION INVESTIGATION AREAS – STRUCTURES

Stations (*)	Proposed Works	Existing Data (**)
~16+244	Tilbury Creek Bridge No. 2 EBL	6 boreholes to depths from 10.7 to 36.3 m
~16+244	Tilbury Creek Bridge No. 2 WBL	
10+000.0	Queen Street Overpass EBL	4 boreholes to depths from 7.5 to 14.2 m
10+000.0	Queen Street Overpass WBL	
~11+766	Little Baptiste Creek Bridge EBL	5 boreholes to depths from 8.1 to 37.2 m
~11+766	Little Baptiste Creek Bridge WBL	
~14+237	Baptiste Creek Bridge EBL	4 boreholes to depths from 15.5 to 30.8 m
~14+237	Baptiste Creek Bridge WBL	
~19+130	McDougall Drain Bridge EBL	6 boreholes to depths from 6.7 to 12.8 m
~19+130	McDougall Drain Bridge WBL	
~20+965	Government Drain No. 1 Bridge EBL	9 boreholes to depths from 6.7 to 28.2 m
~20+965	Government Drain No. 1 Bridge WBL	

Notes: (\*) Stations are approximate.  
(\*\*) Relevant data from previous foundation investigation reports.  
Refer to Table 1-1 for list of reference documents.

### FOUNDATION INVESTIGATION AREAS –CULVERTS

Stations (*)	Proposed Works	Existing Data
10+436.3	Malott Div. Drain Culvert	Data not available
17+262.5	Sinclair Drain Culvert	Data not available

Notes: (\*) Stations provided in the RFP documents.



## 7. CLOSURE

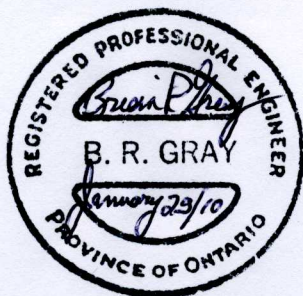
This report was prepared by Mr. C. M. P. Nascimento, P. Eng. Senior Project Engineer and reviewed by Mr. B. R. Gray, M. Eng., P. Eng, MTO Designated Contact.

Yours very truly

Peto MacCallum Ltd.



Carlos M.P. Nascimento, P.Eng.  
Senior Project Engineer



Brian R. Gray, MEng, P.Eng.  
MTO Designated Contact

CN-cn:mi



**TABLE 1-1**  
**LIST OF REFERENCE DOCUMENTS**  
**(GEOGRAPHICAL TOWNSHIP OF TILBURY EAST/NORTH)**

**A. Geological Maps**

- Geological Map of the Province of Ontario, Map No. 1958B Ontario, Department of Mines, Compiled 1958. Scale 1:1,267,200.
- Quaternary Geology of Ontario, Southern Sheet, Map 2556 from Ontario Ministry of Northern Development and Mines, Compiled 1991. Scale 1:1,000,000.
- Drift - Thickness Contours, Kent County, Preliminary Map 52-4A, Prepared by J.F. Caley and B.V. Sanford, 1951, Published 1952 by Department of Mines and Technical Surveys of the Geological Survey of Canada.
- Bedrock Contours, Kent County, Preliminary Map 52-4B, Prepared by J.F. Caley and B.V. Sanford, 1951, Published 1952 by Department of Mines and Technical Surveys of the Geological Survey of Canada.
- Ontario Geological Map, Map No. 2196 from Ontario Department of Mines and Northern Affairs, Compiled 1970. Scale 1:1,013,760 (1 inch = 16 miles).

**B. Physiographic Maps**

- Soil Map of the County of Kent, Soil Survey Report No. 3, Published by the Experimental Farms Branch, Ottawa, 1936, Scale 1/2 inch = 1 mile.
- Physiography of Southern Ontario Map P.2715 Ontario Geological Survey, 1984. Scale 1:600,000.
- Physiography of the Southwestern Portion of Southern Ontario, Map 2225 Ontario Department of Mines and Northern Affairs, Ontario Research Foundation, Published 1972, Scale 1:253,440 (1 inch = 4 miles).

**C. MTO Reports and Drawings**

- (1) Contract Drawings for Tilbury North Township Bridge No. 2 (Tilbury Creek Bridge No. 2 EBL and WBL), WP 160-58, TWP 105-50-1-A and 2-A by De Leuw Cather & Company of Canada Limited, dated June 1960.
- (2) Foundation Investigation Report for Foundation Conditions at the Tilbury Creek Crossing Highway 401 (Tilbury Creek Bridge No. 2 EBL and WBL), WP 160-58 prepared by H.G. Acres & Company Limited, dated December 15, 1959, Geocres No. 40J8-21.



- (3) Contract Drawings for Tilbury North Township Bridge No. 1 (Queen Street Overpass), WP 161-58, TWP 105-51-1A, dated January 1960.
- (4) Foundation Investigation Report for Highway 401 'Line B' & Queen Street Crossing at Tilbury (Queen Street Overpass), WP 161-58, W.J.K-52-2, dated March 1959, Geocres No. 40J8-2.
- (5) Contract Drawings for Little Baptiste Creek Bridge, WP 162-58, TWP 104-187-1-B, dated July 1959.
- (6) Foundation Investigation Report for Highway 401 and Little Baptiste Creek Crossing, WP 162-58, Ref.: 59-F-205C, prepared by E.M. Peto Associates Ltd., dated January 1959, Geocres No. 40J8-17.
- (7) Contract Drawings for Tilbury East Township Bridge No. 8 over the Baptiste Creek (Baptiste Creek Bridges), WP 164-58, TWP 104-188-1A, prepared by A.D. Margison and Associates Limited, dated May 1959.
- (8) Foundation Investigation Report for Highway 401 and Baptiste Creek Crossing, WP 164-58, Ref. 59-F-206C, prepared by E.M. Peto Associates Ltd., dated February 20, 1959, Geocres No. 40J8-18.
- (9) Contract Drawings for Tilbury E. TWP Bridge No. 6 (Queen's Line Underpass), WP 165-58, TWP 104-189-?-(unreadable), prepared by A.M. Lount and Associates, dated July 27, 1960.
- (10) Foundation Investigation Report at Highway 2 Crossing of Highway 401 at Tilbury East (Queens Line Underpass), WP 165-58, prepared by H.G. Acres & Company Limited, dated January 1960, Geocres No. 40J8-22.
- (11) Contract Drawings for Tilbury East Township Bridge No. 4 (McDougall Drain Bridges), WP 9-59, TWP 104-190-1-A, dated October 1959.
- (12) Foundation Investigation Report for Highway 401 and Drain (McDougall Drain Bridges) and Relocated Gravel Road Crossing, WP 9-59, W.J.F-59-12, dated March 16, 1959, Geocres No. 40J8-6 and 40J8-27.
- (13) Contract Drawings for Tilbury East Township Bridge No. 2 (Government Drain No. 1 Bridges), WP 10-59, TWP 104-55-1-A, dated August 1959.
- (14) Foundation Investigation Report for Highway 401, Line 'C' and Drainage Canal (Government Drain No. 1 Bridges) and Realigned County Road Crossing (Merlin Road Underpass), WP 10-59 and 69-59, W.J.F-59-13, dated May 1959, Geocres No. 40J8-7.
- (15) Foundation Investigation Report for Government Drain No. 1 Bridge at Highway 2, North of Highway 401, WP 89-67-00, dated December 1974, Geocres No. 40J8-36.





- (16) Contract Drawings for Contract No. 78-55 for Hot Mix Paving from the east limits of Interchange No. 8 Tilbury easterly to the west limits of Interchange No. 10 Bloomfield Road (General data only - no additional soil data).
- (17) Contract Drawings for Contract No. 97-43 Hot Mix Paving from 0.7 km east of Highway 2 Easterly to 0.8 km West of County Road 27 (Bloomfield Road) (General data only - no additional soil data).

#### **D. Ground Water Data**

- Water Well Records for Ontario (Kent-Lambton) 1946-1974, Ministry of the Environment, Water Resources Bulletin 2-20 Ground Water Series Published 1977.
- Water Well Records for Ontario, Essex 1946 - 1974, Ministry of Environment Water Resources Bulletin 2-19 Ground Water Series Published 1977.
- Ground Water Probability, County of Kent, Water Resources Map 3117-1, Ontario Resources Commission 1970. Scale 1:100,000.
- Southern Ontario Drainage Basins, Map 3002-2, Ministry of the Environment, Water Quantity Management Branch, 1973, Scale 1:500,000.
- Essex-Chatham-Kent Groundwater Management Study, Ministry of Environment, [http://www.ene.gov.on.ca/envision/water/groundwater/essex\\_chatham\\_kent/index.htm](http://www.ene.gov.on.ca/envision/water/groundwater/essex_chatham_kent/index.htm). Last modified on October 21, 2008.

#### **E. Other Sources**

- Air Photo Mapping of existing conditions provided by MTO – digital files.
- Chatham – Kent Base Mapping and Mosaic provided by MTO and MRC – digital files.
- Topographic Map of Ontario, Chatham Sheet, Geographic Section of Department of National Defence 1913, Reprinted 1940. Scale: 1 inch = 1 mile.



**TABLE 1-2**  
**WATER WELL RECORDS SUMMARY**  
**GEOGRAPHICAL TOWNSHIP OF TILBURY EAST/NORTH**

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (SOIL AND DEPTH TO BOTTOM OF UNIT)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
Tilbury North Township								
2	20	176.8	01/54	3.7	173.1	Hardpan 4.3; clay 34.2; sand 34.8	>34.8	<142.0
2	20	176.8	01/53	4.9	171.9	Clay 4.9; blue clay 33.2; hardpan 34.5	>34.5	<142.3
3	20	176.8	10/61	1.8	175.0	Gravel 36.0; sand 39.0; shale 39.7	39.0	137.8
Tilbury East Township								
3	14	176.5	07/54	5.5	171.0	Blue clay 35.4; sand 35.7; shale 36.0	35.7	140.8
3	14	176.5	07/54	Dry	-	Blue clay 35.4; sand 35.7; shale 36.0	35.7	140.8
5	3	176.8	08/62	11.0	165.8	Clay 9.1; sand, clay 10.7; gravel stones sand clay 28.0; sand 28.3; shale sand 29.0	>29.0	<147.8
5	6	176.5	08/73	Dry	-	Clay 27.4; hardpan 30.5; sand muck 35.0	>35.0	<141.5
6	1	177.8	07/71	10.7	167.1	Grey clay 7.6; blue clay 19.8; hardpan 21.4; blue clay 28.4; gravel 28.9	>28.9	<148.9
6	1	178.4	03/67	9.5	168.9	Brown clay 4.3; blue clay 9.5; gravel 11.0; blue clay 13.7	>13.7	<164.7
6	1	178.4	05/66	8.5	169.9	Brown clay 2.7; blue clay 10.7; gravel 11.6; blue clay 12.2	>12.2	<166.2
6	1	178.4	09/63	1.2	177.2	Yellow clay 3.7; brown clay 10.7; clay shale 11.6; clay stones 27.5; hardpan sand 28.1	>28.1	<150.3
6	1	177.8	08/72	1.8	176.0	Clay 12.2; hardpan 15.3; clay 26.8; hardpan 27.5; black shale 28.1	27.5	150.3
6	1	178.4	10/61	1.8	176.6	Blue clay 11.6; gravel 12.5; blue clay stones 26.8; sandy clay 27.1; grey shale 28.9	27.1	151.3



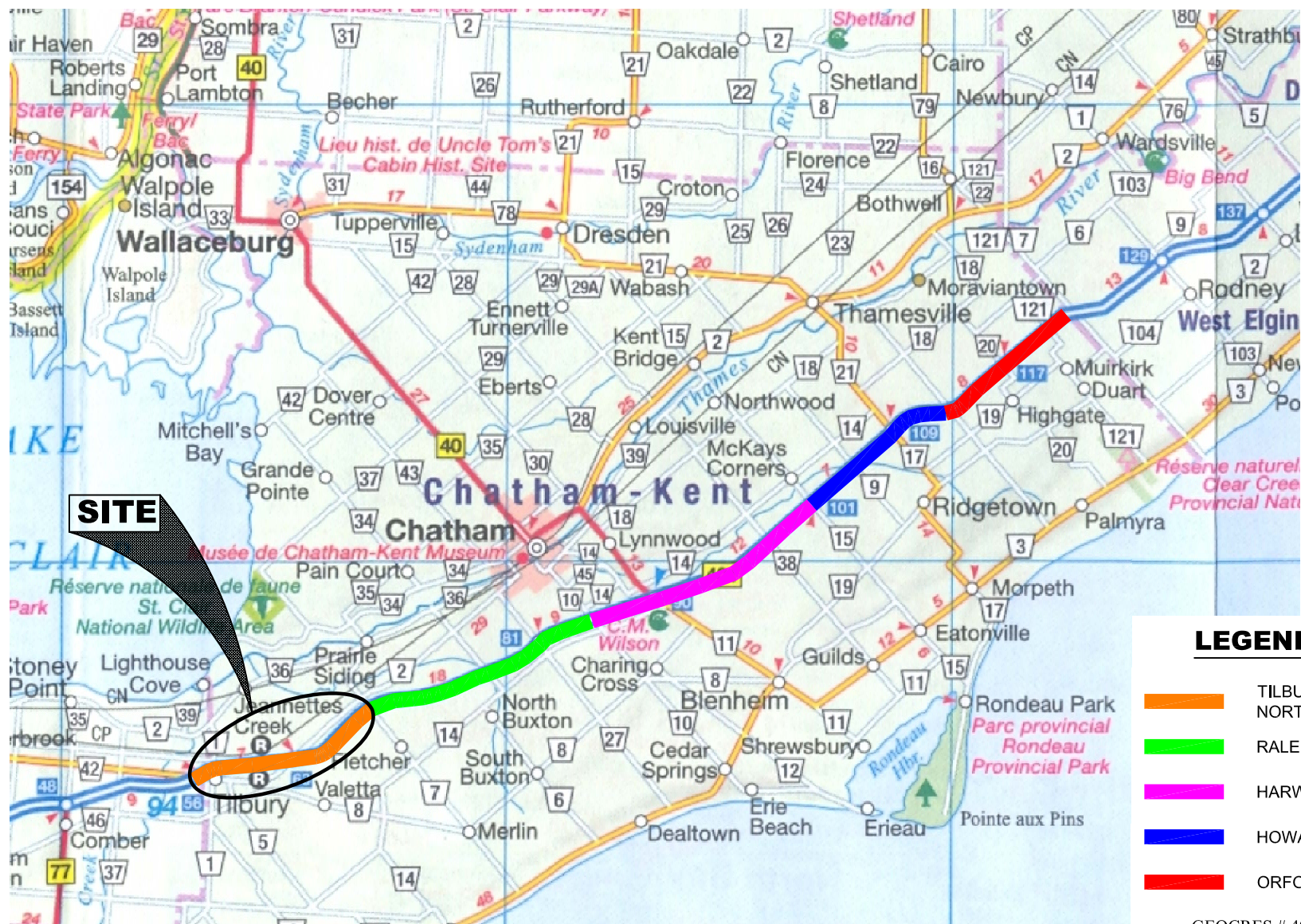


**TABLE 1-2**  
**WATER WELL RECORDS SUMMARY**  
**GEOGRAPHICAL TOWNSHIP OF TILBURY EAST/NORTH**

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (SOIL AND DEPTH TO BOTTOM OF UNIT)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
6	1	178.4	10/61	Dry	-	Clay stones 26.5; clay gravel sand 27.1; black shale 32.0	27.1	151.3
6	1	178.4	07/64	1.2	177.2	Yellow clay 3.7; brown clay 25.9; black clay 27.5; grey shale 27.8	27.5	150.9
6	1	178.4	07/64	Dry	-	Yellow clay 3.7; brown clay 25.9; black clay 27.5; grey shale 27.8	27.5	150.9
6	1	178.4	04/65	Dry	-	Clay 3.7; sand 4.3; clay stones 27.5; sand clay 28.7; shale 29.0	28.7	149.7
6	1	178.4	03/65	Dry	-	Clay stones 4.6; sand 5.5; clay stones 11.6; gravel clay 28.7; shale 29.6	28.7	149.7
6	1	178.4	08/62	2.2	176.2	Clay 9.2; clay stones 27.5; sand gravel 29.6; grey shale 31.4	29.6	148.8
6	4	177.5	07/73	Dry	-	Clay 24.4; hardpan 33.6; shale 35.1	33.6	143.9
6	5	177.8	07/73	1.5	176.3	Clay stones 33.6; sand gravel 33.8; grey limestone 35.1	33.8	144.0
6	6	180.0	03/63	Dry	-	Clay 36.0; sand clay 36.6; shale 42.7	36.6	143.4
6	9	180.0	02/63	3.7	176.3	Clay 39.0; limestone 41.2; shale 58.0	39.0	141.0
6	10	179.6	04/69	Dry	-	Yellow clay 5.2; blue clay 33.6	>33.6	<146.0
6	10	179.6	08/68	Dry	-	Blue clay stones 37.5; shale 39.7	37.5	142.1

**NOTE:**

1. Data taken from MOE Water Well Records for Ontario (Essex) 1946-1974, Water Resources Bulletin 2-19 Groundwater Series for Tilbury North Township and (Kent-Lambton) 1946-1974, Water Resources Bulletin 2-20 for Tilbury East Township.



# LEGEND:

- TILBURY EAST / NORTH TWP
- RALEIGH TWP
- HARWICH TWP
- HOWARD TWP
- ORFORD TWP

GEOCRES # 40J8-46

## REPORT # 1 - TILBURY EAST / NORTH

**FEASIBILITY FOUNDATION INVESTIGATION DESIGN REPORTS  
HIGHWAY 401 WIDENING - CHATHAM - KENT  
GWP 80-00-00**

## KEY MAP



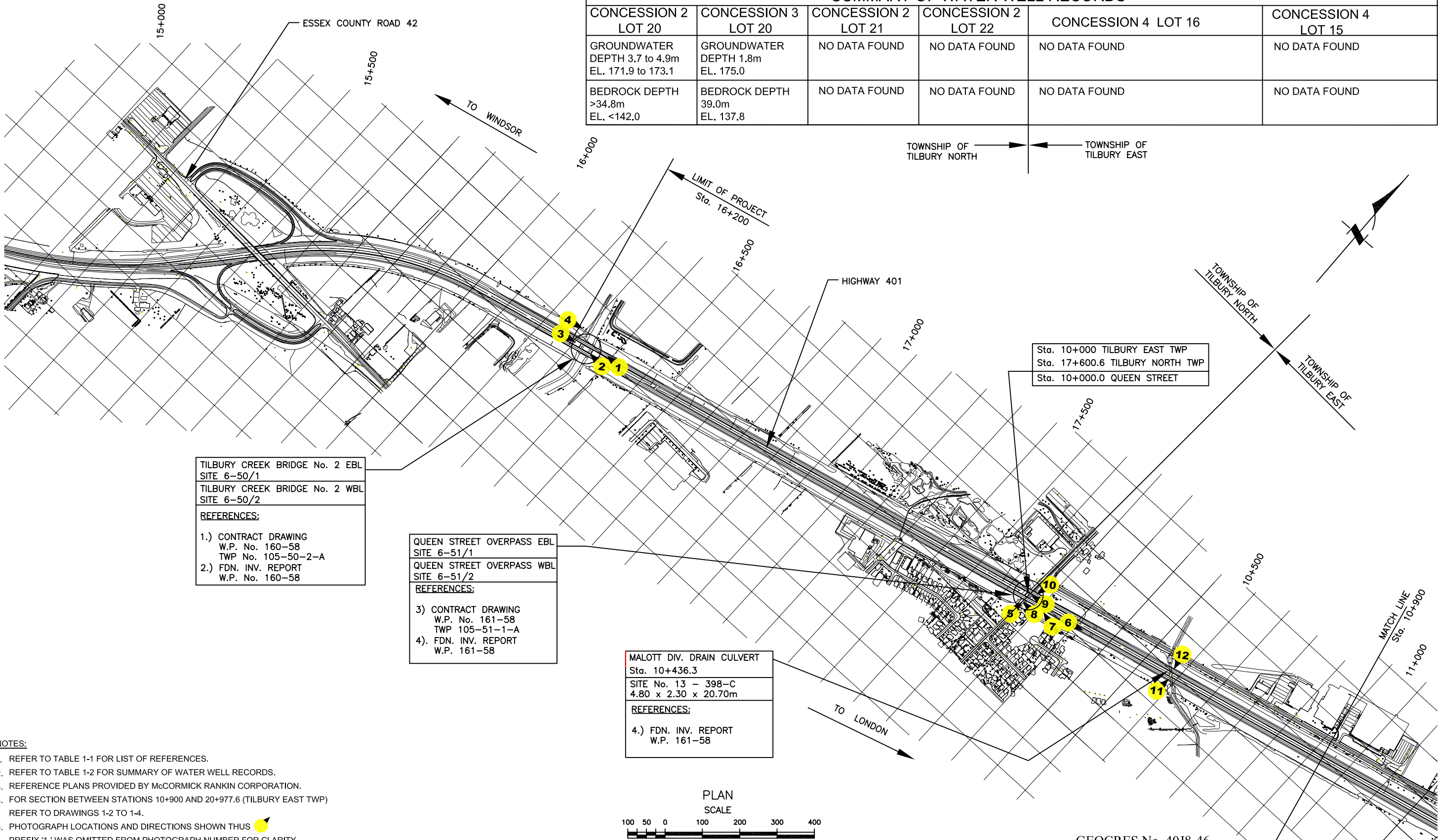
**MCCORMICK RANKIN  
CORPORATION**



**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DRAWN: <b>N.A.</b>	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED: <b>C.N.</b>	<b>JAN. 2010</b>	<b>1 : 400,000</b>	<b>05TF060</b>	<b>1-1</b>
APPROVED: <b>B.R.G.</b>				





GEOCRES No. 40J8-46

METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES



DATE **JANUARY 2010**  
CHECKED BY: **C.N.**

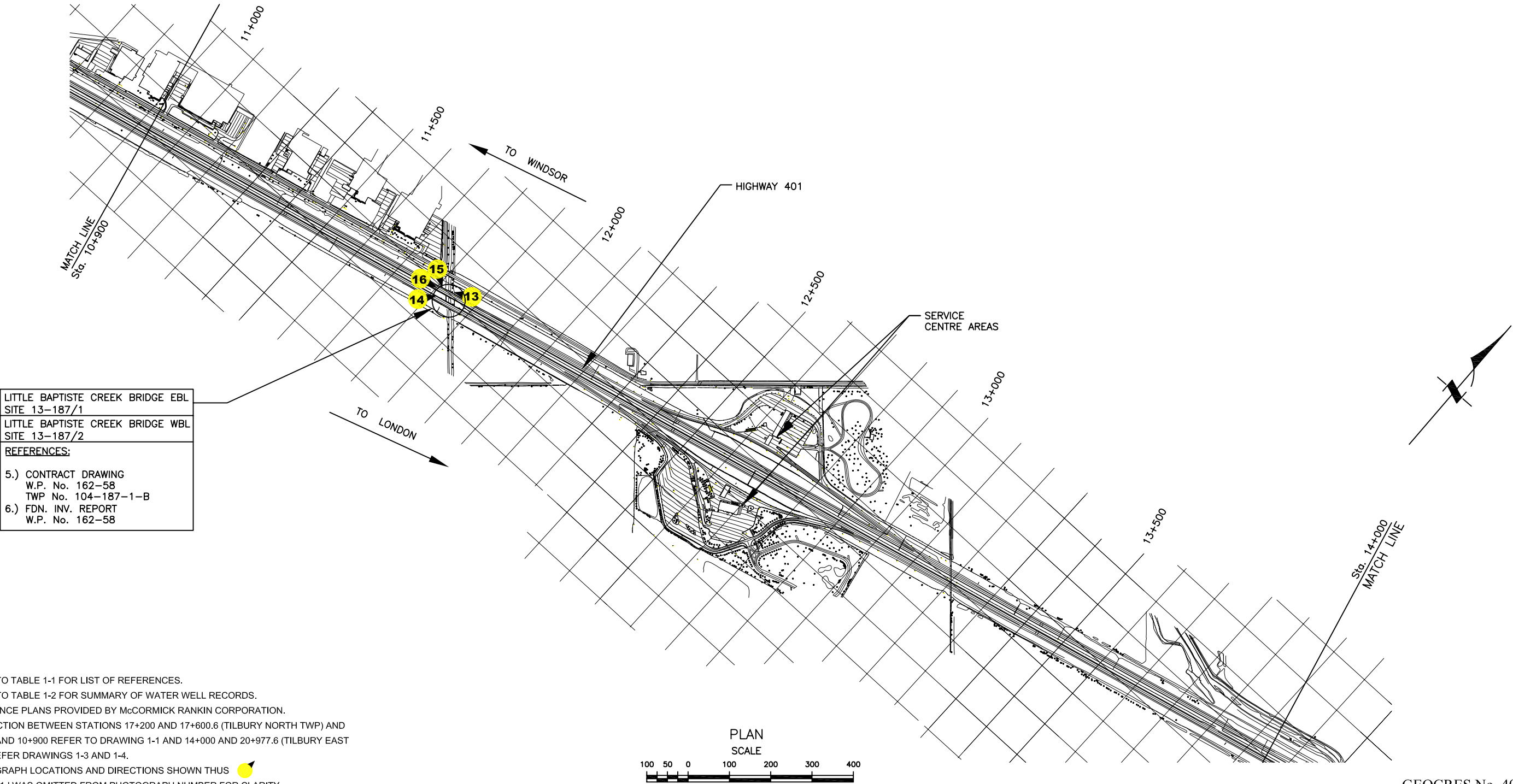
DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**

CONT No  
GWP No **80-00-00**

**HIGHWAY 401**  
WIDENING THROUGH KENT COUNTY  
TILBURY EAST/NORTH TOWNSHIP SECTION  
SITE PLAN

**DRAWING**  
**1-1**

SUMMARY OF WATER WELL RECORDS					
CONCESSION 5 LOT 15	CONCESSION 5 LOT 14	CONCESSION 3 LOT 14	CONCESSION 5 LOT 13	CONCESSION 5 LOT 12	CONCESSION 5 LOT 11
NO DATA FOUND	NO DATA FOUND	GROUNDWATER DEPTH 5.5m EL. 171.0 ONE WELL DRY	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND
NO DATA FOUND	NO DATA FOUND	BEDROCK DEPTH 35.7m EL. 140.8	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND



GEOCRES No. 40J8-46

**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES

 **Ontario**  
 **MCCORMICK RANKIN CORPORATION**  
A member of  **MMM GROUP**

 **Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DATE	<b>JANUARY 2010</b>	DRAWN BY:	<b>N.A.</b>
CHECKED BY:	<b>C.N.</b>	APPROVED BY:	<b>B.R.G.</b>

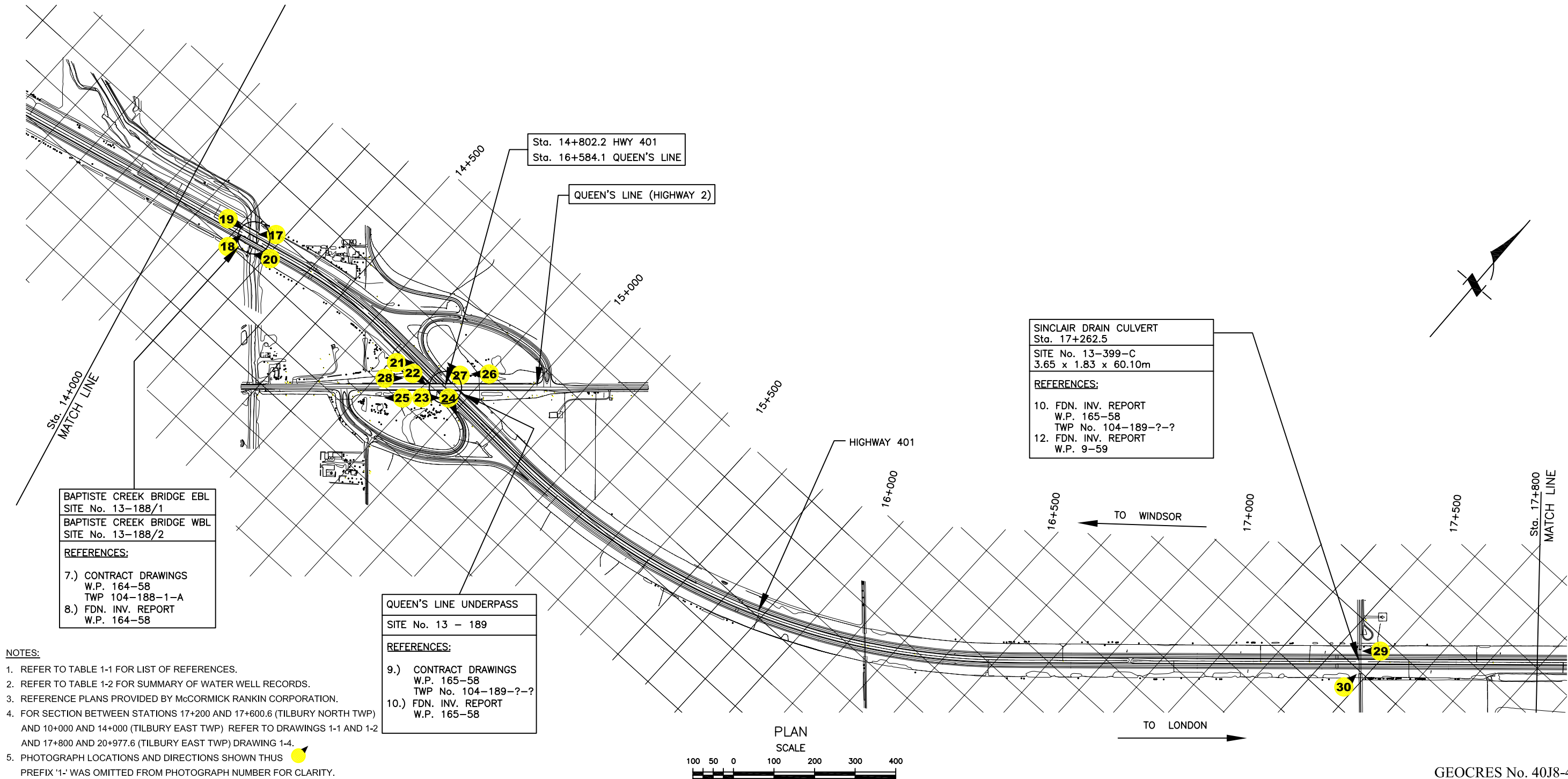
CONT No  
GWP No **80-00-00**

**HIGHWAY 401**  
WIDENING THROUGH KENT COUNTY  
TILBURY EAST/NORTH TOWNSHIP SECTION  
SITE PLAN

 **DRAWING**  
**1-2**

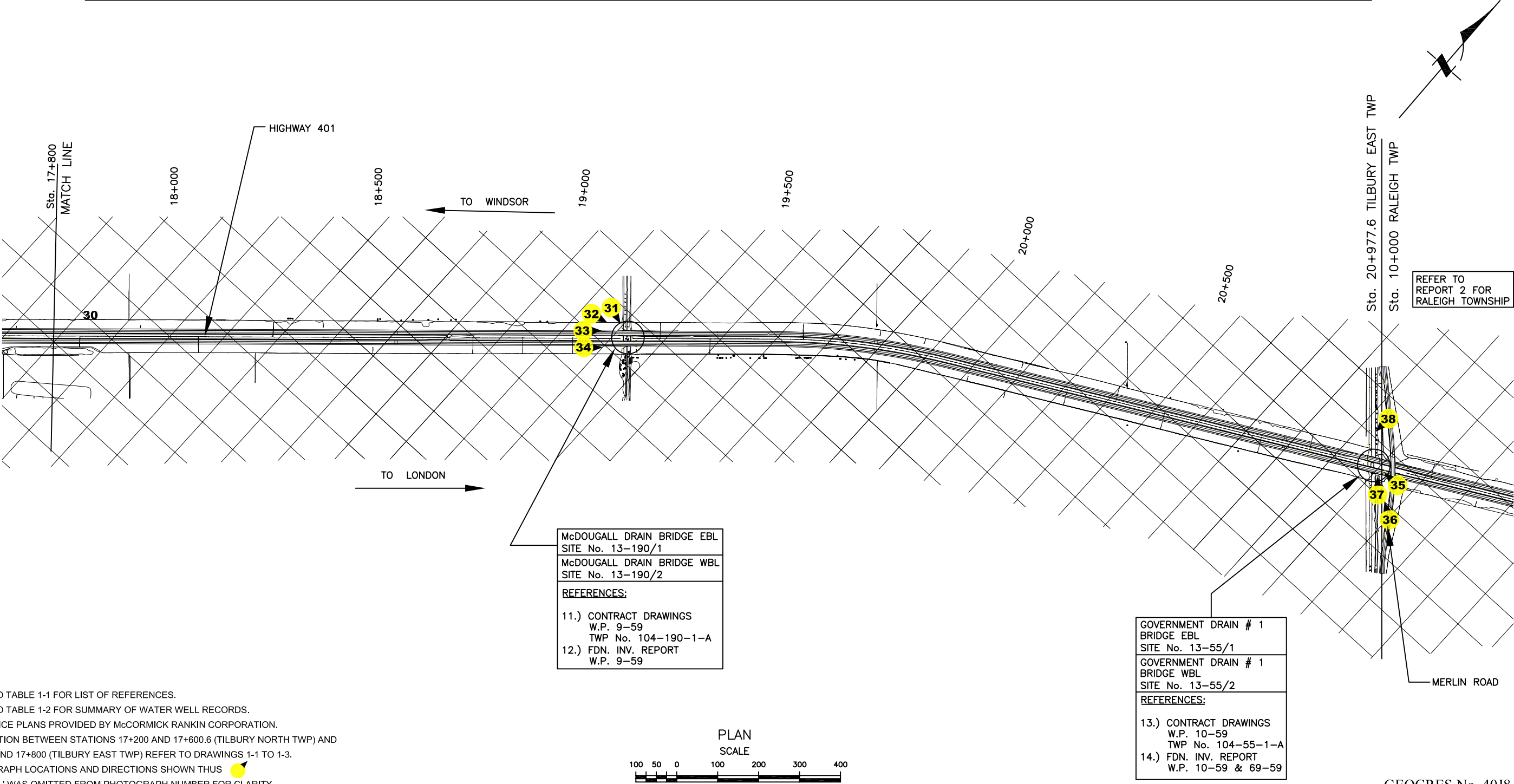


SUMMARY OF WATER WELL RECORDS						
CONCESSION 7 LOT 1	CONCESSION 6 LOT 10	CONCESSION 6 LOT 9	CONCESSION 6 LOT 8	CONCESSION 6 LOT 7	CONCESSION 6 LOT 6	CONCESSION 5 LOT 6
NO DATA FOUND	2 WELLS DRY	GROUNDWATER DEPTH 3.7m EL. 176.3	NO DATA FOUND	NO DATA FOUND	ONE WELL DRY	ONE WELL DRY
NO DATA FOUND	BEDROCK DEPTH >33.6 to 37.5m EL. 142.1 to <146.0	BEDROCK DEPTH 39.0m EL. 141.0	NO DATA FOUND	NO DATA FOUND	BEDROCK DEPTH 36.6m EL. 143.4	BEDROCK DEPTH >35.0m EL. <141.5



GEOCRES No. 40J8-46

SUMMARY OF WATER WELL RECORDS					
CONCESSION 6 LOT 5	CONCESSION 6 LOT 4	CONCESSION 6 LOT 3	CONCESSION 5 LOT 3	CONCESSION 6 LOT 2	CONCESSION 6 LOT 1
GROUNDWATER DEPTH 1.5m EL. 176.3	1 WELL DRY	NO DATA FOUND	GROUNDWATER DEPTH 11.0m EL. 165.8	NO DATA FOUND	GROUNDWATER DEPTH 1.2 to 10.7m EL. 167.1 to 177.2 4 WELLS DRY
BEDROCK DEPTH 33.8m EL. 144.0	BEDROCK DEPTH 33.6m EL. 143.9	NO DATA FOUND	BEDROCK DEPTH >29.0m EL. <147.8	NO DATA FOUND	BEDROCK DEPTH 27.1 to 29.6m EL. 148.8 to 151.3



- NOTES:
- REFER TO TABLE 1-1 FOR LIST OF REFERENCES.
  - REFER TO TABLE 1-2 FOR SUMMARY OF WATER WELL RECORDS.
  - REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  - FOR SECTION BETWEEN STATIONS 17+200 AND 17+600.6 (TILBURY NORTH TWP) AND 10+000 AND 17+800 (TILBURY EAST TWP) REFER TO DRAWINGS 1-1 TO 1-3.
  - PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS PREFIX '5-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES



**PML Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

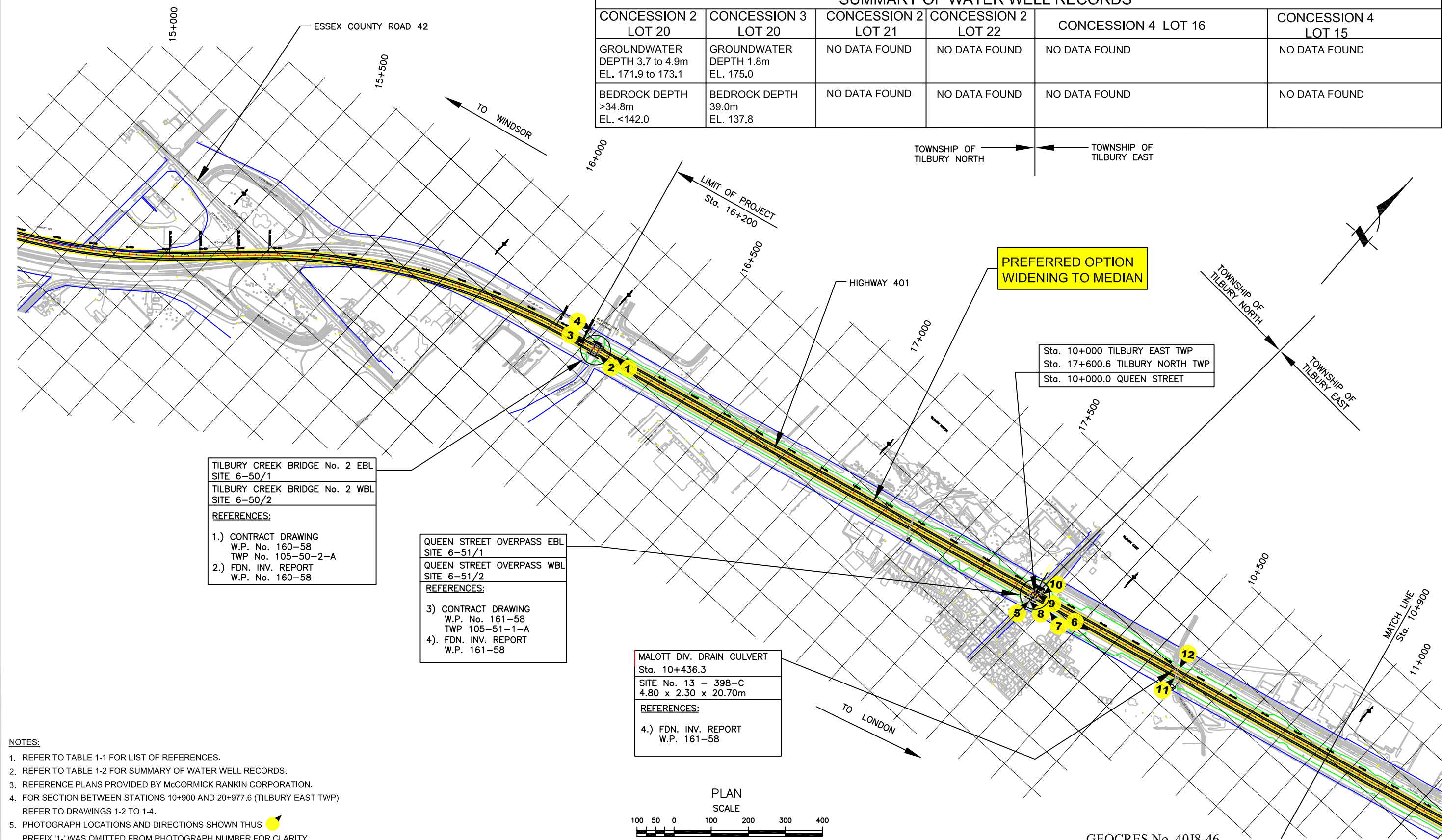
DATE	JANUARY 2010	DRAWN BY:	N.A.
CHECKED BY:	C.N.	APPROVED BY:	B.R.G.

CONT No  
GWP No 80-00-00  
HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
TILBURY EAST/NORTH TOWNSHIP SECTION  
SITE PLAN

DRAWING  
1-4

GEOCRES No. 40J8-46


SUMMARY OF WATER WELL RECORDS					
CONCESSION 2 LOT 20	CONCESSION 3 LOT 20	CONCESSION 2 LOT 21	CONCESSION 2 LOT 22	CONCESSION 4 LOT 16	CONCESSION 4 LOT 15
GROUNDWATER DEPTH 3.7 to 4.9m EL. 171.9 to 173.1	GROUNDWATER DEPTH 1.8m EL. 175.0	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND
BEDROCK DEPTH >34.8m EL. <142.0	BEDROCK DEPTH 39.0m EL. 137.8	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND



TILBURY CREEK BRIDGE No. 2 EBL  
SITE 6-50/1  
TILBURY CREEK BRIDGE No. 2 WBL  
SITE 6-50/2  
**REFERENCES:**  
1.) CONTRACT DRAWING  
W.P. No. 160-58  
TWP No. 105-50-2-A  
2.) FDN. INV. REPORT  
W.P. No. 160-58

QUEEN STREET OVERPASS EBL  
SITE 6-51/1  
QUEEN STREET OVERPASS WBL  
SITE 6-51/2  
**REFERENCES:**  
3.) CONTRACT DRAWING  
W.P. No. 161-58  
TWP 105-51-1-A  
4.) FDN. INV. REPORT  
W.P. 161-58

MALOTT DIV. DRAIN CULVERT  
Sta. 10+436.3  
SITE No. 13 - 398-C  
4.80 x 2.30 x 20.70m  
**REFERENCES:**  
4.) FDN. INV. REPORT  
W.P. 161-58

- NOTES:**
- 1. REFER TO TABLE 1-1 FOR LIST OF REFERENCES.
  - 2. REFER TO TABLE 1-2 FOR SUMMARY OF WATER WELL RECORDS.
  - 3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  - 4. FOR SECTION BETWEEN STATIONS 10+900 AND 20+977.6 (TILBURY EAST TWP)  
REFER TO DRAWINGS 1-2 TO 1-4.
  - 5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS   
PREFIX '1-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES

PREFERRED OPTION



**Ontario**




**McCORMICK RANKIN CORPORATION**  
A member of  **MMM GROUP**



**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DATE	<b>JANUARY 2010</b>	DRAWN BY:	<b>N.A.</b>
CHECKED BY:	<b>C.N.</b>	APPROVED BY:	<b>B.R.G.</b>

CONT No	<b>80-00-00</b>
GWP No	<b>80-00-00</b>
<b>HIGHWAY 401</b> WIDENING THROUGH KENT COUNTY TILBURY EAST/NORTH TOWNSHIP SECTION SITE PLAN	

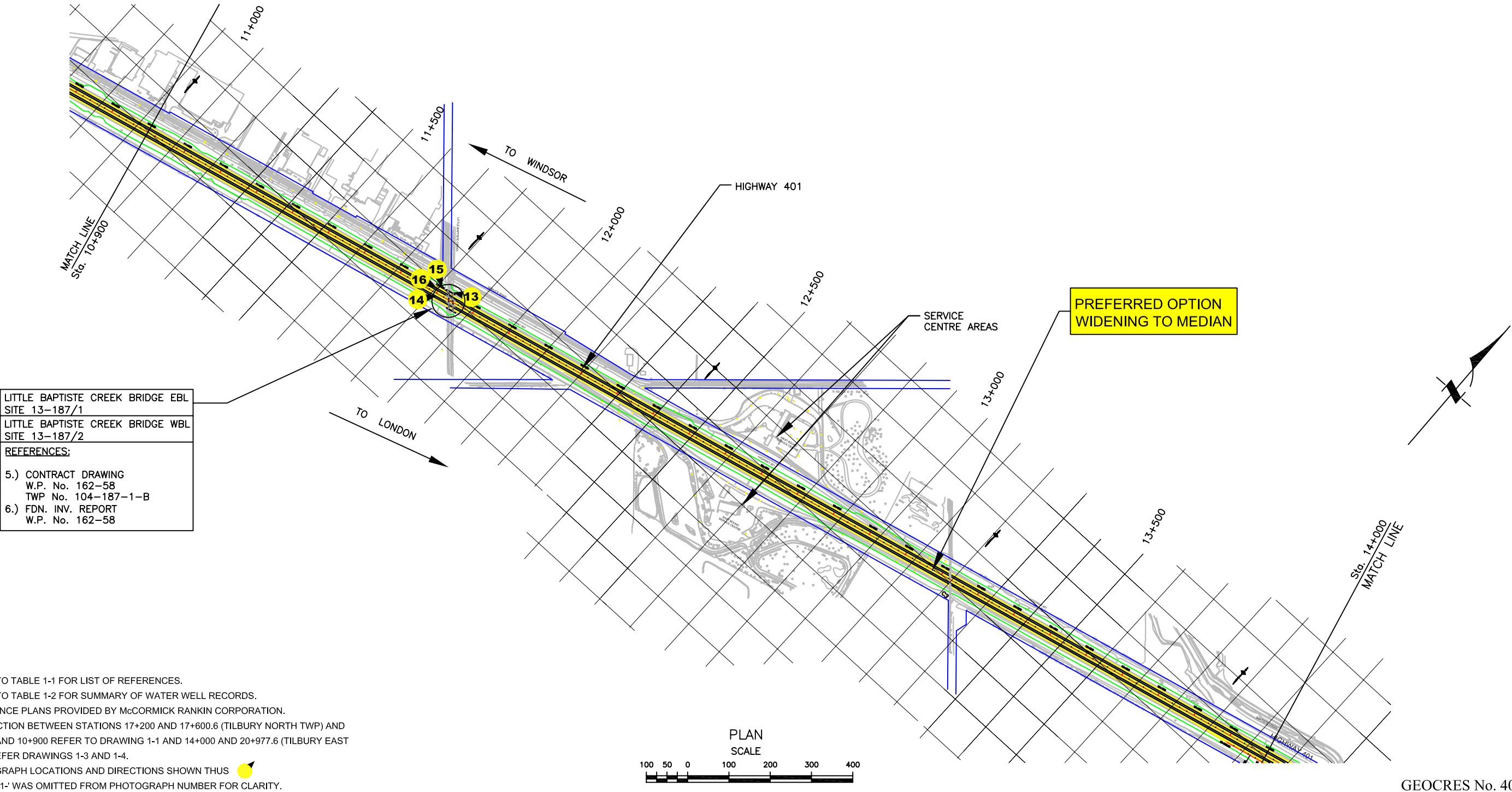


**DRAWING**  
**P1-1**

GEOCRES No. 40J8-46



SUMMARY OF WATER WELL RECORDS					
CONCESSION 5 LOT 15	CONCESSION 5 LOT 14	CONCESSION 3 LOT 14	CONCESSION 5 LOT 13	CONCESSION 5 LOT 12	CONCESSION 5 LOT 11
NO DATA FOUND	NO DATA FOUND	GROUNDWATER DEPTH 5.5m EL. 171.0 ONE WELL DRY	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND
NO DATA FOUND	NO DATA FOUND	BEDROCK DEPTH 35.7m EL. 140.8	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND




GEOCREs No. 40J8-46

**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES

**PREFERRED OPTION**

**Ontario**

**McCORMICK RANKIN CORPORATION**  
A member of  **MMM GROUP**

**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DATE **JANUARY 2010**

CHECKED BY: **C.N.**

DRAWN BY: **N.A.**

APPROVED BY: **B.R.G.**

CONT No

GWP No **80-00-00**

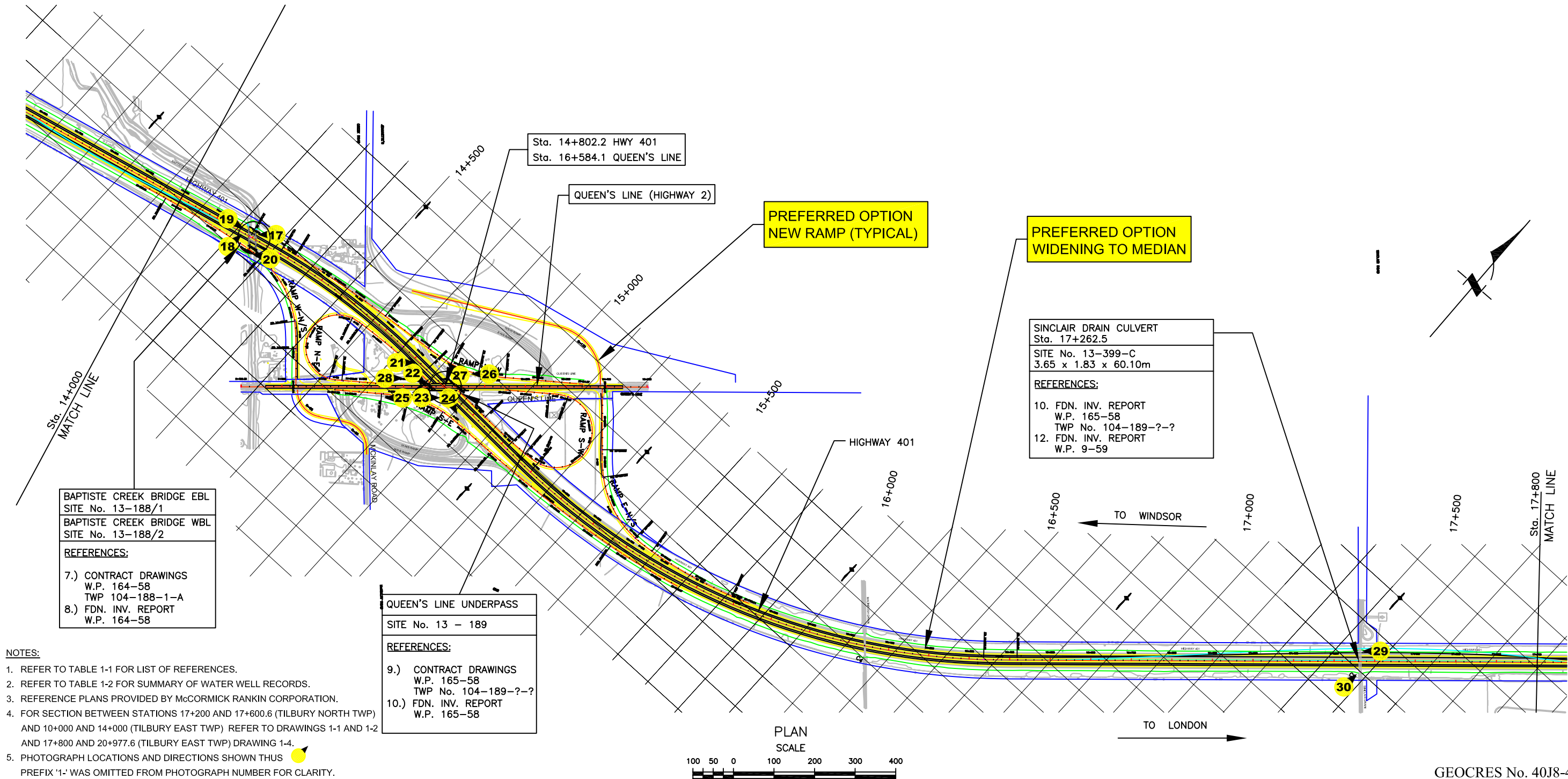
**HIGHWAY 401**  
WIDENING THROUGH KENT COUNTY  
TILBURY EAST/NORTH TOWNSHIP SECTION  
SITE PLAN



**DRAWING**  
**P1-2**



SUMMARY OF WATER WELL RECORDS						
CONCESSION 7 LOT 1	CONCESSION 6 LOT 10	CONCESSION 6 LOT 9	CONCESSION 6 LOT 8	CONCESSION 6 LOT 7	CONCESSION 6 LOT 6	CONCESSION 5 LOT 6
NO DATA FOUND	2 WELLS DRY	GROUNDWATER DEPTH 3.7m EL. 176.3	NO DATA FOUND	NO DATA FOUND	ONE WELL DRY	ONE WELL DRY
NO DATA FOUND	BEDROCK DEPTH >33.6 to 37.5m EL. 142.1 to <146.0	BEDROCK DEPTH 39.0m EL. 141.0	NO DATA FOUND	NO DATA FOUND	BEDROCK DEPTH 36.6m EL. 143.4	BEDROCK DEPTH >35.0m EL. <141.5



GEOCRES No. 40J8-46

**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES

**PREFERRED OPTION**

**Ontario**  
MRC **McCORMICK RANKIN CORPORATION**  
A member of **MMM GROUP**

**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DATE **JANUARY 2010**  
CHECKED BY: **C.N.**

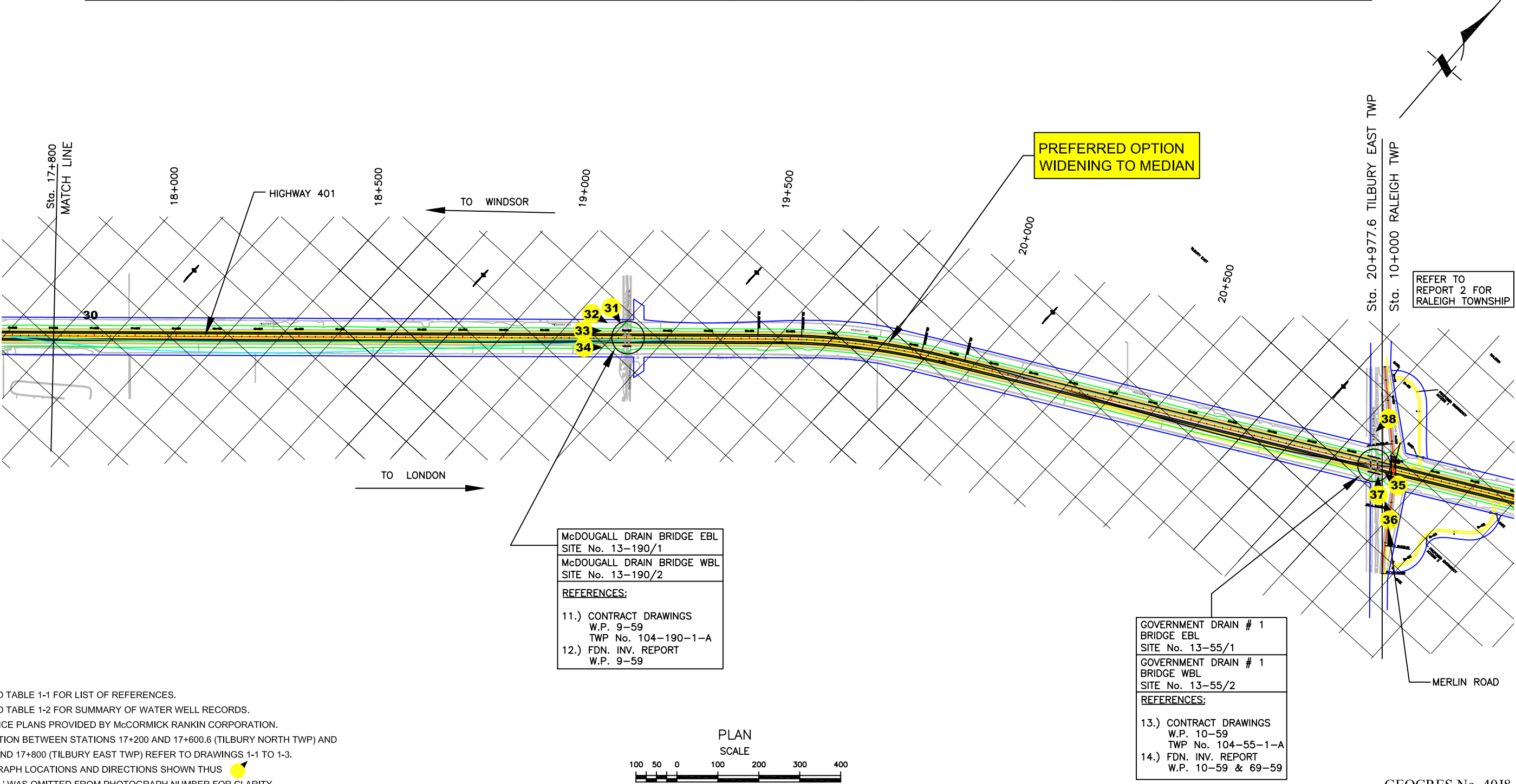
DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**


CONT No  
GWP No 80-00-00

**HIGHWAY 401**  
WIDENING THROUGH KENT COUNTY  
TILBURY EAST/NORTH TOWNSHIP SECTION  
SITE PLAN

**DRAWING**  
P1-3

SUMMARY OF WATER WELL RECORDS					
CONCESSION 6 LOT 5	CONCESSION 6 LOT 4	CONCESSION 6 LOT 3	CONCESSION 5 LOT 3	CONCESSION 6 LOT 2	CONCESSION 6 LOT 1
GROUNDWATER DEPTH 1.5m EL. 176.3	1 WELL DRY	NO DATA FOUND	GROUNDWATER DEPTH 11.0m EL. 165.8	NO DATA FOUND	GROUNDWATER DEPTH 1.2 to 10.7m EL. 167.1 to 177.2 4 WELLS DRY
BEDROCK DEPTH 33.8m EL. 144.0	BEDROCK DEPTH 33.6m EL. 143.9	NO DATA FOUND	BEDROCK DEPTH >29.0m EL. <147.8	NO DATA FOUND	BEDROCK DEPTH 27.1 to 29.6m EL. 148.8 to 151.3



- NOTES:
1. REFER TO TABLE 1-1 FOR LIST OF REFERENCES.
  2. REFER TO TABLE 1-2 FOR SUMMARY OF WATER WELL RECORDS.
  3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  4. FOR SECTION BETWEEN STATIONS 17+200 AND 17+600.6 (TILBURY NORTH TWP) AND 10+000 AND 17+800 (TILBURY EAST TWP) REFER TO DRAWINGS 1-1 TO 1-3.
  5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '5-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES

PREFERRED OPTION



Ontario



McCORMICK RANKIN CORPORATION

A member of  MMM GROUP



Peto MacCallum Ltd.

CONSULTING ENGINEERS

DATE **JANUARY 2010**  
CHECKED BY: **C.N.**

DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**

CONT No  
GWP No 80-00-00

**HIGHWAY 401**  
WIDENING THROUGH KENT COUNTY  
TILBURY EAST/NORTH TOWNSHIP SECTION  
SITE PLAN

  
**DRAWING**  
**P1-4**

GEOCRES No. 40J8-46

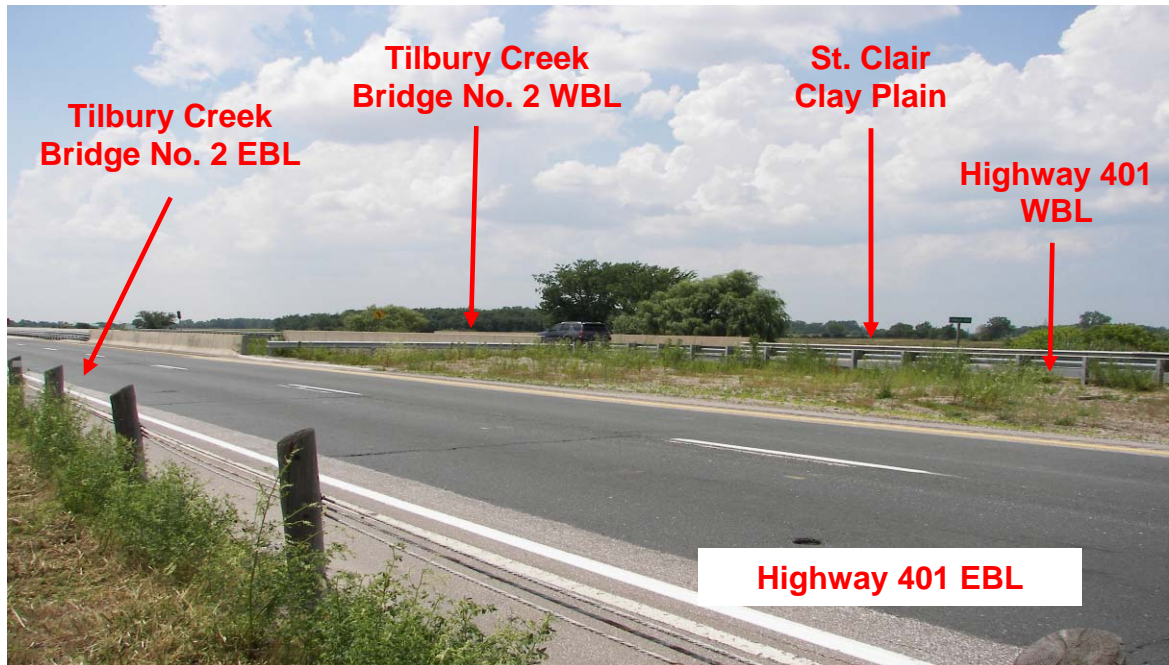


## **APPENDIX A**

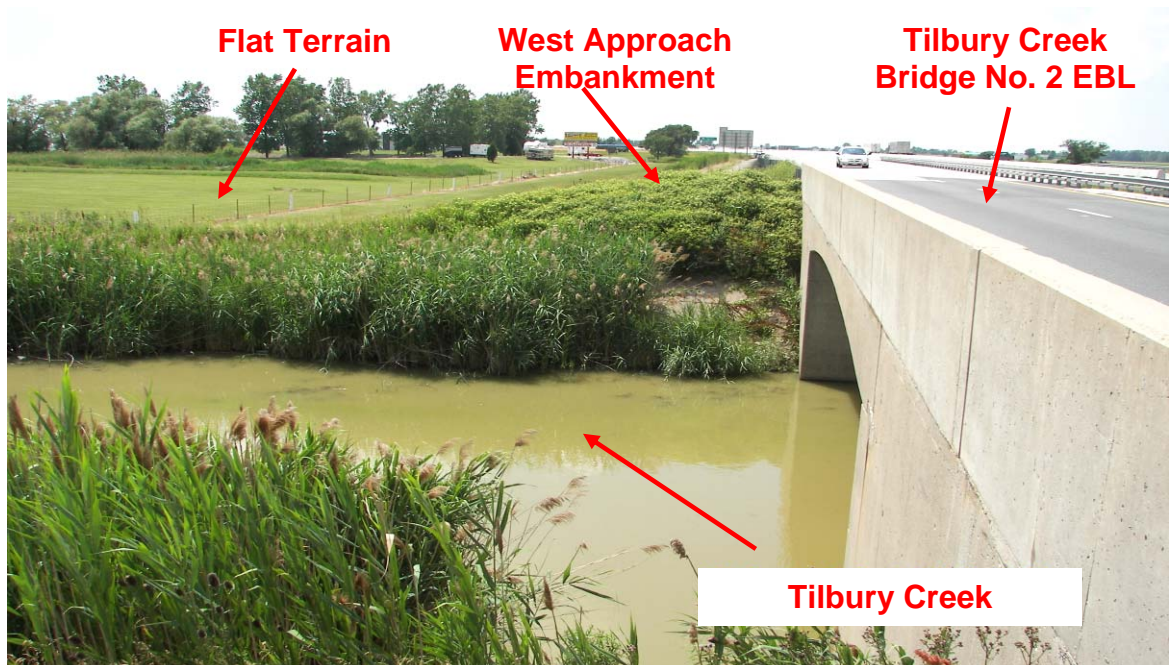
### Site Photographs 1-1 to 1-38

Photographs 1-1 to 1-4	– Tilbury Creek Bridge No. 2
Photographs 1-5 to 1-10	– Queen Street Overpass
Photographs 1-11, 1-12	– Malott Division Drain Culvert
Photographs 1-13 to 1-16	– Little Baptiste Creek Drain Bridges
Photographs 1-17 to 1-20	– Baptiste Creek Bridges
Photographs 1-21 to 1-28	– Queen's Line Interchange
Photographs 1-29, 1-30	– Sinclair Drain Culvert
Photographs 1-31 to 1-34	– McDougall Drain Bridges
Photographs 1-35 to 1-38	– Government Drain No. 1 Bridges



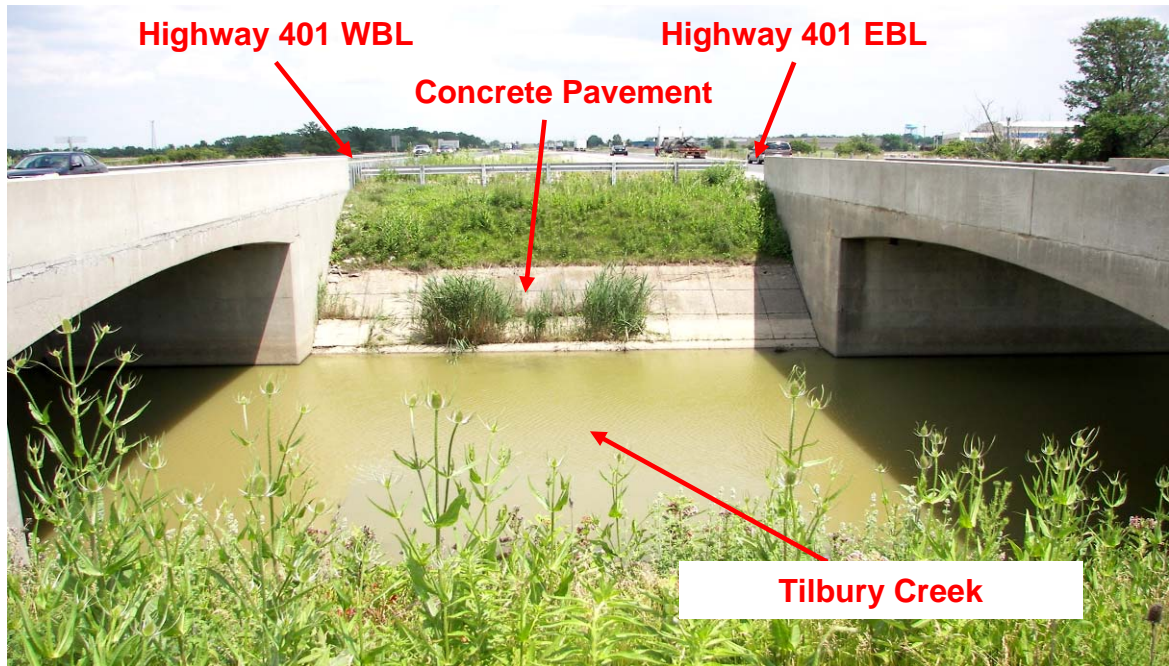


**PHOTOGRAPH 1-1:** Tilbury Creek Bridge No. 2 EBL and WBL. Looking northwesterly from southeast of bridges. Note typical flat terrain of the St. Clair Clay Plain in background, low highway embankments and vegetated Highway 401 median. (June 28, 2006)

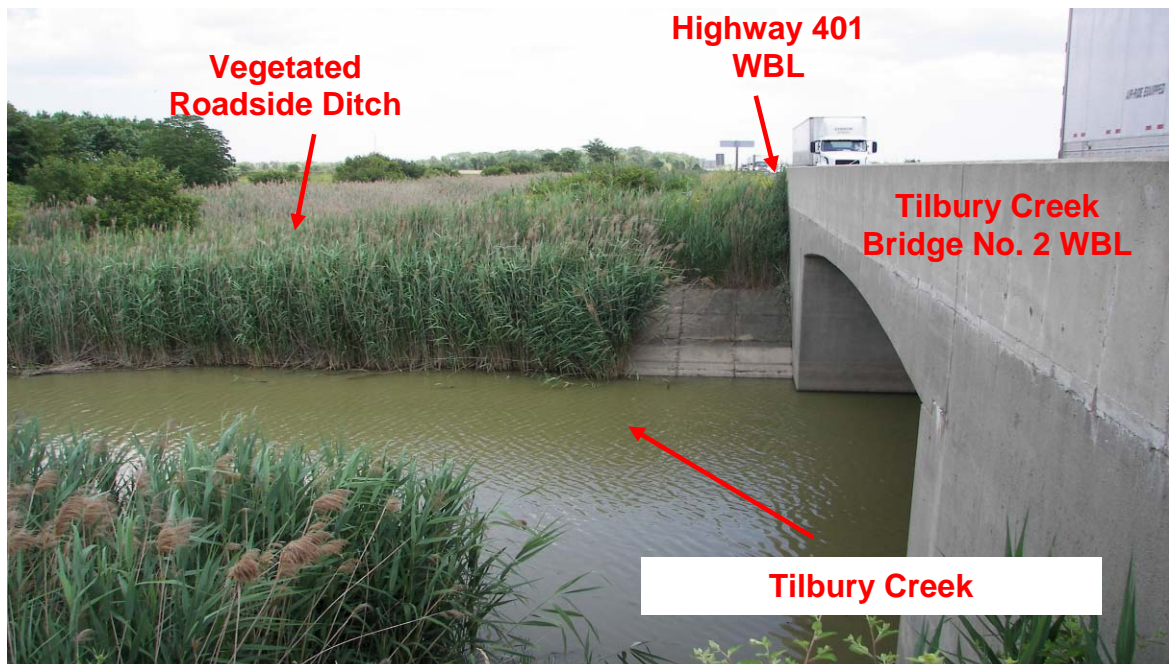


**PHOTOGRAPH 1-2:** Tilbury Creek Bridge No. 2 EBL and WBL. Looking west along south side of Tilbury Creek Bridge No. 2 EBL from east bank of channel. Note low built-up west approach embankment, typical flat terrain beyond R.O.W., wide open drainage channel with well-vegetated side slopes. (June 28, 2006)

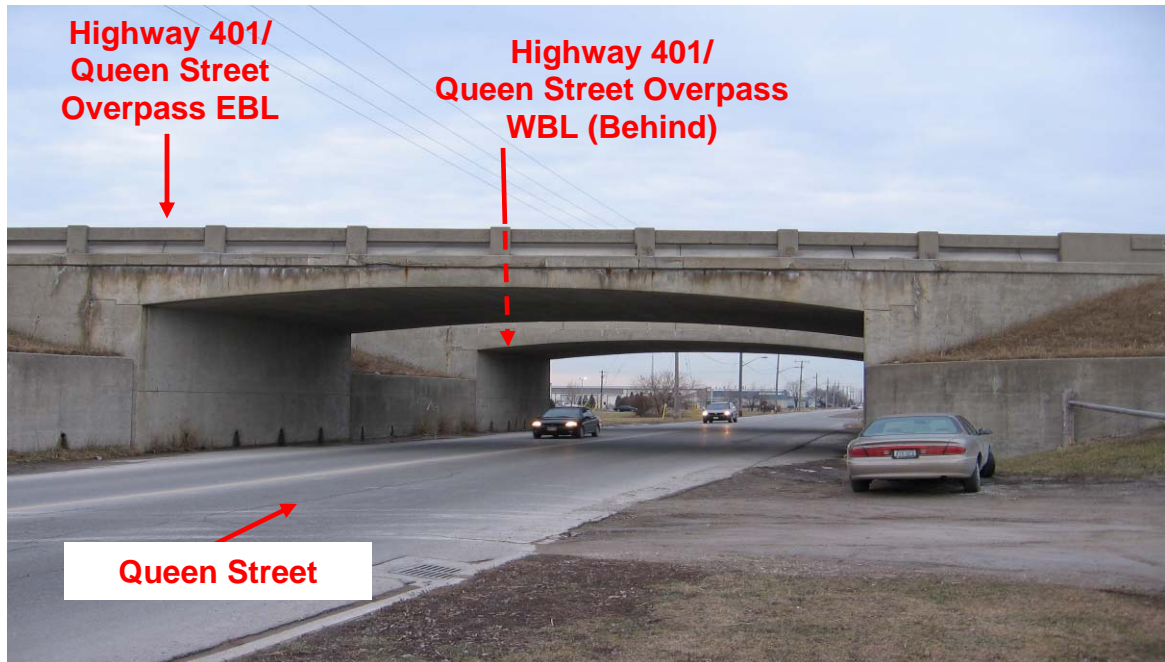




**PHOTOGRAPH 1-3:** Tilbury Creek Bridge No. 2 EBL and WBL. Looking east along centreline of Highway 401 median from top of west bank of Tilbury Creek. Note concrete revetment between abutments of EBL and WBL bridges and wide open creek channel. (June 28, 2006)



**PHOTOGRAPH 1-4:** Tilbury Creek Bridge No. 2 EBL and WBL. Looking east along north side of Tilbury Creek Bridge No. 2 from west bank of Tilbury Creek channel. Note flat terrain, well-vegetated roadside ditches, wide-open channel of Tilbury Creek. (June 28, 2006)



**PHOTOGRAPH 1-5:** Queen Street Overpass Structures. Looking northerly at the Queen Street overpass structures from east boulevard of Queen Street. (January 27, 2006)



**PHOTOGRAPH 1-6:** Queen Street Overpass. Looking easterly from south shoulder of Highway 401 east of EBL structure. Note flat terrain in background, well-grassed built-up approach embankment and residential area of the Town of Tilbury. (January 27, 2006)





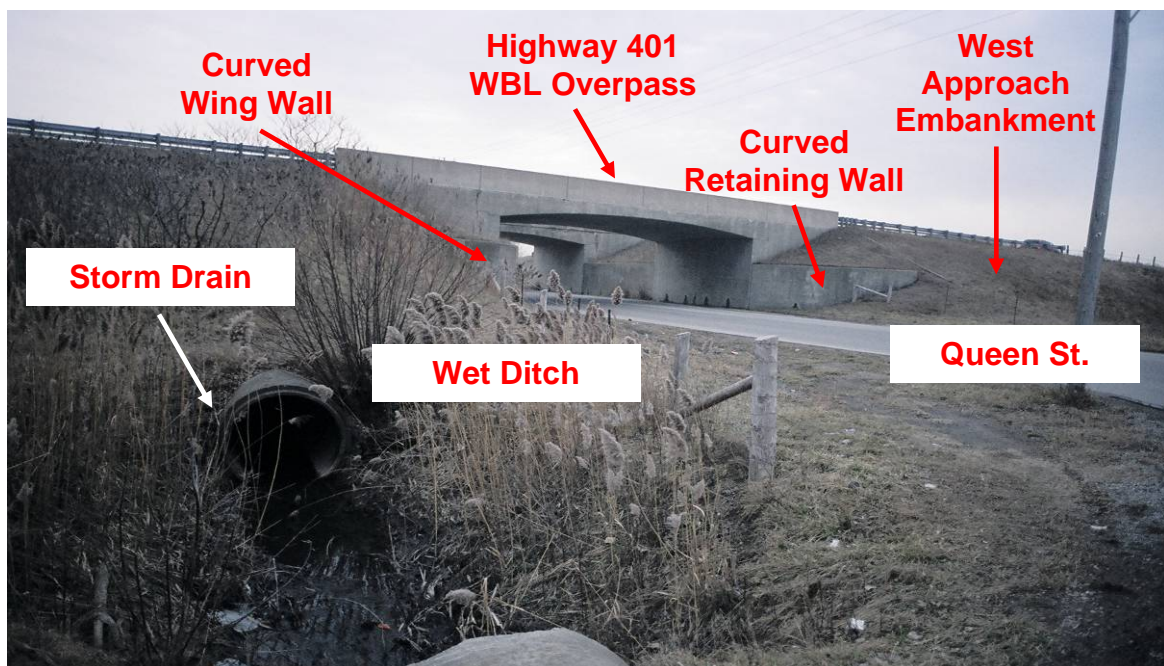
**PHOTOGRAPH 1-7:** Queen Street Overpass. Looking northwesterly from south shoulder of Highway 401 east of EBL structure. View across top of overpass structures and Highway 401 median. Note flat terrain of the St. Clair Clay Plain in the distance. (January 27, 2006)



**PHOTOGRAPH 1-8:** Queen Street Overpass. Looking west from south shoulder of Highway 401 east of EBL structure. Note flat terrain, built-up approach embankments, temporary curbs on bridge deck of EBL structure, curved wing retaining wall at toe of slope. Residential area in background. (January 27, 2006)

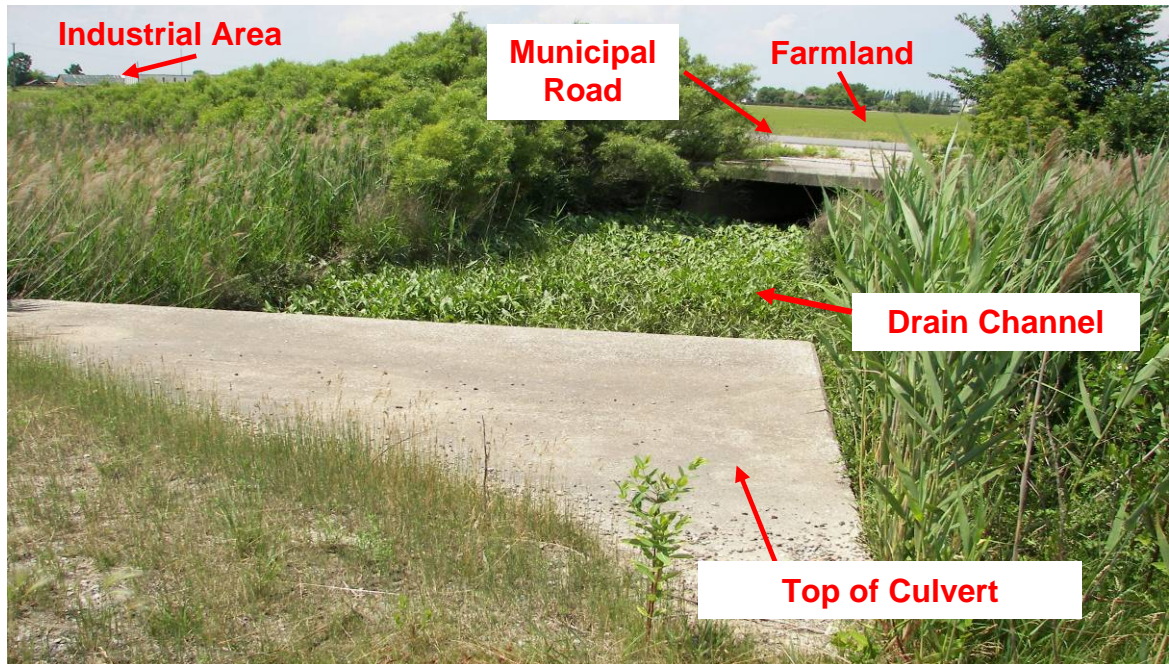


**PHOTOGRAPH 1-9:** Queen Street Overpass. Looking west at retaining wall between west abutments of overpass structures, grassed median of Highway 401 and crash barrier atop the slope. Note good condition of wall showing no significant lateral movement, water seeping through weep holes at base. (January 27, 2006)



**PHOTOGRAPH 1-10:** Queen Street Overpass. Looking south west from north of overpasses and east of Queen Street. Note curved wing retaining walls, good condition of west approach embankment and wet ditch with round pipe drain culvert in foreground. (January 27, 2006)





**PHOTOGRAPH 1-11:** Malott Division Drain Culvert. Looking north across top of Malott Div. Drain Culvert, north of Highway 401 WBL. Note industrial buildings at top left of photograph, municipal road and culvert, farmland and drain channel with heavy vegetation growth. (June 28, 2006)



**PHOTOGRAPH 1-12:** Malott Division Drain Culvert. Looking southwesterly at north end of culvert from east bank of channel. Note well-vegetated banks of drain channel, low embankment of Highway 401 over top of culvert, vegetation growth in drain channel. (June 28, 2006)



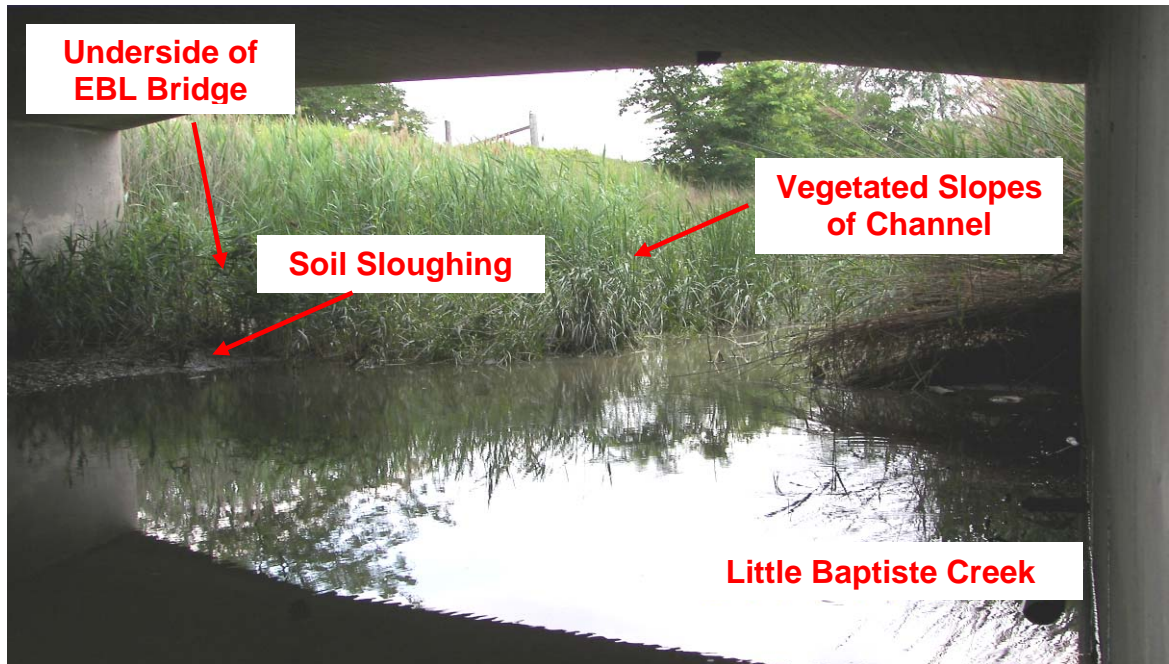


**PHOTOGRAPH 1-13:** Little Baptiste Creek Bridges. Looking westerly from top of east bank of Little Baptiste Creek along north of WBL Bridge. Note well-vegetated roadside ditches, industrial land use in background, warning sign atop flow control west berm, and flow control east berm in foreground. (June 28, 2006)



**PHOTOGRAPH 1-14:** Little Baptiste Creek Bridge. Looking northerly from west side of Little Baptiste Creek bank at Highway 401 median. View under WBL bridge. Note well-vegetated bank and soil sloughing into Creek channel. Note creek carrying high silt content indicating soil erosion. (June 28, 2006)



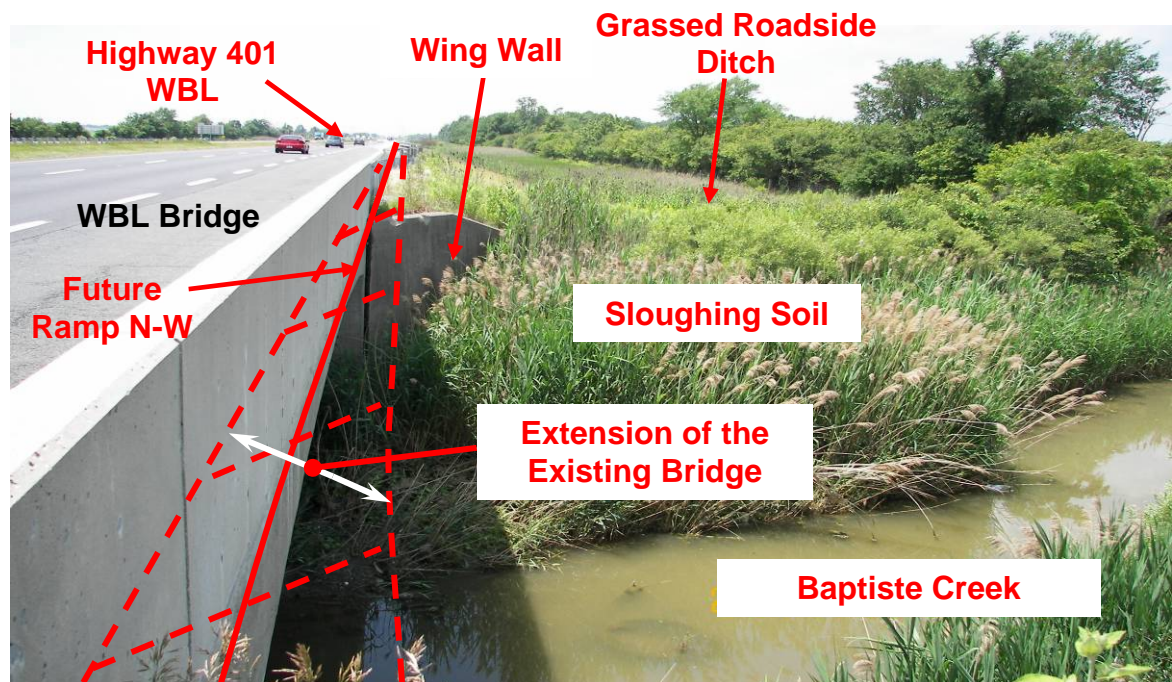


**PHOTOGRAPH 1-15:** Little Baptiste Creek Bridge. Looking southeasterly from west bank of creek south side of Highway 401 median. View under EBL Bridge. Note vegetated sides of drainage channel and some sloughing of soil into channel. (June 28, 2006)



**PHOTOGRAPH 1-16:** Little Baptiste Creek Bridge. Looking east from west of creek at median of Highway 401 and along north side of EBL bridge. Note well-vegetated condition of median, generally flat terrain, low embankment of Highway 401. (June 28, 2006)



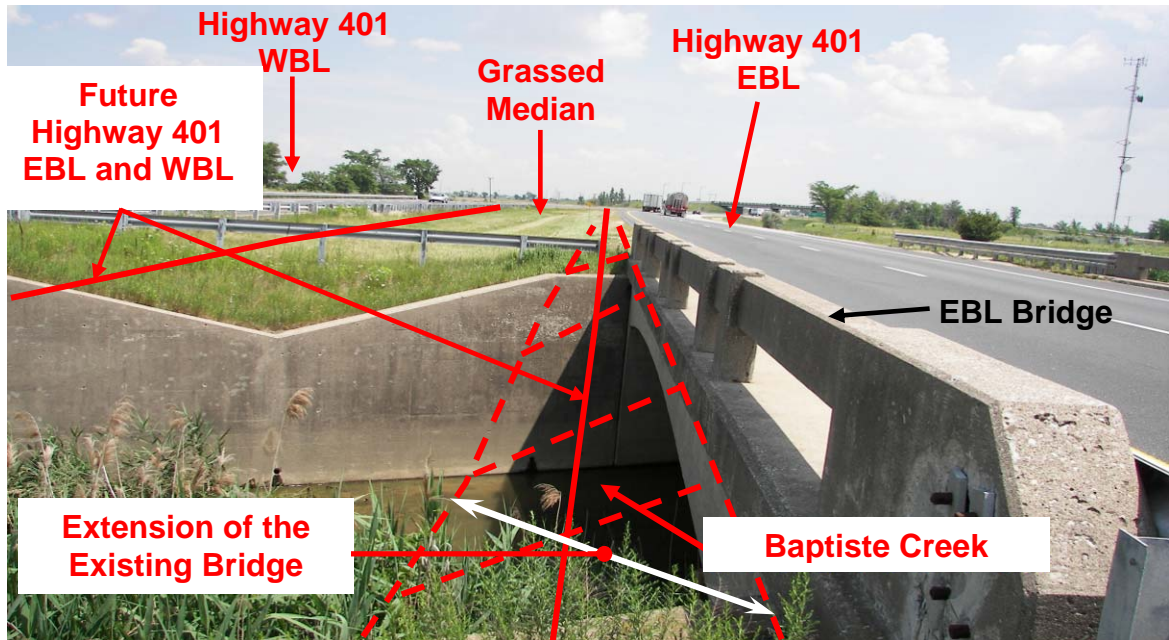


**PHOTOGRAPH 1-17:** Baptiste Creek Bridge. Looking west from east bank of the Baptiste Creek along north side of WBL bridge. Note grassed sideroad ditch, well-vegetated banks of Baptiste Creek channel and soil sloughing in front of wing wall of bridge. Preferred option: Future Ramp N-W of Queen's Line I/C and extension of Baptiste Creek WBL bridge is depicted in the photograph. (June 28, 2006)

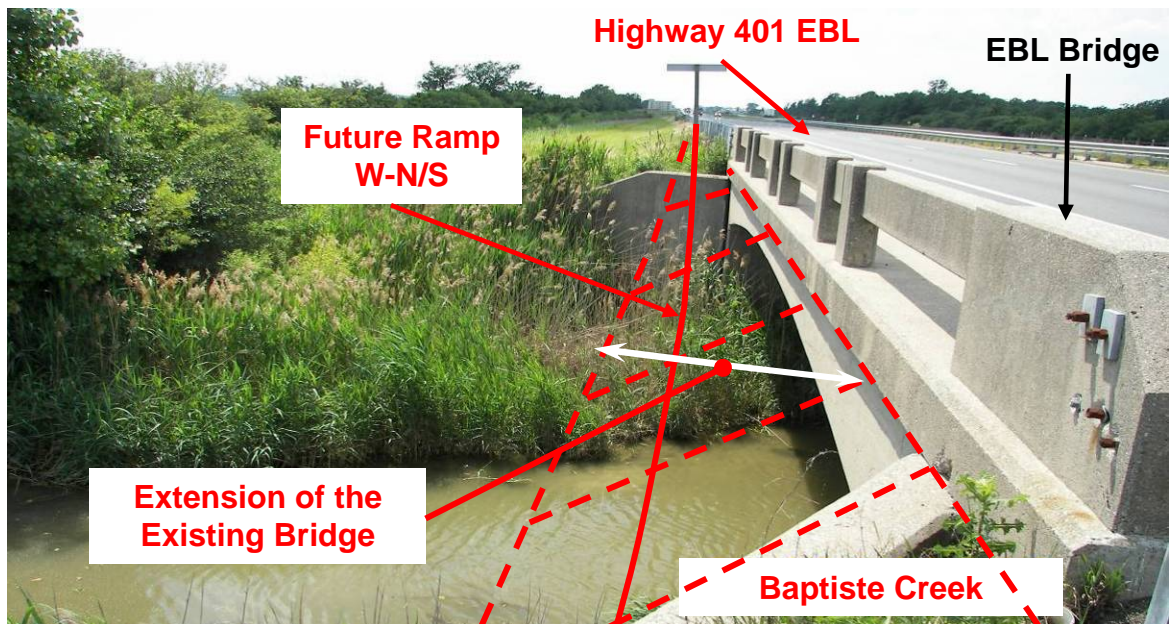


**PHOTOGRAPH 1-18:** Baptiste Creek Bridge. Looking northeasterly from top of Highway 401 median at east abutment of WBL bridge. Note local sedimentation with vegetation growth in front of abutment. (June 28, 2006)

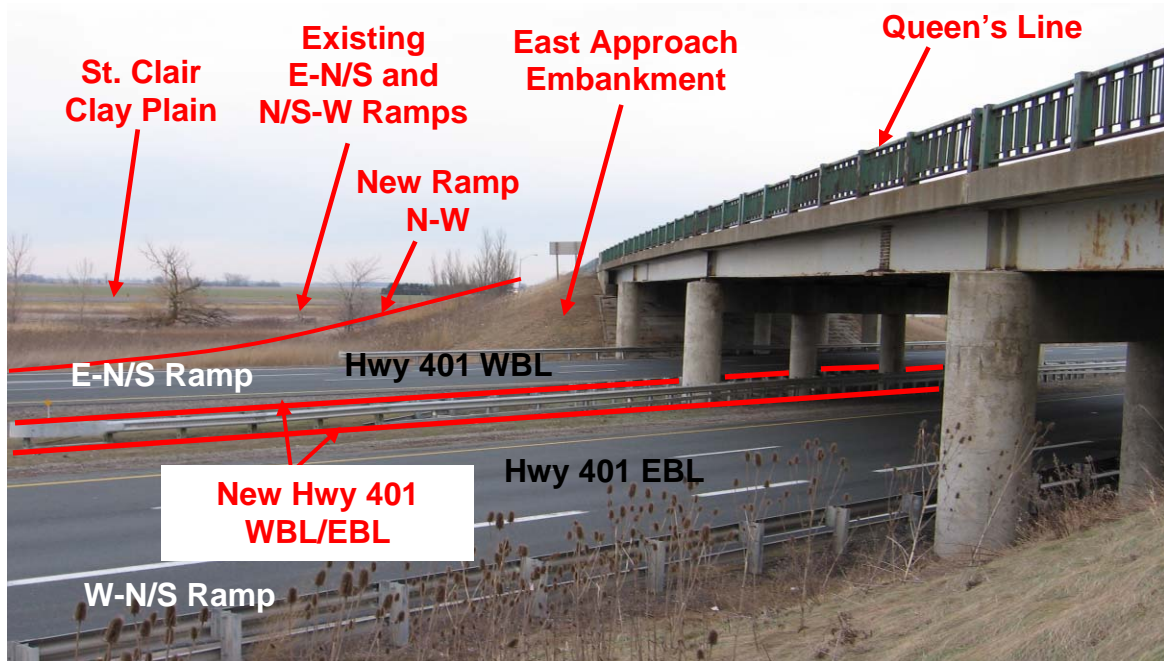




**PHOTOGRAPH 1-19:** Baptiste Creek Bridge. Looking easterly from top of Highway 401 median, west side of Baptiste Creek. Note generally flat terrain, low embankments of Highway 401 approaching bridges and grassed Highway 401 median. Preferred option: Future Highway 401 median lanes and extension of existing EBL bridge shown in the photograph. (June 28, 2006)



**PHOTOGRAPH 1-20:** Baptiste Creek Bridge. Looking west from east of EBL Bridge over the Baptiste Creek. Note built-up approach embankment of Highway 401, soil sloughing in front of wing wall, grassed roadside ditch. Preferred option: Future extension of the Baptiste Creek EBL bridge and W-N/S ramp of new Queen's Line I/C are depicted in the photograph. (June 28, 2006)

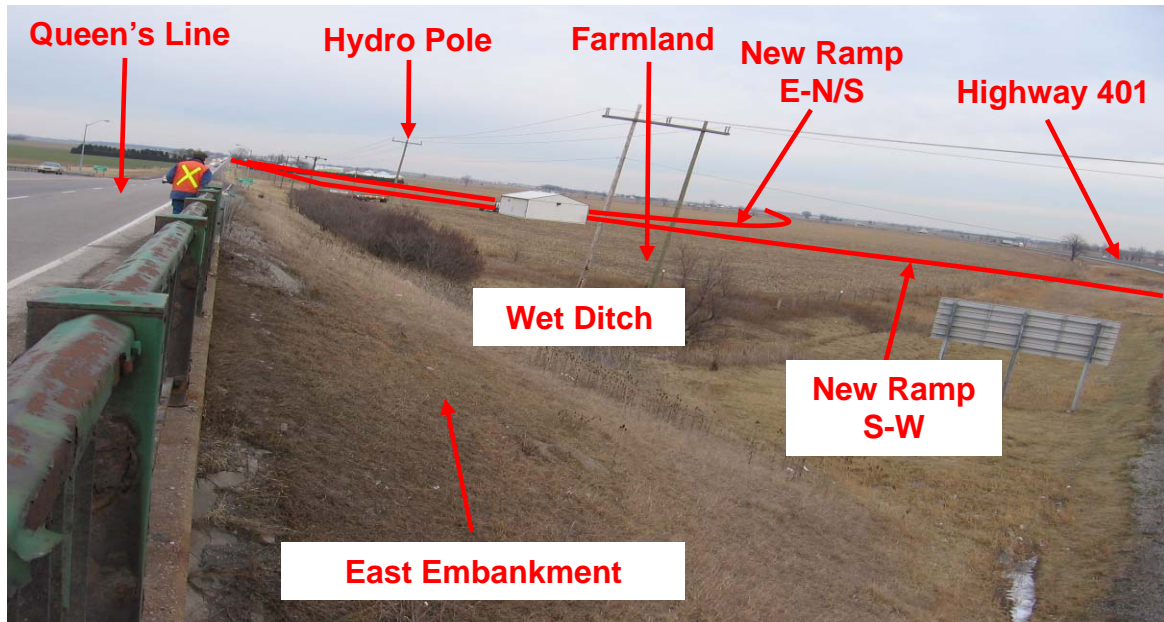


**PHOTOGRAPH 1-21:** Queen's Line Interchange. Looking east from middle of west foreslope along northern side of Underpass structure. Note flat terrain of the St. Clair Clay Plain in background, good condition of east approach embankment slope and low embankment for E-N/S and N/S-W ramps. Preferred option: Future Highway 401 EBL and WBL and N-W ramp are depicted in the photograph. (January 27, 2006)

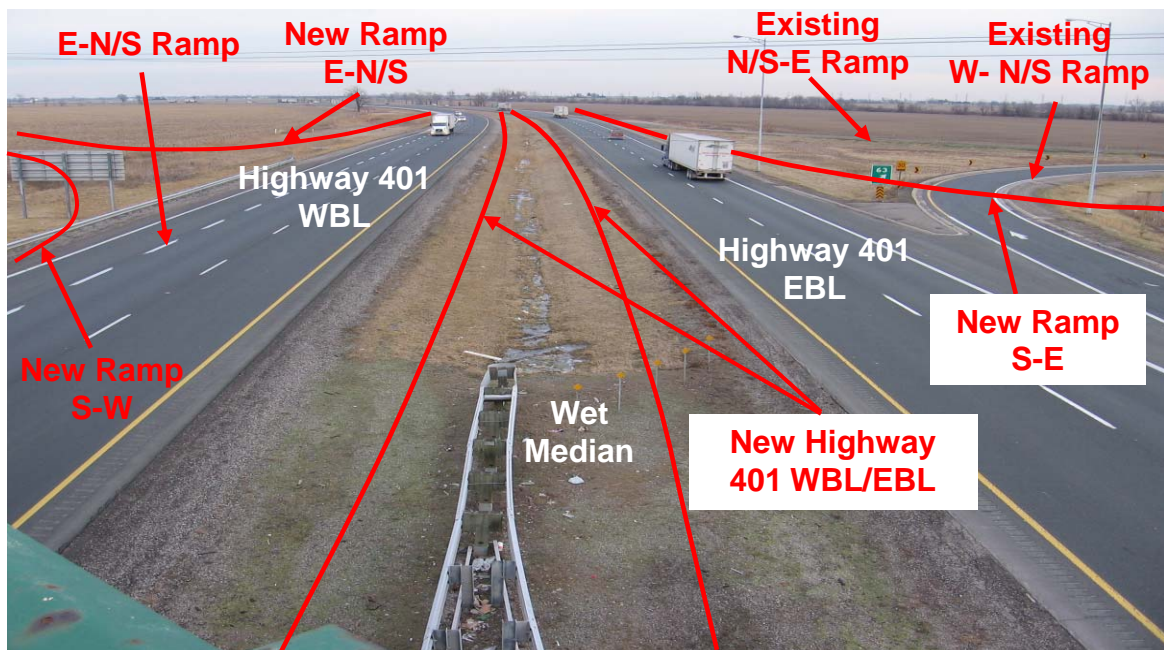


**PHOTOGRAPH 1-22:** Queen's Line Interchange. Looking southeasterly at foreslope of west approach embankment. Note separation in panels of concrete revetment. (January 27, 2006)

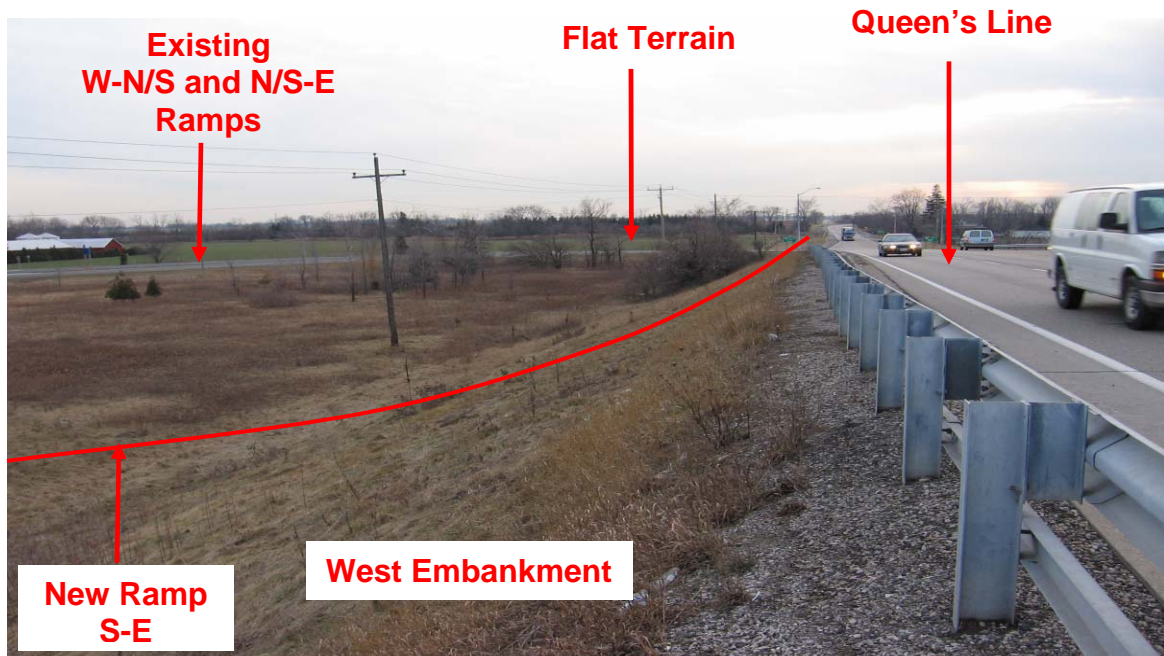




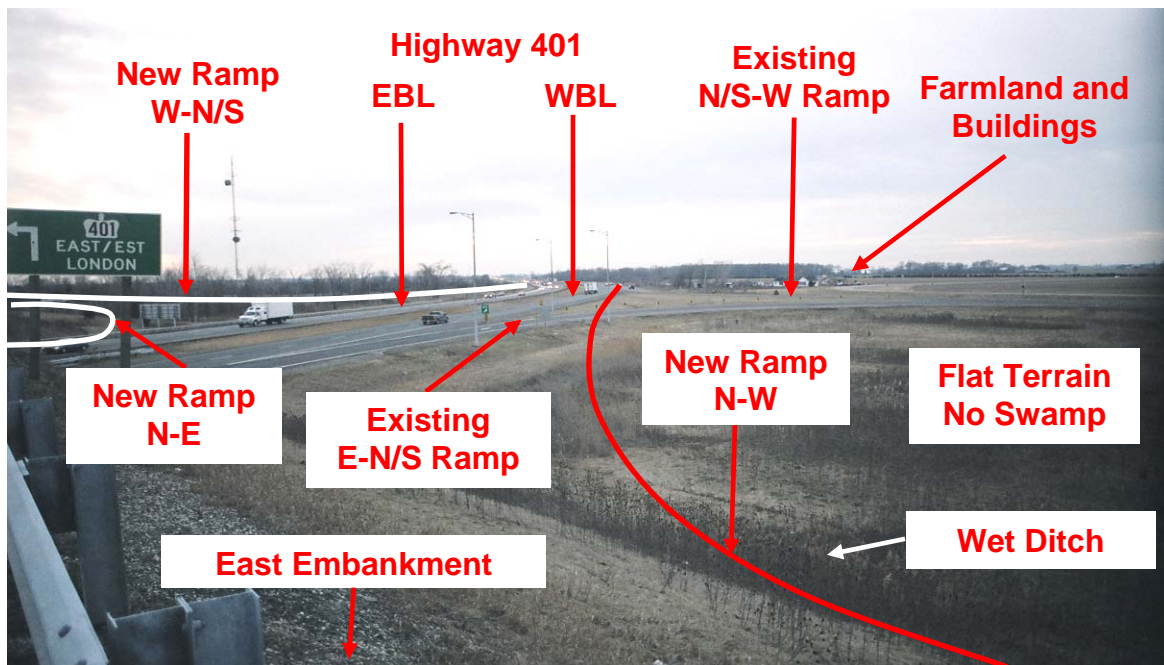
**PHOTOGRAPH 1-23:** Queen's Line Interchange. Looking northeasterly from southeast end of structure deck. Note farmland use, hydro pole line, wet roadside ditch near toe of slope of east approach embankment. Highway 401 is in background right of photograph. Preferred option: Future E-N/S and S-W ramps are shown in the photograph. (January 27, 2006)



**PHOTOGRAPH 1-24:** Queen's Line Interchange. Looking southeasterly from centre of Queen's Line Underpass structure. Note flat terrain and farmland, wetness on Highway 401 median, low embankment for W-N/S and N/S-E ramps of Parclo B interchange configuration. Preferred option: Future Highway 401 EBL and WBL and S-W, S-E and E-N/S ramps are depicted in the photograph. (January 27, 2006)



**PHOTOGRAPH 1-25:** Queen's Line Interchange. Looking southwesterly from top of west approach embankment near southwest corner of underpass structure. Note good condition of embankment slope, W-N/S and N/S-E ramps in background left of photography, typically flat terrain without swamp land. Preferred option: Future S-E ramp shown in the photograph. (January 27, 2006)

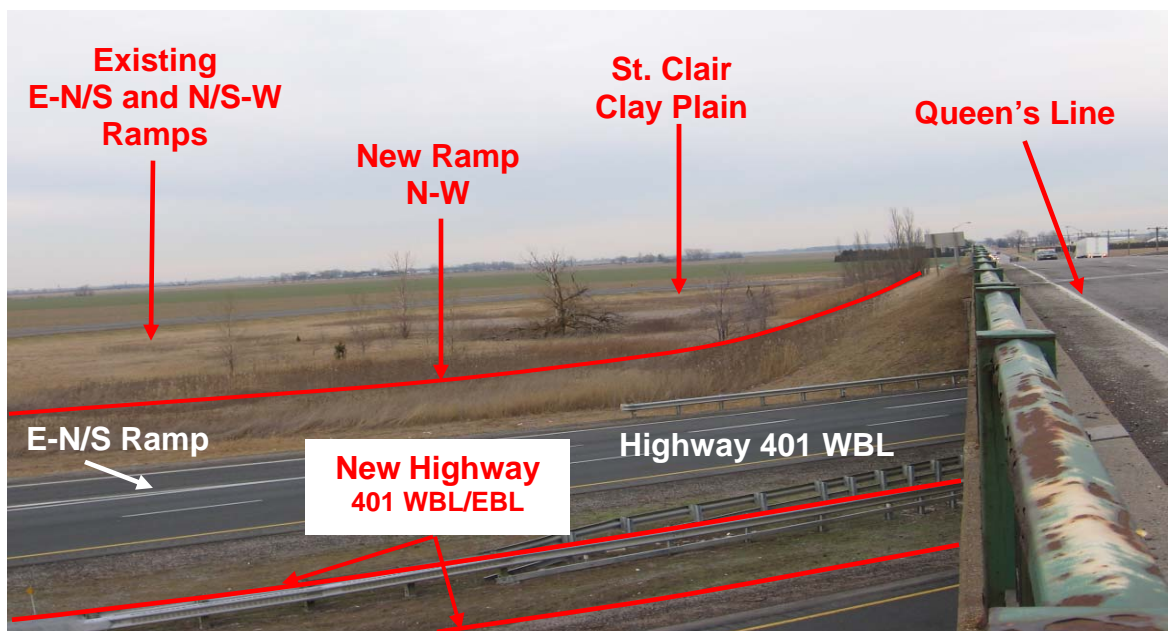


**PHOTOGRAPH 1-26:** Queen's Line Interchange. Looking northwesterly from east approach embankment. Note farming landuse, low embankments of Highway 401 and ramps, good condition of east approach embankment and flat terrain with wet ditch at toe of slope. Preferred option: Future N-E, N-W and W-N/S ramps are depicted in the photograph. (January 27, 2006)



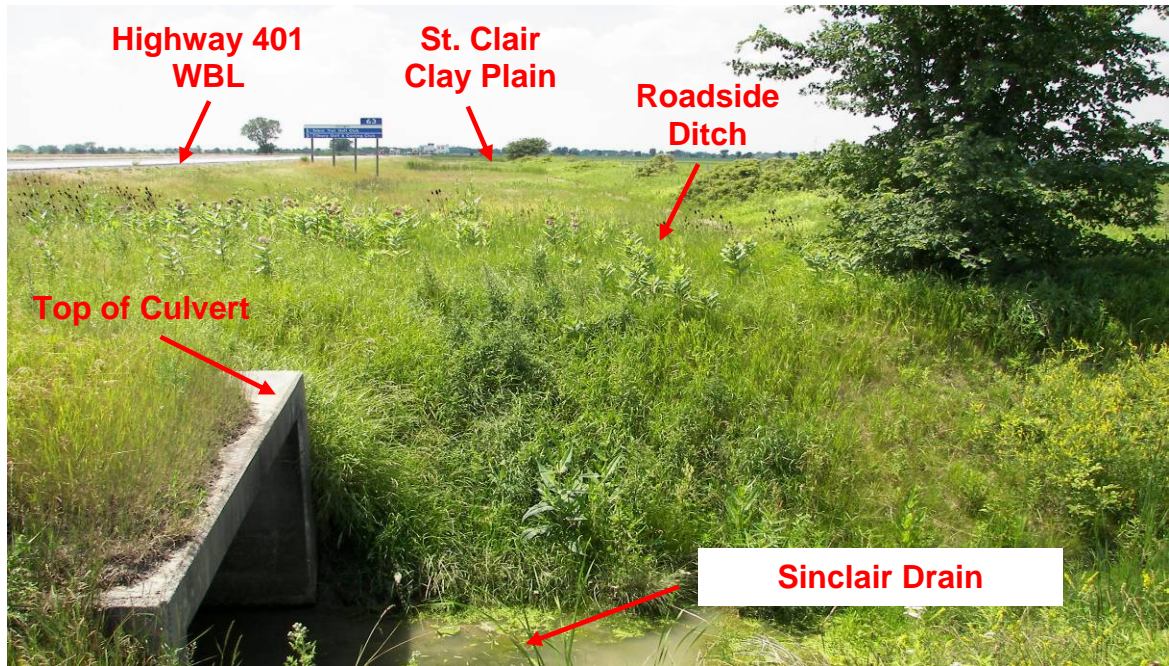


**PHOTOGRAPH 1-27:** Queen's Line Interchange. Looking northwesterly from top of deck of underpass structure. Note flat terrain with farm buildings, locally wet median and low embankments of Highway 401 and interchange ramps. Preferred option: Future Highway 401 EBL and WBL and W-N/S, N-E and N-W ramps are depicted in the photograph. (January 27, 2006)

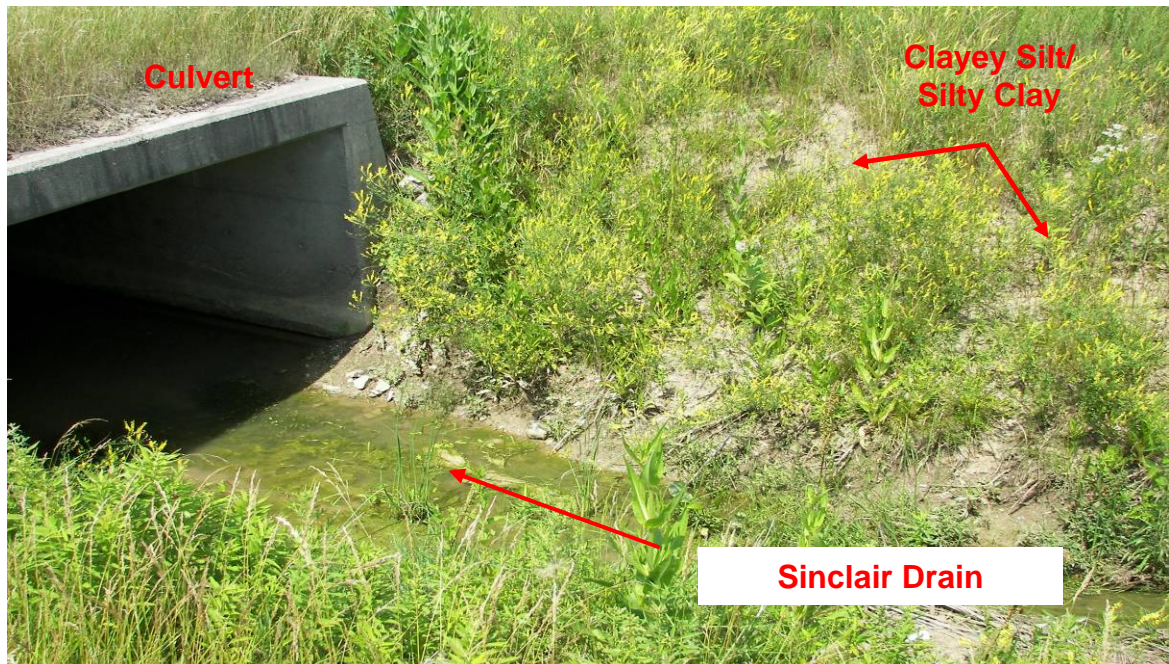


**PHOTOGRAPH 1-28:** Queen's Line Interchange. Looking east from southwest corner of deck of underpass structure. Note flat terrain of St. Clair Clay Plain. E-N/S and N/S-W ramps constructed on shallow embankments. Preferred option: Future Highway 401 EBL and WBL and N-W ramp depicted in the photograph. (January 27, 2006)



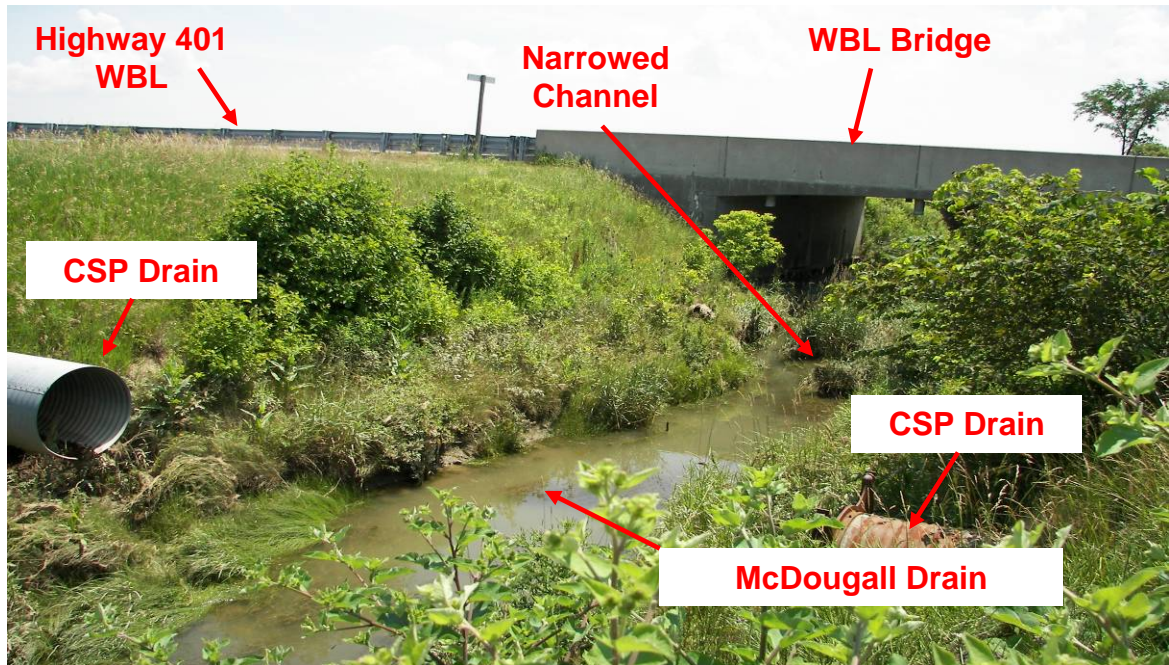


**PHOTOGRAPH 1-29:** Sinclair Drain Culvert. Looking westerly from north roadside ditch of Highway 401 and across top of Sinclair Drain culvert. Note flat terrain of the St. Clair Clay Plain, well grassed roadside ditch. (June 28, 2006)

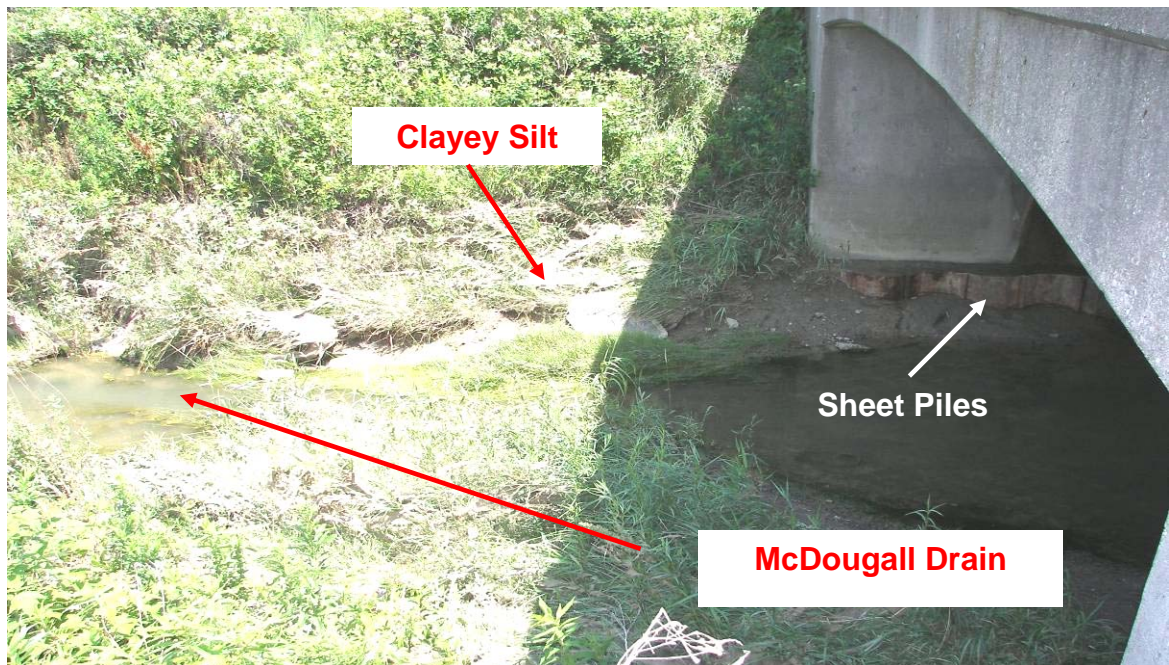


**PHOTOGRAPH 1-30:** Sinclair Drain Culvert. Looking northeasterly at south end of Sinclair Drain Culvert, south of Highway 401. Note open vegetation cover with possible erosion of bank slope, clayey silt/silty clay type soil in bank. (June 28, 2006)





**PHOTOGRAPH 1-31:** McDougall Drain Bridges. Looking southerly from north of Highway 401 west bank of McDougall Drain. View of WBL Bridge. Note grassed over banks of drain, narrowed drainage channel, CSP drains. (June 28, 2006)



**PHOTOGRAPH 1-32:** McDougall Drain Bridges. Close-up of base of east abutment of WBL Bridge. Note top of sheet pile wall, sloughing or sedimentation of channel and clayey silt type soil. (June 28, 2006)





**PHOTOGRAPH 1-33:** McDougall Drain Bridges. Looking east from Highway 401 median west of McDougall Drain channel. Note flat terrain, shallow median ditch and well vegetated side slope of median at channel, soil sloughing at toe of median slope into channel. (June 28, 2006)

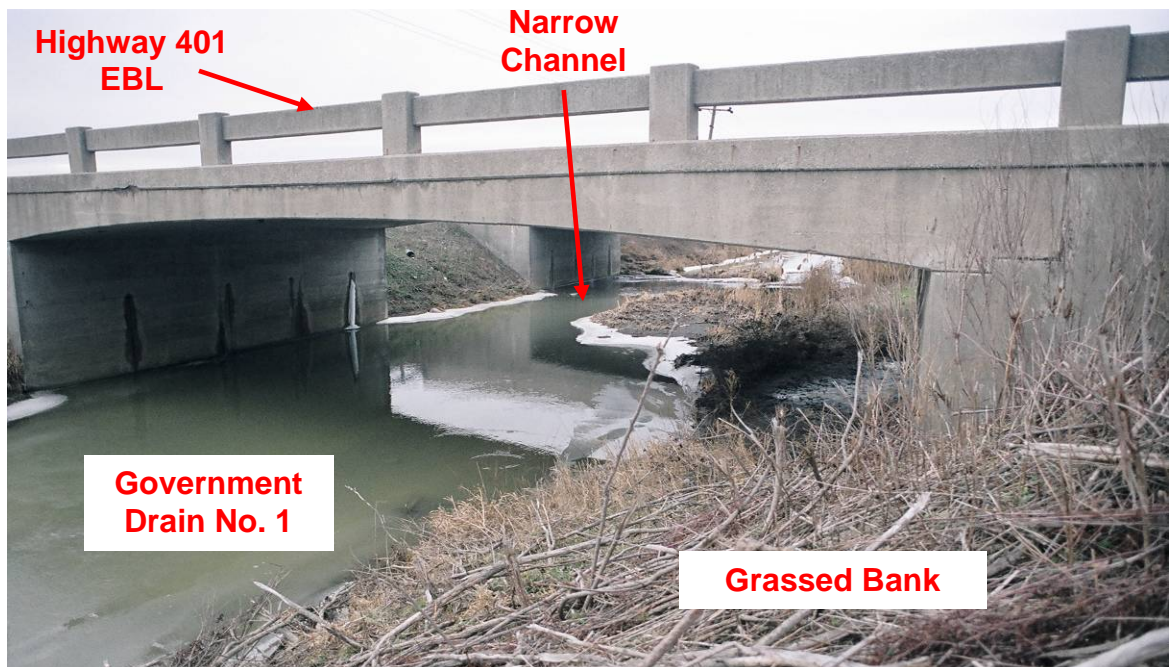


**PHOTOGRAPH 1-34:** McDougall Drain Bridges. Looking easterly from Highway 401 median and along north of EBL Bridge. Note flat terrain of the St. Clair Clay Plain, farmland use temporary barrier wall along inside of bridge side wall. (June 28, 2006)





**PHOTOGRAPH 1-35:** Government Drain No. 1 Bridges. Looking northwesterly from south embankment of Merlin Road Underpass structure. Note flat terrain of the St. Clair Clay Plain, built-up berm south of EBL Bridge for water flow control in roadside ditch. (January 27, 2006)

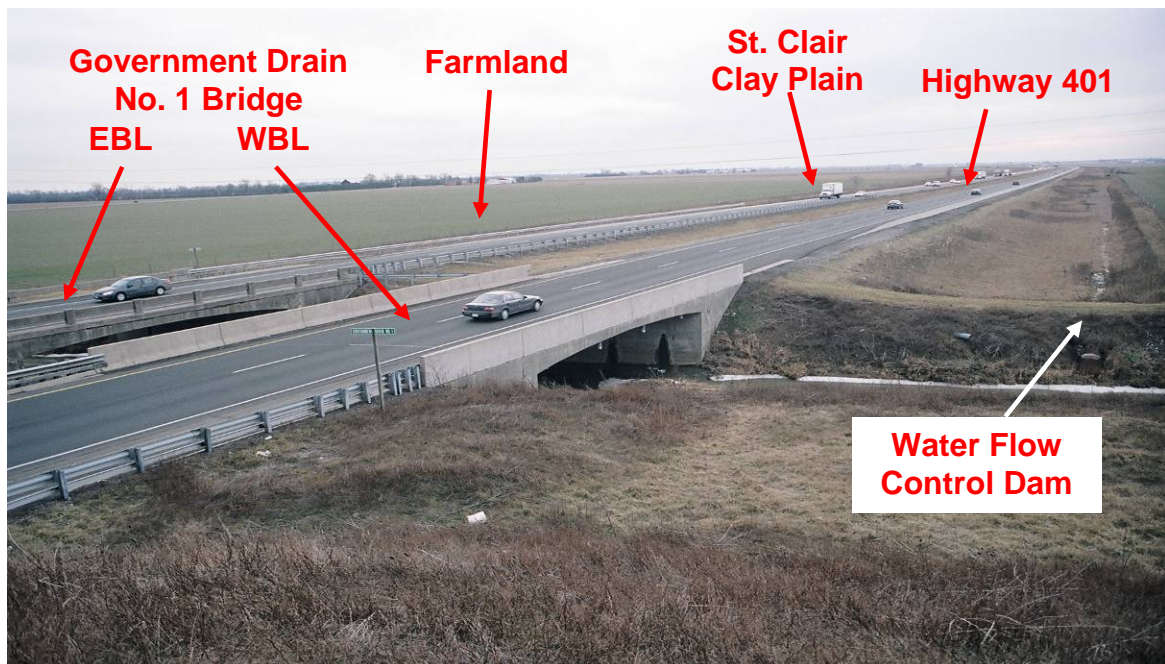


**PHOTOGRAPH 1-36:** Government Drain No. 1 Bridges. Looking northwesterly from east of channel and south of EBL Bridge. Note narrowed channel at median, water flow from weepholes on west abutments and grassed bank in foreground. (January 27, 2006)





**PHOTOGRAPH 1-37:** Government Drain No. 1 Bridges. Looking north from the southeast bank of the EBL Bridge. Note narrowing of drainage channel due to sloughing of soil from Highway 401 median and siltation against the east abutments. (January 27, 2006)



**PHOTOGRAPH 1-38:** Government Drain No. 1 Bridges. Looking southwesterly from north approach embankment of Merlin Road. Note flat terrain of the St. Clair Clay Plain, farming landuse, low Highway 401 embankment and stormwater flow control near channel. (January 27, 2006)



## **APPENDIX B**

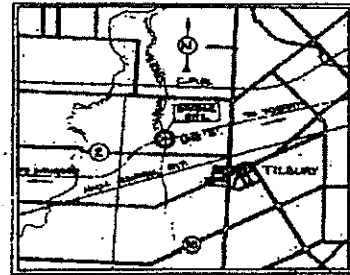
### **Previous Soil Data and Records of Boreholes**

- (1) Contract Drawings for WP 160-58 (Tilbury Creek Bridge No. 2 EBL and WBL)
- (2) Foundation Investigation Report for WP 160-58 (Tilbury Creek Bridge No. 2 EBL and WBL)
- (3) Contract Drawings for WP 161-58 (Queen Street Overpass)
- (4) Foundation Investigation Report for WP 161-58 (Queen Street Overpass)
- (5) Contract Drawings for WP 162-58 (Little Baptiste Creek Bridge)
- (6) Foundation Investigation Report for WP 162-58 (Little Baptiste Creek Crossing)
- (7) Contract Drawings for WP 164-58 (Baptiste Creek Bridges)
- (8) Foundation Investigation Report for WP 164-58 (Baptiste Creek Crossing)
- (9) Contract Drawings for WP 165-58 (Queen's Line Underpass)
- (10) Foundation Investigation Report for WP 165-58 (Queens Line Underpass)
- (11) Contract Drawings for WP 9-59 (McDougall Drain Bridges)
- (12) Foundation Investigation Report for WP 9-59 (McDougall Drain Bridges)
- (13) Contract Drawings for WP 10-59 (Government Drain No. 1 Bridges)
- (14) Foundation Investigation Report for WP 10-59 and 69-59 (Government Drain No. 1 Bridges and Merlin Road Underpass)
- (15) Foundation Investigation Report for WP 89-67-00 (Government Drain No. 1 Bridge at Highway 2, North of Highway 401)
- (16) Contract Drawings for Contract No. 78-55 (General data only - no additional soil data)
- (17) Contract Drawings for Contract No. 97-43 (General data only - no additional soil data)

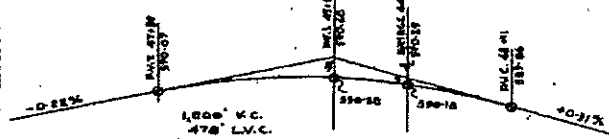


- (1) Contract Drawings for Tilbury North Township Bridge No. 2 (Tilbury Creek Bridge No. 2 EBL and WBL), WP 160-58, TWP 105-50-1-A and 2-A by De Leuw Cather & Company of Canada Limited, dated June 1960.



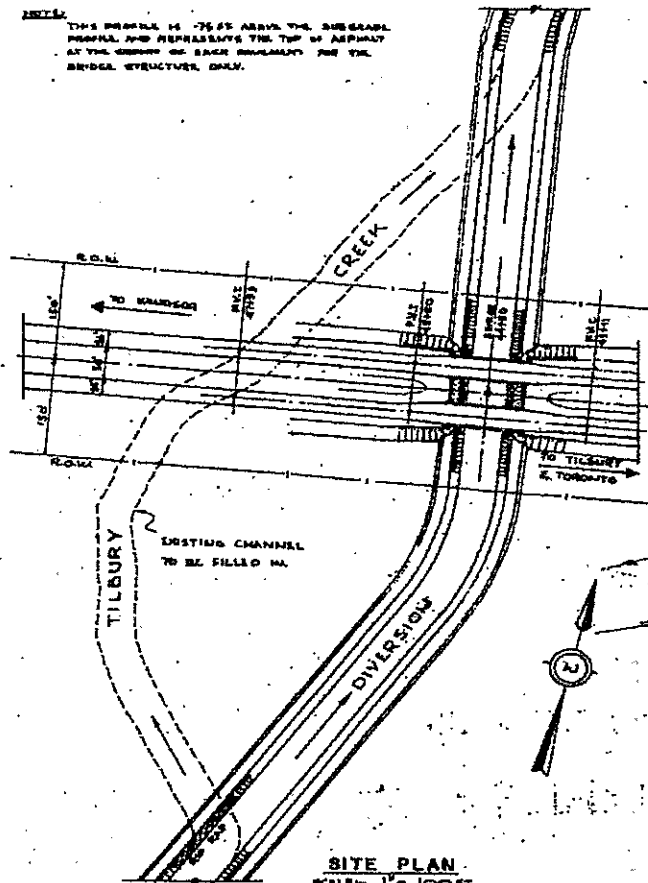


LOCATION PLAN  
SCALE: 1" = 1 MILE

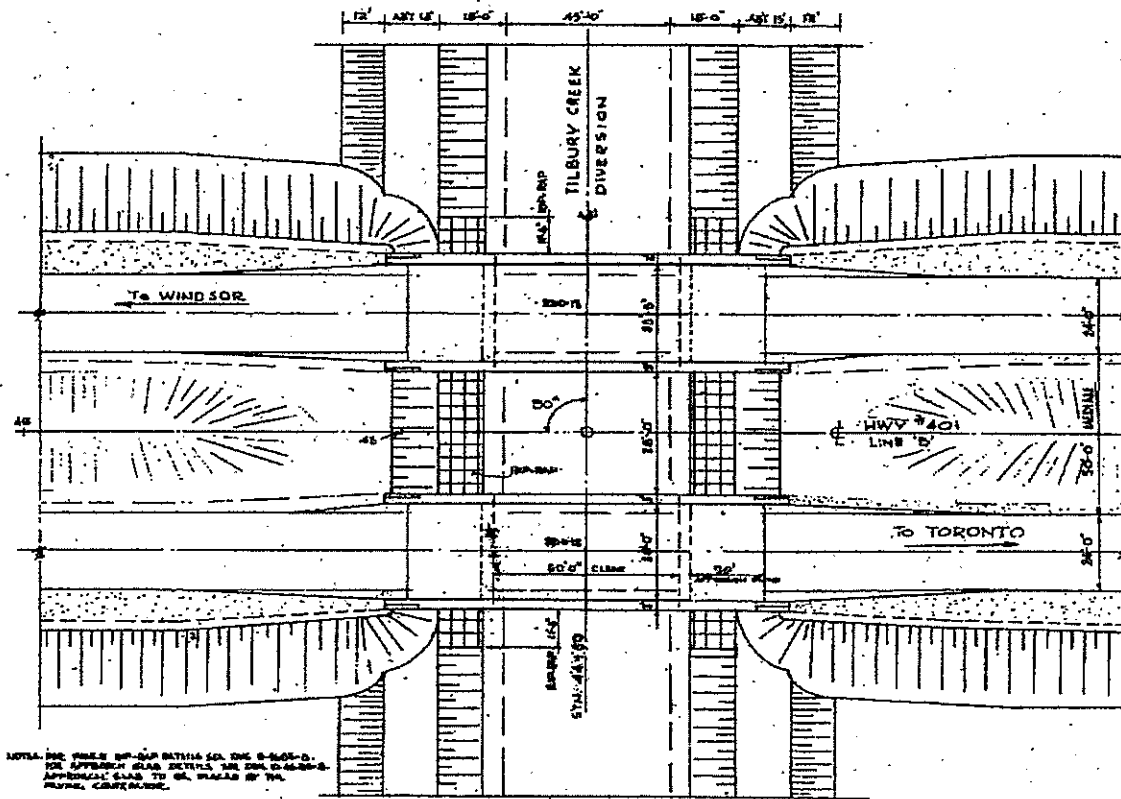


FINISHED CROWN PROFILE ALONG HWY. 401  
SCALE: HORIZONTAL 1" = 100 FT. VERTICAL 1" = 10 FT.

NOTE: THIS PROFILE IS 75 FT. ABOVE THE MEAN SEA LEVEL. THE ELEVATION OF THE TOP OF ASPHALT AT THE CENTER OF EACH DIVERSION FOR THE BRIDGE STRUCTURE ONLY.

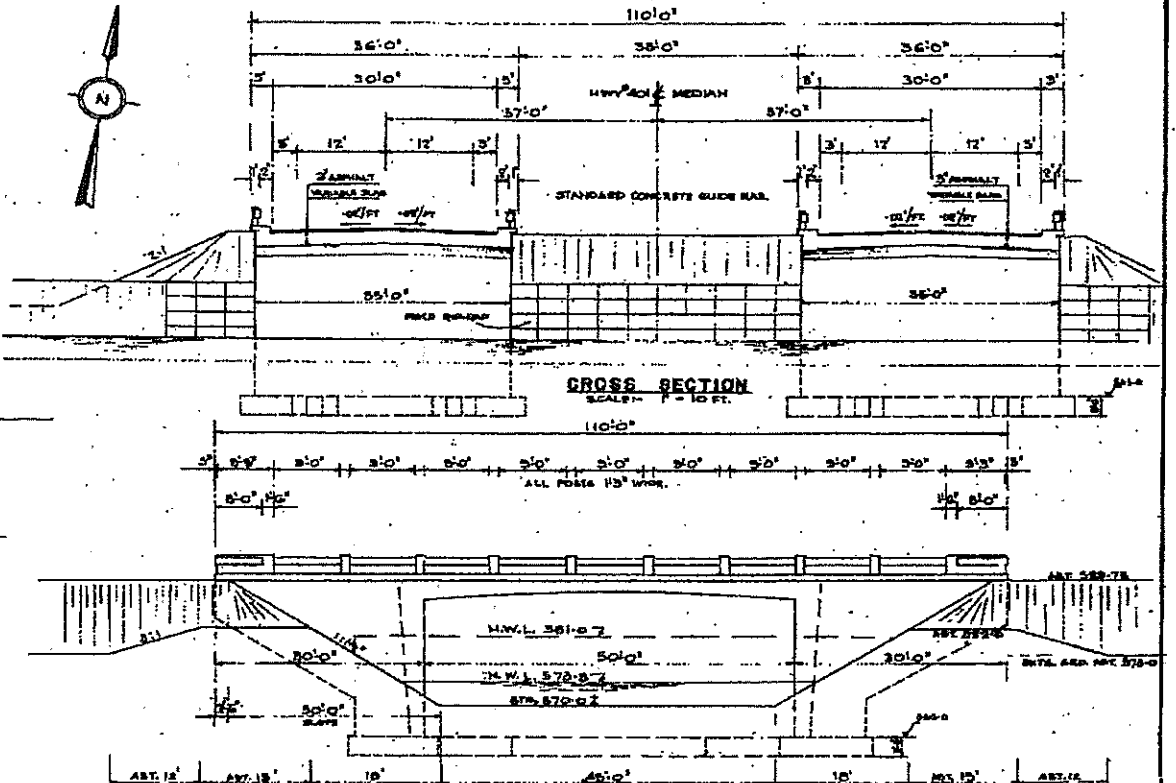


SITE PLAN  
SCALE: 1" = 100 FT.



PLAN  
SCALE: 1" = 20 FT.

NOTE: THE CROWN OF THE BRIDGE SHALL BE 5'-0" ABOVE THE MEAN SEA LEVEL. THE ELEVATION OF THE TOP OF ASPHALT AT THE CENTER OF EACH DIVERSION FOR THE BRIDGE STRUCTURE ONLY.



ELEVATION  
SCALE: 1" = 10 FT.

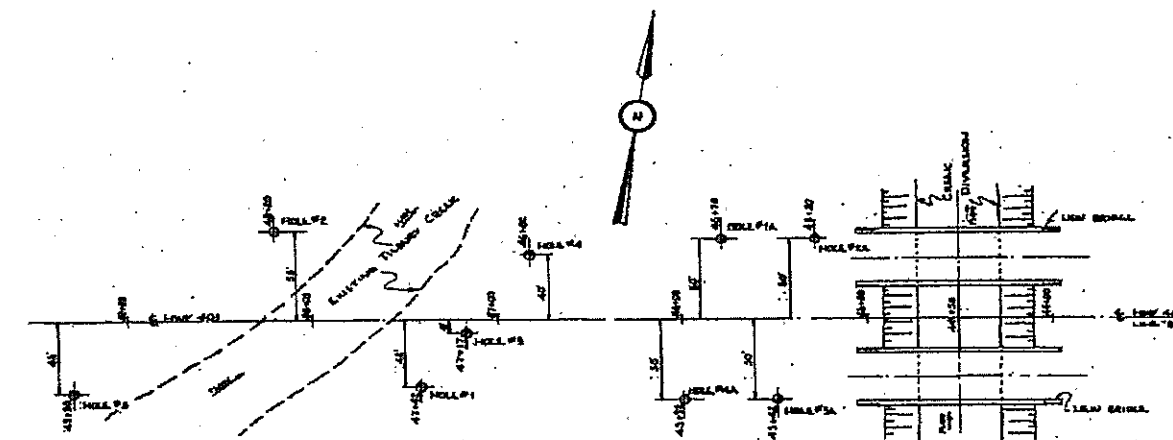
#### GENERAL NOTES:

- These drawings are to be read in conjunction with the Specifications.
- Concrete work on this structure shall not be commenced until all necessary permits have been obtained from the District Engineer.
- Structure to be built in accordance with Form No. 3, and the Special Provisions, unless otherwise noted on the drawings.
- The complete and detailed Report may be obtained from the District Engineer, Department of Highways, Toronto. The Engineer does not guarantee the accuracy of the Report or the design shown on drawings No. 2-4488-2.
- All reinforcement to be high bond bars (if high grade steel unless noted otherwise).
- Cover to reinforcement to be as follows (unless otherwise noted on drawings):  
1" where concrete is less than 4" thick;  
2" elsewhere (bottom, sides, and top of deck, where noted to be 1 1/2").
- All concrete to be placed and compacted to a density of 140 p.c.f. with 1 1/2" max. aggregate.
- All concrete to be placed, and handling to be of 140 p.c.f. density with 1 1/2" max. aggregate.
- Accessories to be added as directed by the District Engineer & District Engineer.
- All materials to be furnished in accordance with the Specifications.
- All exposed edges to have a 1/4" x 1/4" chamfer unless otherwise noted.
- No construction joints other than those shown on the drawings to be permitted without the approval of the Engineer.
- Center line of deck (if any) are for deck line definition. The Contractor shall make allowance for deflection of beams and for settlement of footings.
- When beams and abutments are in place and frame deck and sidewalks have been placed and cured for 14 days. The concrete pavement supporting slabs.
- The bridge to be placed with deck slabs in place.
- Backfill to be carried up continuously at both abutments.

WP 160-58	
DE LEINW CATHIE & COMPANY OF CANADA LIMITED CONSULTING ENGINEERS TORONTO	
DEPARTMENT OF HIGHWAYS-ONTARIO BRIDGE OFFICE-TORONTO	
TILBURY NORTH TWP. BRIDGE NO. 2 TILBURY CREEK	
THE BRIDGE NUMBER IS: 201	DATE: MAY 1, 1950
DR. ENGINEER	DR. ENGINEER
TWP. TILBURY NORTH	DATE: MAY 1, 1950
GENERAL ARRANGEMENT	
APPROVED: <i>[Signature]</i>	
DATE: JUNE 1950	

TWP 105-50-1-A

SOIL BOREHOLES																	
L101		L102		L103		L104		L105		L101A		L102A		L103A		L104A	
DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION	DEPTH	DESCRIPTION
0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3	0	SURFACE EL. 578-3
0	TOPSOIL	0	TOPSOIL	0	TOPSOIL	0	TOPSOIL	0	TOPSOIL	0	TOPSOIL	0	TOPSOIL	0	TOPSOIL	0	TOPSOIL
5	STIP. BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY	5	CLAY TILL - BRN. MUDY CLAY
10		10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY	10	CLAY TILL - BRN. MUDY CLAY
20		20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY	20	CLAY TILL - BRN. MUDY CLAY
30		30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY	30	CLAY TILL - BRN. MUDY CLAY
40		40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY	40	CLAY TILL - BRN. MUDY CLAY
50		50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY	50	CLAY TILL - BRN. MUDY CLAY
60		60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY	60	CLAY TILL - BRN. MUDY CLAY
70		70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY	70	CLAY TILL - BRN. MUDY CLAY
80		80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY	80	CLAY TILL - BRN. MUDY CLAY
90		90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY	90	CLAY TILL - BRN. MUDY CLAY
100		100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY	100	CLAY TILL - BRN. MUDY CLAY
110		110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY	110	CLAY TILL - BRN. MUDY CLAY
120		120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY	120	CLAY TILL - BRN. MUDY CLAY



BOREHOLE LOCATION PLAN  
SCALE: 1" = 40'-0"

NOTE: FOR INFORMATION PURPOSES ONLY  
THE COMPLETE SOIL INVESTIGATION REPORT IS A-555-A-5-5  
AND IS AVAILABLE AT THE BRIDGE OFFICE, DHD-ADMINISTRATION  
BUILDING, COMPTON ST. ST. CATHARINES, ONT. L9A 5K6  
ACCURACY OF THE REPORT.

WP-160-68	
DE LEW CATHAR & COMPANY OF CANADA LIMITED CONSULTING ENGINEERS TORONTO	
DEPARTMENT OF HIGHWAYS-ONTARIO BRIDGE OFFICE-TORONTO	
TILBURY NORTH TWP. BRIDGE #2 TILBURY CREEK	
THE BRIDGE NUMBER IS 401	FILE NO. 1
ON. DISTRICT	LOV. NO.
TOWN OF TILBURY NORTH	CONTRACT NO.
BOREHOLES	
APPROVED: <i>[Signature]</i>	
DATE: July 1968	

WP-160-68  
A-555-A-5-5



- (2) Foundation Investigation Report for Foundation Conditions at the Tilbury Creek Crossing Highway 401 (Tilbury Creek Bridge No. 2 EBL and WBL), WP 160-58 prepared by H.G. Acres & Company Limited, dated December 15, 1959, Geocres No. 40J8-21.

## DRILLING REPORT

[illegible]



H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS  
NIAGARA FALLS, CANADA

DRILLING REPORT

CLIENT Department of Highways of Ontario

JOB No. 837

PROJECT Hwy 401 and Tilbury Creek Crossing

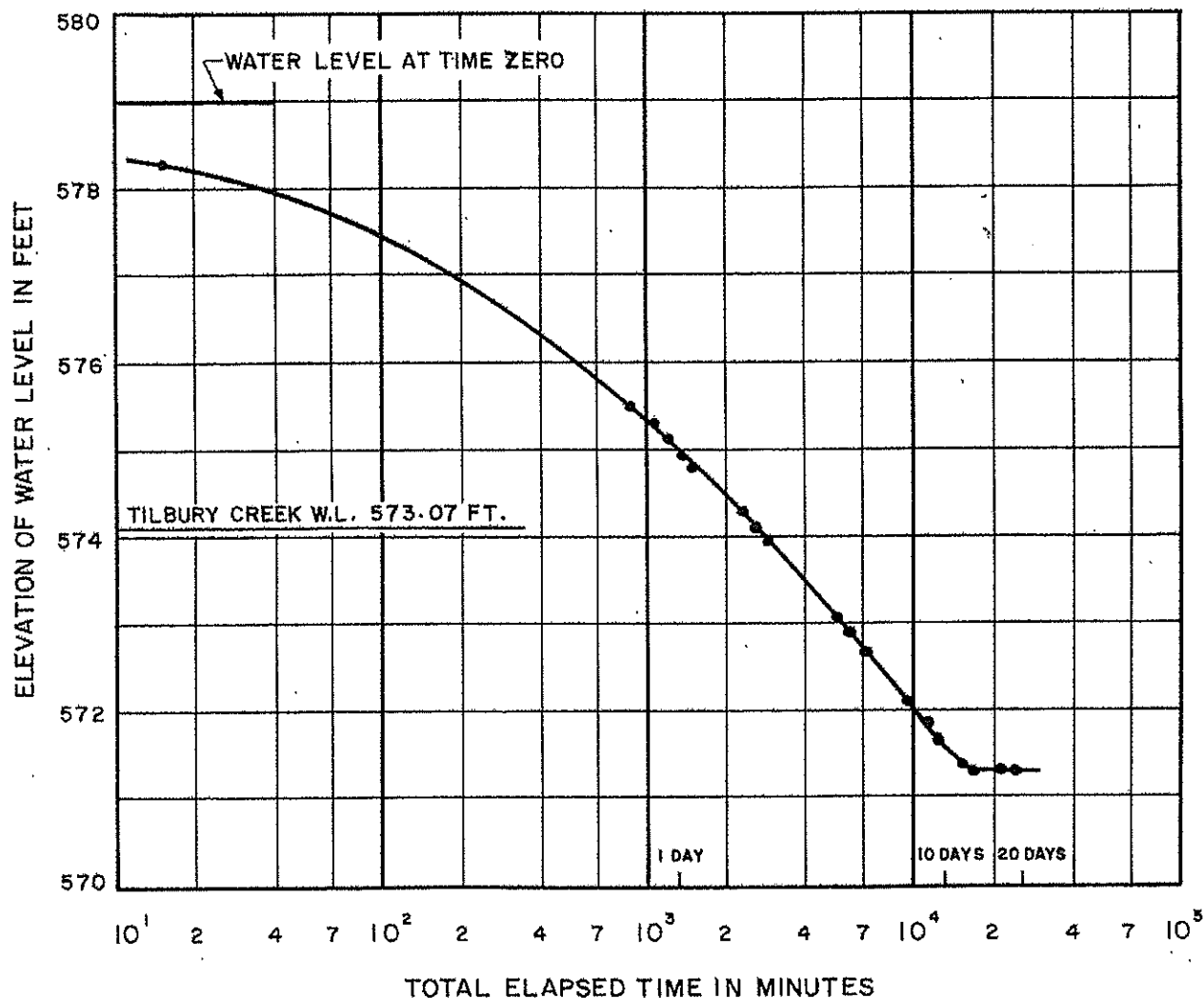
HOLE No. 1-B

SITE Tilbury Creek, Ontario

SHEET No. 2 OF 2

Date	Time	Total Elapsed Time in Minutes	Elevation of Water Level in Piezometer Tube
September 14, 1959	1730	0	578.97
September 14, 1959	1745	15	578.26
September 15, 1959	800	870	575.51
September 15, 1959	1100	1,050	575.30
September 15, 1959	1315	1,185	575.09
September 15, 1959	1535	1,325	574.91
September 15, 1959	1728	1,438	574.78
September 16, 1959	745	2,295	574.28
September 16, 1959	1200	2,550	574.12
September 16, 1959	1730	2,880	573.97
September 18, 1959	815	5,205	573.09
September 18, 1959	1730	5,760	572.89
September 19, 1959	730	6,600	572.68
September 21, 1959	800	9,510	572.15
September 22, 1959	1200	11,190	571.84
September 23, 1959	800	12,390	571.66
September 25, 1959	730	15,270	571.39
September 26, 1959	700	16,650	571.30
September 29, 1959	800	21,030	571.34
September 30, 1959	800	22,470	571.32
October 1, 1959	1200	24,150	571.34

NOTE: Ground surface elevation 578.97



NOTE:

MEASUREMENTS WERE STARTED ON SEPT. 14, 1959 AT 1730 HOURS.

WATER LEVEL AT TIME ZERO WAS EL. 578.97 FT.

H. G. ACRES & COMPANY, LIMITED  
CONSULTING ENGINEERS  
NIAGARA FALLS CANADA

DEPARTMENT OF HIGHWAYS OF ONTARIO  
HWY. 401 AND TILBURY CREEK CROSSING

ELEVATIONS OF WATER LEVEL  
IN PIEZOMETER TUBE, HOLE 1B

APPROVED

DATE: DEC. 11, 1959

*D. H. Macdonald*  
H.G. ACRES & COMPANY LTD.

SCALE JOB No. 837

PLATE - II C

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT Department of Highways of Ontario JOB No. 837  
 PROJECT Hwy 401 and Tilbury Creek Crossing HOLE No. 2-B  
 SITE Tilbury Creek, Ontario SHEET No. 1 OF 2  
 CONTRACTOR: F.E. Johnston Drilling Co. Ltd. STARTED 5:00 p.m. September 11 19 59  
 FINISHED 2:30 p.m. September 19 19 59  
 METHOD OF DRILLING: SOIL Wash Boring CASING DIAM. 4 inch  
 ROCK Diamond drill CORE DIAM. AXT  
 LOCATION: LATITUDE CH 48+ 20 ELEVATIONS: DATUM G.S.C.  
 DEPARTURE 55.0 Ft Right DRILL PLATFORM -  
 BEARING - GROUND SURFACE 579.4  
 INITIAL DIP 90 degrees ROCK SURFACE 490.6  
 OTHER DIPS - BOTTOM OF HOLE 485.6  
 WATER TABLE 573

DEPTH	SOIL TYPE	DESCRIPTION: COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTION, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION
			NO.	TYPE	SIZE	DEPTH	RET'D	
0					Inches	Feet	Feet	
	Topsoil	Dark grey to black, very dry with shrinkage cracks, contains well rounded pebbles and occasional boulders	1	CO	3	5.0	1.0	Tapped
				Vane	Test	7.0		Tapped
				Vane	Test	8.0		Tapped
2.0			2	CO	3	10.0	1.5	Tapped
	Clay till	Brown with grey streaks, weathered, fissured, but not stratified, contains angular pebbles		Vane	Test	13.5		Tapped
				Vane	Test	15.0		Pushed
14.0			3	CO	3	16.0	1.5	Pushed
	Clay till	Grey with brown streaks, stiff, weathered, not stratified, contains angular pebbles, water content increasing with depth		Vane	Test	18.5		Pushed
			4	CO	3	20.0	1.5	Pushed
				Vane	Test	23.5		Pushed
20.0				Vane	Test	24.5		Pushed
	Clay till	Grey with brown streaks, firm, slightly weathered, not stratified, contains angular pebbles	5	CO	3	25.0	1.5	Tapped
			6	CO	3	28.0	1.5	Pushed
28.0				Vane	Test	30.0		Pushed
	Clay till	Grey, unweathered, firm but remoulds to soft clay, contains pebbles as above	7	CO	3	31.5	1.5	Pushed

**SAMPLING METHOD**

A — SPLIT TUBE  
 B — THIN WALL TUBE  
 C — PISTON SAMPLER  
 D — CORE BARREL

E — AUGER  
 F — WASH

**SHIPPING CONTAINER**

N — INSERT  
 O — TUBE  
 P — WATER CONTENT TIN  
 Q — GLASS JAR

R — CLOTH BAG  
 S — PLIOFILM BAG  
 Z — DISCARDED

INSPECTOR G. Wilson

LOGGED BY G. Wilson

APPROVED D. H. MacDonald

DATE

December 11, 1959

Plate III A

## DRILLING REPORT

JOB No. 837

HOLE No. 24B

SHEET No. 2 OF 2

Plate III



**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT Department of Highways of Ontario JOB No. 837  
 PROJECT Hwy 401 and Tilbury Creek Crossing HOLE No. 3-B  
 SITE Tilbury Creek, Ontario SHEET No. 1 OF 2  
 CONTRACTOR: F.E. Johnston Drilling Co. Ltd. STARTED 7:00 a.m. September 21, 1959  
 FINISHED 5:30 p.m. September 25, 1959  
 METHOD OF DRILLING: SOIL Wash Boring CASING DIAM. 4 inch  
 ROCK --- CORE DIAM. ---  
 LOCATION: ~~LATITUDE~~ CH 47+17 ELEVATIONS: DATUM G.S.C.  
 DEPARTURE 8.0 Feet Left DRILL PLATFORM ---  
 BEARING --- GROUND SURFACE 576.9  
 INITIAL DIP 90 degrees ROCK SURFACE 458.9  
 OTHER DIPS --- BOTTOM OF HOLE 458.9  
 WATER TABLE ---

DEPTH	SOIL TYPE	DESCRIPTION: COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION #49
			NO.	TYPE *	SIZE	DEPTH	RET'D	
0					Inches	Feet	Feet	
	Topsoil	Dark grey, very stiff, fissured		Vane	Test	5.8		Pushed
2.0								9" only
	Clay till	Brown, very stiff, weathered, fissured, not stratified, contains angular pebbles	14	BO	3	6.5	1.5	Pushed
				Vane	Test	10.0		Pushed
				Vane	Test	15.0		Pushed
13.0								
	Clay till	Grey with some brown streaks, firm, not stratified	15	CO	3	16.5	1.5	Pushed
				Vane	Test	20.0		Pushed
35.0				Vane	Test	25.0		Pushed
	Clay till	Grey, firm to soft, not stratified, contains angular pebbles	16	CO	3	26.5	1.5	Pushed
83.0				Vane	Test	30.0		Pushed
	Stratified clay till and silty sand.	Alternating bands of compact silty sand and soft clay till.		Vane	Test	35.0		Pushed
			17	CO	3	36.6	1.5	Pushed
				Vane	Test	40.0		Pushed
				Vane	Test	45.0		Pushed
			18	CO	3	46.5	1.5	Pushed
118.0								
	Rock			Vane	Test	50.0		Pushed
				Vane	Test	50.0		Pushed

**SAMPLING METHOD**

\* A — SPLIT TUBE      E — AUGER  
 B — THIN WALL TUBE      F — WASH  
 C — PISTON SAMPLER  
 D — CORE BARREL

**SHIPPING CONTAINER**

N — INSERT      R — CLOTH BAG  
 O — TUBE      S — PLIOFILM BAG  
 P — WATER CONTENT TIN      Z — DISCARDED  
 Q — GLASS JAR

INSPECTOR G. Wilson  
 LOGGED BY G. Wilson

APPROVED D. H. MacDonald  
 DATE December 11, 1959  
 Plate IYA

H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS  
 NIAGARA FALLS, CANADA  
**DRILLING REPORT**

CLIENT Department of Highways of Ontario  
 PROJECT Hwy 401 and Tilbury Creek Crossing  
 SITE Tilbury Creek, Ontario

JOB No. 837  
 HOLE No. 3-B  
 SHEET No. 2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION: COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION
			NO.	TYPE	SIZE	DEPTH	RET'D	
					Inches	Feet	Feet	
	Note:	At depth of 118 feet, struck very hard formation which was either bedrock or boulder lying on bedrock	19	CO	3	56.5	1.5	Pushed
				Vane Test		60.0		Pushed
				Vane Test		65.0		Pushed
		Very strong natural gas supply blew all water from the casing Pressure dropped gradually with time but further drilling was made impossible	20	CO	3	66.5	1.5	Pushed
				Vane Test		70.0		Pushed
				Vane Test		75.0		Pushed
		No water was lost or gained	21	BO	3	76.5	1.5	Pushed
		Hole was sealed with cement and soil		Vane Test		83.0		Tapped but no penetration
			22	AR	2	83.0	0.5	92 blows
						to 84.5		140-lb hammer falling 30"

Plate IVB

## DRILLING REPORT

LOCATION:	<u>LATITUDE</u>	CH 49+ 30	ELEVATIONS:	DATUM	G.S.C.
	<u>DEPARTURE</u>	45.0 Feet Left		DRILL PLATFORM	---
	<u>BEARING</u>	--		GROUND SURFACE	577.4
	<u>INITIAL DIP</u>	90 degrees		ROCK SURFACE	464.4
	<u>OTHER DIPS</u>	--		BOTTOM OF HOLE	452.4
				WATER TABLE	565-

R - CLOTH BAG  
S - PLIOFILM BAG  
Z - DISCARDED

DATE December 11, 1964

## DRILLING REPORT

LOCATION:	<del>LATITUDE</del>	CH 47+42	ELEVATIONS:	DATUM	G.S.C.
	DEPARTURE	42.0 Feet Left		DRILL PLATFORM	---
	BEARING	---		GROUND SURFACE	576.8
	INITIAL DIP	90 degrees		ROCK SURFACE	459.8
	OTHER DIPS	---		BOTTOM OF HOLE	459.8
				WATER TABLE	571

FORM NO. 91-A



# DRILLING REPORT

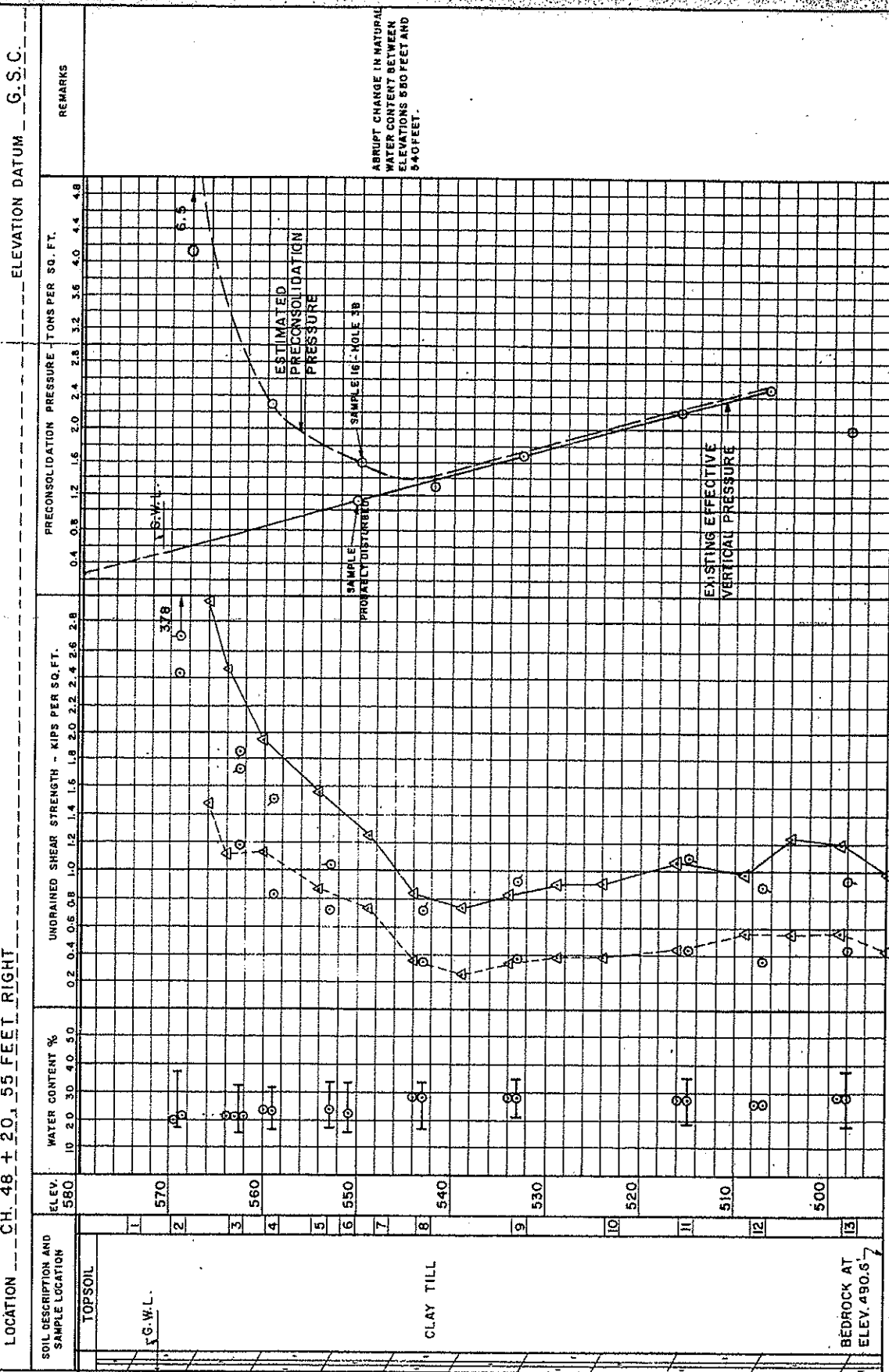
WATER TABLE 571

Plate VII

H.G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS NIAGARA FALLS CANADA

# SUMMARY OF DRILLING & TEST RESULTS

CLIENT --- DEPARTMENT OF HIGHWAYS OF ONTARIO  
PROJECT --- HIGHWAY 401 AND TILBURY CREEK CROSSING  
SITE --- TILBURY CREEK, ONTARIO  
JOB NO. 837  
HOLE NO. 2B  
SHEET 1 OF 1  
LOCATION --- CH. 48 + 20.55 FEET RIGHT  
ELEVATION DATUM G.S.C.



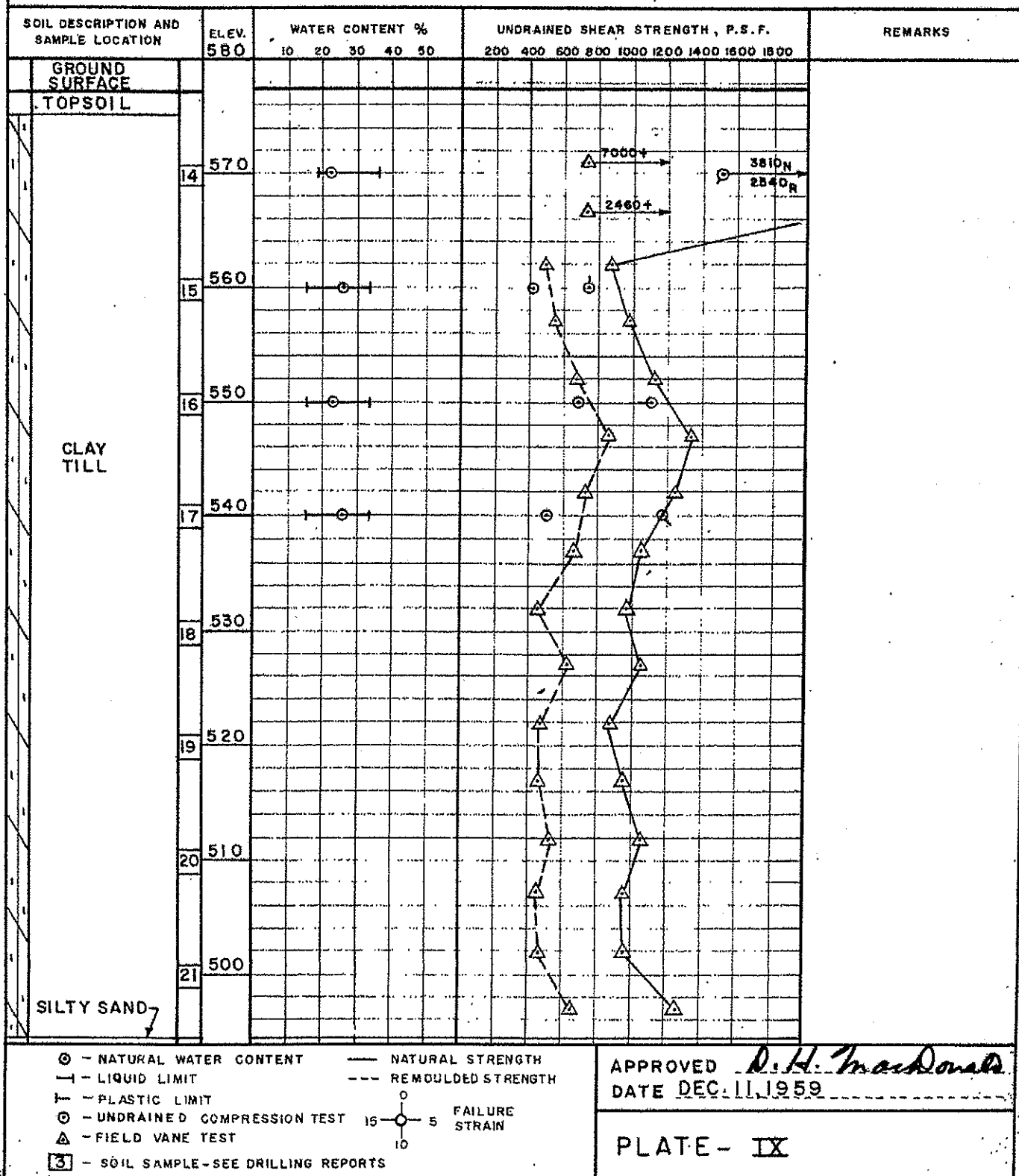
APPROVED *D.H. Macdonald*  
DATE DEC. 11, 1959  
PLATE VII

LEGEND:  
○ NATURAL WATER CONTENT  
△ FIELD VANE TEST  
○ UNDRAINED COMPRESSION TEST  
○ SOIL SAMPLE - SEE DRILLING REPORTS  
— LIQUID LIMIT  
— PLASTIC LIMIT  
○ FAILURE STRAIN  
— NATURAL STRENGTH  
— REMOULDED STRENGTH

ABRUPT CHANGE IN NATURAL  
WATER CONTENT BETWEEN  
ELEVATIONS 560 FEET AND  
540 FEET.

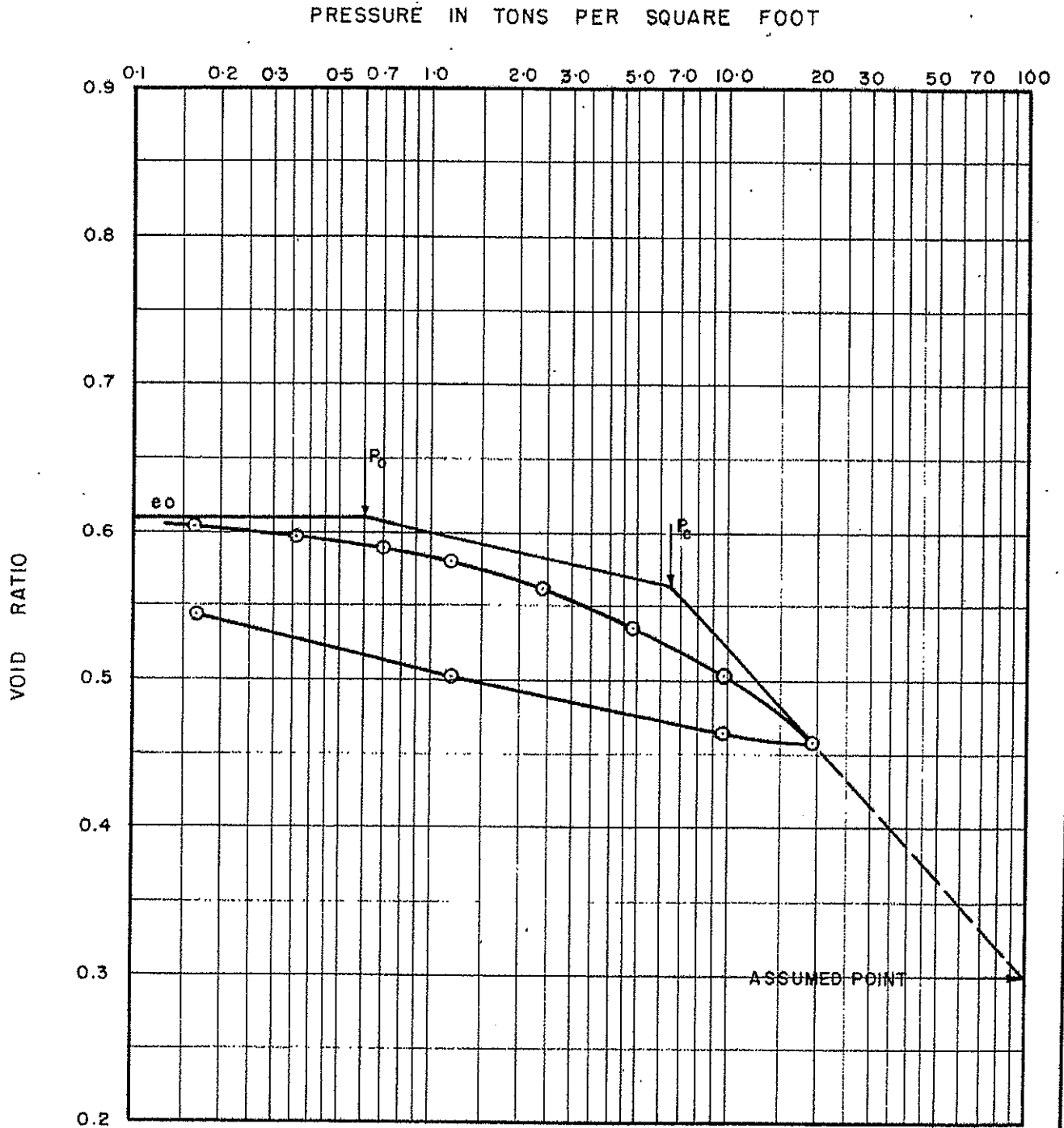
H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS NIAGARA FALLS CANADA  
**SUMMARY OF DRILLING & TEST RESULTS**

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO JOB NO. 837  
PROJECT HWY. 401 & TILBURY CREEK CROSSING HOLE NO. 3B  
SITE TILBURY CREEK, ONTARIO SHEET NO. 1 OF 1  
LOCATION CH. 47 + 17, 8.0 FEET LEFT ELEVATION DATUM G.S.C.



H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS NIAGARA FALLS CANADA  
CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO JOB NO. 837  
PROJECT HWY. 401 & TILBURY CREEK CROSSING HOLE NO. 2B  
SITE TILBURY CREEK ONTARIO SAMPLE ELEVATION 569



$P_0$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
LOADING INTERVAL - 25 MIN.

APPROVED D. H. MacDonald  
DATE DEC. 11, 1959

PLATE - X



H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS

NIAGARA FALLS, CANADA

### CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

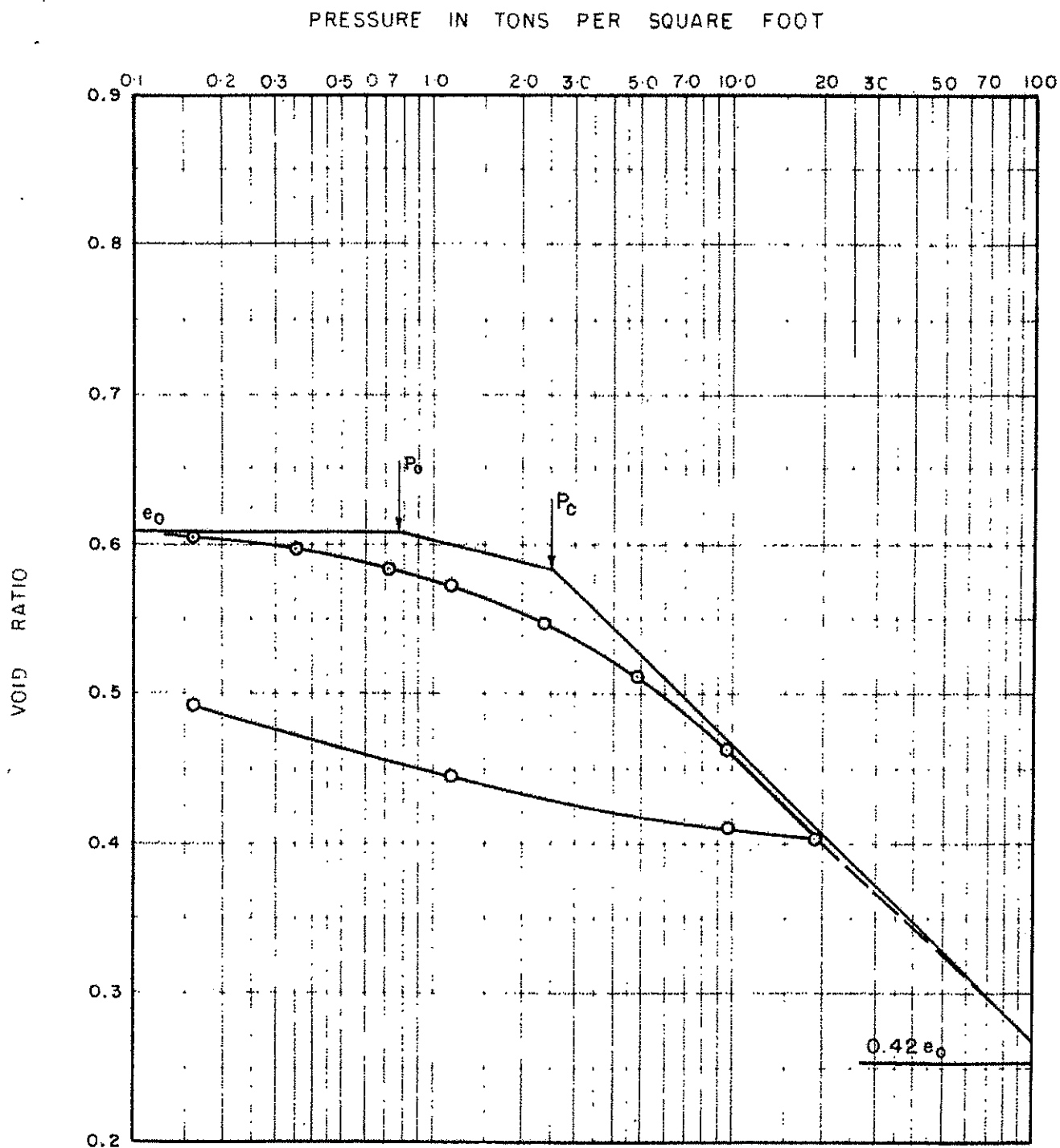
JOB NO 837

PROJECT HWY. 401 & TILBURY CREEK CROSSING

HOLE NO 2B

SITE TILBURY CREEK ONTARIO

SAMPLE ELEVATION 563



$P_0$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
LOADING INTERVAL - 25 MIN.

APPROVED *D. H. MacDonald*  
DATE DEC. 11, 1959

PLATE - XI

H. G. ACRESON COMPANY LIMITED - CONSULTING ENGINEERS

NIAGARA FALLS, CANADA

# CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

TEST NO. 837

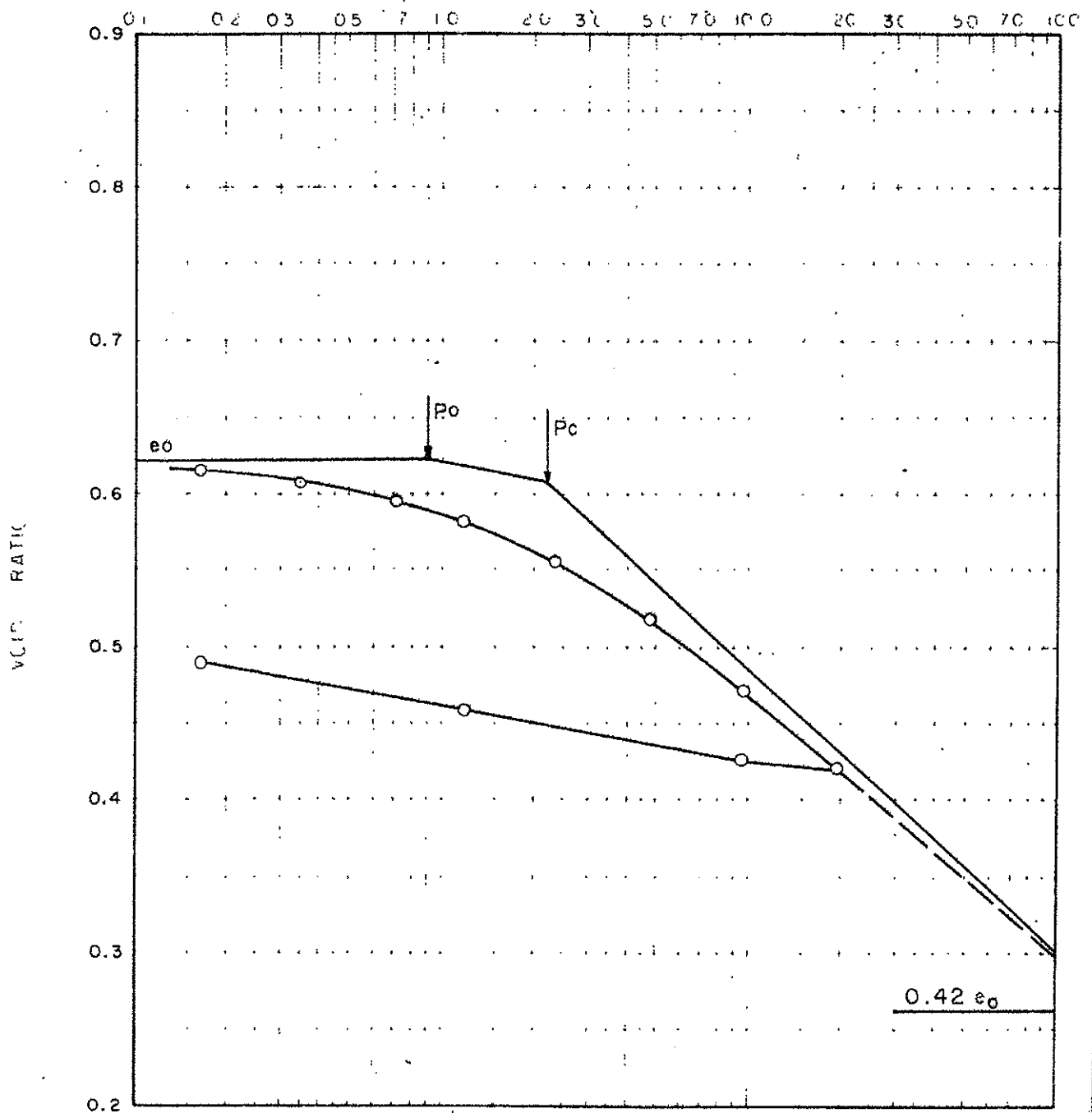
PROJECT HWY. 401 & TILBURY CREEK CROSSING

TEST NO. 2B

SITE TILBURY CREEK ONTARIO

SAMPLE ELEVATION 559

PRESSURE IN TONS PER SQUARE FOOT



$P_0$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
LOADING INTERVAL - 25 MIN.

APPROVED *D. H. MacDonald*  
DATE DEC. 11, 1959

PLATE - XII

H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS

NIAGARA FALLS, CANADA

CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

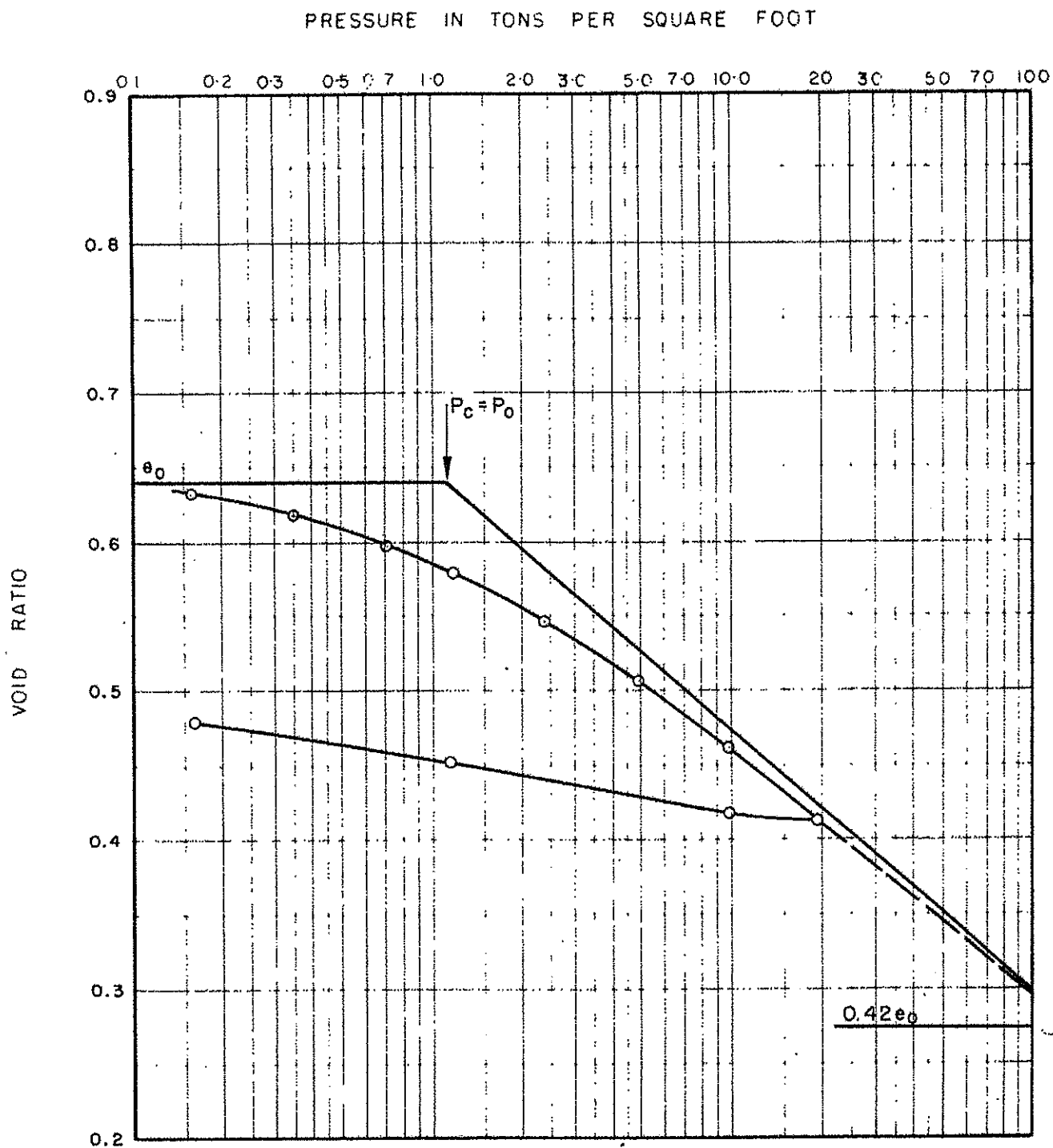
JOB NO 837

PROJECT HWY. 401 & TILBURY CREEK CROSSING

HOLE NO 2B

SITE TILBURY CREEK ONTARIO

SAMPLE ELEVATION 551



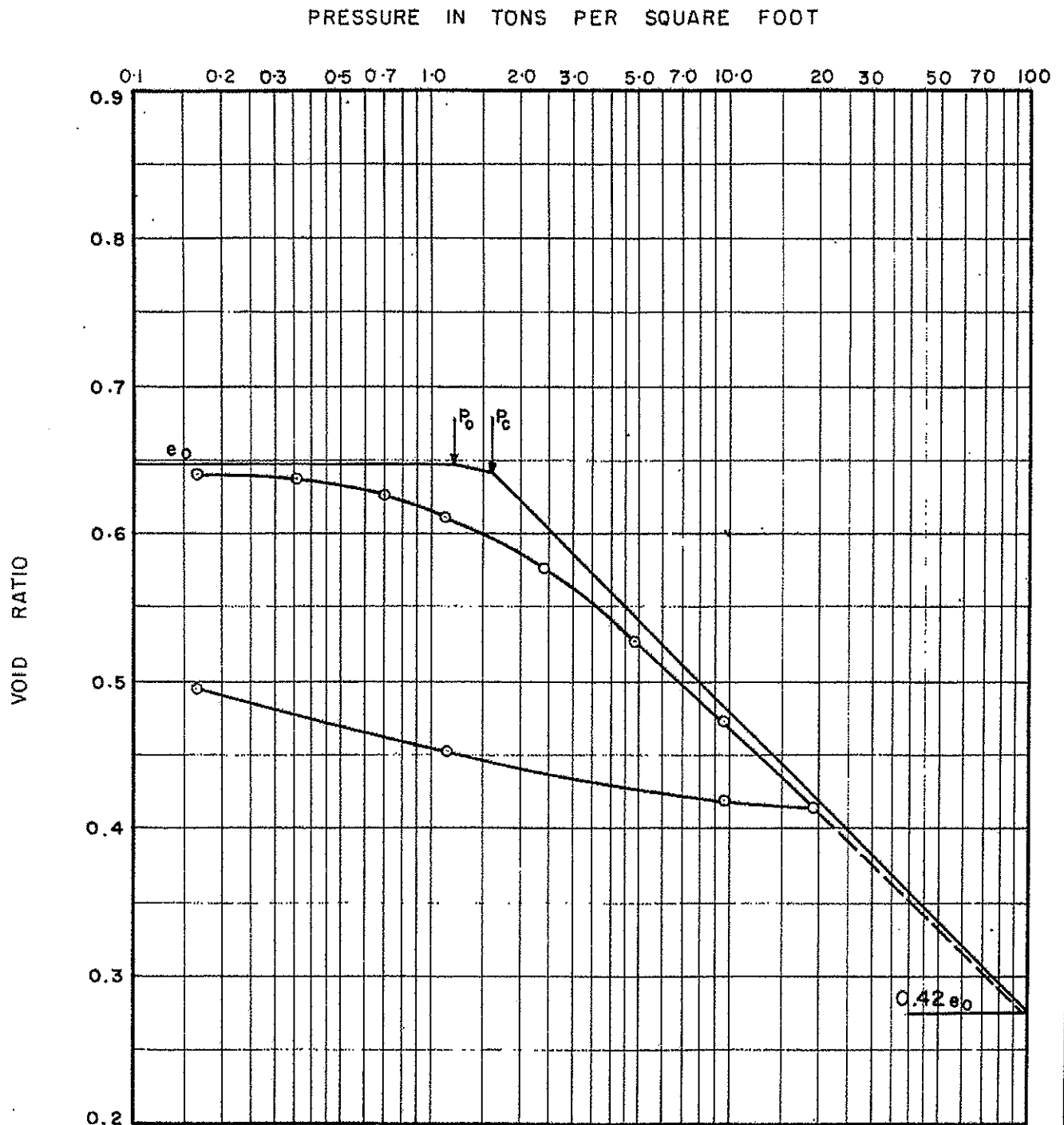
$P_0$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
LOADING INTERVAL - 25 MIN.

APPROVED *D. H. MacDonald*  
DATE DEC. 11, 1959

PLATE - XIII

H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS NIAGARA FALLS CANADA  
CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO JOB NO. 837  
PROJECT HWY. 401 & TILBURY CREEK CROSSING HOLE NO. 3B  
SITE TILBURY CREEK, ONTARIO SAMPLE ELEVATION 550



$P_0$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
LOADING INTERVAL - 25 MIN.

APPROVED A. H. MacDonell  
DATE DEC. 11, 1959

PLATE - XIV



H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS  
 NIAGARA FALLS, CANADA

CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

JOB NO 837

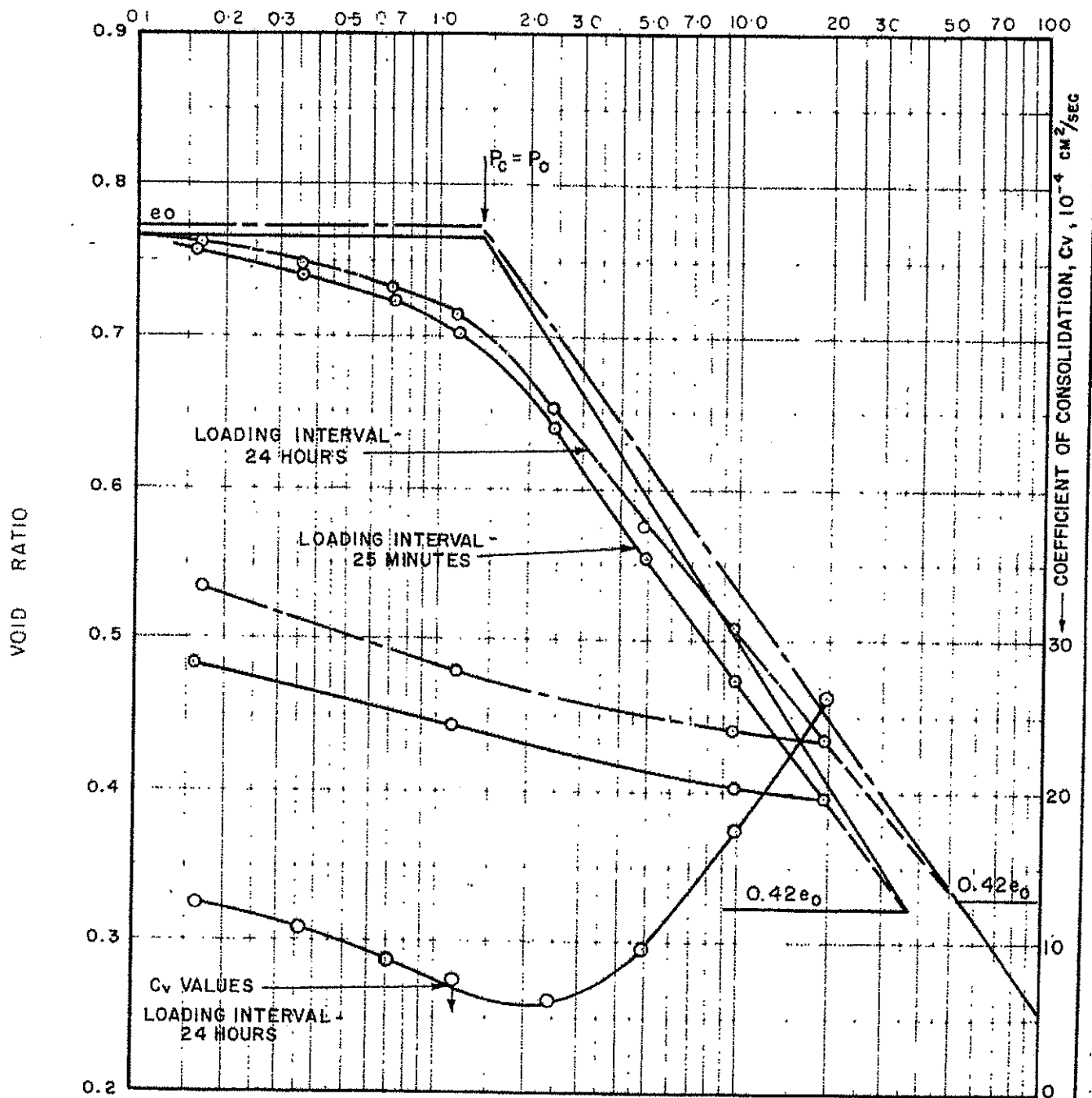
PROJECT HWY. 401 & TILBURY CREEK CROSSING

HOLE NO 2B

SITE TILBURY CREEK ONTARIO

SAMPLE ELEVATION 543

PRESSURE IN TONS PER SQUARE FOOT



$P_0$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
 LOADING INTERVAL - AS NOTED

APPROVED *D. H. MacDonald*  
 DATE DEC. 11, 1959

PLATE - XV

H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS  
NIAGARA FALLS, CANADA

CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

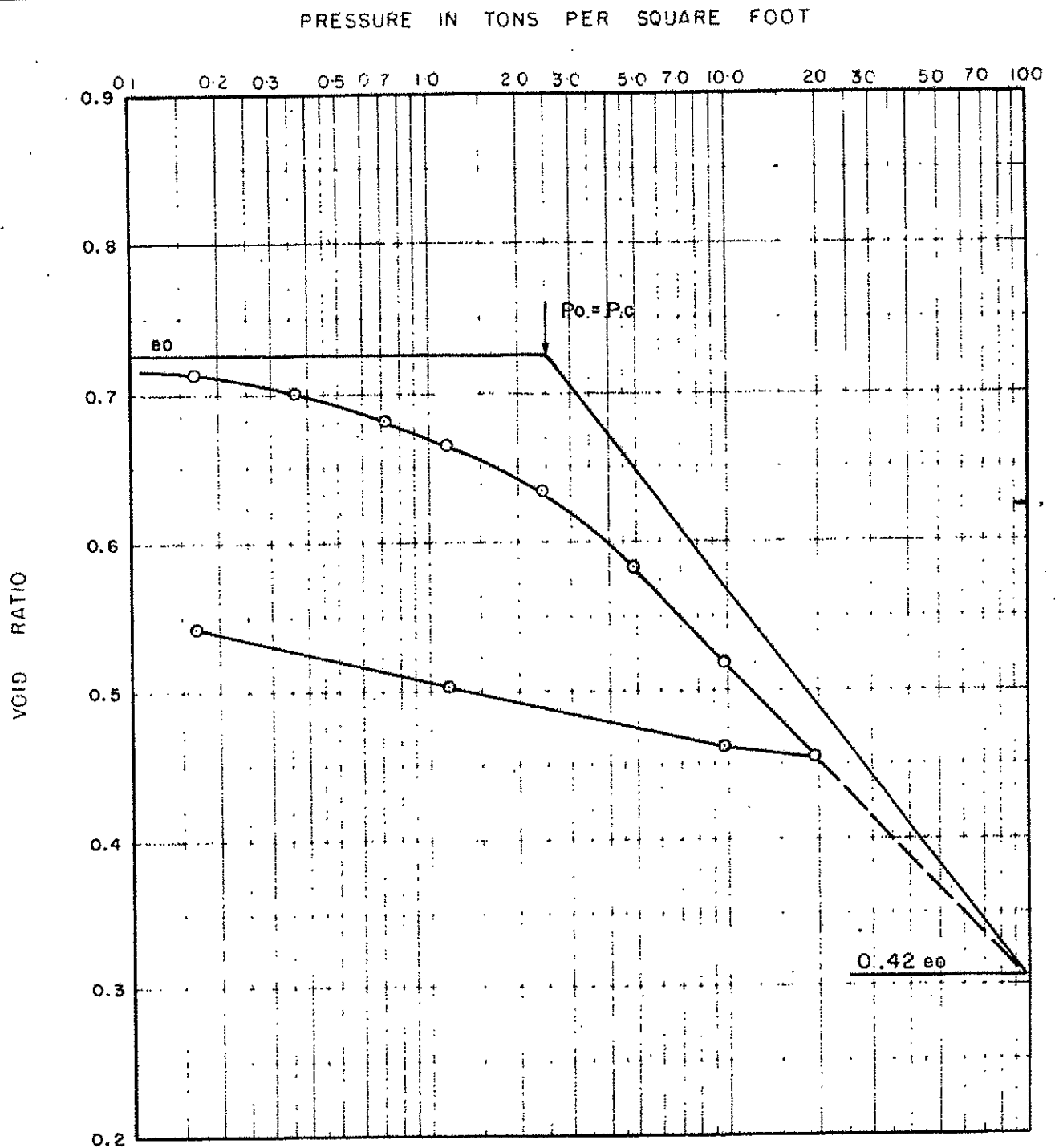
JOB NO 837

PROJECT HWY. 401 & TILBURY CREEK CROSSING

HOLE NO 2B

SITE TILBURY CREEK ONTARIO

SAMPLE ELEVATION 507



$P_o$  - OVERBURDEN PRESSURE  
 $P_c$  - PRECONSOLIDATION PRESSURE  
LOADING INTERVAL-25 MIN.

APPROVED *D. H. MacDonald*  
DATE DEC. 11, 1959

PLATE - XVIII

H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS

NIAGARA FALLS, CANADA

# CONSOLIDATION TEST

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

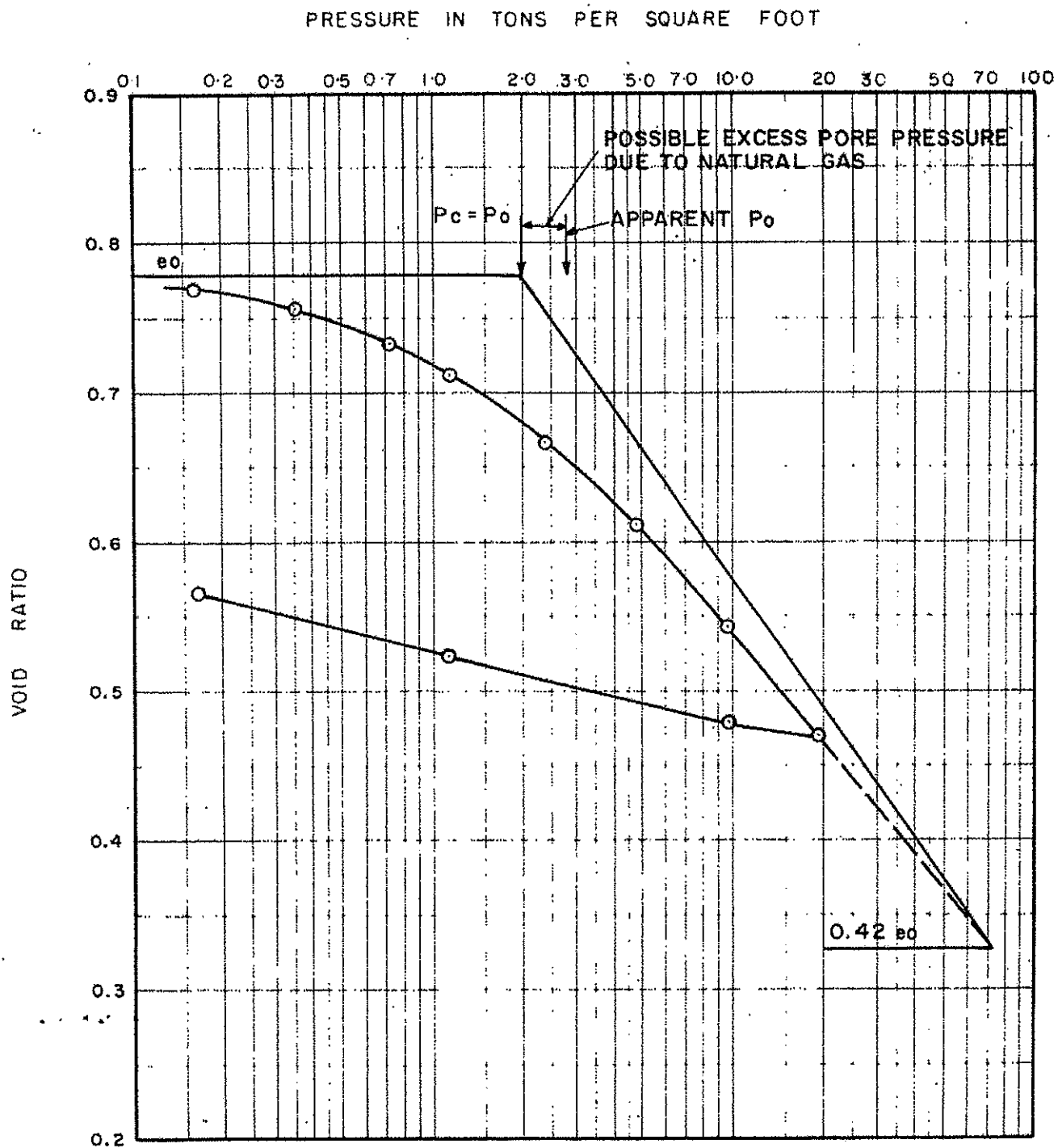
JOB NO. 837

PROJECT HWY. 401 & TILBURY CREEK CROSSING

HOLE NO. 2B

SITE TILBURY CREEK ONTARIO

SAMPLE ELEVATION 498



$P_0$  - OVERBURDEN PRESSURE

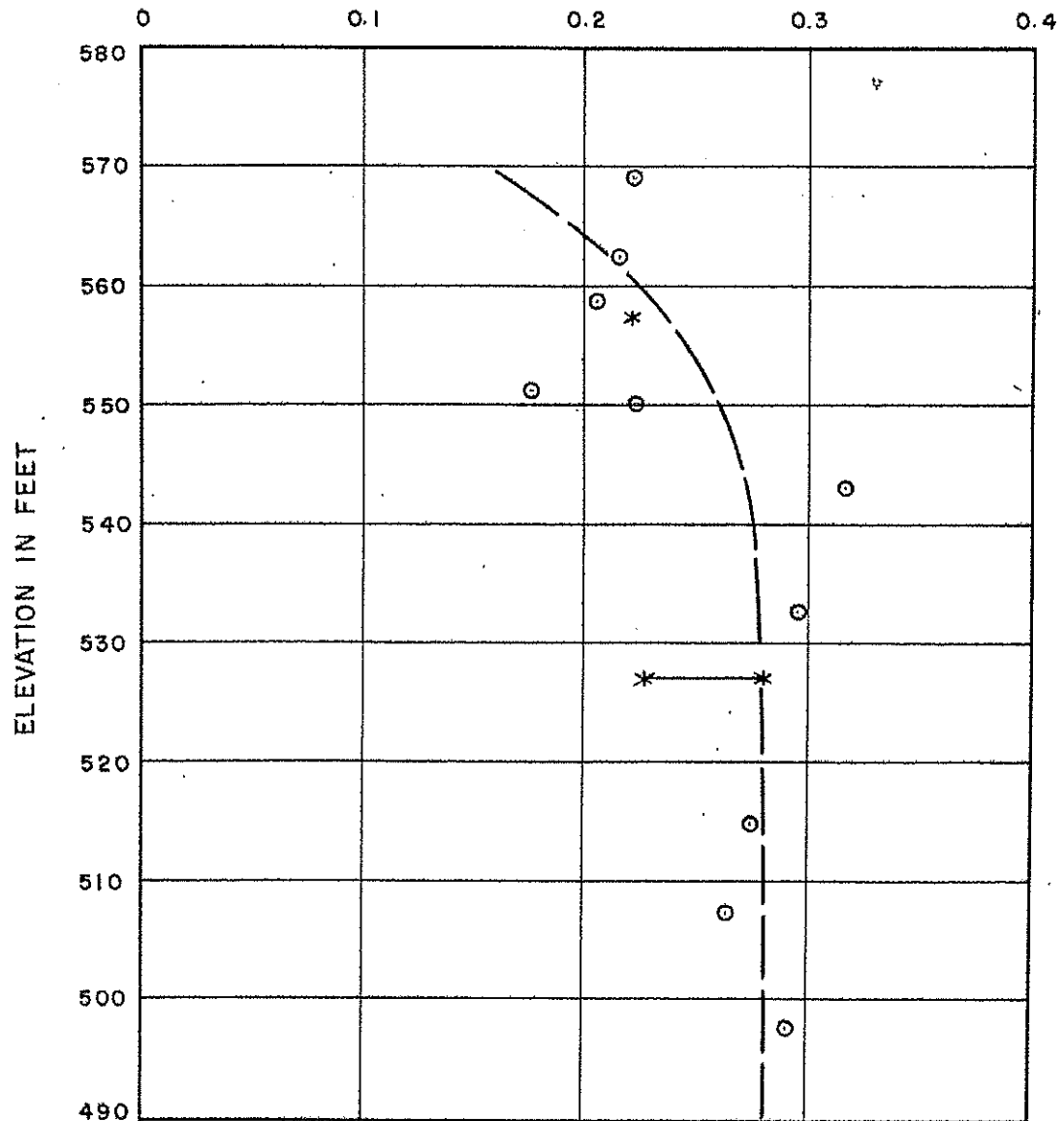
$P_c$  - PRECONSOLIDATION PRESSURE

LOADING INTERVAL - 25 MIN.

APPROVED *D. H. Macdonald*  
DATE DEC. 11, 1959

PLATE - XIX

# COMPRESSION INDEX, $C_c$



$$C_c = \frac{e_0 - e}{\log_{10} \left( \frac{P_0 + \Delta P}{P_0} \right)}$$

## LEGEND:

○-LABORATORY TEST BY ACRES

\*-LABORATORY TEST BY PETO

H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS  
NIAGARA FALLS CANADA

DEPARTMENT OF HIGHWAYS OF ONTARIO

HWY. 401 AND TILBURY CREEK CROSSING

VARIATION OF COMPRESSION  
INDEX WITH DEPTH

APPROVED

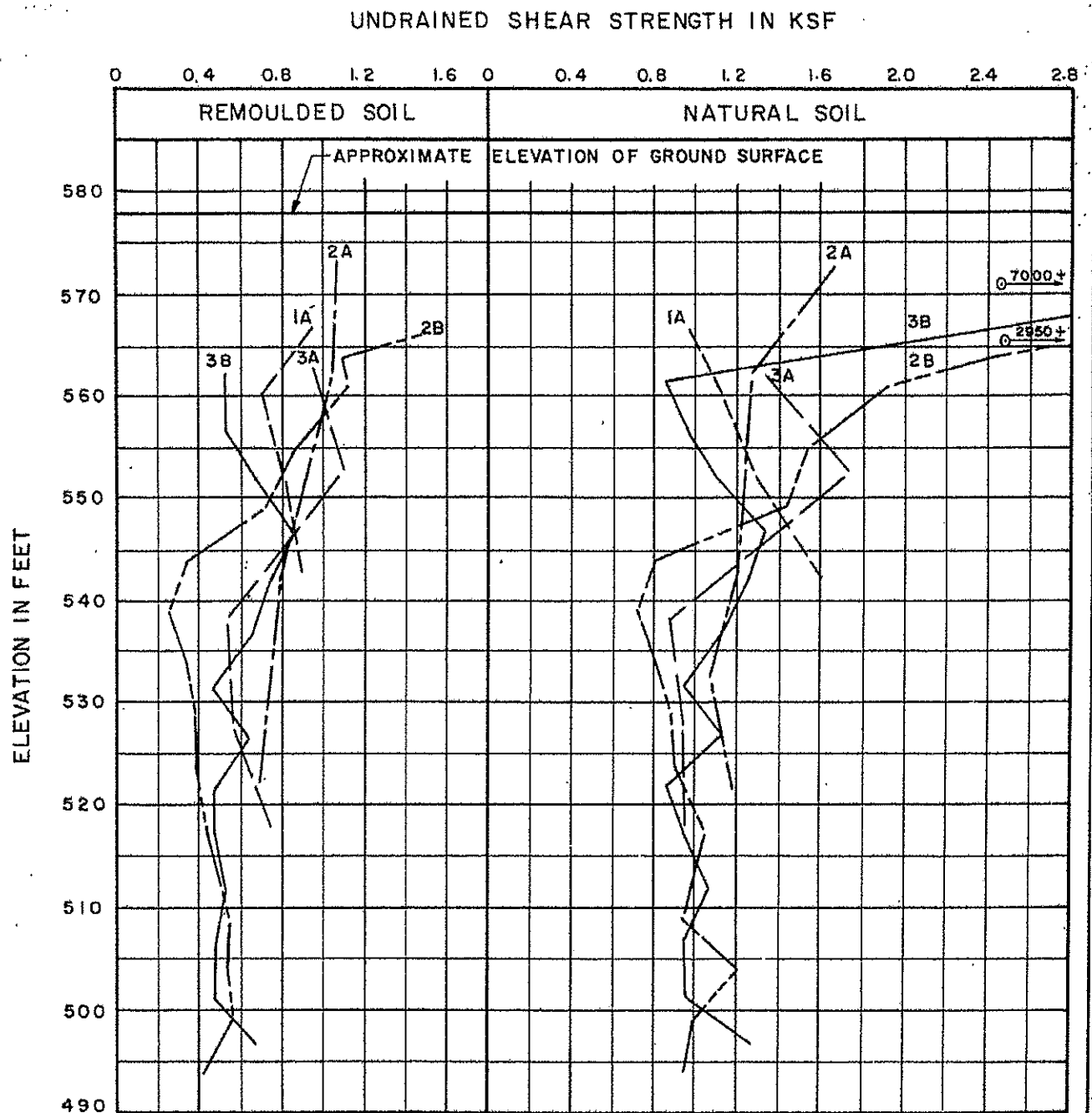
DATE: DEC. 11, 1959

*D. H. MacDonald*  
H. G. ACRES & COMPANY LTD.

SCALE JOB No.  
837

PLATE - XX





**NOTE:**

HOLES No. 1A, 2A, 3A - DEPARTMENT OF HIGHWAYS OF ONTARIO.

HOLES No. 2B, 3B - ACRES

**H. G. ACRES & COMPANY LIMITED**  
CONSULTING ENGINEERS  
NIAGARA FALLS CANADA

DEPARTMENT OF HIGHWAYS OF ONTARIO

HWY. 401 AND TILBURY CREEK CROSSING

**COMPARISON OF RESULTS OF  
FIELD VANE TESTS**

APPROVED

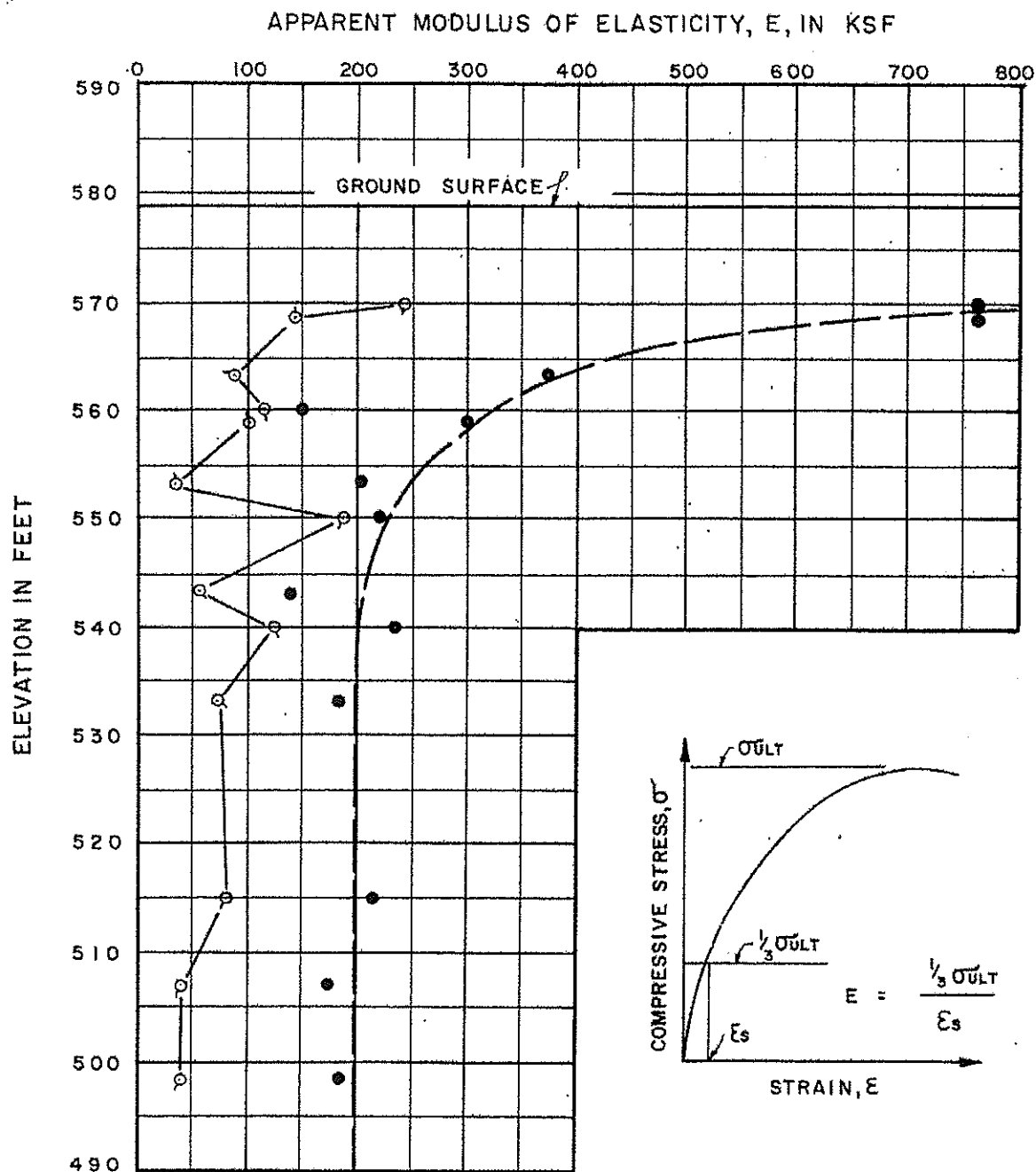
DATE: DEC. 11, 1959

*D. H. McDonald.*

SCALE    JOB No.  
837

H.G. ACRES & COMPANY LTD.

PLATE - XXI



LEGEND:

- LABORATORY TEST RESULT
- CORRECTED LABORATORY TEST RESULT  
ASSUMING STRAIN AT FAILURE TO BE 1.0 %.



OBSERVED FAILURE STRAIN

H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS  
NIAGARA FALLS CANADA

DEPARTMENT OF HIGHWAYS OF ONTARIO

HWY. 401 AND TILBURY CREEK CROSSING

VARIATION OF APPARENT MODULUS  
OF ELASTICITY WITH DEPTH

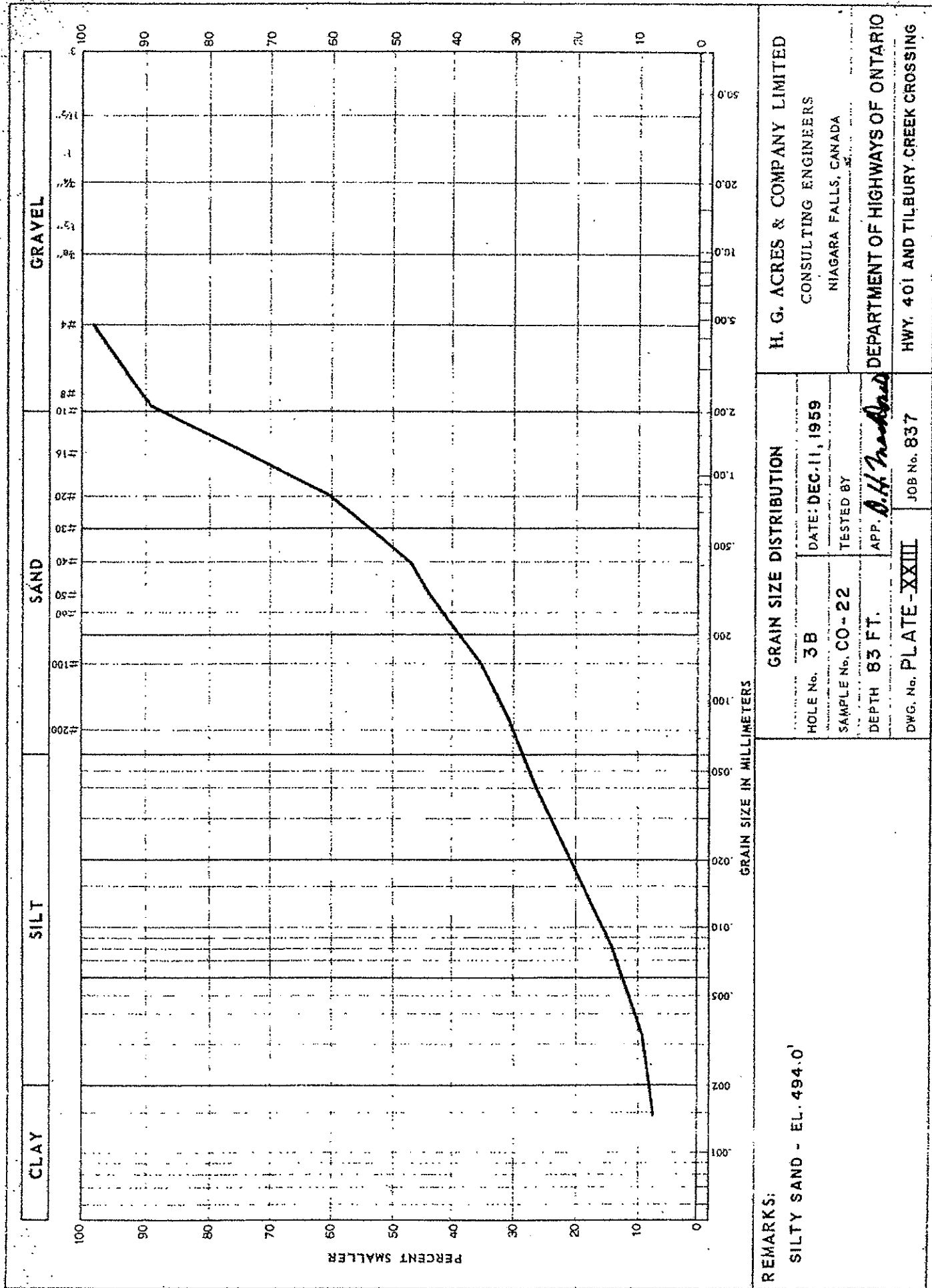
APPROVED

DATE: DEC. 11, 1959

*H. G. Acres*  
H. G. ACRES & COMPANY LTD.

SCALE JOB No.  
837

PLATE - XXII



H. G. ACRES &amp; COMPANY, LIMITED

NIAGARA FALLS, CANADA

GEOTECHNICAL LABORATORY

TRIAXIAL COMPRESSION TEST  
TEST RESULTS

SAMPLE No.

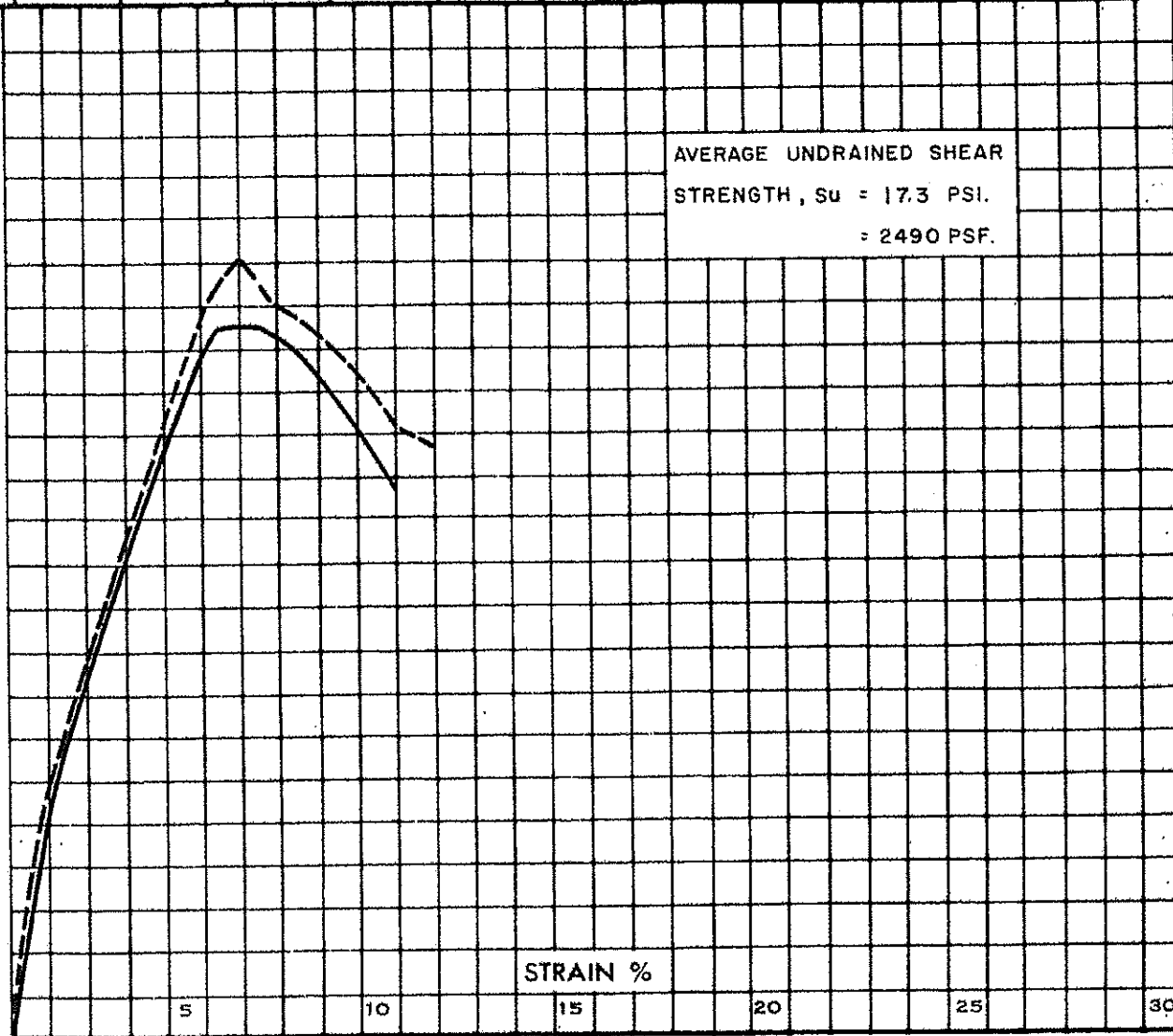
837

HS

I

SAMPLE LOCATION: ROCK GLEN, ARKONA, ONTARIO

TEST No	$\sigma_c$ P.S.I.	$\sigma_3$ P.S.I.	$\epsilon_f$ %	$u_f$ P.S.I.	$\sigma'_{3f}$ P.S.I.	$(\sigma_1 - \sigma_3)_f$ P.S.I.	$\sigma'_{1f}$ P.S.I.	$w_o$ %	$\gamma_{D_o}$ P.C.F.		
12	18	—	25	6.0	—	33.2	—	14.08	123.0		
12	19	—	25	6.0	—	36.1	—	14.06	124.0		

DEVIATOR STRESS,  $(\sigma_1 - \sigma_3)$ , P.S.I.40  
36  
32  
28  
24  
20  
16  
12  
8  
4  
0

STRAIN %

5

10

15

20

25

30

DEPARTMENT OF HIGHWAYS OF ONTARIO

HWY. 401 AND TILBURY CREEK CROSSING

RESULTS OF COMPRESSION TESTS ON  
SAMPLE OF SHALE OUTCROP

APPROVED

DATE: DEC. 11, 1959

*D. H. MacDonald.*

SCALE

JOB No.

837

H.G. ACRES &amp; COMPANY LTD.

PLATE - XXIV



H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS

NIAGARA FALLS, CANADA

### CONSOLIDATION TEST

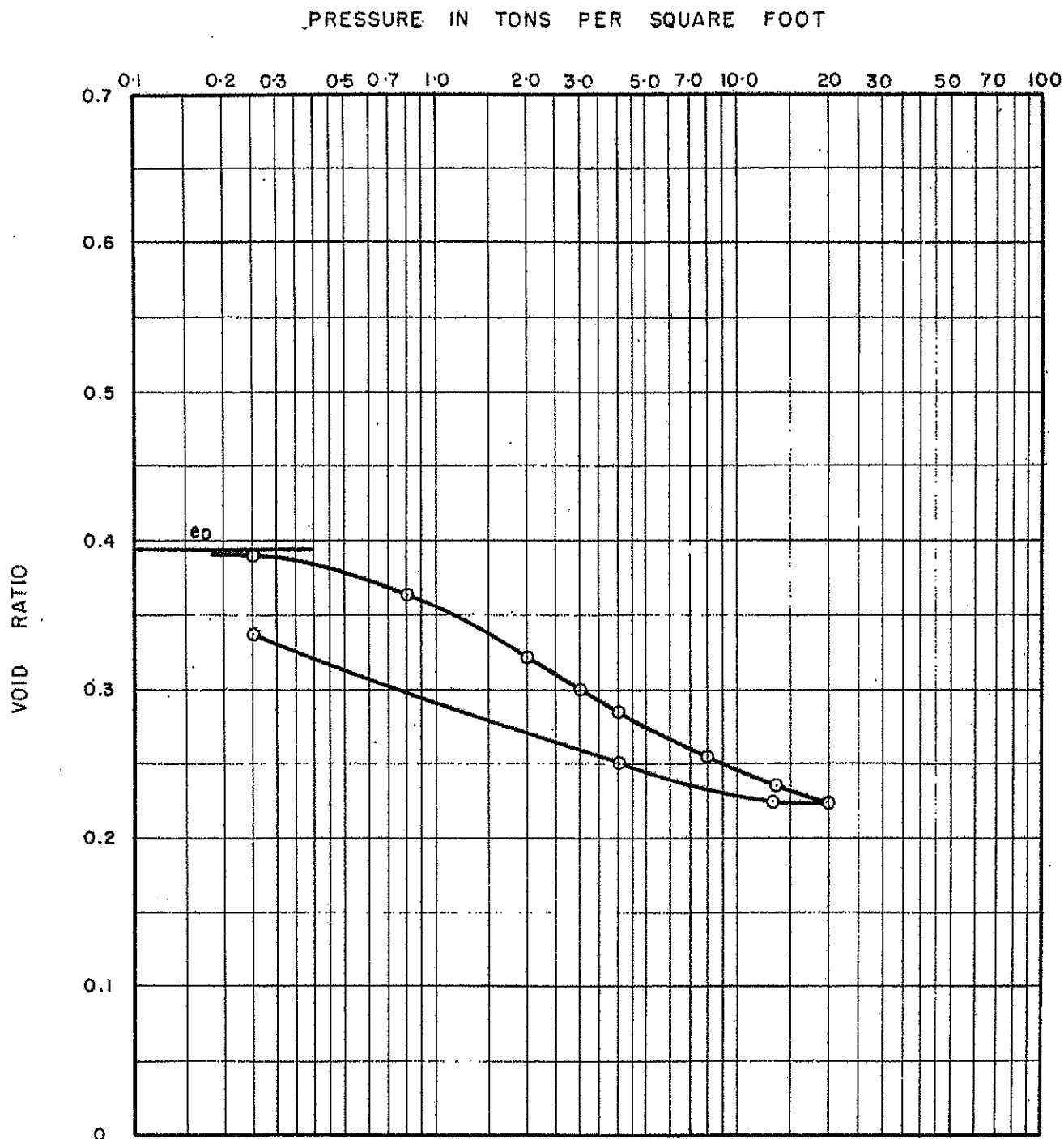
CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO

JOB NO. 837

PROJECT HWY. 401 & TILBURY CREEK CROSSING

HOLE NO.       

SAMPLE LOCATION ROCK GLEN, ARKONA, ONTARIO



$P_0$  - OVERBURDEN PRESSURE

$P_c$  - PRECONSOLIDATION PRESSURE

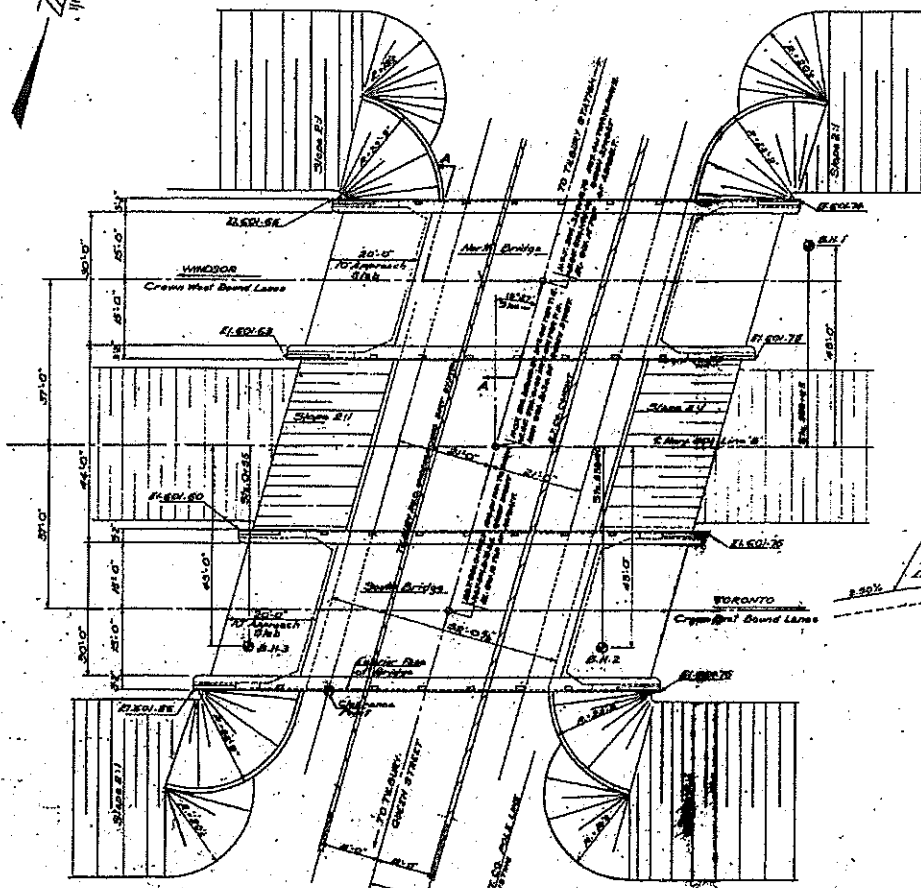
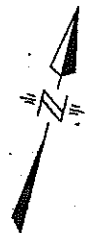
LOADING INTERVAL - 24 HOURS

APPROVED A. H. MacDonald  
DATE DEC. 11, 1959

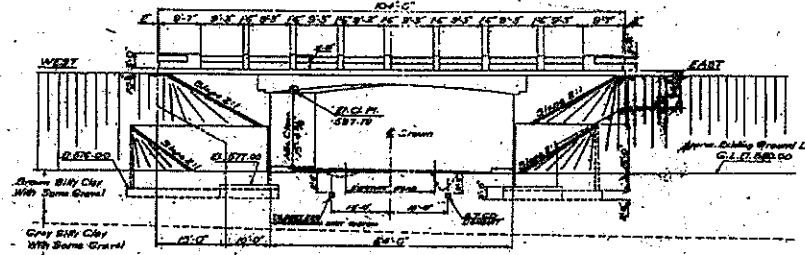
PLATE - XXV



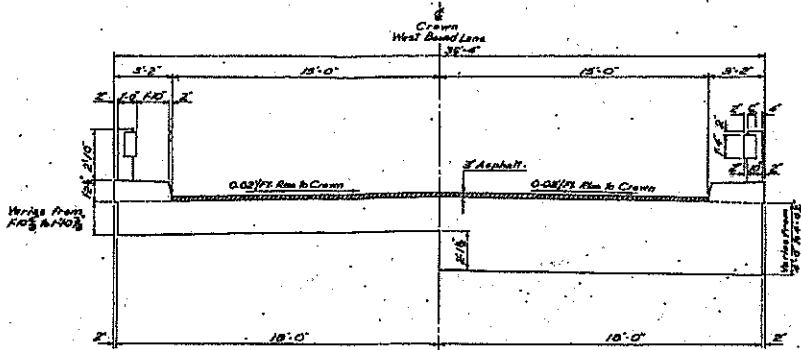
- (3) Contract Drawings for Tilbury North Township Bridge No. 1 (Queen Street Overpass), WP 161-58, TWP 105-51-1A, dated January 1960.



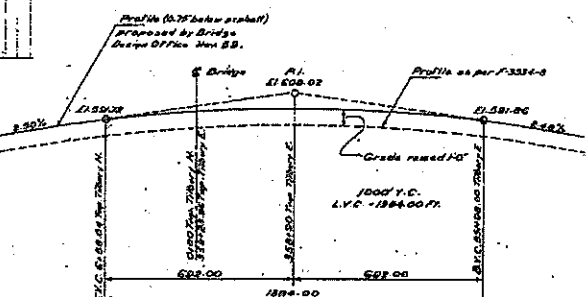
PLAN  
Scale: 1/4"=1'-0"



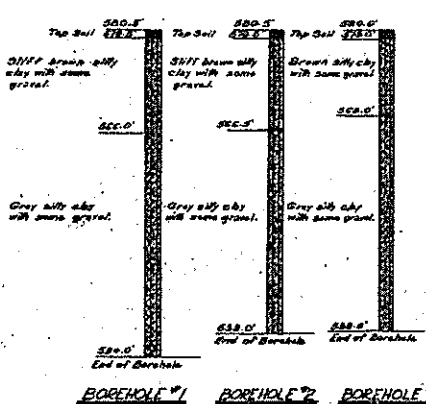
SOUTH ELEVATION  
Scale: 1/4"=1'-0"



SECTION A-A  
Scale: 1/4"=1'-0"



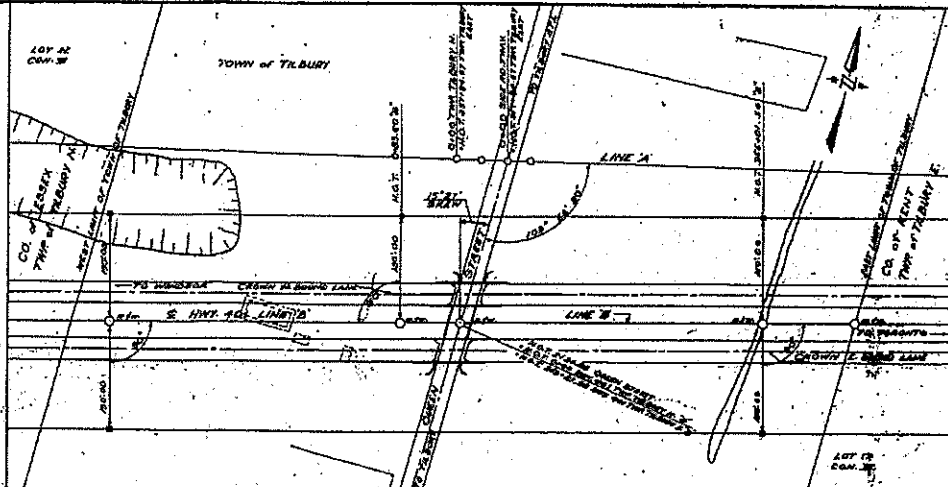
PROFILE HWY. 401 LINE B  
0.75' Below Top of Asphalt at Crown



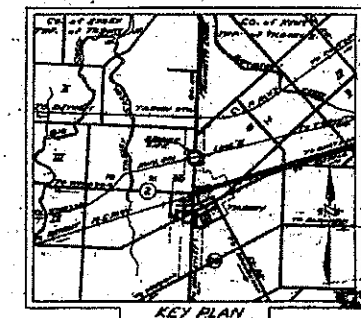
PROFILE OF QUEEN STREET  
TOP OF ASPHALT AT CROWN

SKW 15'27"  
Sta. 0+00-3973  
Cp. 0+00-3973  
Tn. 0+00-3973  
Sec. 1+00-3973

NOTES:  
1. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
2. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
3. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
4. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
5. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
6. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
7. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
8. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
9. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.  
10. The bridge is to be constructed in accordance with the plans and specifications of the Department of Highways, Ontario.



SITE PLAN  
Scale: 1"=100'-0"



KEY PLAN  
Scale: 1"=100'-0"

DEPARTMENT OF HIGHWAYS, ONTARIO	
BRIDGE OFFICE-TORONTO	
TILBURY NORTH TWP. RE. 1	
QUEEN ST. OVERPASS	
THE KING'S HIGHWAY NO. 401	
CO. Essex & Kent	
TWP. Tilbury N. & E. Twp. E.	
GENERAL PLAN	
APPROVED	
JAN 1960	
6-51 TWP 105-51-1-A	



- (4) Foundation Investigation Report for Highway 401 'Line B' & Queen Street Crossing at Tilbury (Queen Street Overpass), WP 161-58, W.J.K-52-2, dated March 1959, Geocres No. 40J8-2.



## SUMMARY OF FIELD & LABORATORY TESTS

[illegible]

Table No. 1 (cont'd)

JOB F-59-2W.P. 161-58

## SUMMARY OF FIELD &amp; LABORATORY TESTS

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
	SL3	75'-77'	Soft to med. grey silty clay with sand layers	18	-	-	-	-	-	In-situ vane test.
		28'	Stiff grey silty clay	-	-	-	-	1760	-	
		38'	" "	-	-	-	-	1840	-	
		43'	" "	-	-	-	-	1280	-	
		53'	Soft to med. grey silty clay	-	-	-	-	560	-	
		58'6"	" "	-	-	-	-	720	-	
Note: Laboratory test results of R.H. No. 3 presented were taken from an additional boring adjacent to B.H. No. 3.										
Tl denotes thin-walled Shelby samples. Sl denotes split spoon sample.										
Consolidation characteristics:-										
Depth		0'-25'	Coefficient of volume compressibility		0.007			sq.ft./ton.		
			Coefficient of consolidation		0.14			sq.ft./day.		
Depth		25' & below	Compression index		0.16			sq.ft./day		
			Coefficient of consolidation		0.0875			sq.ft./day		
			Preconsolidation pressure					submerged unit weight x depth (normal consolidation)		

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-6 OPERATION BORE HOLE PENETRATION JOB F-59-2 WP 161-59 BORING 1 STA 358+62.45 RT.  
CASING B X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB. 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 7 JAN. 1959  
SAMPLE CONDITION

## ABBREVIATIONS

V - INSITU VANE SHEAR TEST  
M - MECHANICAL ANALYSIS  
U - UNCONFINED COMPRESSION  
QC - TRIAXIAL CONSOLIDATED QUICK

Q - TRIAXIAL QUICK K - PERMIABILITY  
S - TRIAXIAL SLOW C - CONSOLIDATION  
WL - WATER LEVEL IN CASING CA - CASING  
WT - WATER TABLE IN SOIL  $\gamma$  - UNIT WEIGHT

## SAMPLE TYPES

C.S. - CHUNK	S.S. - SLEEVE SAMPLE
O.O. - DRIVE OPEN	P.S. - PISTON SAMPLE
D.F. - DRIVE FOOT VALVE	W.S. - WASHED SAMPLE
T.O. - THIN WALLED OPEN	R.C. - ROCK CORE

**SAMPLE CONDITION**

- DISTURBED
- FAIR
- GOOD
- LOST

[illegible]

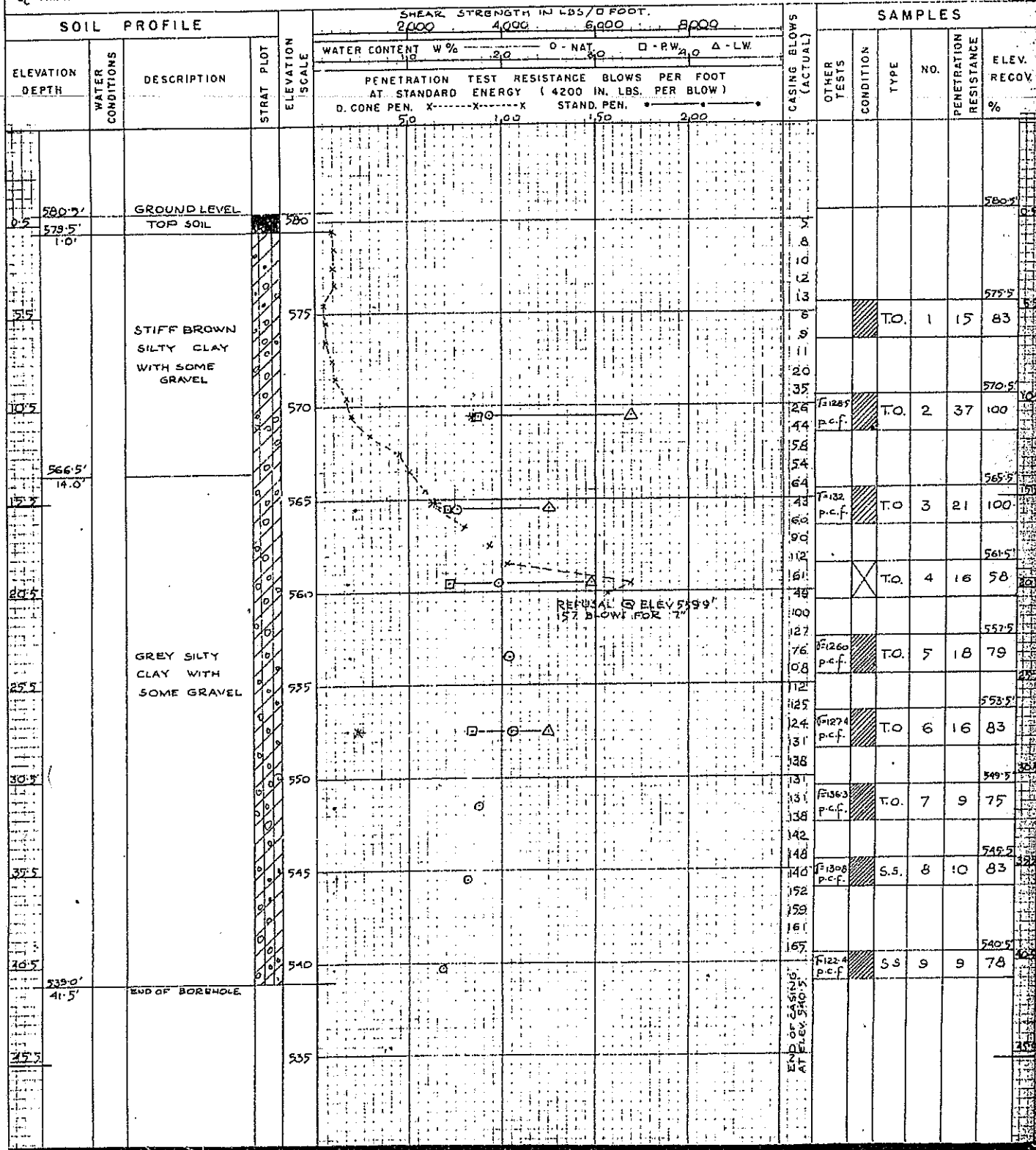
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG 54-6 OPERATION BORE & PENETRATION JOB F-59-2 WP 161-50 BORING 2 STA 359+00 42' LT  
CASING 2 X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 9 JAN 1959

**ABBREVIATIONS**  
V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY C.S. - CHUNK S.S. - SLEEVE SAMPLE  
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION D.O. - DRIVE OPEN P.S. - PISTON SAMPLE  
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING D.F. - DRIVE FOOT VALVE WS - WASHED SAMPLE  
Qc - TRIAXIAL CONSOLIDATED QUICK W.T. - WATER TABLE IN SOIL γ - UNIT WEIGHT T.O. - THIN WALLED OPEN R.C. - ROCK CORE

**SAMPLE TYPES**  
S.S. - SLEEVE SAMPLE  
P.S. - PISTON SAMPLE  
WS - WASHED SAMPLE  
R.C. - ROCK CORE

**SAMPLE CONDITION**  
- DISTURBED  
- FAIR  
- GOOD  
- LOST



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG 54-G OPERATION BORE & PENETRATION JOB F-59-2 WP 161-58 BORING 3 STA. 00+53.47  
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB 1955  
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 13 JAN 1959

## ABBREVIATIONS

V - INSITU VANE SHEAR TEST O - TRIAXIAL QUICK K - PERMIABILITY  
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION  
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING  
QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL  $\gamma$  - UNIT WEIGHT

## SAMPLE TYPES

CS - CHUNK SS - SLEEVE SAMPLE  
DO - DRIVE OPEN PS - PISTON SAMPLE  
DF - DRIVE FOOT VALVE WS - WASHED SAMPLE  
TO - THIN WALLED OPEN RC - ROCK CORE

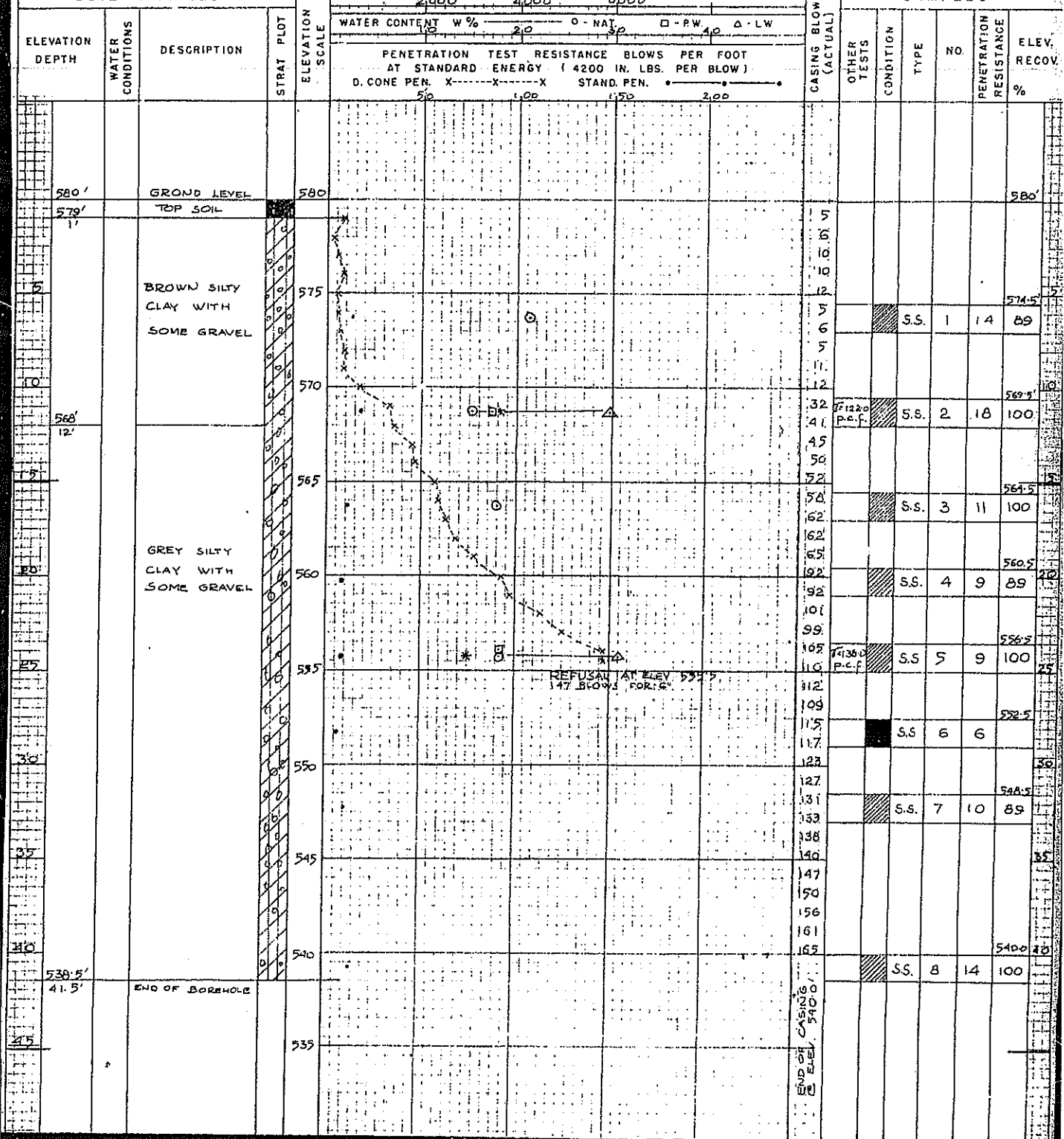
## SAMPLE CONDITION



- DISTURBED  
- FAIR  
- GOOD  
- LOST

## SOIL PROFILE

## SAMPLES





DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG 54-G OPERATION PENETRATION JOB F-58-2 WP 161-58 BORING 4 STA. 00+20 45' RT.  
 CASING B X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB 1959  
 SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 20 JAN 1959

## ABBREVIATIONS

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

## SAMPLE TYPES

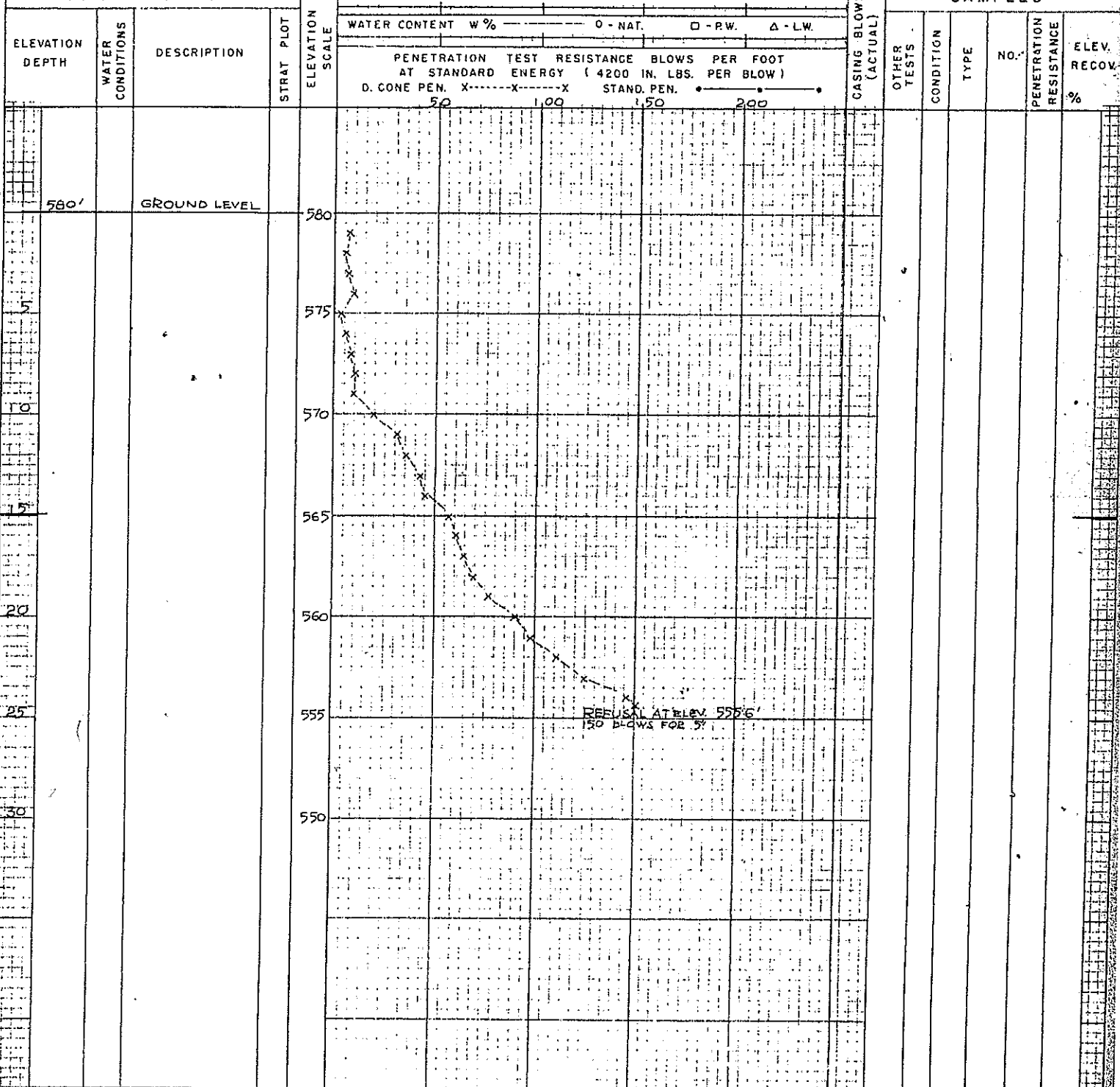
C.S. - CHUNK S.S. - SLEEVE SAMPLE  
 D.O. - DRIVE OPEN P.S. - PISTON SAMPLE  
 D.F. - DRIVE FOOT VALVE W.S. - WASHED SAMPLE  
 T.O. - THIN WALLED OPEN R.C. - ROCK CORE

## SAMPLE CONDITION



- DISTURBED  
 - FAIR  
 - GOOD  
 - LOST

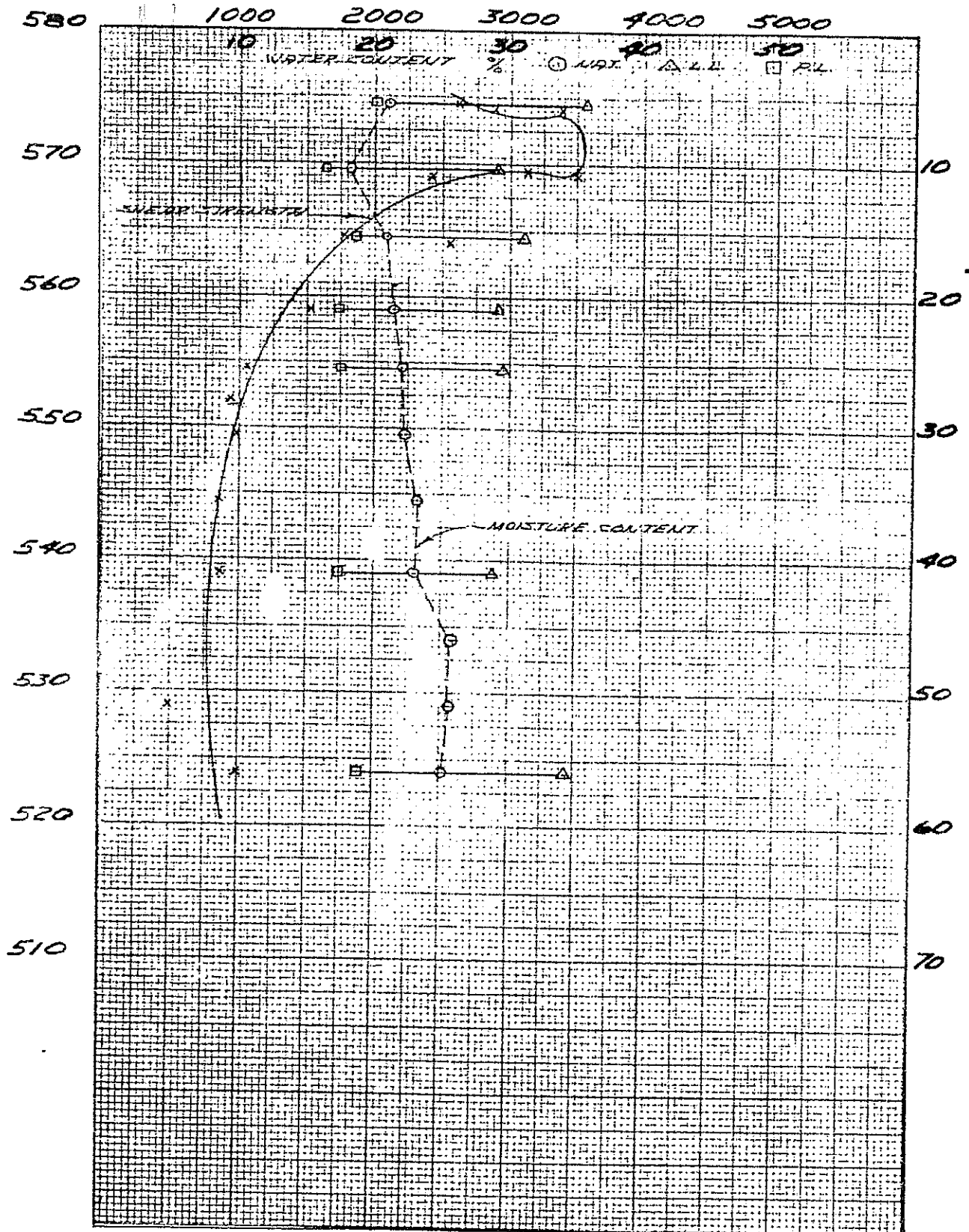
## SOIL PROFILE

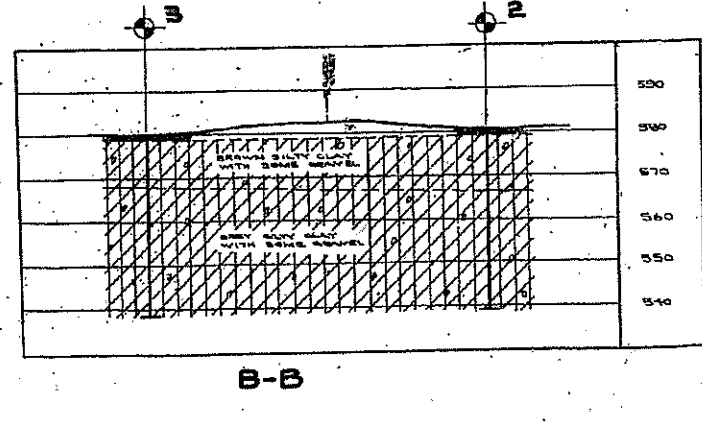
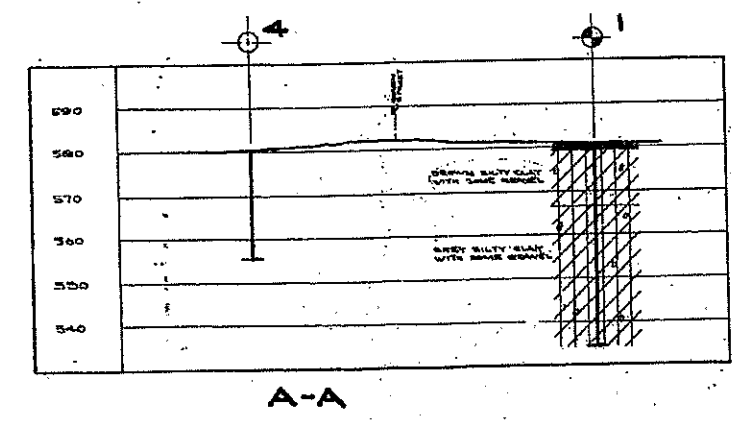
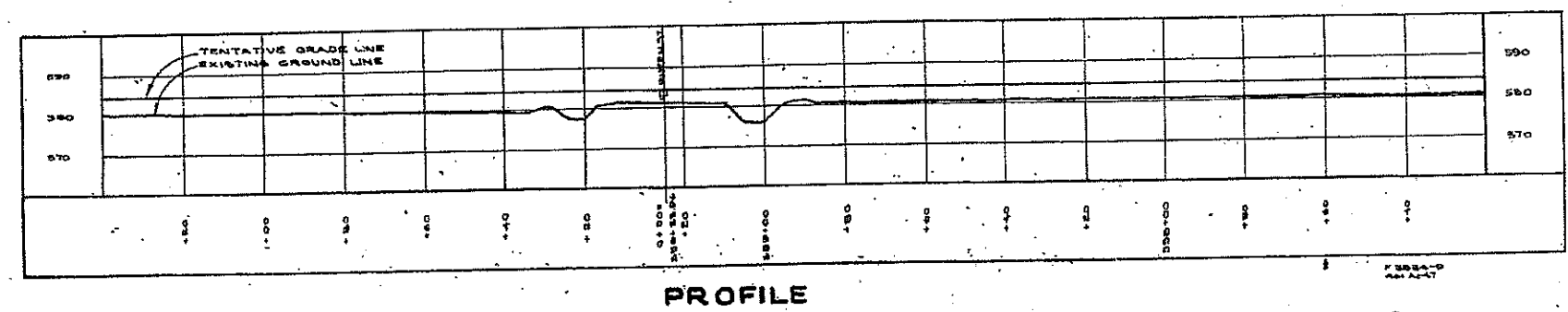
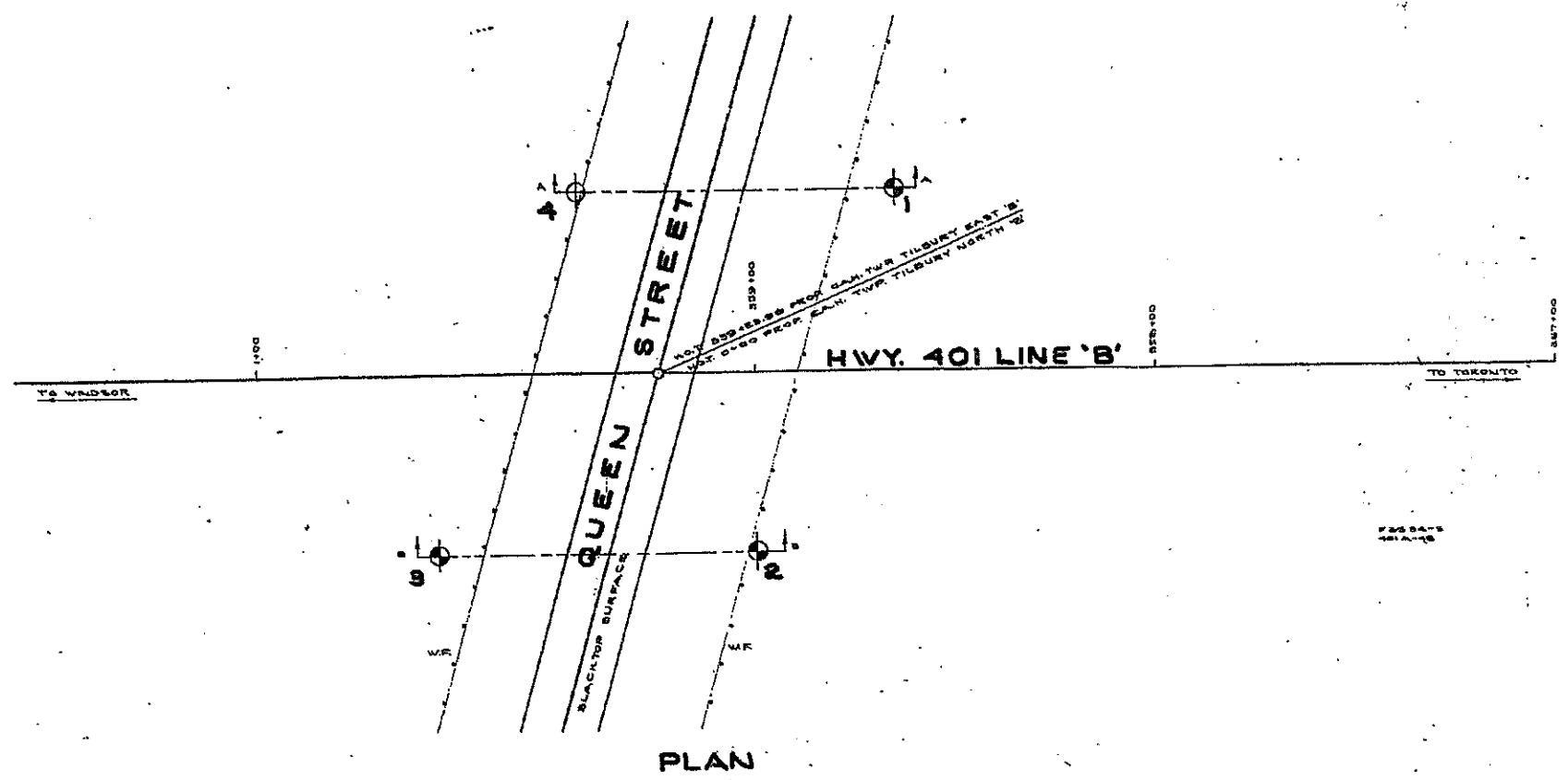


W. P. 161-58

JOB F-59-2

# SHEAR STRENGTH IN P.S.F.





**LEGEND**

BORE HOLE   
 PENETRATION HOLE   
 BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM 'E'
1	580.5'	555+15	48' ET.
2	580.5'	559+00	45' ET.
3	580.0'	00+55	45' ET.
4	580.0'	00+100	45' ET.

— NOTE —

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND ARE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS-ONTARIO  
MATERIALS & RESEARCH SECTION

**QUEEN STREET  
PROPOSED CROSSING**

SHOWING POSITIONS & ELEVATIONS OF HOLES

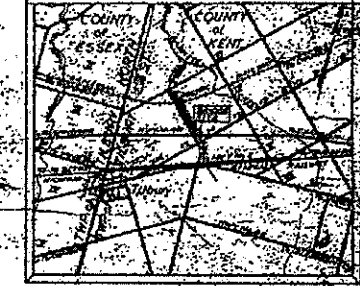
HWY. 401 DISTRICT 1 COUNTY E. & S. 1  
 TOWNSHIP TILBURY EAST NORTH LOT 22 CON. 3

DRAWING BY T. M. M. L. O. R. S. CHECKED BY: M. R. 1-1-59  
 DATE MARCH 12/59 APPROVED BY: DRAWING NO. F 59-2A

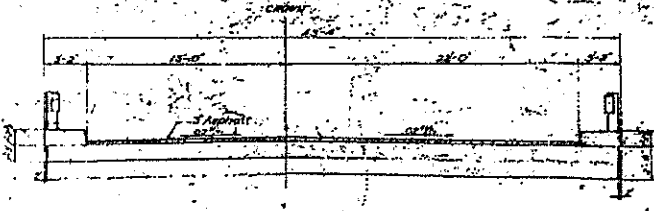
SCALE 1" = 20'



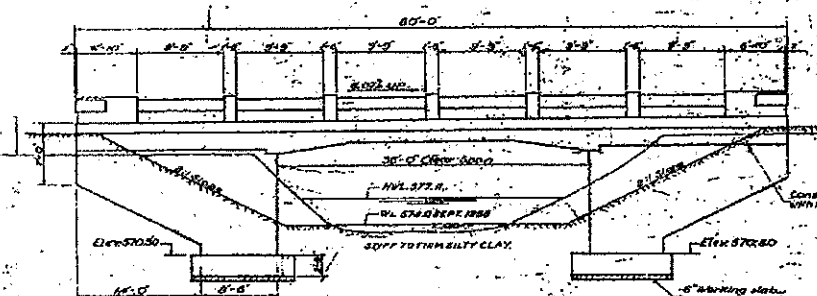
- (5) Contract Drawings for Little Baptiste Creek Bridge, WP 162-58, TWP 104-187-1-B, dated July 1959.



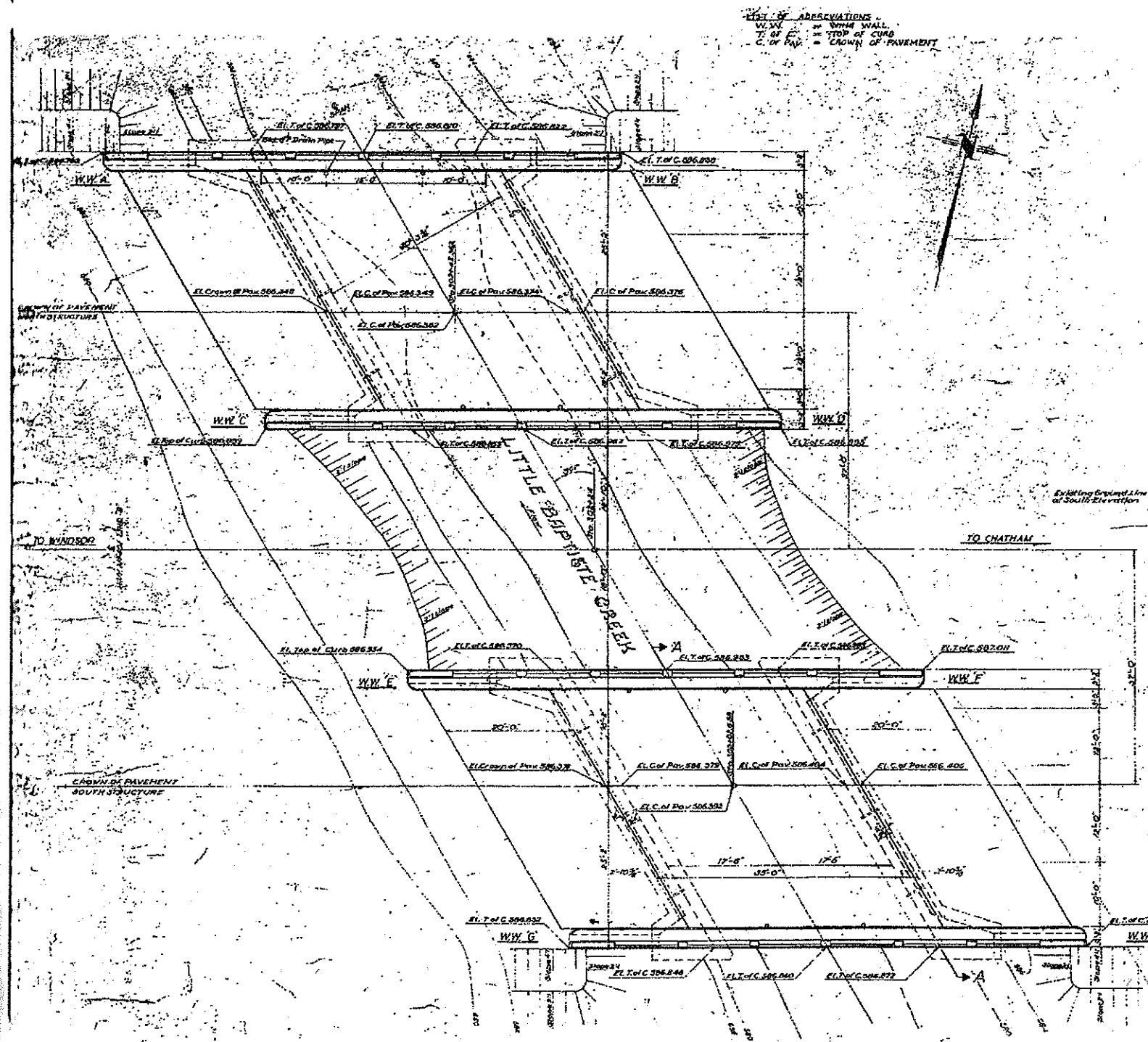
KEY PLAN  
Scale: 1/4" = 100'



SECTION A-A  
Scale: 1/4" = 100'



SOUTH ELEVATION  
Scale: 1/4" = 100'



PLAN  
Scale: 1/4" = 100'

**NOTE TO DESIGN ENGINEER**  
Concrete work is shown in solid lines to be constructed in accordance with the Department of Highways, Ontario, Standard Specifications for Road and Bridge Work, 1963 Edition, as amended.

**NOTE TO CONTRACTOR**  
Reference is made to the drawings and specifications for the bridge. All construction shall be in accordance with the Department of Highways, Ontario, Standard Specifications for Road and Bridge Work, 1963 Edition, as amended.

**CONCRETE**  
Minimum concrete strength shall be 3000 psi. All concrete shall be placed in accordance with the Department of Highways, Ontario, Standard Specifications for Road and Bridge Work, 1963 Edition, as amended.

**WORKING DATA**  
The complete set of drawings for the bridge is available from the Department of Highways, Ontario, Bridge Office, Toronto.

**REINFORCING STEEL**  
Steel reinforcement shall be in accordance with the Department of Highways, Ontario, Standard Specifications for Road and Bridge Work, 1963 Edition, as amended.

**CONSTRUCTION NOTES**  
All exposed edges of the bridge shall be finished in accordance with the Department of Highways, Ontario, Standard Specifications for Road and Bridge Work, 1963 Edition, as amended.

SKETCHED  
BY: J. J. J. J. J.  
DATE: 10-1-60  
BY: J. J. J. J. J.  
DATE: 10-1-60  
BY: J. J. J. J. J.  
DATE: 10-1-60

- LIST OF DRAWINGS**
- D-4382-1 GENERAL LAYOUT
  - D-4382-2 DETAILS OF FOOTINGS, ABUTMENTS, DECK
  - D-4382-3 DETAILS OF WINGWALLS, APPROACH SLAB
  - D-4382-4 CURB, HANDRAIL, POSTS
  - D-4382-5 REINFORCING STEEL SCHEDULE

DEPARTMENT OF HIGHWAYS-ONTARIO	
BRIDGE OFFICE-TORONTO	
LITTLE BAPTISTE CREEK BRIDGE	
THE KING'S HIGHWAY NO. 401	CO. OF KENT
TWP. OF TILBURY EAST	CONTRACT NO.
GENERAL LAYOUT	
APPROVED	DATE
BY	FOR
DATE	DATE





- (6) Foundation Investigation Report for Highway 401 and Little Baptiste Creek Crossing, WP 162-58, Ref.: 59-F-205C, prepared by E.M. Peto Associates Ltd., dated January 1959, Geocres No. 40J8-17.

**SON LIGHTING SERVICE** (TORONTO, ONTARIO)

## FOREKOLE LOG

Job Number: 401-Little, Burlingame Co. Job No. 58162

[illegible]

Crossing  
Clear. Dept. of Highways of Ontario. (Comm. by 22" dia.)

Boeing Date: Dec. 26-1958.

Datum **Geodetic** Adopted from American 1911 Geodetic Datums **Computed by** **H. H. Hudson**

Classed by \_\_\_\_\_ Pa. No. \_\_\_\_\_

SAMPLE CONDITION

 UNSTUBB

☒ DISTURBED

 **LOST**

**SAMPLE TYPE**

### 2.5. 2° STANDARD SPILL TUBE SAMPLES

### 3.4. SPLIT SAMPLE WITH CHIPS

W. 2. #AS116 SAMPLE.

R.C. MURK COM.

#### ABBREVIATIONS

Y. I. IZMIRSKII AND E. M. IESL

Q7. UNCLASSIFIED COMPROMISE INTENT

M.T. 公認会計士試験 科目別 解答

DATE	TIME	LOCATION	DEPTH	SOIL TYPE	MOISTURE	TEMP.	REMARKS
			0' 5"				
SANDY CLAY SILTY CLAY FISSURED, ORGANIC TRACES AS ABOVE	MOTTLED BROWN MOTTLED BROWN MOTTLED	STIFF	5' 0"	13			NAT. M.C. = 16.4% DRIER THAN PLASTIC LIMIT.
SILTY CLAY, FISSURED.	GREY-BROWN	STIFF	10' 0"	14			NAT. M.C. = 21.9% DRIER THAN PLASTIC LIMIT.
SILTY CLAY, GRITS AND STONES TO 3" SIZE	BROWN	STIFF	14' 0"	19			NAT. M.C. = 17.6% AT PLASTIC LIMIT.
SILTY CLAY, MAINLY BLACK GRITS	DARK GREY	STIFF	17' 0"	22			NAT. M.C. = 18.1% WETTER THAN PLASTIC LIMIT.
STRATIFIED SILTY CLAY, NUMEROUS BLACK GRITS	DARK GREY	FIRM TO STIFF	20' 0"	11			NAT. M.C. = 20.4% MUCH WETTER THAN PLASTIC LIMIT.
SILTY CLAY, GRITS	DARK GREY	FIRM	25' 0"	12			NAT. M.C. = 22.1% C = 370 p.s.f.
SILTY CLAY, GRITS AND LIMESTONE PEBBLES TO 1/2"	DARK GREY	FIRM	30' 0"	12			MUCH WETTER THAN PLASTIC LIMIT.
SILTY CLAY, GRITS	GREY	FIRM	35' 0"	8			NAT. M.C. = 23.3 - 25.3% C = 150 - 730 p.s.f. & 20% STRAIN.
SILTY CLAY, BLACK GRITS	GREY	FIRM	40' 0"	8			MUCH WETTER THAN PLASTIC LIMIT.
AS ABOVE	"	SOFT	45' 0"	7			NAT. M.C. = 25.1% C = 650 p.s.f.
AS ABOVE	GREY	SOFT	50' 0"	7			MUCH WETTER THAN PLASTIC LIMIT.
AS ABOVE	GREY	SOFT	55' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	60' 0"	8			NAT. M.C. = 26.0 - 28.3% C = 410 p.s.f.
AS ABOVE, 2' SEAM OF GRITS AND FINE GRAVEL IN MATRIX OF SILTY CLAY	"	"	65' 0"	8			NAT. M.C. = 22.6% C = 650 p.s.f.
SILTY CLAY, BLACK GRITS	GREY	SOFT	70' 0"	7			MUCH WETTER THAN PLASTIC LIMIT. C = APPROX. 300 p.s.f.
AS ABOVE	GREY	SOFT	75' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	80' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	85' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	90' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	95' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	100' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	105' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	110' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	115' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	120' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	125' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	130' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	135' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	140' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	145' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	150' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	155' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	160' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	165' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	170' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	175' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	180' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	185' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	190' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	195' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	200' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	205' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	210' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	215' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	220' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	225' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	230' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	235' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	240' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	245' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	250' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	255' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	260' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	265' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	270' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	275' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	280' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	285' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	290' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	295' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	300' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	305' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	310' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	315' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	320' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	325' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	330' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	335' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	340' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	345' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	350' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	355' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	360' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	365' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	370' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	375' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	380' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	385' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	390' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	395' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	400' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	405' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	410' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	415' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	420' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	425' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	430' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	435' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	440' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	445' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	450' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	455' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	460' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	465' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	470' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	475' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	480' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	485' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	490' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	495' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	500' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	505' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	510' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	515' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	520' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	525' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	530' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	535' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	540' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	545' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	550' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	555' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	560' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	565' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	570' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	575' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	580' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	585' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	590' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	595' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	600' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	605' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	610' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	615' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	620' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	625' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	630' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	635' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	640' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	645' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	650' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	655' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	660' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	665' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	670' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	675' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	680' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	685' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	690' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	695' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	700' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	705' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	710' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	715' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	720' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	725' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	730' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	735' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	740' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	745' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	750' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	755' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	760' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	765' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	770' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	775' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	780' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	785' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	790' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	795' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	800' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	805' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	810' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	815' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	820' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	825' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	830' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	835' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	840' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	845' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	850' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	855' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	860' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	865' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	870' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	875' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	880' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	885' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	890' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	895' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	900' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	905' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	910' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	915' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	920' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	925' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	930' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	935' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	940' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	945' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	950' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	955' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	960' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	965' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	970' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	975' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	980' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	985' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	990' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	995' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1000' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1005' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1010' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1015' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1020' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1025' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1030' 0"	9			AS ABOVE.
AS ABOVE	GREY	SOFT	1035' 0"	9			AS ABOVE.
AS ABOVE	GREY						

## BOREHOLE LOG

Borehole No. 2

Boring Date ..Dec., 18, 20, 1958.

Checked By .....E.....M.....Peta

## ABBREVIATIONS

#### V. T. IN SITU VANE SHEAR TEST

Q/u UNCONFINED COMPRESSIVE STRENGTH

W.L. WATER LEVEL IN CASING

W. T. GROUND WATER TABLE IN SOIL

R. C. ROCK CORE

CASING WITHDRAWN, DEC. 20, '58  
DEPTH TO WATER 12'6"  
DEC. 22, '58.

## BOREHOLE LOG

Revised to: 2  
Revised to: Dec. 22-Jan. 1, 1958-9.  
Revised to: H. H. Pifer

SAMPLE CONDITIONS

4.4.3.3. *Phylogenetic analysis*

-  UNRASTERED
-  FINE
-  MEDIUM
-  COAT

TABLE 17 (continued)

5. C.	2" WHITE-GRAY GROUT TEST SAMPLE
5. D.	WHITE-BROWN WHITE GROUT
5. E.	THIN-WATERED GRINDY TEST SAMPLE
5. F.	WASTE SAMPLE
5. G.	WASTE SAMPLE

**Abstract:** The purpose of this study was to determine the effect of a 12-week training program on the physical fitness of 10-year-old children. The study was conducted in a primary school in the city of Ankara, Turkey. The children were divided into two groups: a control group and an experimental group. The experimental group participated in a 12-week training program that included aerobic, strength, and flexibility exercises. The physical fitness of the children was measured at the beginning and end of the training program using a series of tests. The results of the study showed that the experimental group had significantly higher levels of physical fitness than the control group at the end of the training program. The findings of this study suggest that a 12-week training program can improve the physical fitness of 10-year-old children.

SILTY CLAY, GRITS.	WETTED GREY BROWN DARK SILTY, NOTTED	STIFF	10	AT PLASTIC LIMIT
AS ABOVE, ORGANIC CONTENT ORGANIC SILTY LOAM				NAT. W.C. = 23.3 % WETTER THAN PLASTIC LIMIT
SILTY CLAY, GRITS.	GREY-BROWN	STIFF	9	NAT. W.C. = 22.4 % WETTER THAN PLASTIC LIMIT
STRATIFIED SILTY CLAY, BLACK GRITS.	BROWN	STIFF	27	NAT. W.C. = 16.2 % WETTER THAN PLASTIC LIMIT
AS ABOVE	DARK GREY	STIFF	13	MUCH WETTER THAN PLASTIC LIMIT
AS ABOVE	GREY	STIFF	14	AS ABOVE
AS ABOVE	GREY	STIFF	16	MUCH WETTER THAN PLASTIC LIMIT
SILTY CLAY, GRITS TO 1/2 SIZE	GREY	FIRM	9	MUCH WETTER THAN PLASTIC LIMIT
SILTY CLAY, GRITS.	GREY	FIRM	7	MUCH WETTER THAN PLASTIC LIMIT
AS ABOVE	GREY	FIRM	9	AS ABOVE
SILTY CLAY, GRITS	GREY	FIRM	10	MUCH WETTER THAN PLASTIC LIMIT
AS ABOVE				
SILTY CLAY, NUMEROUS GRITS	GREY	FIRM	7	AS ABOVE
GRADING TO SANDY AND SILTY CLAY, MANY GRITS.	GREY	PROBABLY FIRM		
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				
AS ABOVE				

## BOREHOLE LOG

Datum Geodetic Compiled By M. Mindega

Boring Date Jan 2-5, 1959.

Checked By E. M. Peto

## ABBREVIATIONS

**LOST**

S.S. 2" STANDARD SPLIT TUBE SAMPLE  
S.L. SPLIT BARREL WITH LINERS  
S.T. THIN-WALLED SHELBY TUBE SAMPLE  
W.S. WASH SAMPLE  
R.C. ROCK CORE

V. T. IN SITU VANE SHEAR TEST  
Q/c UNCONFINED COMPRESSIVE STRENGTH  
W. L. WATER LEVEL IN CASING  
W. T. GROUND WATER TABLE IN SOIL

[illegible]



SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

Job Name Hwy. 401-Little Baptiste Cr. Job No. 58162  
Crossing  
 Client Dept. of Highways of Ontario. Casing BX (2½" diam.)  
 Datum Geodetic Compiled By M. Mindess

Borehole No. ....5.....  
Boring Date ....Jan. 15, 1959.  
Checked By ....E. M. Peto.....

### ABBREVIATIONS

V.T. IN SITU VANE SHEAR TEST  
Q/u UNCONFINED COMPRESSIVE STRENGTH  
W.L. WATER LEVEL IN CASING  
W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
EXCAVATED MATERIAL:			0' 0"					
FISSURED SILTY AND SANDY CLAY, GRITS AND PEBBLES, ORGANIC TRACES	MOTTLED GREY-BROWN		584.4					
ORGANIC SILTY CLAY TOPSOIL SILTY CLAY, GRITS.	PARK BROWN MOTTLED GREY-BROWN.	VERY STIFF	5' 0"		A C	S.L.	TAPPED	DRIER THAN PLASTIC LIMIT NAT. M.C.=21.8 %
SILTY CLAY, GRITS.	MOTTLED GREY-BROWN.	VERY STIFF	10' 0"		A C	S.L.	TAPPED	WETTER THAN PLASTIC LIMIT NAT. M.C.=19.2 %
SILTY CLAY, GRITS AND PEBBLES.	GREY	STIFF	15' 0"		A C	S.L.	TAPPED	WETTER THAN PLASTIC LIMIT NAT. M.C.=18.2 %
AS ABOVE	"	FIRM	20' 0"		A C	S.L.	TAPPED	WETTER THAN PLASTIC LIMIT NAT. M.C.=19.7 %
AS ABOVE	GREY	FIRM	25' 0"		A C	S.L.	PUSHED	MUCH WETTER THAN PLASTIC LIMIT NAT. M.C.=20.1 % TO 19.7 %
			HOLE TERMINATED					
								HOLE TO 25 FT DEPTH, ONLY UPPER 10 FT. CASED, NO WATER OVERNIGHT JAN. 15 TO JAN. 16, 1959

APPENDIX I

LABORATORY TEST RESULTS

SHRINKAGE LIMITS

Job No. 58162

Borehole Number	1	3	3	3
Sample Number	3	2A	3	3
Depth	10'-11'	9'6"-10'	10'-11'	10'-11'
Wt. of dish & wet soil - gms.	53.06	50.66	51.84	50.74
Wt. of dish & dry soil - gms.	44.89	40.75	43.09	38.80
Wt. of dish gms.	24.93	24.93	24.93	17.35
Wt. of water gms.	8.17	2.91	8.84	10.94
Wt. of dry soil - gms. (W <sub>o</sub> )	19.96	15.82	18.07	22.45
Moisture Content % (W)	41.0	62.6	49.8	48.3
Volume of dish c.c. (V)	15.70	15.70	15.70	10.20
Volume of dry soil c.c. (V <sub>o</sub> )	10.79	8.70	9.90	12.30
Shrinkage Volume c.c. (V-V <sub>o</sub> )	4.91	7.00	5.80	6.90
Shrinkage Limit = (W <sub>s</sub> ) $W - \frac{(V-V_o \times 100\%)}{W_o}$	16.4%	18.4%	16.2%	17.6%
Shrinkage Ratio (R) = $\frac{W_o}{V_o}$	1.855	1.820	1.830	1.826
S. G. = $\frac{1}{1/R^3 W_s/100}$	2.63	2.74	2.61	2.69

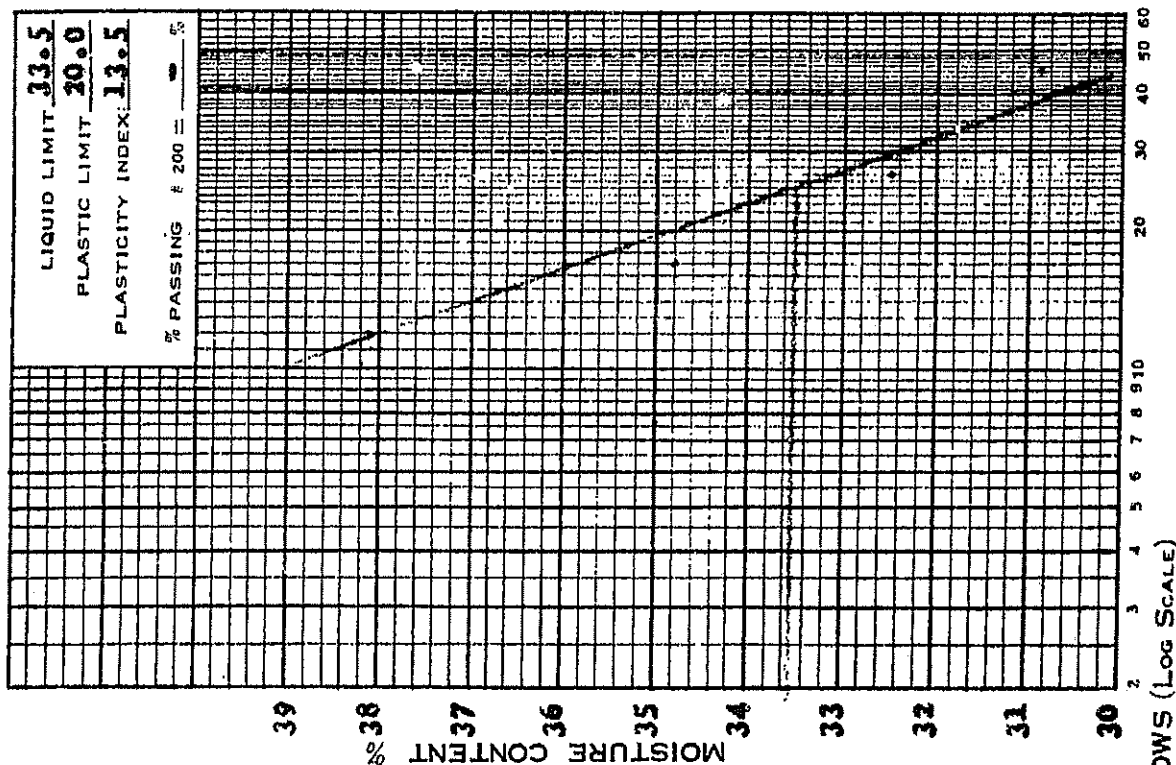
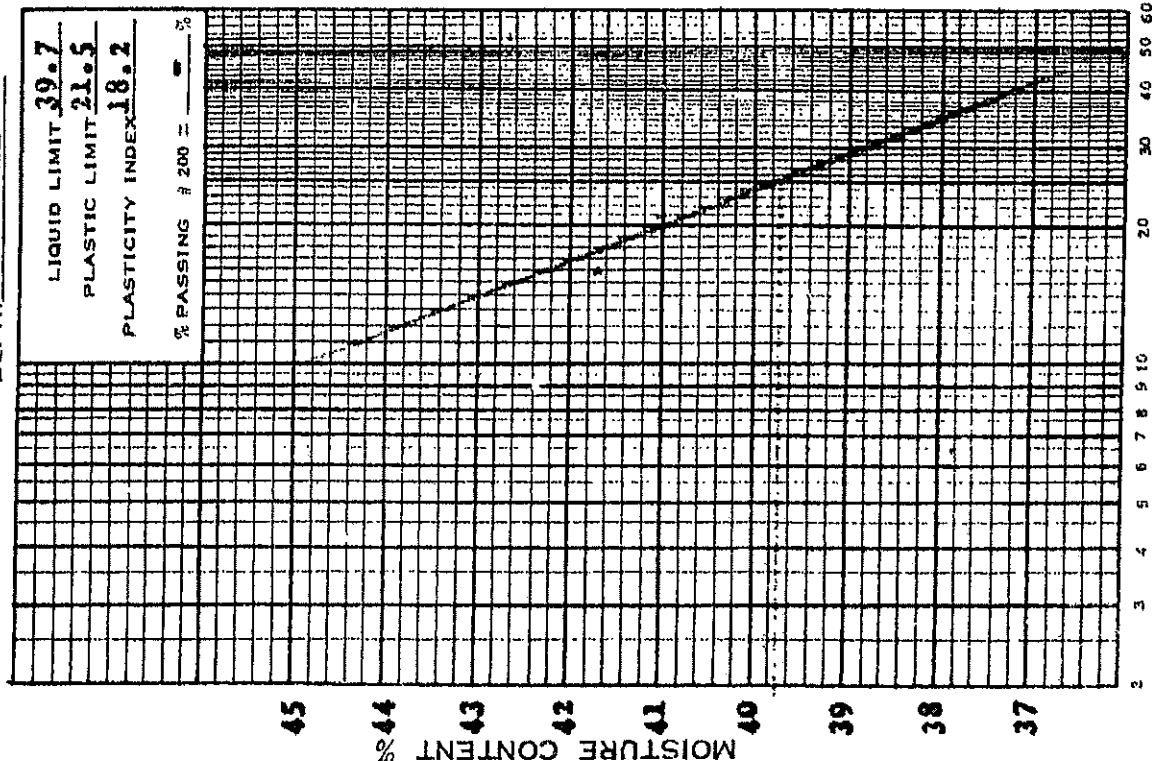
# e. m. peto associates ltd.

## SOIL TESTING LABORATORY

### LIQUID LIMIT TEST

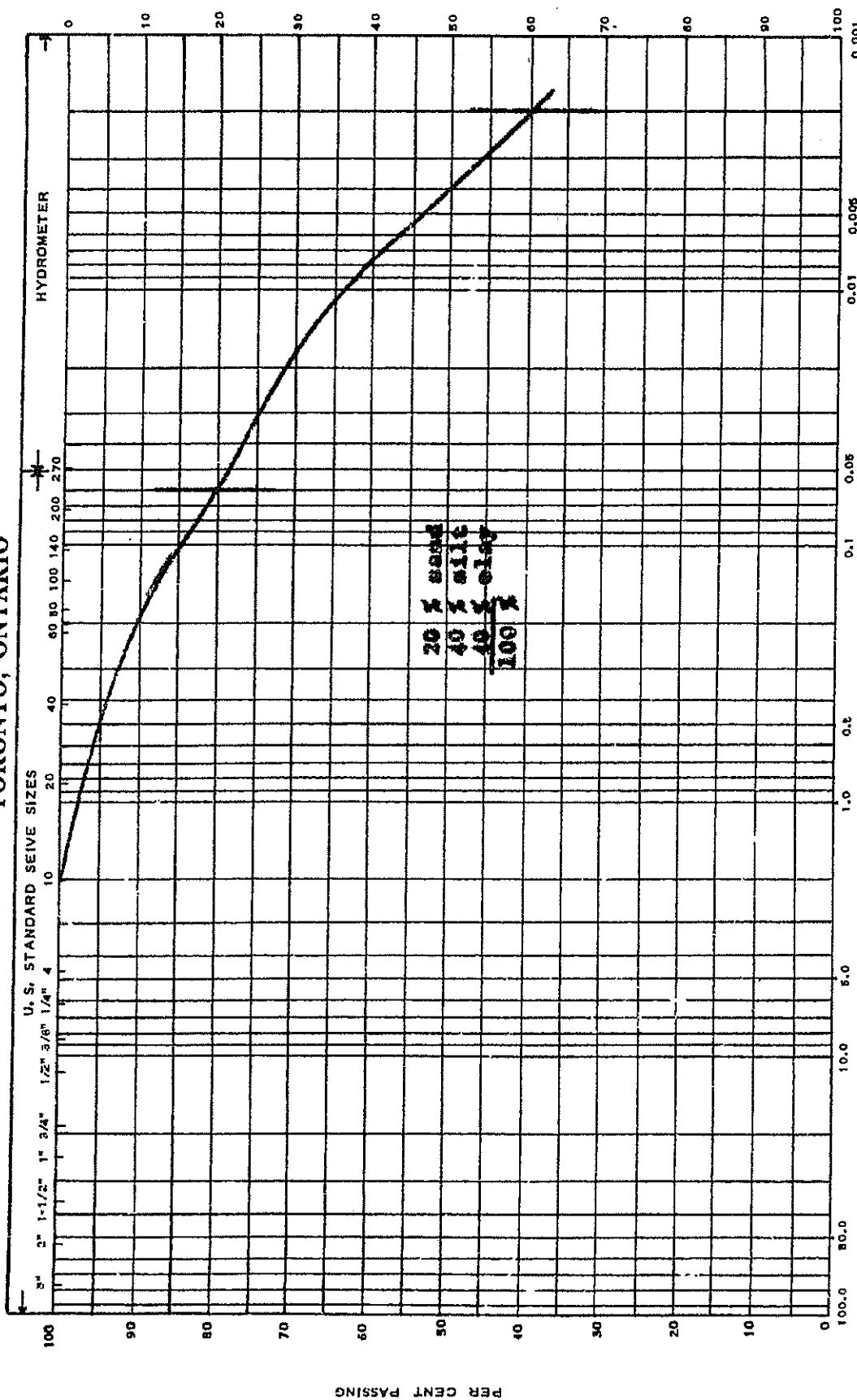
### FLOW LINE CHARTS

JOB No 58162 PROJECT Hwy. 401 - Little Baptiste Creek Crossing  
 SAMPLE FROM Borehole 1, Sa. 3  
 DEPTH 10' - 11'



NO. OF BLOWS (Log Scale)

# e. m. peto associates ltd. TORONTO, ONTARIO



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME **Wey. 401-Little Rapids Cr.** JOB NO. **58162** HOLE NO. **2** SAMPLE NO. **1**

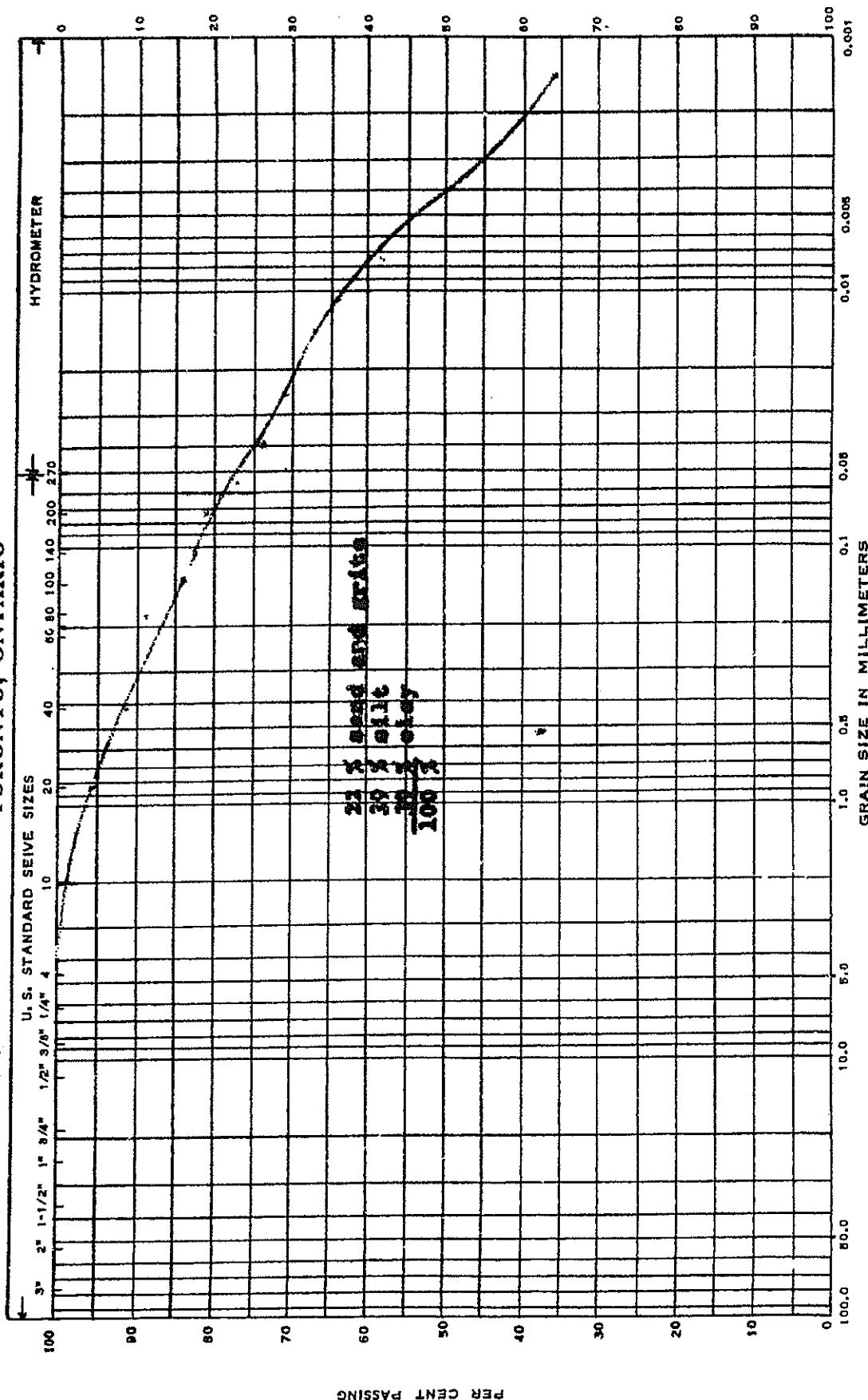
DEPTH **15.16'** ELEVATION **569.0** REMARKS

GRAIN SIZE DISTRIBUTION



# e. m. peto associates ltd.

## TORONTO, ONTARIO



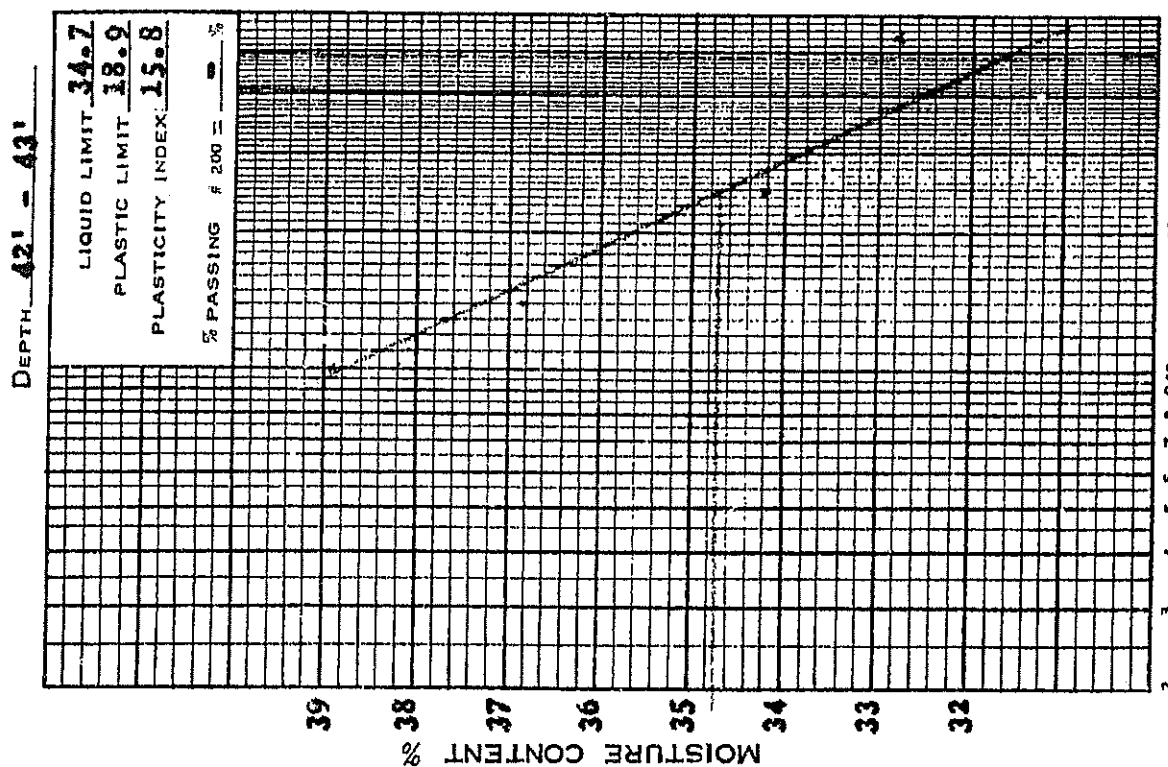
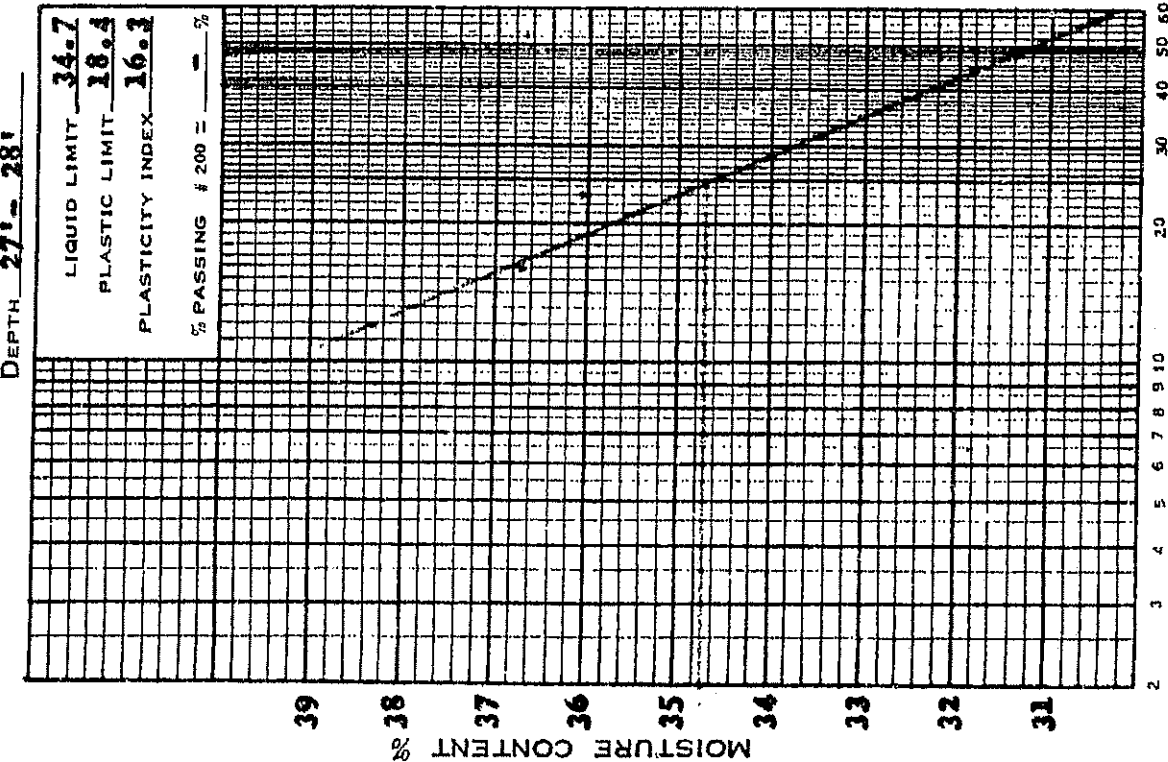
# e. m. peto associates ltd. SOIL TESTING LABORATORY

## LIQUID LIMIT TEST

## FLOW LINE CHARTS

JOB No 53162 PROJECT Hwy. 401 - Little Baptiste Creek Crossing  
SAMPLE FROM Borehole 1, Sa. 7 SAMPLE FROM Borehole 1, Sa. 11

DEPTH 27' - 28'



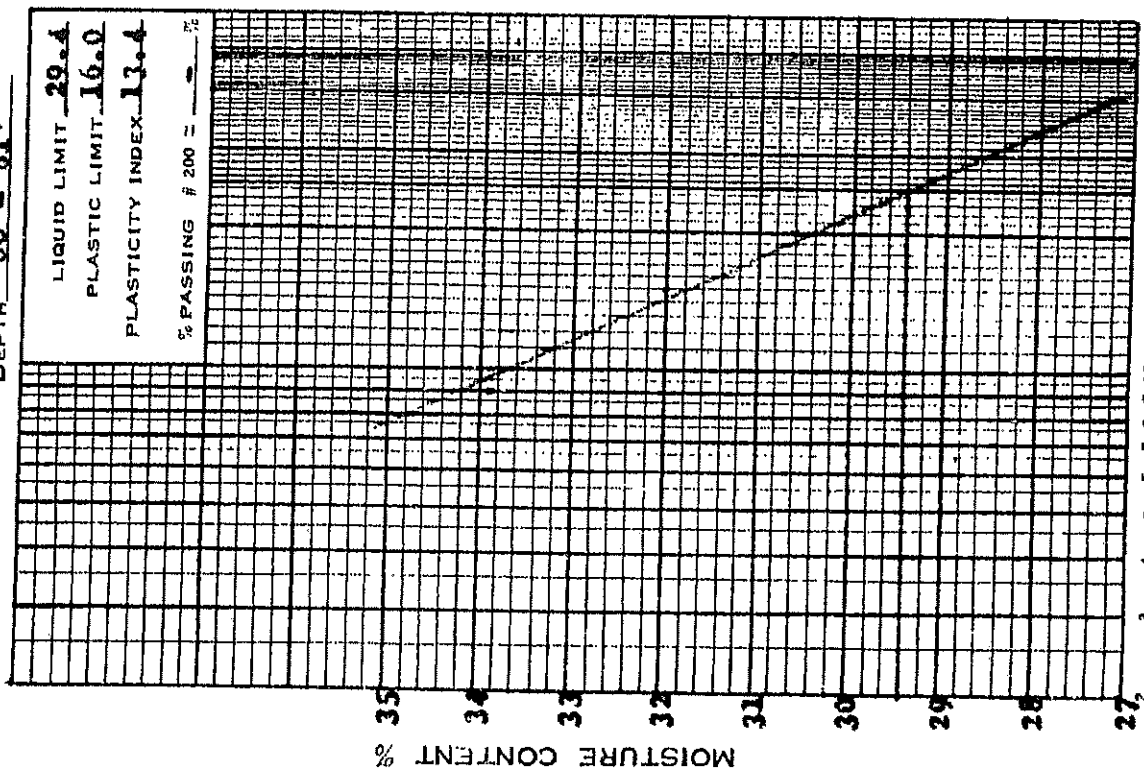
NO. OF BLOWS (LOG SCALE)

# e. m. peto associates ltd. SOIL TESTING LABORATORY

## LIQUID LIMIT TEST

JOB No. 58162 PROJECT Way. 401 - Little Baptiste Creek Crossing  
SAMPLE FROM Borehole 1, Sa. 19

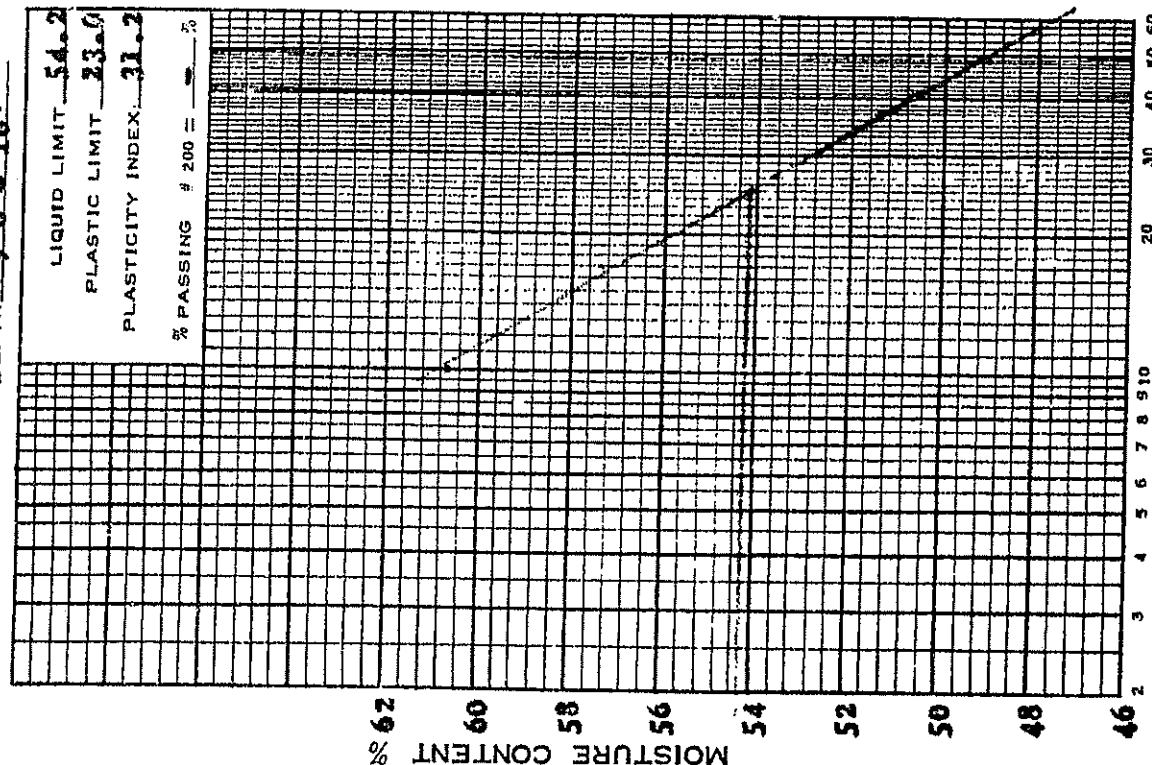
DEPTH 20' - 31'



## FLOW LINE CHARTS

JOB No. 58162 PROJECT Way. 401 - Little Baptiste Creek Crossing  
SAMPLE FROM Borehole 2, Sa. 2A

DEPTH 9'6" - 10'



NO. OF BLOWS (LOG SCALE)

# e. m. peto associates ltd. SOIL TESTING LABORATORY

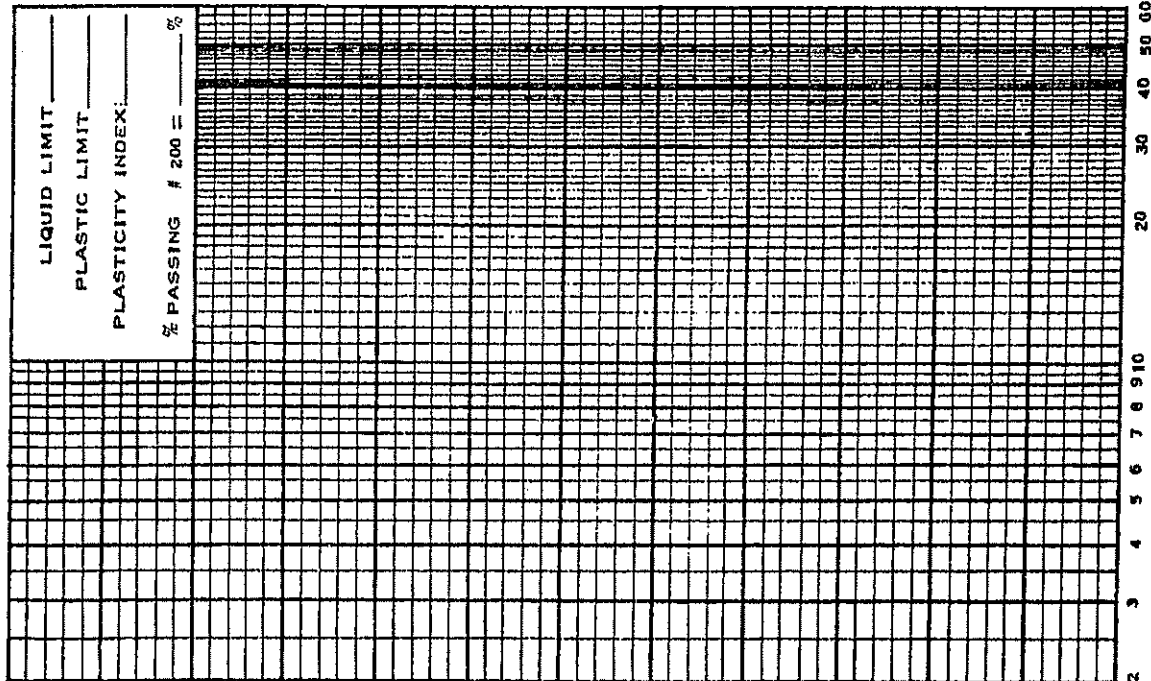
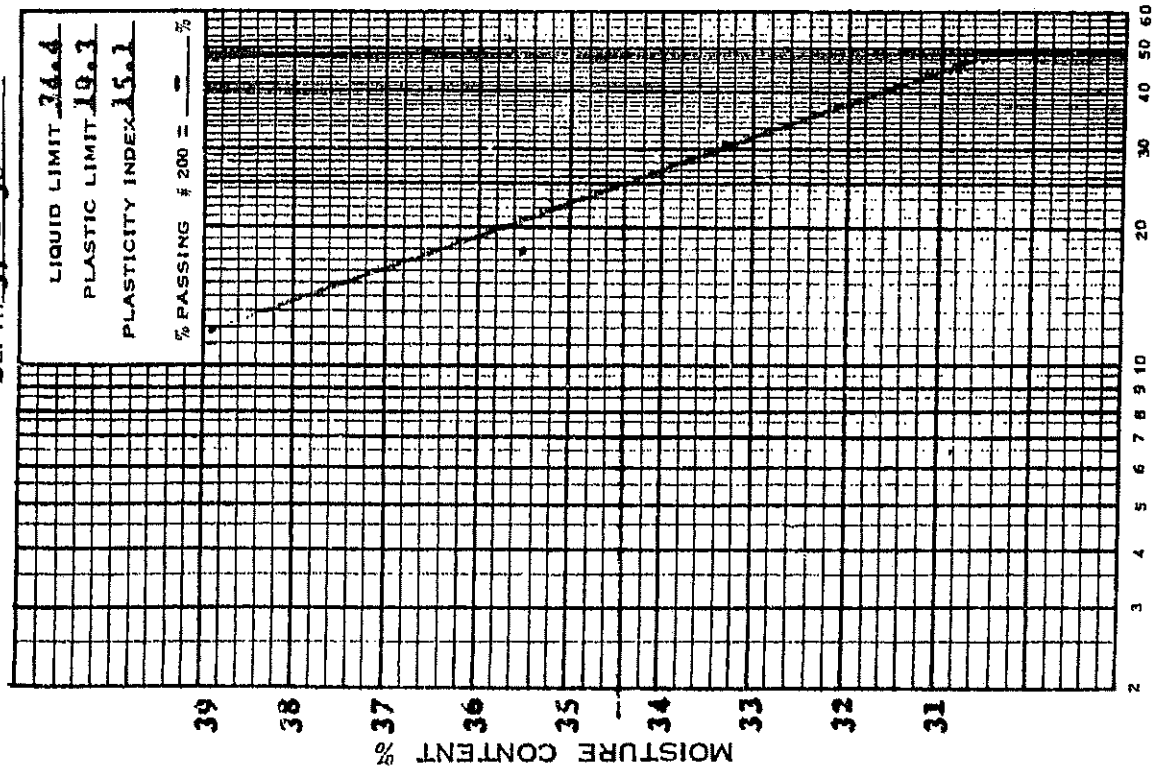
## LIQUID LIMIT TEST

## FLOW LINE CHARTS

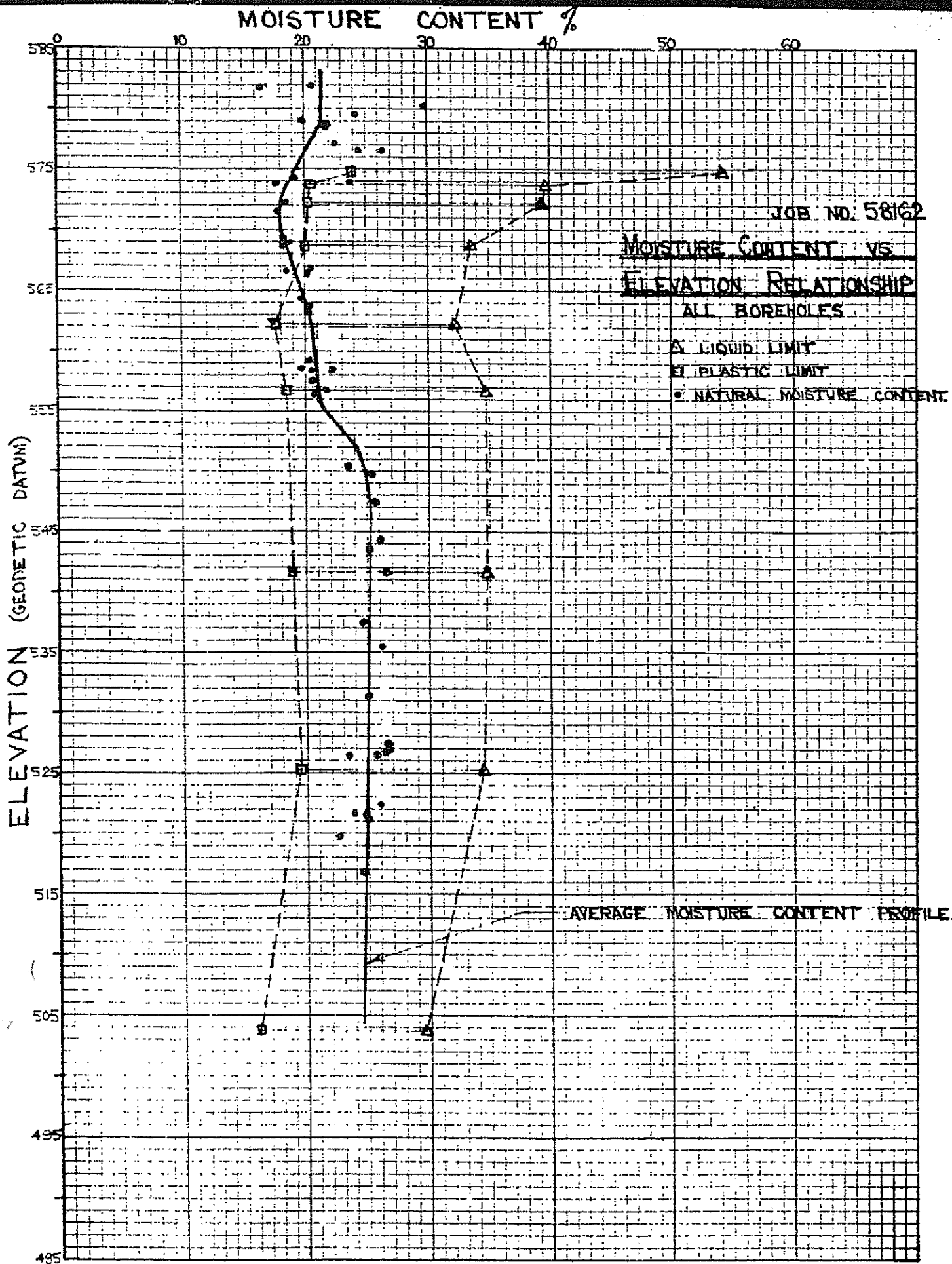
Job No. 58162 PROJECT Hwy. 401 - Little Baptiste Creek Crossing  
SAMPLE FROM Borehole 3, Sta. 14

DEPTH 57'-58'

DEPTH 57'-58'



NO. OF BLOWS (LOG SCALE)





# SUMMARY OF SHEAR STRENGTH TEST RESULTS

Job No. 59162

Borehole Sample number	Depth	Elevation	Natural M.C. %	Wet Density P.C.F.	Dry Density P.C.F.	Degrees of Saturation	Void Ratio	% Strain at failure	Shear Strength, C P.S.F.
1 6B	25'6"-29'	553.6	22.1	131.0	107.0	100 %	0.500	20%	1370
1 8B	35'6"-34'	550.6	21.3	125.0	104.5	100	0.607	20	1150
1 8C	34'-34'6"	556.1	25.3	123.0	102.0	100	0.544	20	793
1 10B	40'6"-41'	543.6	25.1	125.9	100.6	100	0.607	20	650
1 14B	50'6"-51'	537.6	20.6	125.1	98.0	100	0.602	20	416 Remould 274
1 14C	57'-57'6"	537.1	20.3	125.2	98.2	100	0.600	20	416 Remould 216
1 15C	64'-64'6"	530.1	22.6	123.5	100.5	100	0.500	20	650 Remould 345
2 11A	40'-40'6"	544.3	25.1	126.8	100.5	100	0.600	20	574
2 13A	53'-53'6"	531.3	25.1	125.8	100.4	100	0.600	20	426
2 15A	62'-62'6"	522.3	25.0	125.4	99.6	100	0.583	20	496
2 15B	62'6"-63'	521.6	23.9	127.4	102.9	100	0.590	13.3	656 Remould 443
2 15C	63'-63'6"	531.3	25.0	124.9	99.8	100	0.600	20	574
3 4B	10'6"-10'	506.9	20.3	125.0	112.2	100	0.482	20	2196 Remould 1908
3 4C	10'-10'6"	506.4	20.1	125.0	112.4	100	0.482	20	1904
3 7B	25'6"-26'	506.9	21.6	127.1	112.6	100	0.480	20	1640
3 7C	26'-26'6"	506.4	20.6	123.1	116.3	100	0.520	20	1046 Remould 1090
3 9A	30'-30'6"	547.4	25.7	132.3	105.4	100	0.500	20	490
3 11A	45'-45'6"	537.4	24.6	127.3	102.3	100	0.620	20	641
3 13B	50'6"-50'	526.9	20.5	126.0	99.5	100	0.600	10.0	638 <sup>1</sup>
3 13C	50'-50'6"	526.4	23.7	126.0	100.2	100	0.672	2.5	1030 <sup>1</sup>
3 13C	50'-50'6"	526.4	23.3	126.0	103.1	100	0.643	12.5	561 <sup>1</sup>
3 15B	65'6"-66'	516.9	24.6	126.1	101.2	100	0.656	20	500
4 2	5'-0'	576.6	20.4	123.9	98.0	99.7	0.711	5.7	2000
4 6	23-1/2'-24'	522.4	20.7	124.0	111.1	100	0.500	20	1510

SUMMARY OF SHEAR STRENGTH TEST RESULTS

Job No. 58162

Sample Borehole Number	Depth	Elevation	Natural Wet Density M.C. %	Dry Density p.c.f.	Degree of p.s.f.	% Strain Ratio at Failure	Shear Strength, C p.s.f.
1B	5-1/2'-8"	573.7	21.8	122.1	103.3	0.883	3.3
2A	10'-10-1/2"	574.2	19.2	134.9	112.9	0.497	12.7
3A	15'-15-1/2"	569.2	18.2	134.0	113.3	0.483	20
4A	20'-20-1/2"	564.2	19.7	135.6	113.3	0.483	20
5A	25'-25-1/2"	559.2	20.1	132.9	110.5	0.534	20
5B	25-1/2'-29"	552.7	19.7	131.7	116.0	0.532	20

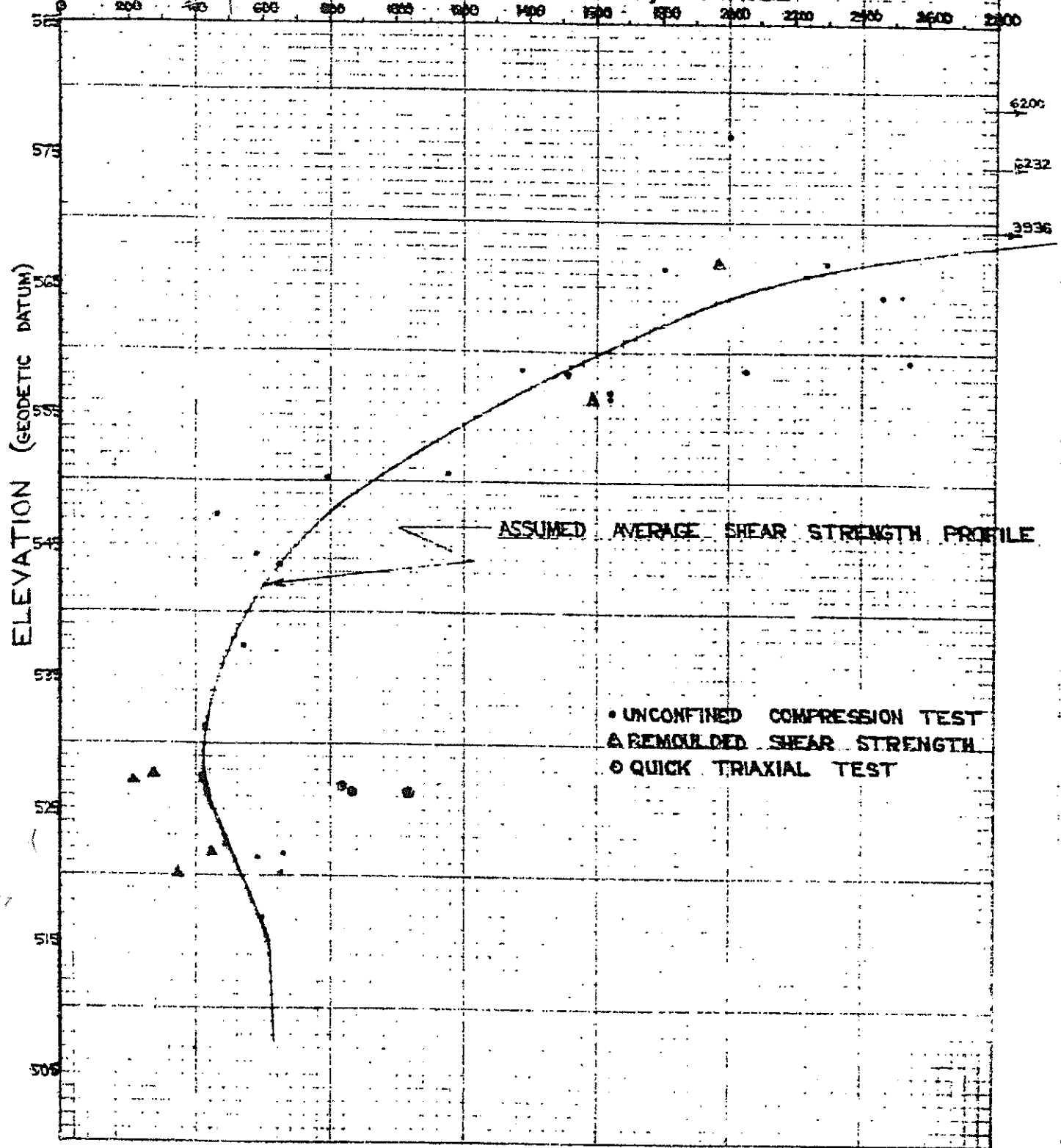
\* Denotes 1/3 x deviator stress from quick triaxial compression test.

JOB NO. 58162

# PLOT OF SHEAR STRENGTH VS. ELEVATION

COMPOSITE RESULTS OF ALL FIVE BOREHOLES

SOIL SHEAR STRENGTH, C - P.S.F.



359.5  
10X10 TO THE INCH  
LUNIL SYSTEM

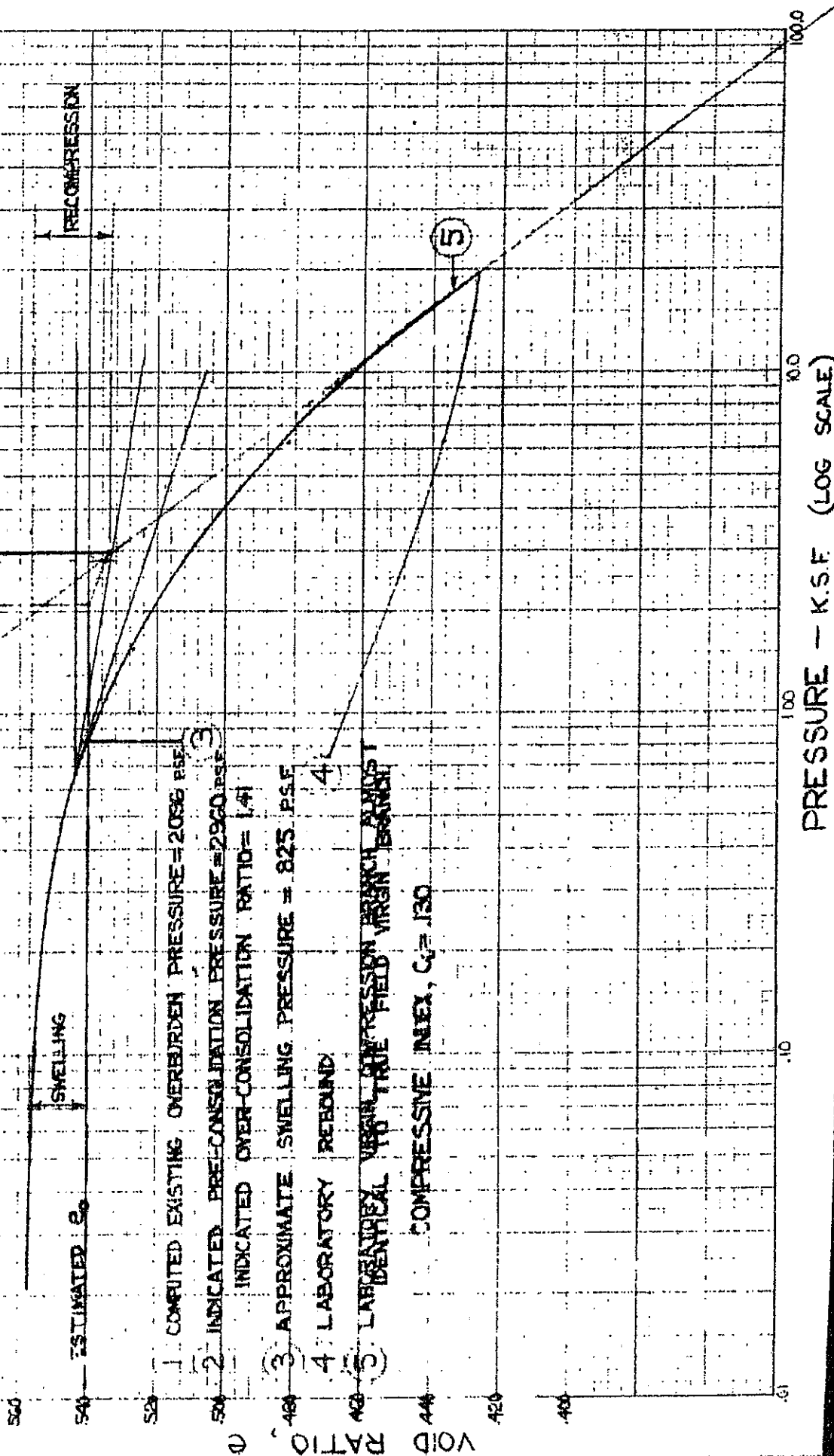
# CONSOLIDATION TEST

# PRESSURE-VOID RATIO CURVE

JOB NO. 58162

BOREHOLE 2 SAMPLE 5C

DEPTH: 210' - 214'



# MOHR'S CIRCLE DIAGRAM

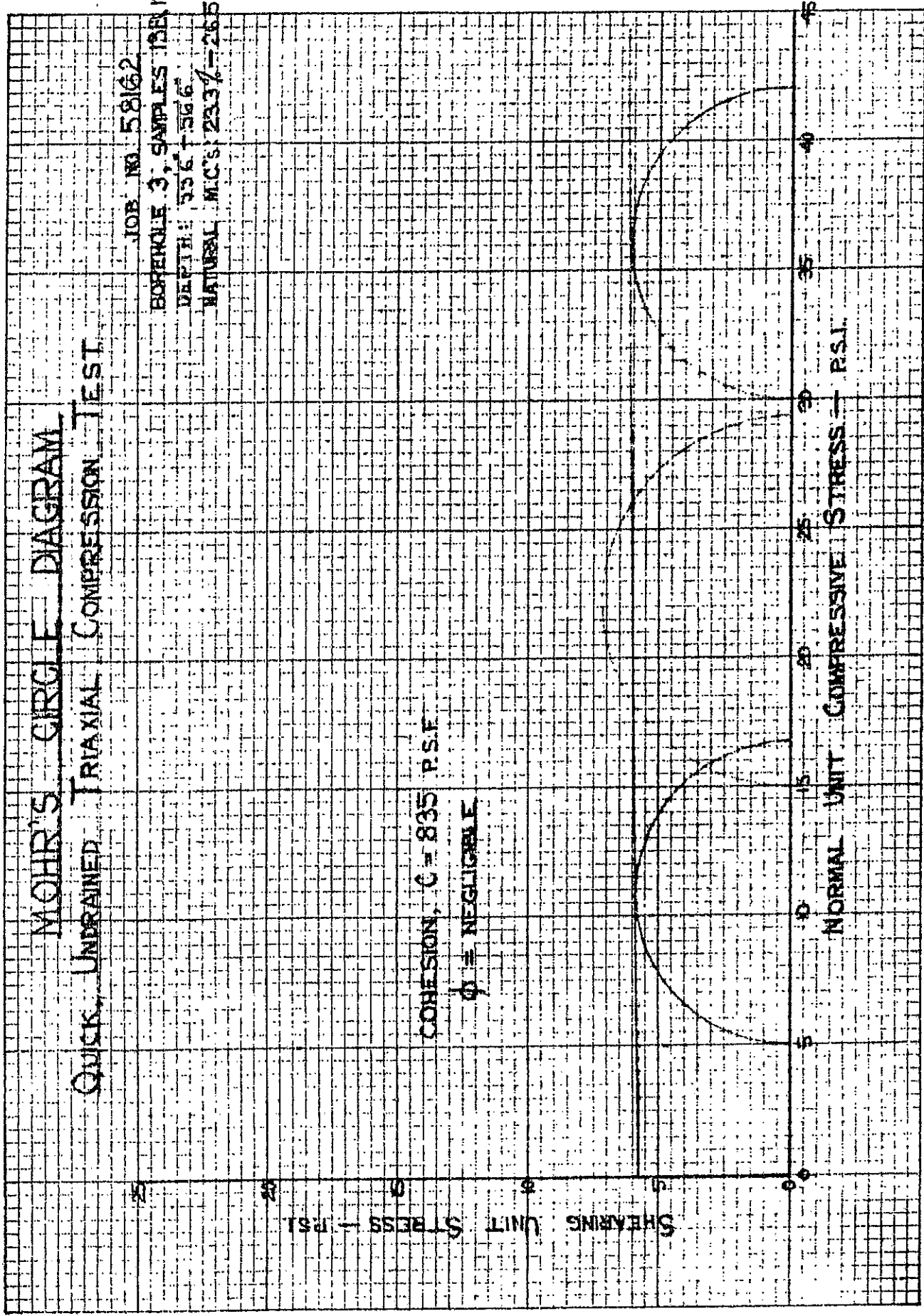
QUICK, UNDRAINED TRIAXIAL COMPRESSION TEST

JOB NO 58162  
BOREHOLE 3, SAMPLES 12B, 13C  
DEPTH 536' - 566'  
NATURAL M.C.'s: 23.3% - 26.5%

COHESION,  $C = 835$  P.S.F.  
 $\phi = \text{NEGLIGIBLE}$

SHEARING UNIT STRESS - P.S.I.

NORMAL UNIT COMPRESSION STRESS - P.S.I.





MOHR'S CIRCLE DIAGRAM  
CONSOLIDATED - UNDRAINED TRIAXIAL TEST WITH  
Pore Water Pressure Measurements

JOB NO. 58162

BOREHOLE 4

SAMPLES 16A, 16B

DEPTHS: 65'-05", 65'-06"

NAT MC's BEFORE TEST: 24.1%

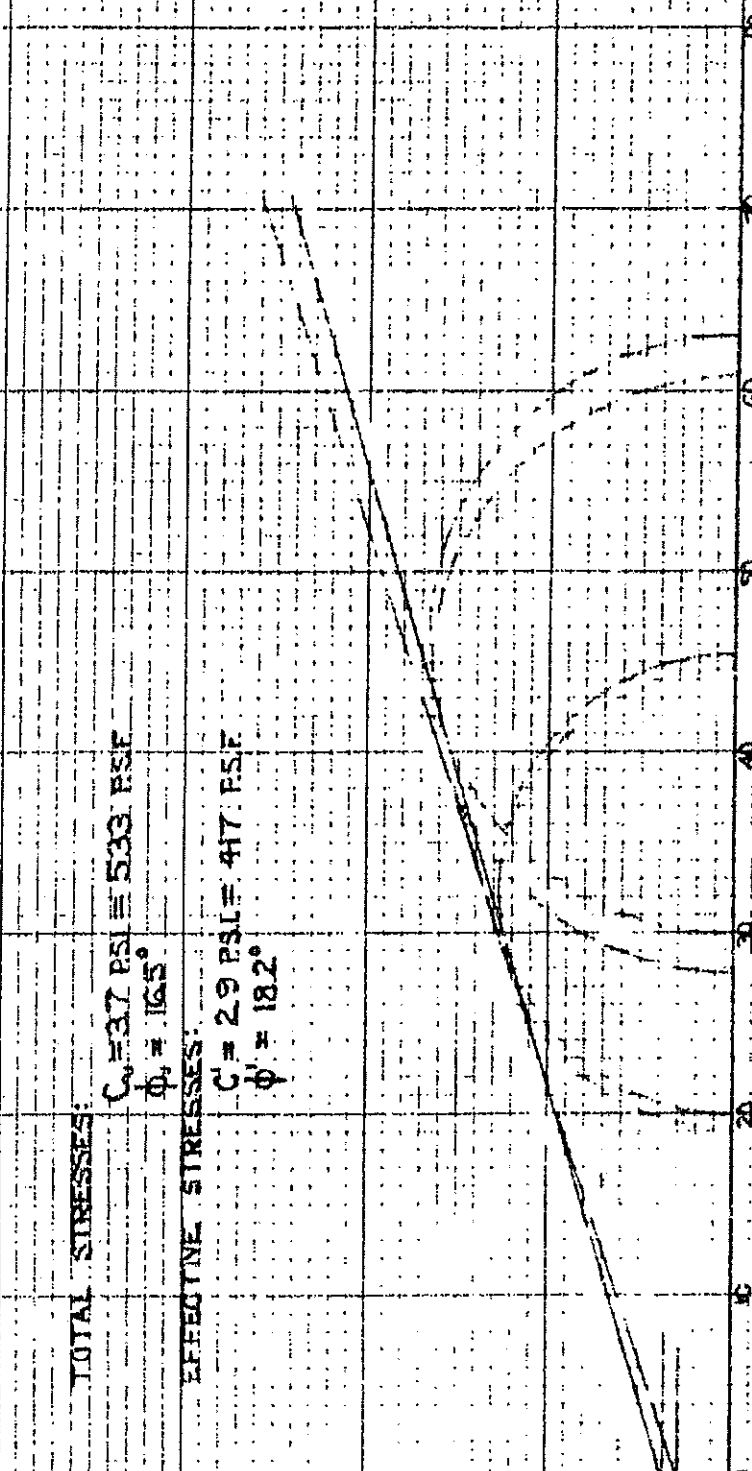
MC's AFTER TEST: 22.3%, 21.9%

TOTAL STRESSES:  
 $C_u = 37 \text{ PSI} \approx 533 \text{ PSF}$   
 $\phi_u = 16.5^\circ$

EFFECTIVE STRESSES:  
 $C' = 29 \text{ PSI} \approx 417 \text{ PSF}$   
 $\phi' = 18.2^\circ$

SHEARING UNIT STRESS - PSI

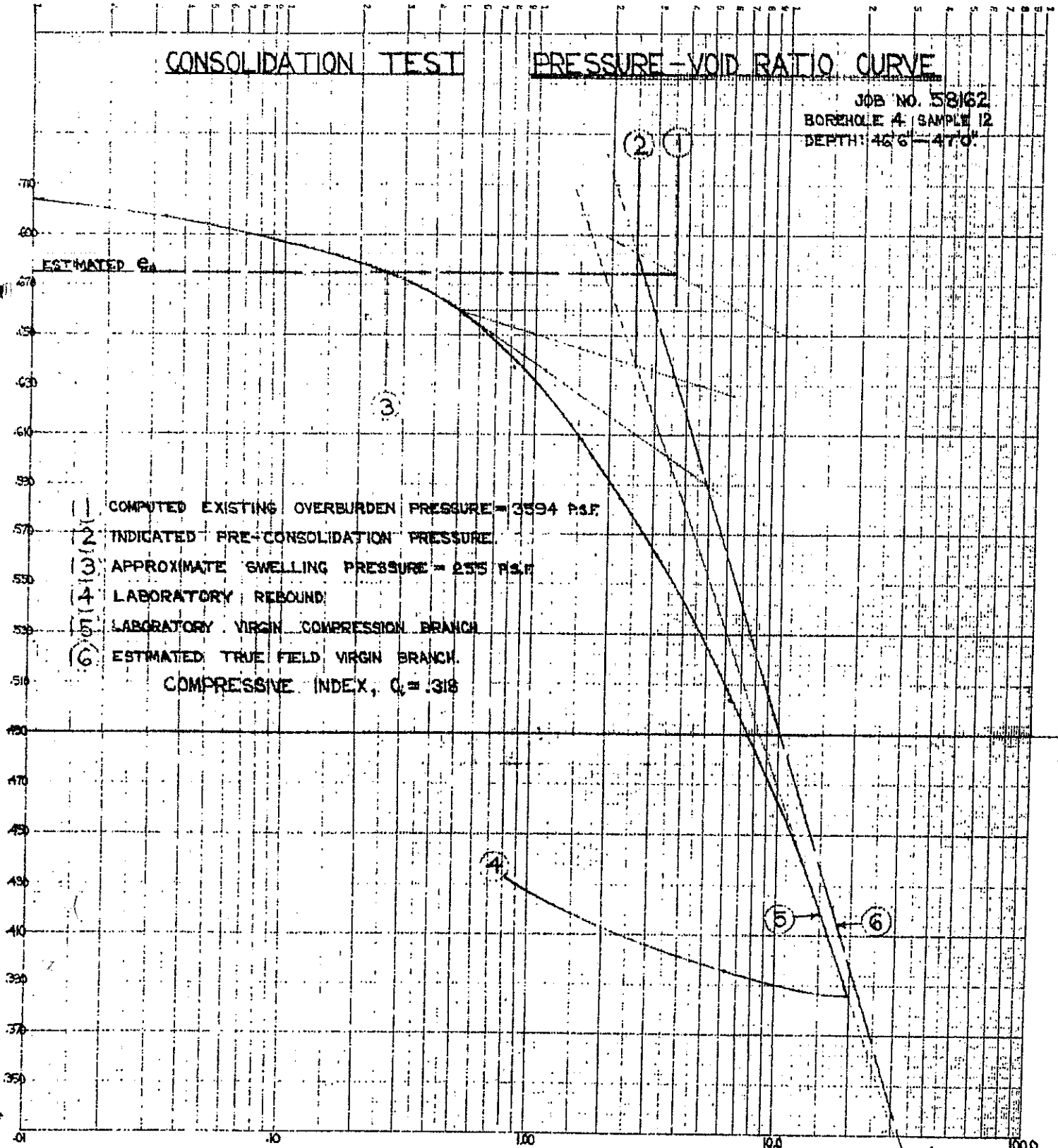
NORMAL UNIT COMPRESSIVE STRESS - PSI



CONSOLIDATION TEST

PRESSURE-VOID RATIO CURVE

JOB NO. 58162  
 BOREHOLE 4 (SAMPLE 12)  
 DEPTH: 46' 6" - 47' 0"



12%e

## APPENDIX II

### METHOD OF OPERATION

The field investigation work is carried out by means of a skid-mounted diamond drill rig.

Standard sampling procedures are followed. Casing is driven and cleaned, either by tubes or by wash water.

Samples are recovered ahead of the casing at frequent intervals, with either a 2 inch or 3 inch O. D. split barrel sampling tube, Shelby tube, or split barrel sampling tube fitted with brass liners and special sharp cutting nose.

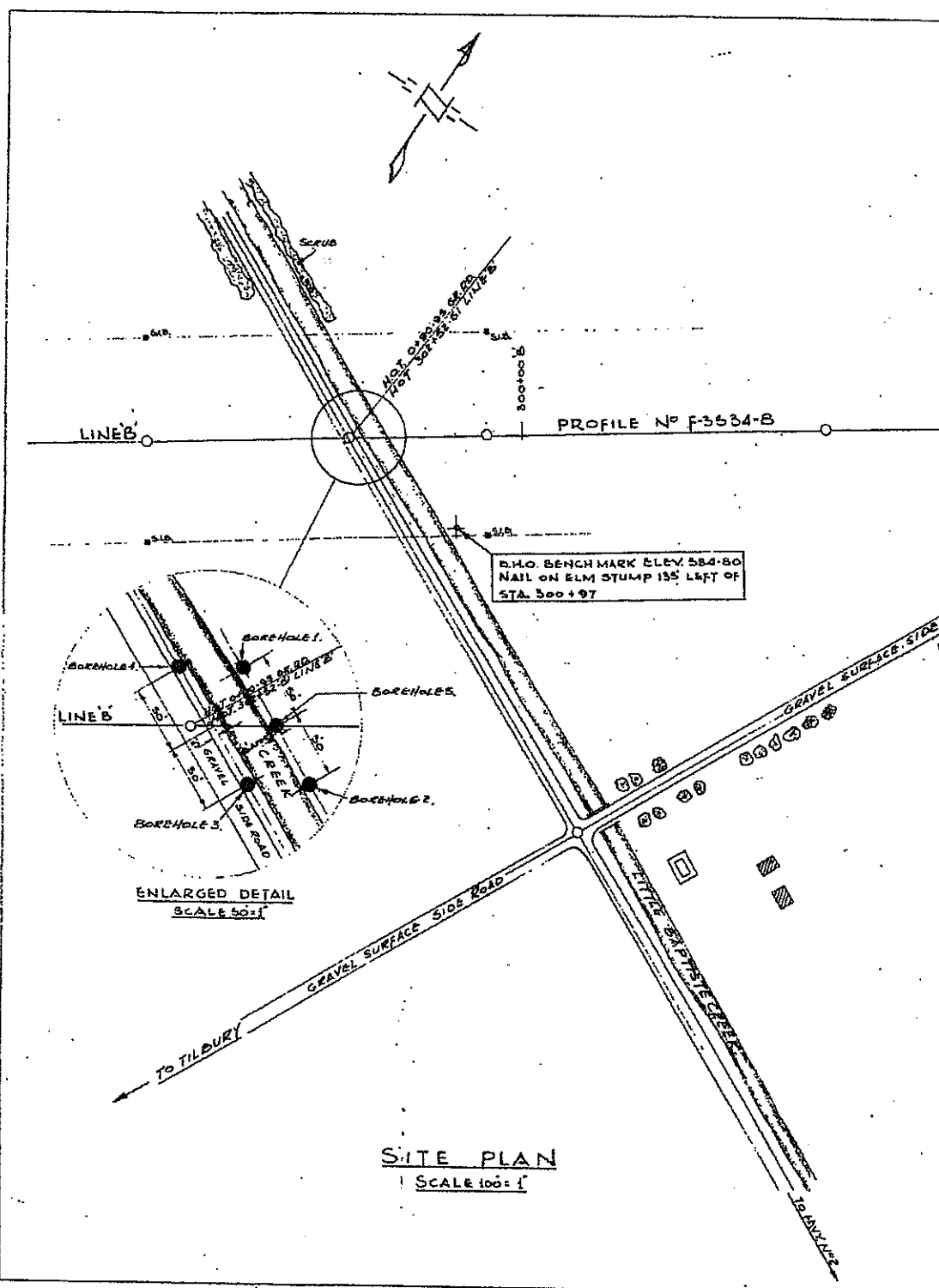
The standard penetration test results are recorded when sampling with the regular 2 inch O. D. split barrel sampler, these being the number of blows of a 140 pound hammer falling 30 inches, required to drive the sampling tube a distance of one foot into undisturbed soil.

The Dutch cone probe test is made by driving the drill rods into the ground with a 2-1/4" - 90° cone tip. The number of 4200 inch pound blows per foot of penetration are recorded, as in the standard penetration test.

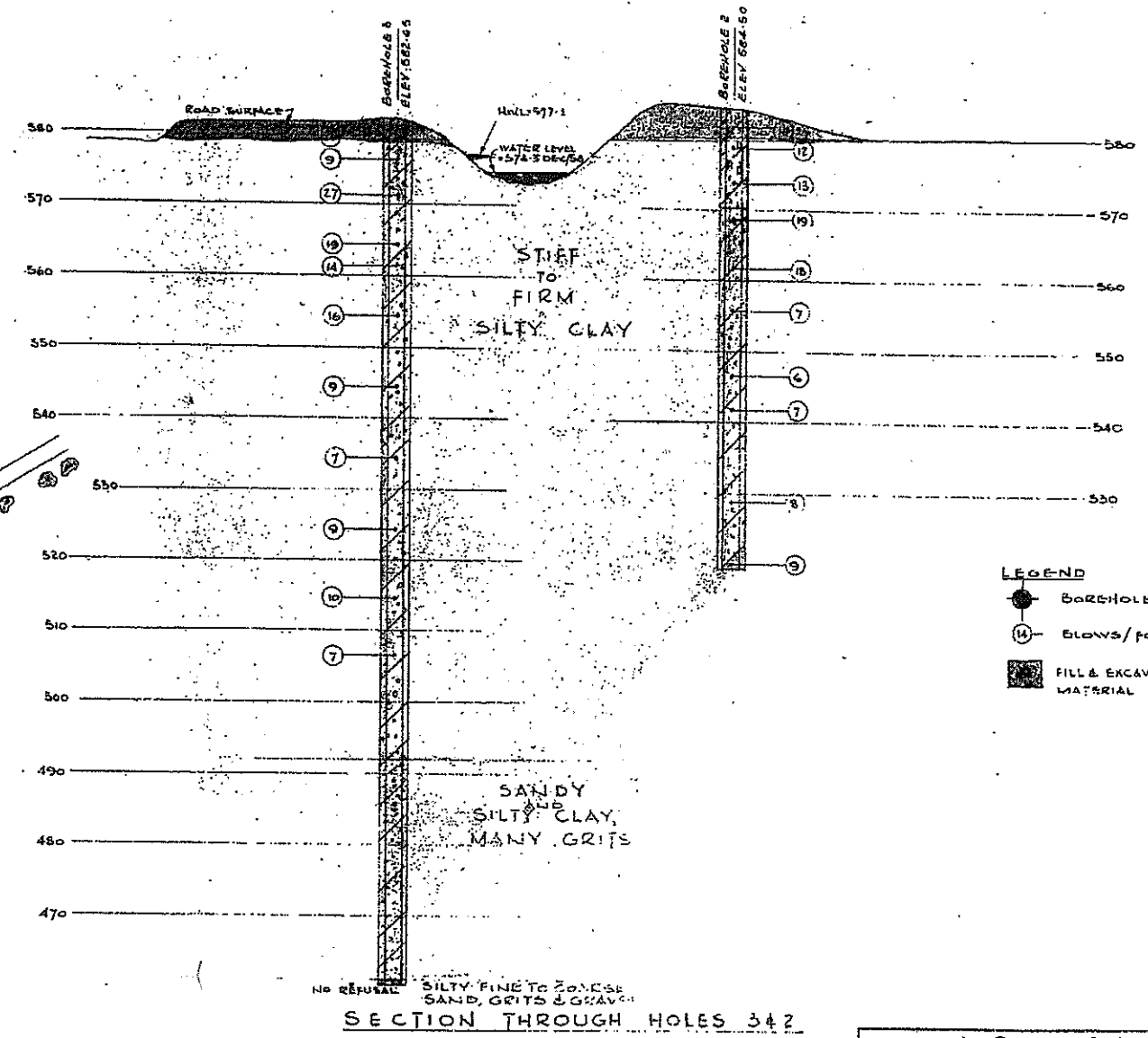
Where required, "in situ" shear strength tests are made ahead of the casing, using modified Acker vane test equipment.

Disturbed samples are visually classified in the field, sealed in sample jars, and are re-examined, and tested as necessary, in the soils laboratory. Undisturbed samples are returned to the laboratory for later examination and testing, as required.

The test holes are bailed at the end of the day and on completion. Subsequent water level readings are taken for the duration of the field work. Water pressure readings are recorded when Artesian water conditions are encountered. Moisture content samples are recovered at frequent intervals to assist in the soil classification and the interpretation of water table results.



SITE PLAN  
SCALE 100:1



- LEGEND
- Borehole
  - Blows/foot
  - Fill & excavated material

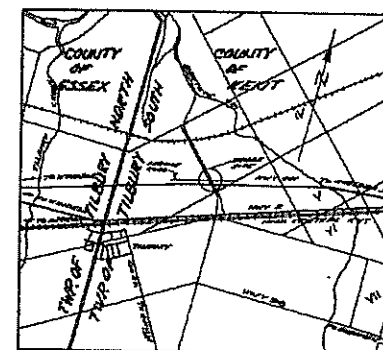
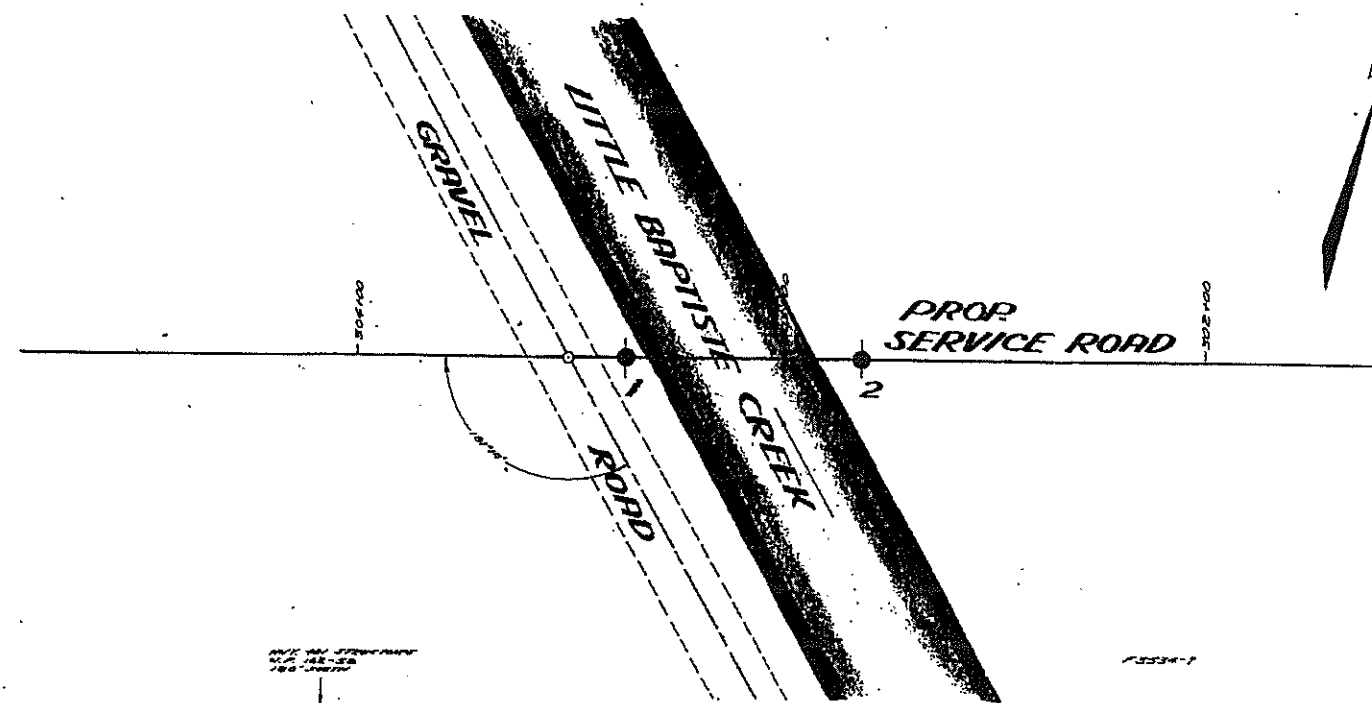
NOTE: See Borehole Logs for  
complete soil details



**e.m. peto & associates inc.**

SOIL SITE INVESTIGATION  
AT  
HWY. 401-LITTLE BAPTISTE CR. CROSSING  
TILBURY, ONTARIO  
FOR  
DEPT. OF HIGHWAYS OF ONTARIO

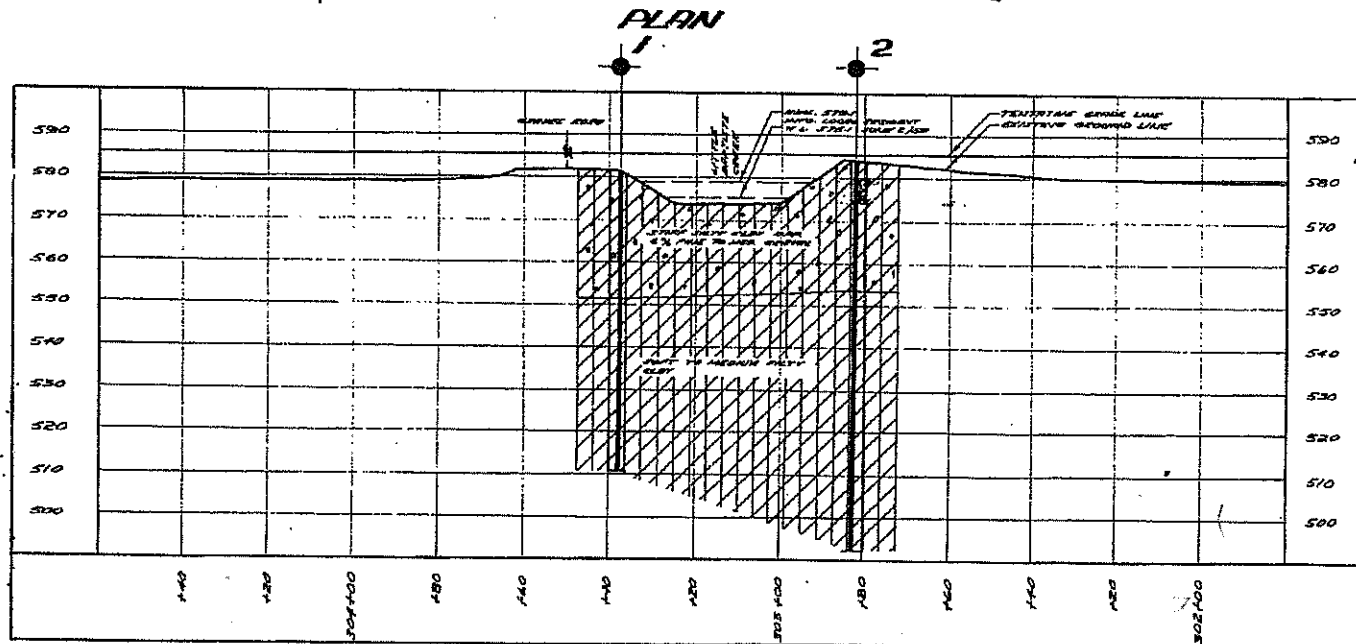
OUR JOB No. 50102 DATE: 15 JAN/59  
CLIENTS PLAN No. E-3413-1 & F-3534-B C.J.W.



LEGEND			
BORE HOLE			
PERCUSSION HOLE			
BORE & PERCUSSION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM
1	508.0'	303+38	E
2	504.0'	302+82	E

NOTE -

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH SECTION

**LITTLE BAPTISTE CREEK**

**PROPOSED CROSSING**

SHOWING POSITIONS & ELEVATIONS OF HOLES

ON HIGHWAY DISTRICT 1 COUNTY KENT

TOWNSHIP TILBURY LOT 14 CON. II

LOCATION AND IN SHALE OF TILBURY

DRAWN BY J. HALLS CHECKED BY J. H. W. P. 225-53

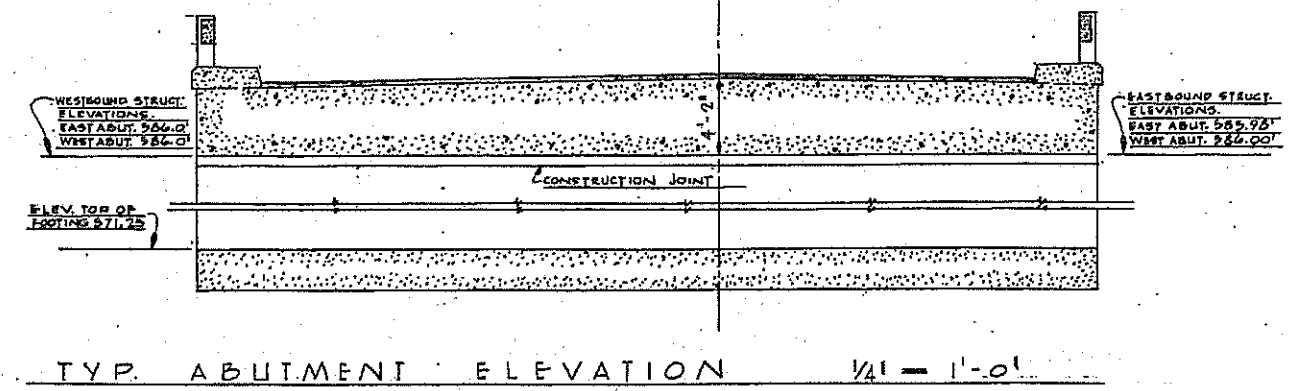
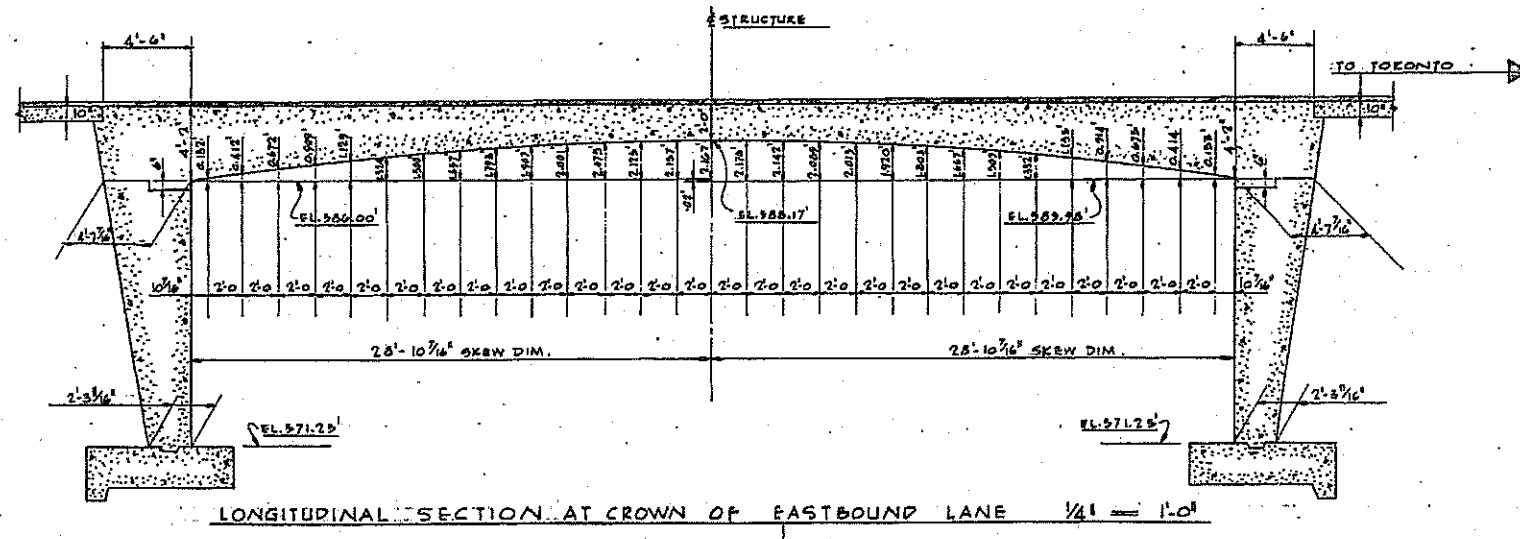
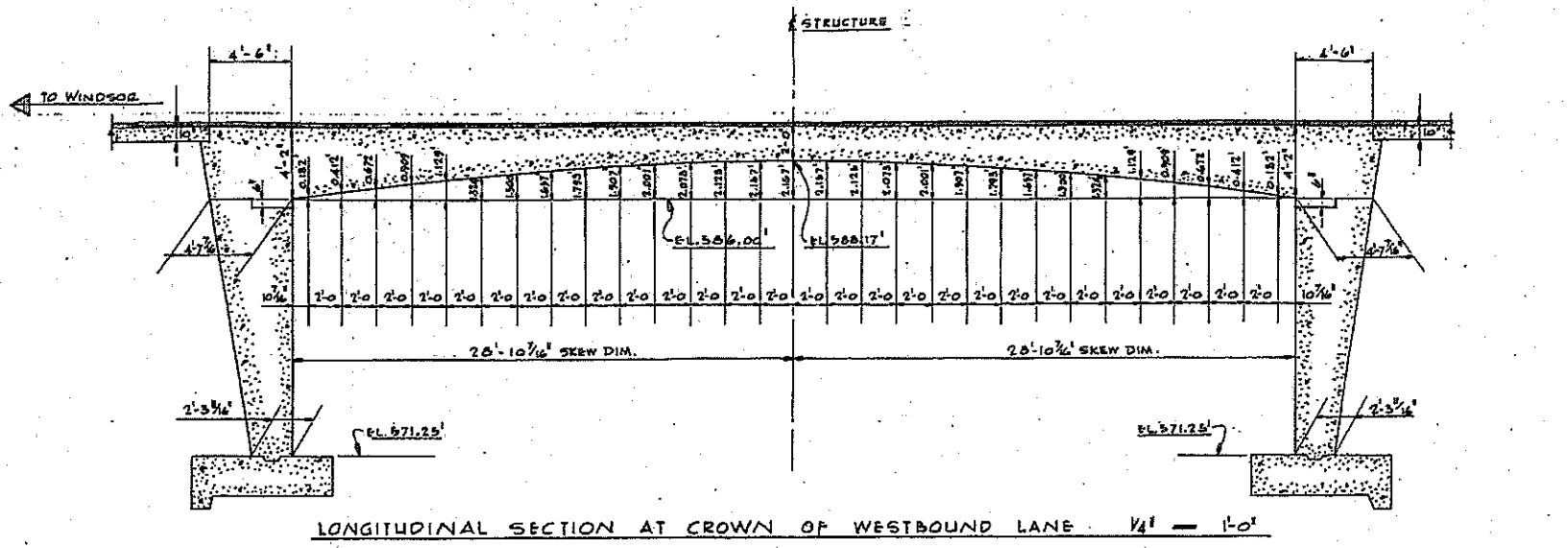
DATE 2/10/62 APPROVED BY

SCALE 1 in. = 20 ft. DRAWING NO. F59-72A





- (7) Contract Drawings for Tilbury East Township Bridge No. 8 over the Baptiste Creek (Baptiste Creek Bridges), WP 164-58, TWP 104-188-1A, prepared by A.D. Margison and Associates Limited, dated May 1959.



GROUNDWATER LEVEL EQUALS APPROX. STREAM WATER LEVEL.

BOREHOLE NO. 1.	BOREHOLE NO. 2.	BOREHOLE NO. 3.	BOREHOLE NO. 4.
SOIL DESCR.	ELEV. LEG. P.F.	SOIL DESCR.	ELEV. LEG. P.F.
SILTY CLAY, GREY AND PEBBLES SOME FOR SAND, SILENTLY GREY BROWN, STIFF	5.0	DRYING SAND, LIGHT BROWN, SILENTLY GREY BROWN, STIFF	5.0
CLAYEY AND SANDY SILT, GREY AND PEBBLES, MOTTLED GREY BROWN, COMPACT	10.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	10.0
STEPPED SILTY CLAY, GREY AND PEBBLES, TUM AND SAND SEAMS, BROWN, BEST BY STIFF	15.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	15.0
STEPPED SILTY CLAY, GREY AND PEBBLES, TUM AND SAND SEAMS, BROWN, BEST BY STIFF	20.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	20.0
STEPPED SILTY CLAY, GREY AND PEBBLES, TUM AND SAND SEAMS, BROWN, BEST BY STIFF	25.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	25.0
STEPPED SILTY CLAY, GREY AND PEBBLES, TUM AND SAND SEAMS, BROWN, BEST BY STIFF	30.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	30.0
AS ABOVE, NUMEROUS GREY, STIFF	35.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	35.0
SILTY CLAY, GREY, STIFF	40.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	40.0
STEPPED SILTY CLAY, GREY, STIFF	45.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	45.0
SILTY CLAY, GREY, STIFF	50.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	50.0
AS ABOVE	55.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	55.0
AS ABOVE	60.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	60.0
AS ABOVE	65.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	65.0
AS ABOVE	70.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	70.0
AS ABOVE	75.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	75.0
AS ABOVE	80.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	80.0
AS ABOVE	85.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	85.0
AS ABOVE	90.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	90.0
AS ABOVE	95.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	95.0
AS ABOVE	100.0	STEPPED SILTY CLAY, DARK GREY, SAND SEAMS, BROWNISH GREY, STIFF	100.0

**BORING DATA**  
THE COMPLETE SOIL INVESTIGATION REPORT D8809 MAY BE EXAMINED AT THE BRIDGE OFFICE, TORONTO. THE DEPARTMENT DOES NOT GUARANTEE THE ACCURACY OF THIS REPORT OR THE ASSIGNED VERSION SHOWN ON THESE PLANS.  
FOR LOCATION OF BOREHOLES SEE DRAWG. D4311-11.

WP 164-68

A.D. MARGISON AND ASSOCIATES LIMITED  
CONSULTING PROFESSIONAL ENGINEERS  
TORONTO CANADA

DEPARTMENT OF HIGHWAYS-ONTARIO  
BRIDGE OFFICE-TORONTO

TILBURY EAST TOWNSHIP  
BRIDGE N° 8 OVER BAPTISTE CREEK  
THE KING'S HIGHWAY NO. 601 DIST. NO. 1  
CO. OF KENT  
TWP. EAST TILBURY LOT 11 CON. V

BRIDGE FRAME DIMENSIONS & SOIL BORING DATA

APPROVED: *[Signature]*  
BRIDGE ENGINEER

DATE: MAY 1959

TWP 104-188-2-A



- (8) Foundation Investigation Report for Highway 401 and Baptiste Creek Crossing, WP 164-58, Ref. 59-F-206C, prepared by E.M. Peto Associates Ltd., dated February 20, 1959, Geocres No. 40J8-18.

**e. m. pyto associates ltd.**  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO  
BOREHOLE LOG

Highway 401 - Baptiste Creek Crossing. Job No. 58160 Borehole No. 1.  
Client: Dep't. of Highways of Ontario. Casing: BX (21" Dia.) Boring Date: Jan. 6th, -12th, 1959.  
Datum: Geodetic. Compiled By: M. Mindess. Checked By: E.M. Pyto.

SAMPLE CONDITION		SAMPLE TYPE		ABBREVIATIONS	
	UNDISTURBED	S.S.	2" STANDARD SPIT TUBE SAMPLE	V.T.	IN-SITU VANE SHEAR TEST
	FAIR	S.L.	2" SL. SAMPLE WITH LENS	Q.U.	UNCONFINED COMPRESSIVE STRENGTH
	DISTURBED	S.T.	TRENCHWALL SAMPLE BY TUBE SAMPLE	W.L.	WATER LEVEL IN CASING
	LOST	W.S.	WASH SAMPLE	W.T.	GROUND WATER TABLE IN SOIL
		R.C.	ROCK SAMPLE		
SOIL DESCRIPTION	DEPTH	THICKNESS	TEST	WATER LEVEL	SOIL, BOREHOLE & REMARKS
SILTY CLAY, GRITS AND PEBBLES, SOME FINE SAND.	0' 0" - 5' 0"	5' 0"	1  S.S. 14		NAT. M.C.=17.5% DRIER THAN PLASTIC LIMIT.
CLAYEY AND SANDY SILT, GRITS AND PEBBLES	5' 0" - 10' 0"	5' 0"	2  S.S. 20		MOIST, NON-PLASTIC. NATURAL M.C.=16.9%.
SILTY CLAY, GRITS AND PEBBLES.	10' 0" - 15' 0"	5' 0"	3  S.S. 25		NAT. M.C.=18.9% AT PLASTIC LIMIT.
STRATIFIED SILTY CLAY, GRITS AND PEBBLES, THIN FINE SAND SEAM.	15' 0" - 20' 0"	5' 0"	4  S.S. 32		NAT. M.C.=20.0% DRIER THAN PLASTIC LIMIT.
STRATIFIED SILTY CLAY, GRITS AND PEBBLES.	20' 0" - 25' 0"	5' 0"	5  S.S. 27		NAT. M.C.=16.6% AT PLASTIC LIMIT.
STRATIFIED SILTY CLAY, BLACK GRITS.	25' 0" - 30' 0"	5' 0"	6  S.S. 22		NAT. M.C.=15.2% WETTER THAN PLASTIC LIMIT.
AS ABOVE, NUMEROUS GRITS.	30' 0" - 35' 0"	5' 0"	7  S.L. TAPPED 8  S.S. 23		WETTER THAN PLASTIC LIMIT.
SILTY CLAY, GRITS.	35' 0" - 40' 0"	5' 0"	9  S.S. 14		NAT. M.C.=21.0% MUCH WETTER THAN PLASTIC LIMIT.
STRATIFIED SILTY CLAY, GRITS	40' 0" - 45' 0"	5' 0"	10  S.L. PUSHED 11  S.S. 14		MUCH WETTER THAN PLASTIC LIMIT.
	45' 0" - 50' 0"	5' 0"	12  S.L. PUSHED		
SILTY CLAY, GRITS	50' 0" - 55' 0"	5' 0"	13  S.L. PUSHED 14  S.S. 10		MUCH WETTER THAN PLASTIC LIMIT.
AS ABOVE	55' 0" - 60' 0"	5' 0"	15  S.L. PUSHED 16  S.S. 7		AS ABOVE. SPECIFIC GRAVITY=2.76.
HOLE TERMINATED NO STIFFENING OR REFUSAL					





## BOREHOLE LOG

HOPE TERMINATED - NO REFUSAL

e. m. peto associates ltd.

# BOREHOLE LOG

Highway 401 -  
Job Name ..... Baptist Creek Crossing. Job No. .... 58160

Client Dep't. of Highways of Ontario Casing... BX ( 2<sup>1/2</sup>" dia.)

**Geodetic.** **Compiled By** **P.M.Aylett.**

Borehole No. 4

Boring Date Jan. 12th. - 13th. 1950.

Checked By: M. Mindess.

**SAMPLE CONDITION**

**SAMPLE TYPE**

### ABBREVIATIONS

 UNDISTURBED

 FAIR

**✕** **DISTURBED**

**LOST**

8.5. 2° STANDARD SPLIT TUBE SAMPLE

### 5.1. SPLIT BARREL WITH LINES

S. T. THIN-WALLED SKELBY TUBE SAMPLE

W. S. WASH SAMPLE

### N. E. ROCK CORE

### V. T. IN SITU VANE SHEAR TEST

0.4% UNCONFINED COMPRESSIVE STRENGTH

W.L. WATER LEVEL IN CASING

W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOR	Density or Consistency	Depth Elevation	Sample No. and Count	Sample Type	No. of Blows per Ft.	WATER LEVEL, SOIL MOISTURE & REMARKS
DEPTH OF FLOOD 2' 6"			0' 0"				
			583' 9"				
SILTY CLAY, MINOR SAND POCKETS, GRITS	MOTTLED GREY-BROWN	FIRM		1	SS	14	NAT. M.C. = 16.4% DRIER THAN PLASTIC LIMIT.
AS ABOVE, WITH SHALE FRAGMENTS	AS ABOVE	STIFF		2	SS	27	NAT. M.C. = 15.2% DRIER THAN PLASTIC LIMIT.
			10' 0"				
SILTY CLAY, MANY GRITS, SMALL SAND POCKETS	GREYISH-BROWN	VERY STIFF		3	SS	32	NAT. M.C. = 19.3% AT PLASTIC LIMIT.
			15' 0"				
SILTY CLAY, GRITS STRATIFIED	GREY	STIFF		4	SS	20	NAT. M.C. = 15.9% WETTER THAN PLASTIC LIMIT.
			20' 0"				
AS ABOVE	GREY	STIFF		5A	SS	15	
				5B	AVOID	-	WETTER THAN PLASTIC LIMIT.
			25' 0"				
AS ABOVE	GREY			6	S.L.	TAPPED	
			30' 0"				
AS ABOVE	GREY	STIFF		7	S.S.	15	NAT. M.C. = 17.0% WETTER THAN PLASTIC LIMIT.
			35' 0"				
AS ABOVE	GREY			8	S.L.	TAPPED	
			40' 0"				
AS ABOVE	GREY	FIRM		9	SS	12	NAT. M.C. = 22.3% MUCH WETTER THAN PLASTIC LIMIT.
			45' 0"				
AS ABOVE	GREY			10	S.L.	PUSHED	
			50' 0"				
AS ABOVE	GREY	FIRM		11	SS	10	MUCH WETTER THAN PLASTIC LIMIT.
			532' 9"				
HOLE TERMINATED - NO REFUSAL							

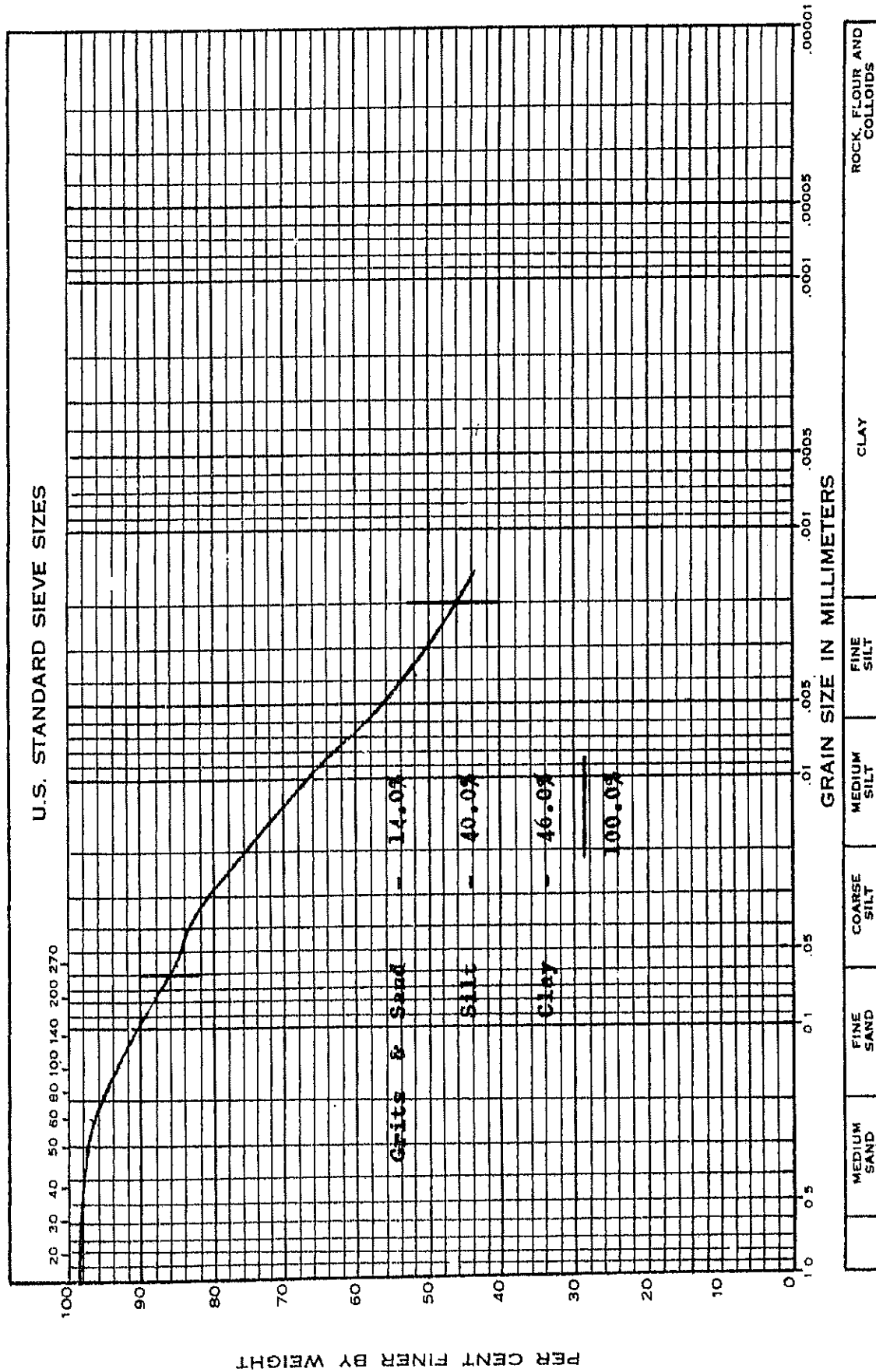
APPENDIX I

LABORATORY TEST RESULTS

**SHRINKAGE LIMITS****Job No. 58189**

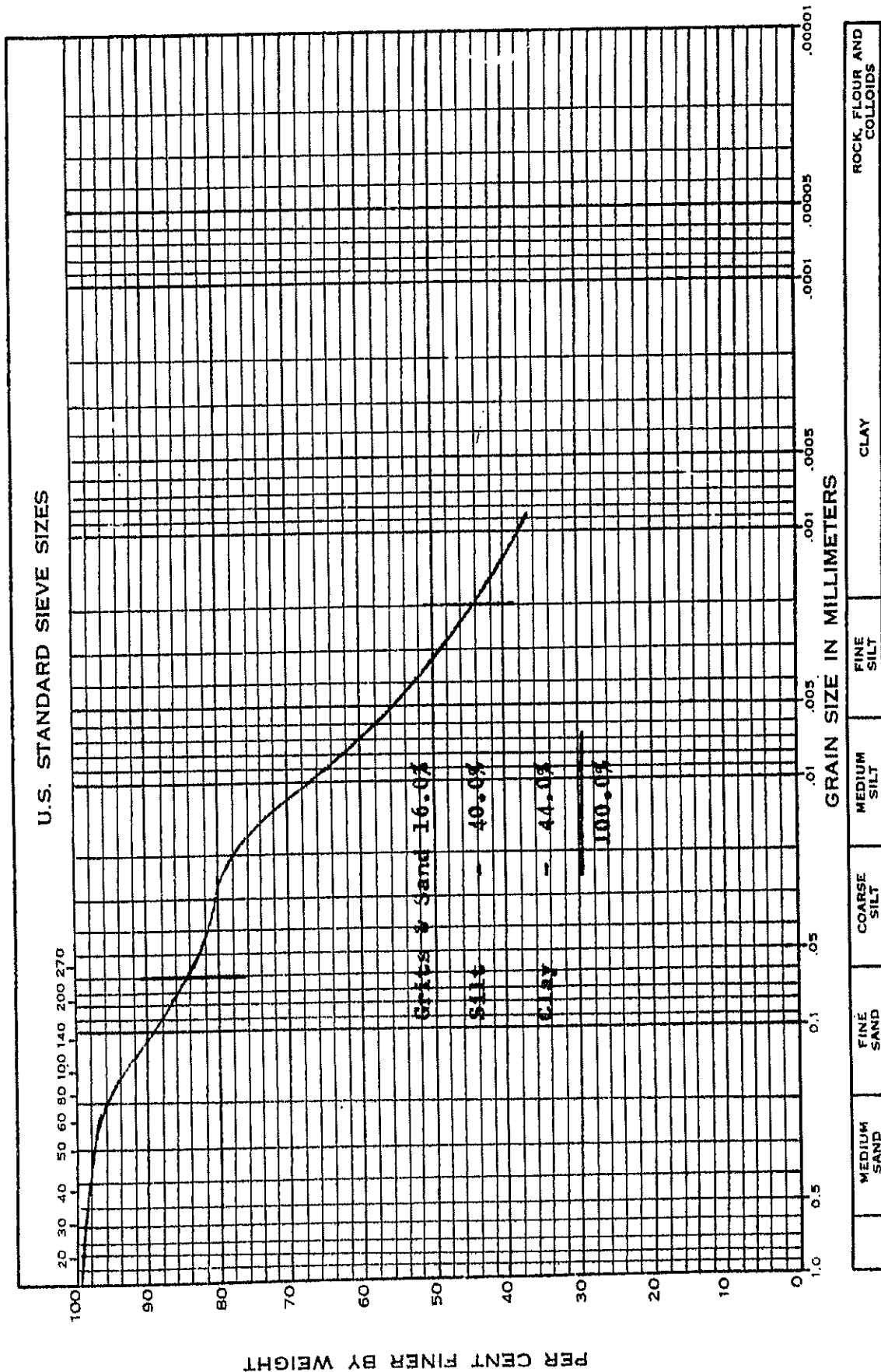
Borehole Number	2	4
Sample Number	3	2
Depth	9' - 10'	5' - 6'
Wt. of dish & wet soil - gms	51.37	52.49
Wt of dish & dry soil - gms	40.95	42.27
Wt. of dish gms	17.35	17.67
Wt. of water gms	10.42	10.22
Wt. of dry soil - gms (W <sub>o</sub> )	23.60	24.60
Moisture Content. % (W)	44.4	41.60
Volume of dish c.c. (V)	19.20	19.35
Volume of dry soil c.c. (V <sub>o</sub> )	12.65	13.18
Shrinkage Volume c.c. (V-V <sub>o</sub> )	6.55	6.17
Shrinkage Limit = (W <sub>s</sub> ) $W - \frac{(V-V_o) \times 100\%}{W_o}$	18.6	18.5
Shrinkage Ratio (R) = $\frac{W_o}{V_o}$	1.870	1.870
S. G. = $\frac{1}{1/R - W_s/100}$	2.71	2.70

E. M. PETO ASSOCIATES LTD.  
HYDROMETER GRAIN SIZE DISTRIBUTION DIAGRAM



M.I.T. CLASSIFICATION		REMARKS	
Job Name	Hwy. 401-Baptiste Creek Crossing.	Job No.	58160
Depth	20'-21'	Borehole No.	2
Elevation	562.9	Sample No.	5
Typical Grading Silty Clay Soil, Tilbury Area			

E. M. PETO ASSOCIATES LTD.  
HYDROMETER GRAIN SIZE DISTRIBUTION DIAGRAM



MEDIUM SAND	FINE SAND	COARSE SILT	MEDIUM SILT	FINE SILT	CLAY	ROCK, FLOUR AND COLLOIDS
<b>Hwy. 401 - Baptiste Creek M.I.T. CLASSIFICATION</b> <b>Crossing. 58160</b>						
JOB NAME		JOB NO.		BOREHOLE NO.		SAMPLE NO.
59'8"-60'8"		523.8		1		16
<b>Typical Grading Silty Clay Soil.</b>						
DEPTH		ELEVATION		REMARKS		

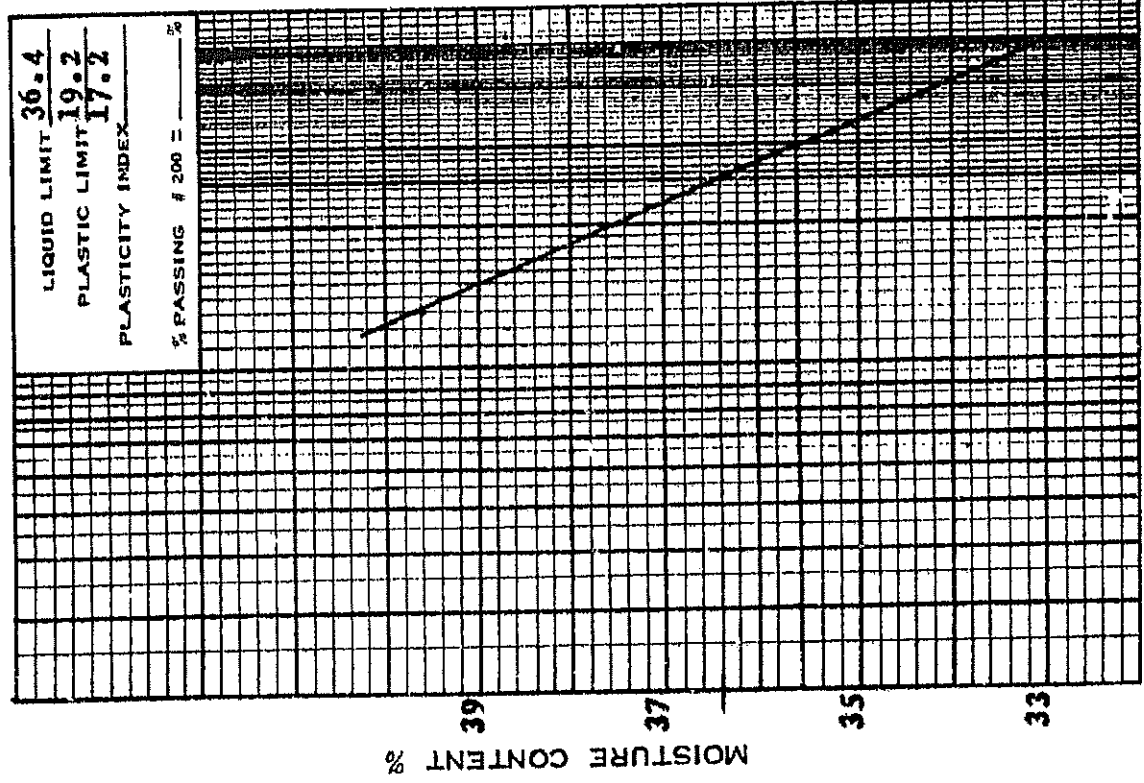


# e. m. peto associates ltd. SOIL TESTING LABORATORY

## LIQUID LIMIT TEST

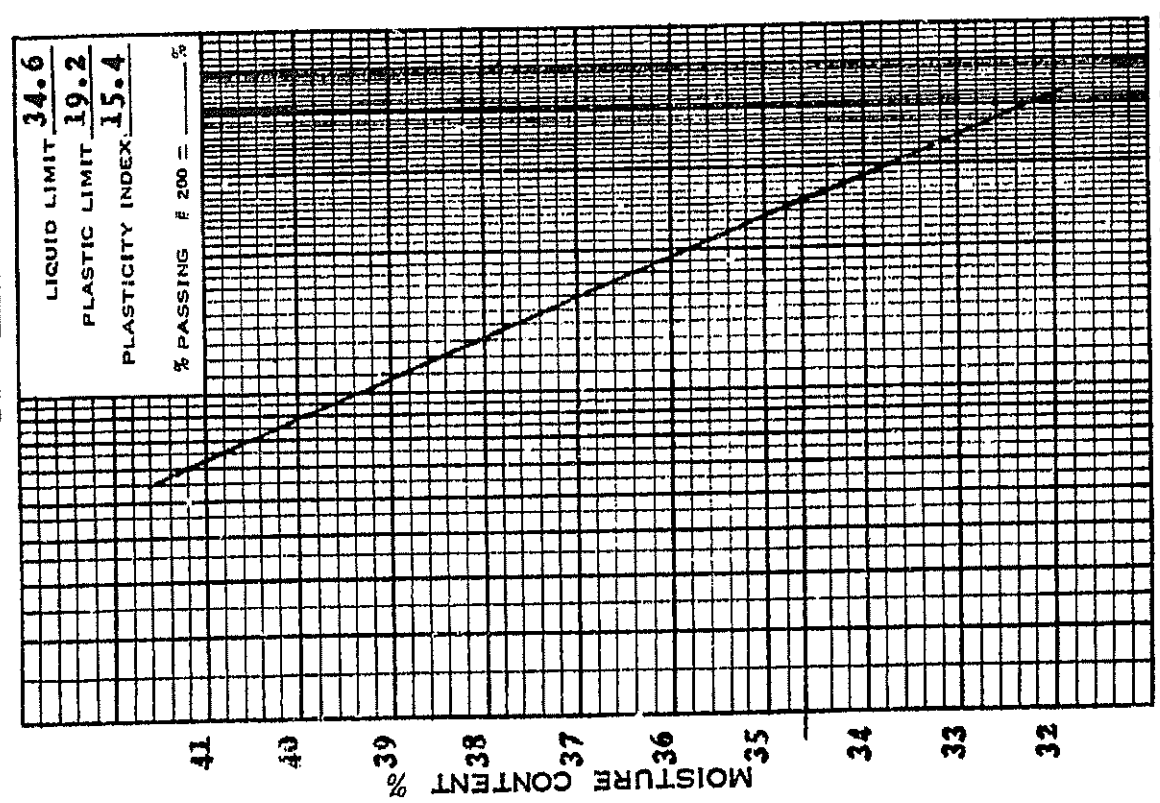
Job No. 58160 PROJECT Hwy. 401 - Baptiste Creek Crossing.  
SAMPLE FROM B.H.4. Sample # 2.

DEPTH 5' - 6'



## FLOW LINE CHARTS

SAMPLE FROM B.H.2. Sample # 3.  
DEPTH 9' - 10'



NO. OF BLOWS (LOG SCALE)

# e. m. peto associates ltd.

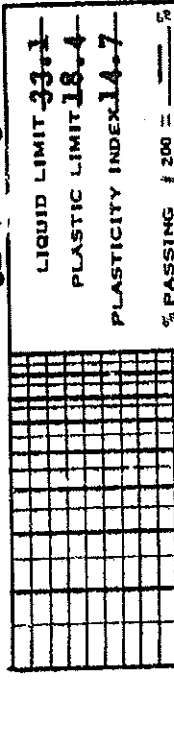
## SOIL TESTING LABORATORY

### FLOW LINE CHARTS

#### LIQUID LIMIT TEST

JOB No. 58160 PROJECT Hwy. 401 - Baptiste Creek Crossing  
 SAMPLE FROM R.H. # 1 Sample # 8

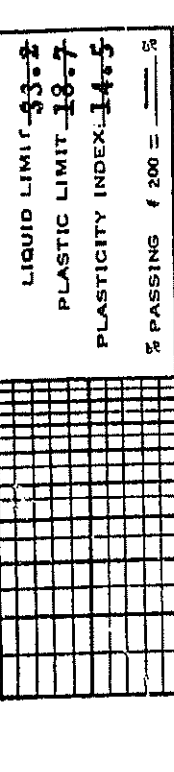
DEPTH 31.18' - 32.18'



#### LIQUID LIMIT TEST

JOB No. 58160 PROJECT Hwy. 401 - Baptiste Creek Crossing  
 SAMPLE FROM R.H. # 2 Sample # 9

DEPTH 40' - 41'



NO. OF BLOWS (Log Scale)

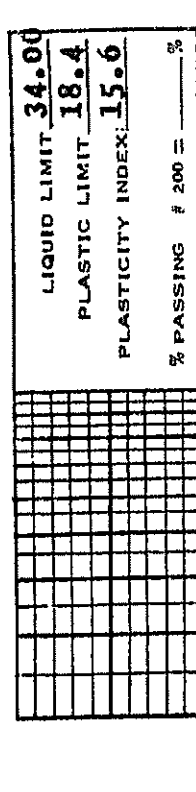
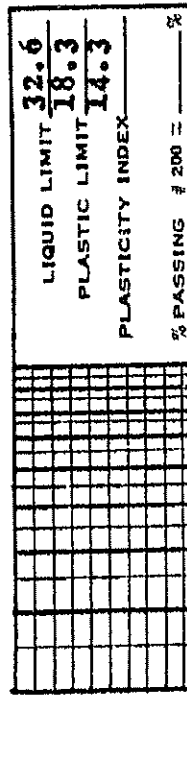
# e. m. peto associates ltd. SOIL TESTING LABORATORY

## LIQUID LIMIT TEST

## FLOW LINE CHARTS

JOB No. 58160 PROJECT Hwy. 401 - Baptiste Creek Crossing.  
SAMPLE FROM B.H.3. Sample # 13.

DEPTH 50' - 51'



NO. OF BLOWS (Log Scale)

# e. m. peto associates ltd.

## SOIL TESTING LABORATORY

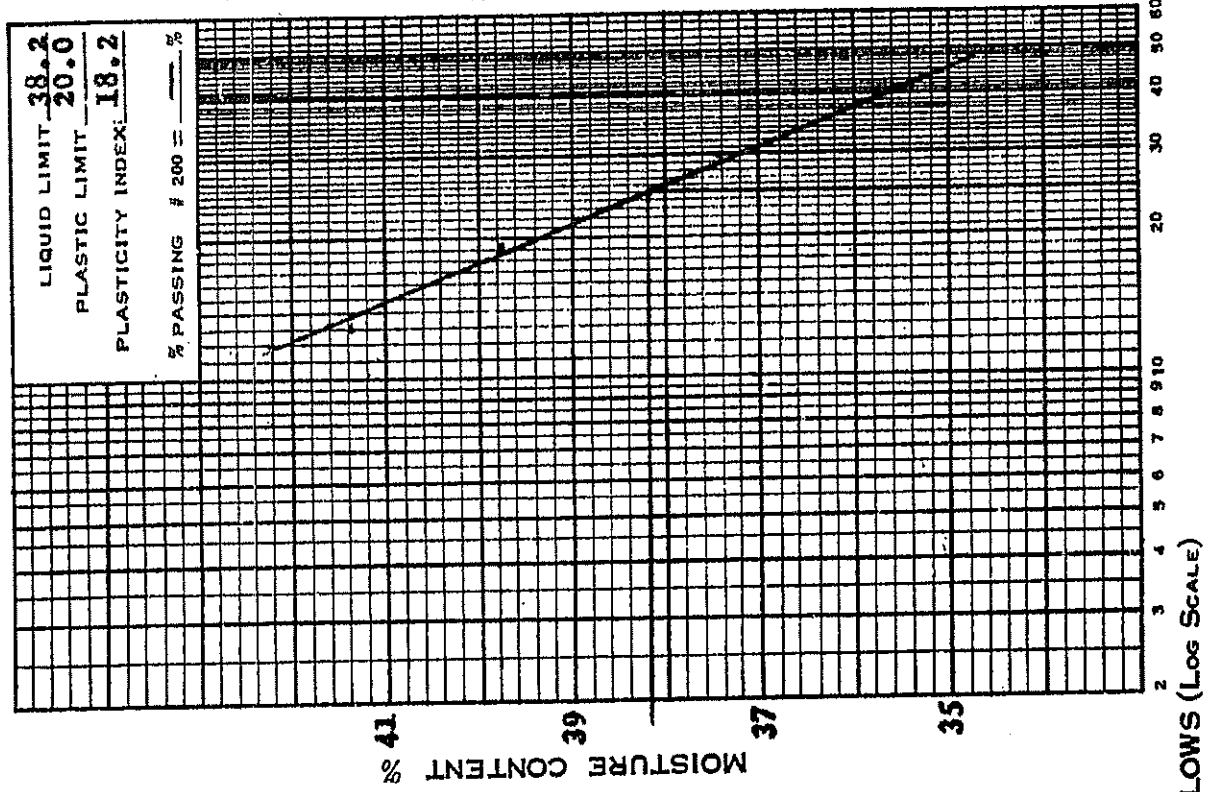
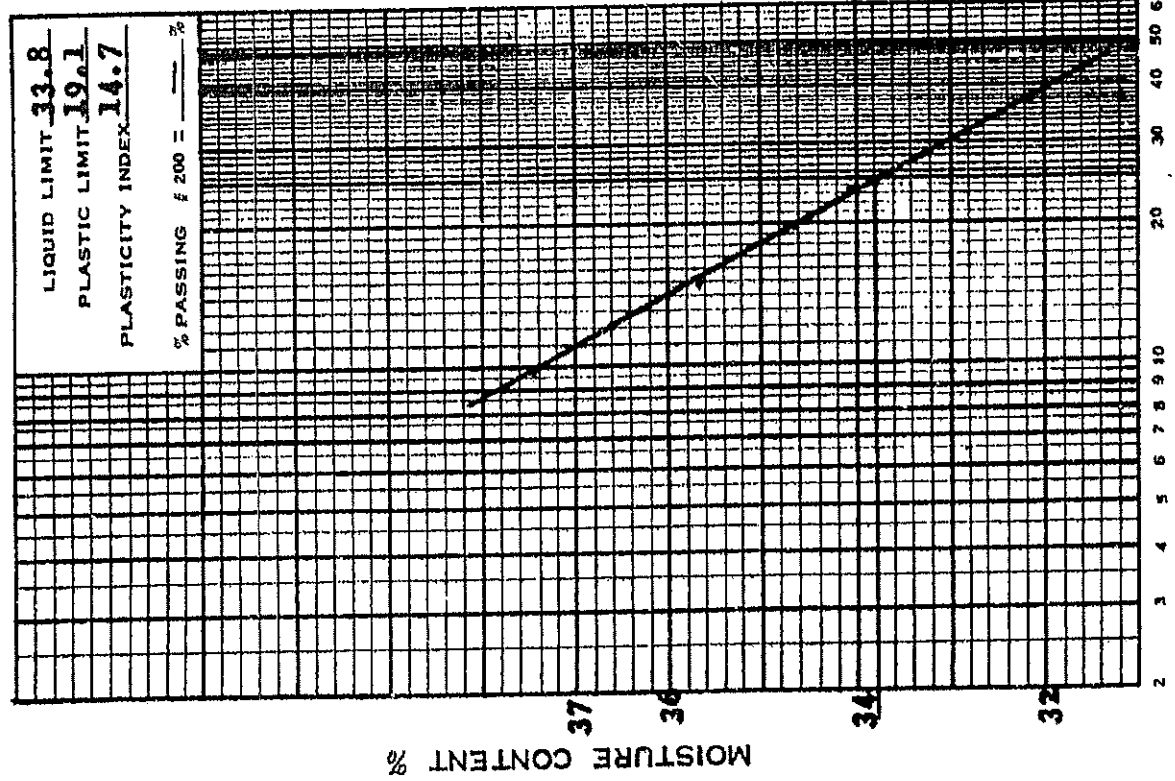
### LIQUID LIMIT TEST

### FLOW LINE CHARTS

JOB No. 58160 PROJECT Hwy. 401 - Baptiste Creek Crossing.  
 SAMPLE FROM B.H. # 2, Sample # 17. SAMPLE FROM B.H. # 2, Sample # 21.

DEPTH 75' - 76 1/2'

DEPTH 90' - 91'



# e. m. peto associates ltd. SOIL TESTING LABORATORY

## LIQUID LIMIT TEST

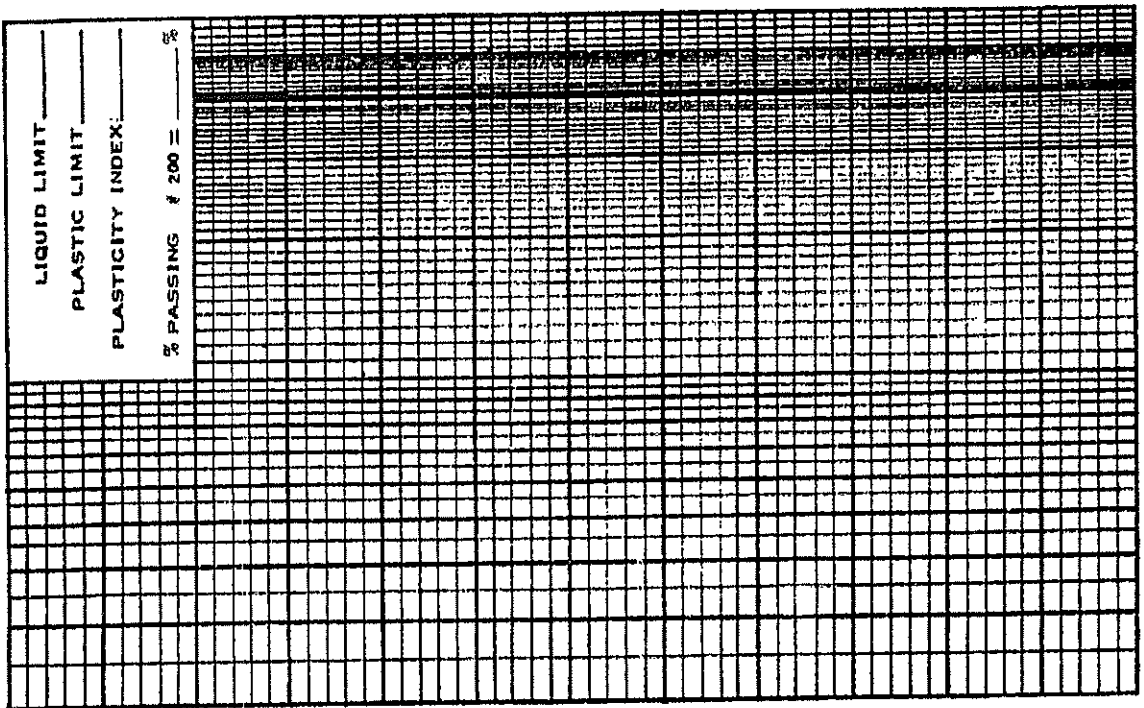
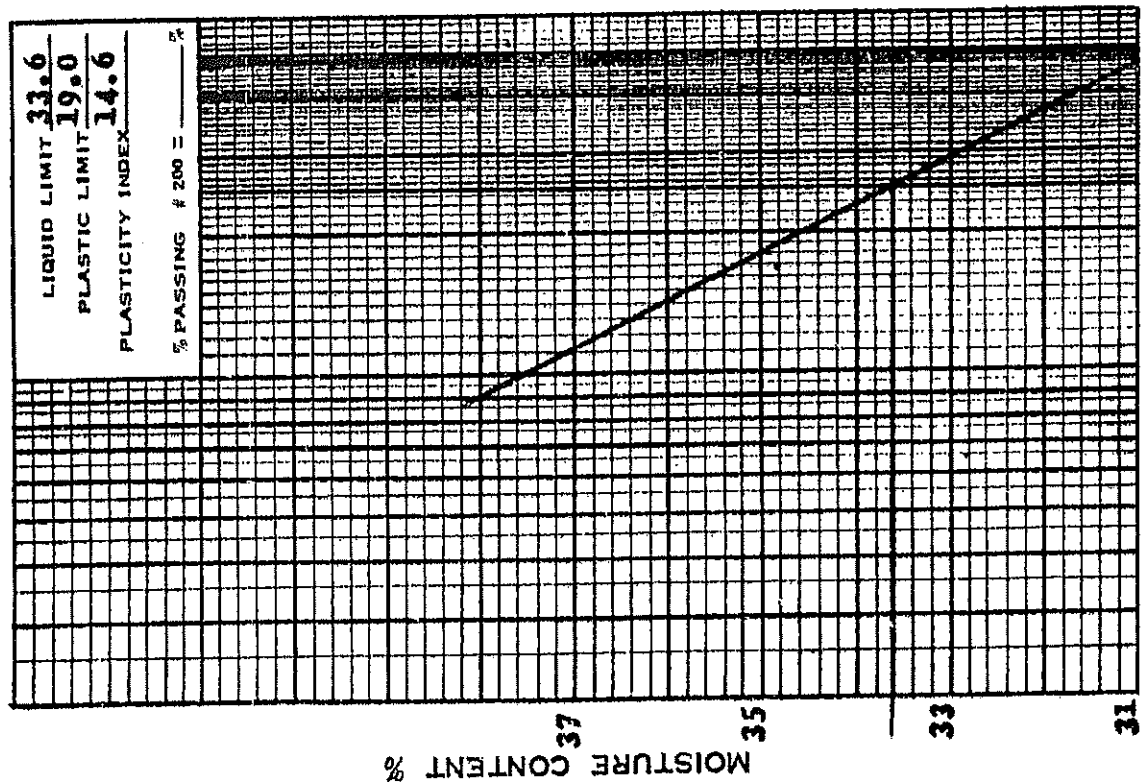
## FLOW LINE CHARTS

Job No. 58160P PROJECT Hwy. 491 - Baptiste Creek Crossing.  
SAMPLE FROM B.H.# 2. Sample # 23.

DEPTH 100' - 101'

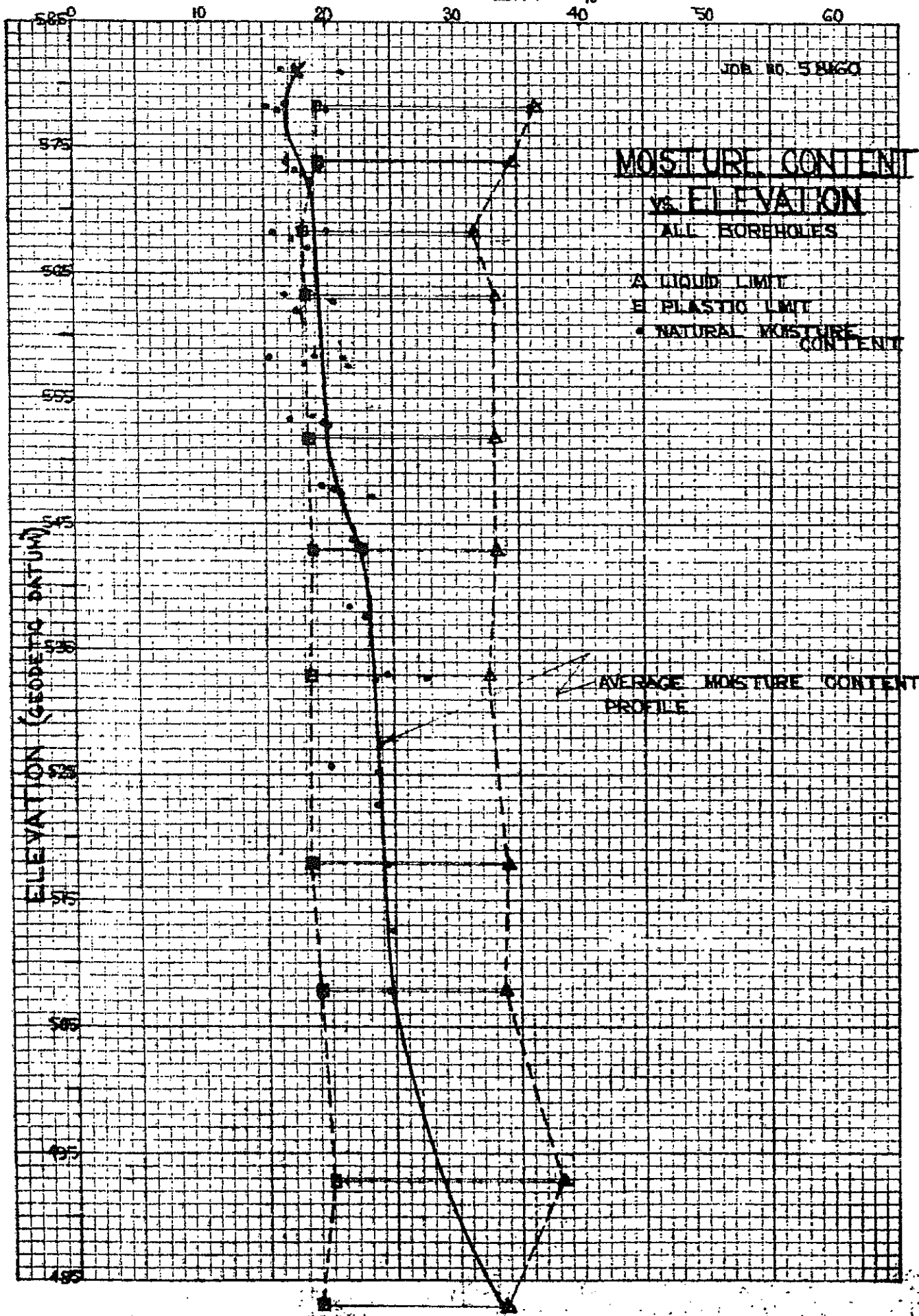
DEPTH \_\_\_\_\_

SAMPLE FROM \_\_\_\_\_



NO. OF BLOWS (Log Scale)

# MOISTURE CONTENT %





# SUMMARY OF SOIL SHEAR STRENGTH TESTS

Job No. 58160

Bore- Sample Hole # No.	Depth	Elevation	Nat. M.C. %	Wet Density p.c.f.	Degree of Saturation %	Void Ratio, e	% Strain at Failure	Soil Shear Strength C, p.s.f.
1								
7A	30' - 30'6"	553.7	18.9	134.4	100	.491	20	4395
10A	40' - 40'6"	543.7	21.8	132.0	100	.570	14.5	1750 <sup>x</sup>
10B	40'6" - 41'	543.2	22.6	132.2	100	.561	20	1838
13A	51' - 51'6"	532.7	23.4	128.3	100	.621	20	1345
15A	53' - 53'6"	525.7	20.0	128.0	100	.605	8.5	2672 <sup>x</sup>
15B	53'6" - 59'	525.2	23.5	126.3	100	.621	20	804
2								
4B	15'6" - 16'	567.6	17.1	135.0	99.0	.467	20	3935
6A	25' - 25'6"	558.1	21.1	131.6	100	.553	20	1722
6B	25'6" - 26'	557.6	21.5	130.1	100	.580	9.5	1038 <sup>x</sup>
8B	35'6" - 36'	547.6	20.4	133.7	100	.521	20	2460
8C	36' - 36'6"	547.1	23.2	134.0	100	.560	11.5	2210 <sup>x</sup>
10B	45'6" - 46'	537.6	22.8	129.6	100	.604	16.7	1640
14B	60'6" - 61'	512.6	23.6	128.9	100	.615	20	1065
16B	70'6" - 71'	512.6	24.9	128.9	100	.632	13.3	1050
4								
6A	25' - 25'6"	558.6	19.0	135.8	100	.478	20	3608
8B	35'6" - 36'	548.1	19.3	135.2	100	.486	20	2950
10A	45' - 45'6"	538.6	21.6	130.9	100	.583	20	1640

<sup>x</sup> Denotes 1/2 x deviator stress from quick triaxial compression test  
Lateral pressure approximately = overburden pressure.

# SHEAR STRENGTH VERSUS ELEVATION

JCE NO. 52160

SOIL SHEAR STRENGTH, C --- PSF

4500

4000

3500

3000

2500

2000

1500

1000

500

0

500

1000

1500

2000

2500

3000

3500

4000

4500

5000

5500

6000

6500

7000

7500

8000

8500

9000

9500

10000

10500

11000

11500

12000

12500

13000

13500

14000

14500

15000

15500

16000

16500

17000

17500

18000

18500

19000

19500

20000

20500

21000

21500

22000

22500

23000

23500

24000

24500

25000

25500

26000

26500

27000

27500

28000

28500

29000

29500

30000

30500

31000

31500

32000

32500

33000

33500

34000

34500

35000

35500

36000

36500

37000

37500

38000

38500

39000

39500

40000

40500

41000

41500

42000

42500

43000

43500

44000

44500

45000

45500

46000

46500

47000

47500

48000

48500

49000

49500

50000

50500

51000

51500

52000

52500

53000

53500

54000

54500

55000

55500

56000

56500

57000

57500

58000

58500

59000

59500

60000

60500

61000

61500

62000

62500

63000

63500

64000

64500

65000

65500

66000

66500

67000

67500

68000

68500

69000

69500

70000

70500

71000

71500

72000

72500

73000

73500

74000

74500

75000

75500

76000

76500

77000

77500

78000

78500

79000

79500

80000

80500

81000

81500

82000

82500

83000

83500

84000

84500

85000

85500

86000

86500

87000

87500

88000

88500

89000

89500

90000

90500

91000

91500

92000

92500

93000

93500

94000

94500

95000

95500

96000

96500

97000

97500

98000

98500

99000

99500

100000

100500

101000

101500

102000

102500

103000

103500

104000

104500

105000

105500

106000

106500

107000

107500

108000

108500

109000

109500

110000

110500

111000

111500

112000

112500

113000

113500

114000

114500

115000

115500

116000

116500

117000

117500

118000

118500

119000

119500

120000

120500

121000

121500

122000

122500

123000

123500

124000

124500

125000

125500

126000

126500

127000

127500

128000

128500

129000

129500

130000

130500

131000

131500

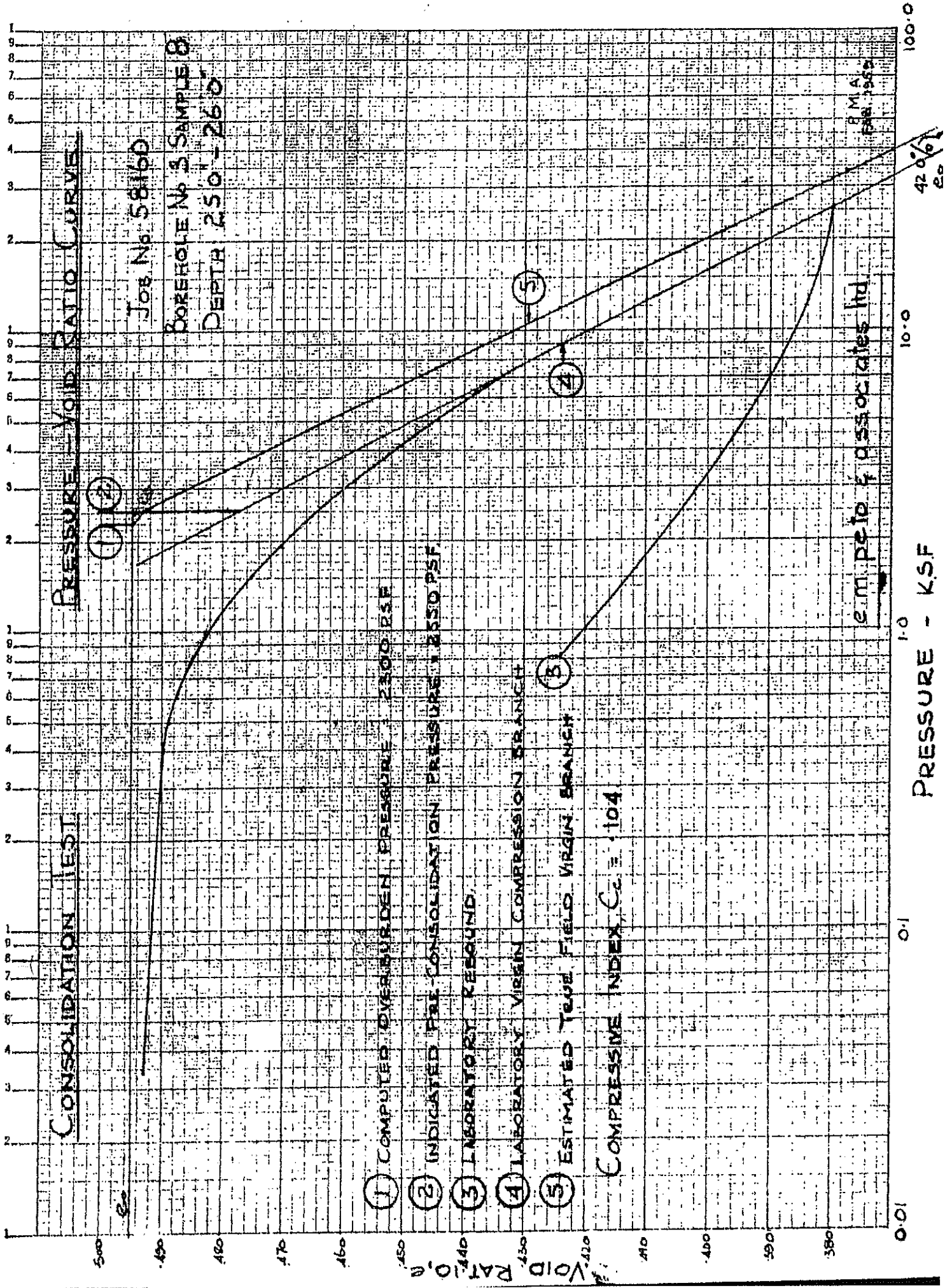
132000

132500

133000

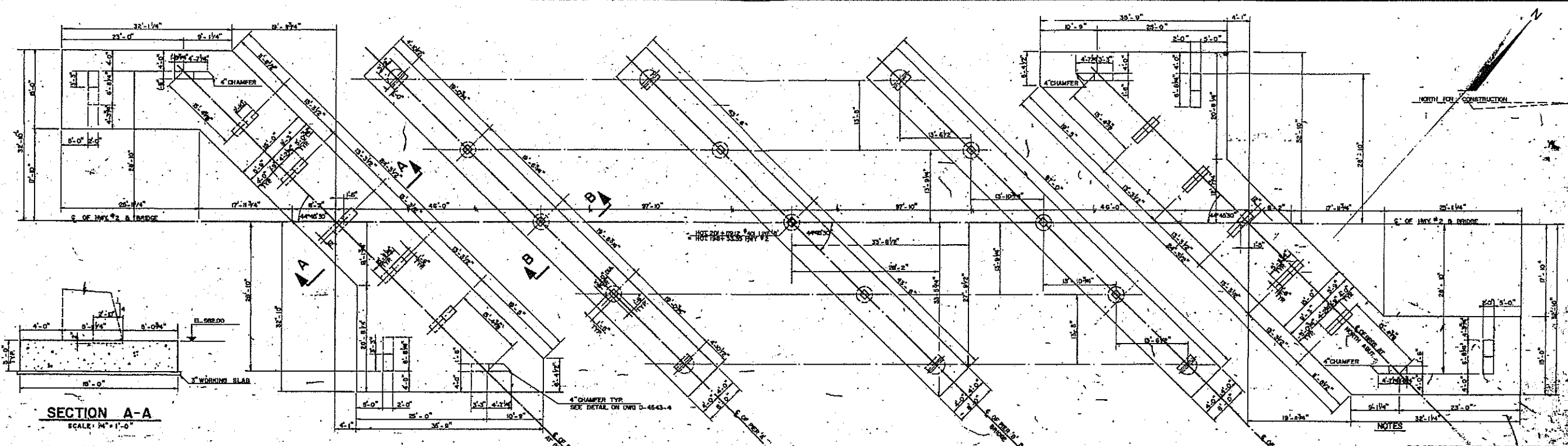
133500

134000

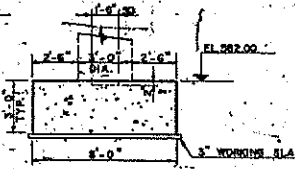




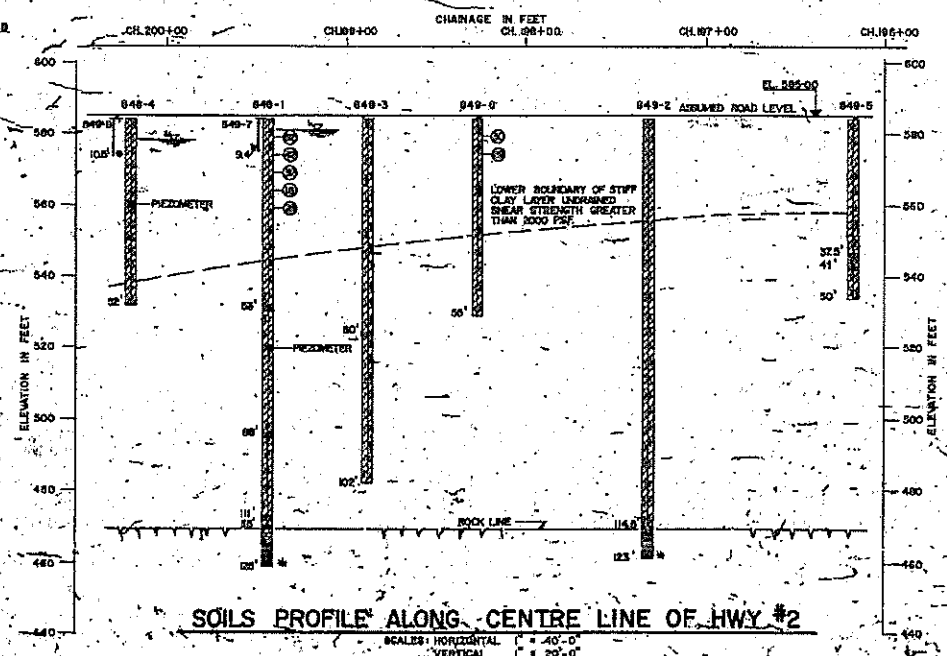
- (9) Contract Drawings for Tilbury E. TWP Bridge No. 6 (Queens Line Underpass), WP 165-58, TWP 104-189-?-(unreadable), prepared by A.M. Lount and Associates, dated July 27, 1960.



**SECTION A-A**  
SCALE: 1/4" = 1'-0"

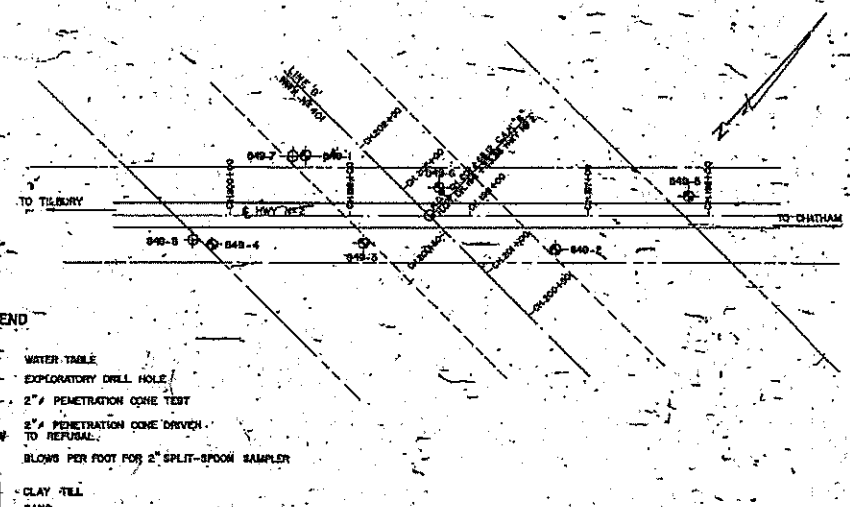


**SECTION B-B**  
SCALE: 1/4" = 1'-0"



**SOILS PROFILE ALONG CENTRE LINE OF HWY #2**  
SCALE: HORIZONTAL 1" = 40'-0" VERTICAL 1" = 20'-0"

**LAYOUT OF FOOTINGS**  
SCALE: 1/8" = 1'-0"



**PLAN SHOWING BORE HOLE AND PENETRATION TEST LOCATIONS.**  
SCALE: 1" = 80'-0"

- NOTES**
- THE DEPARTMENT DOES NOT GUARANTEE THE ACCURACY OF THE DATA AND THE CONTOUR LINES.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING D-4043-1 FOR LAYOUT OF ABUTMENTS AND PILES.
  - FOR LAYOUT OF ABUTMENTS AND PILES SEE DRAWING D-4043-1.
  - FOR LAYOUT OF ABUTMENTS AND PILES SEE DRAWING D-4043-1.
  - ALL CONCRETE WORKING SLABS TO HAVE MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS.
  - CONCRETE IN WORKING SLABS TO HAVE MINIMUM STRENGTH OF 1500 PSI AT 28 DAYS.
  - ALL EXPOSED CORNERS TO HAVE 1" CHAMFER EXCEPT WHERE SHOWN.



**A. M. LOUNT AND ASSOCIATES**  
CONSULTING ENGINEERS  
164 EGLINTON AVE. E.  
TORONTO, ONT. M5G 1B5  
DEPARTMENT OF HIGHWAYS, ONTARIO  
BRIDGE OFFICE, TORONTO

**TILBURY E. TWE BRIDGE**  
HWY 104 AND HWY 2 INTERCHANGE  
APPROX. 3 MILES EAST OF TILBURY  
THE KING'S HIGHWAY ACT, 1960  
100 OF KENT  
TWP. OF TILBURY, CO. OF DUNDAS

**LAYOUT OF FOOTINGS & BORE**

APPROVED: *[Signature]*  
DATE: JULY 27, 1960

NO.	DATE	REVISION
1	JULY 27, 1960	ISSUED FOR CONSTRUCTION



- (10) Foundation Investigation Report at Highway 2 Crossing of Highway 401 at Tilbury East (Queens Line Underpass), WP 165-58, prepared by H.G. Acres & Company Limited, dated January 1960, Geocres No. 40J8-22.



TABLE 1SUMMARY OF FIELD VANE TEST RESULTS - HOLE NO. 849-1

Elevation Feet	Undrained Shear Strength, Psf		Sensitivity
	Natural	Remoulded	
548.9	2,640	1,480	1.8
540.7	2,320	1,390	1.7
530.9	1,480	804	1.8
515.9	1,240	715	1.7
495.4	+3,700 (not typical)	-	-
481.3	1,550	930	1.7
471.2	2,010	680	2.9
470.2	930	495	1.9

TABLE 2

SUMMARY OF FIELD VANE TEST RESULTS - HOLE NO. 849-2

Elevation Feet	Undrained Shear Strength, Psf		Sensitivity
	Natural	Remoulded	
521.4	1,390	930	1.5

TABLE 3SUMMARY OF FIELD VANE TEST RESULTS - HOLE NO. 849-3

Elevation Feet	Undrained Shear Strength, Psf		Sensitivity
	Natural	Remoulded	
546.2	1,860	990	1.9
531.2	1,080	650	1.7
522.5	+3,700 (not typical)	-	-
517.5	1,240	770	1.6
506.2	1,700	1,080	1.6
496.2	1,730	920	1.9
481.2	1,700	870	2.0

TABLE 4

SUMMARY OF FIELD VANE TEST RESULTS - HOLE NO. 849-4

Elevation Feet	Undrained Shear Strength, Psf		Sensitivity
	Natural	Remoulded	
566.6	3,240	2,010	1.6
561.6	3,100	2,010	1.5
556.6	3,100	2,170	1.4
551.6	2,780	2,010	1.4
546.6	2,620	1,550	1.7
541.6	2,010	1,240	1.6..
531.6	1,240	775	1.6

TABLE 5SUMMARY OF FIELD VANE TEST RESULTS - HOLE NO. 849-5

Elevation Feet	Undrained Shear Strength, Psf		Sensitivity
	Natural	Remoulded	
572.8	+3,700	-	-
566.3	2,320	1,550	1.5
561.3	2,170	1,550	1.4
556.5	1,860	1,240	1.5
551.5	1,700	1,240	1.4
546.5	3,100	1,700	1.8
541.5	1,420	1,080	1.3
531.5	920	465	2.0

TABLE 6

SUMMARY OF FIELD VANE TEST RESULTS - HOLE NO. 849-6

Elevation Feet	Undrained Shear Strength, Psf		Sensitivity
	Natural	Remoulded	
566.3	+3,700	-	-
561.3	2,780	2,010	1.4
553.3	2,010	1,390	1.4
547.3	2,010	990	2.0
536.3	1,080	557	1.9
526.3	1,050	557	1.9



TABLE 7

Summary of Laboratory Tests

Hole No.	Sample No.	Elevation Feet	Water Content %	Liquid Limit %	Plastic Limit %	$S_{u_n}$ Psf	$e_f$ %	$S_{u_r}$ Psf	St
849-2	1	569	19.0	-	-	2,380	16	1,870	1.3
	2	554	20.6	-	-	1,630	20	1,038	1.6
	3	539	23.8	-	-	994	14	465	2.1
	4	524	23.9	-	-	695	20	455	1.5
	5	509	22.7	-	-	1,128	19	530	2.1
849-3	2	574	20.3	33.7	16.2	8,200	18	-	-
	6	554	20.9	32.6	17.0	1,965	19	1,328	1.5
	9	534	23.4	33.0	17.1	918	15	491	1.9
	10	524	23.6	-	-	814	15	345	2.4
	11	509	22.7	31.8	16.9	1,020	12	441	2.3
	13	484	24.6	37.7	17.5	936	20	685	1.4
849-5	2	574	15.9	32.3	16.2	7,100	18	7,475	-
	6	554	20.8	31.5	17.7	1,592	20	1,088	1.5
	9	534	24.7	32.7	17.1	834	15	343	2.6
849-6	3	569	18.0	30.7	16.7	4,250	20	2,945	1.4
	6	556	20.5	32.5	16.7	1,785	20	1,130	1.6
	10	529	23.5	-	-	806	14	404	2.0

 $e_f$  - Failure strain $S_{u_n}$  = Natural undrained shear strength $S_{u_r}$  = Remoulded undrained shear strength

St = Sensitivity

APPENDIX C

List of Plates

- |             |   |   |
|-------------|---|---|
| Plate I     | - | Exploratory Holes, Plan and Section                               |
| Plate II    | - | Drilling Report, Hole No. 849-1                                   |
| Plate III   | - | Drilling Report, Hole No. 849-2                                   |
| Plate IV    | - | Drilling Report, Hole No. 849-3                                   |
| Plate V     | - | Drilling Report, Hole No. 849-4                                   |
| Plate VI    | - | Drilling Report, Hole No. 849-5                                   |
| Plate VII   | - | Drilling Report, Hole No. 849-6                                   |
| Plate VIII  | - | Standard Penetration Cone Test 849-7                              |
| Plate IX    | - | Standard Penetration Cone Test 849-8                              |
| Plate X     | - | Summary of Drilling and Test Results,<br>Hole No. 849-1           |
| Plate XI    | - | Summary of Drilling and Test Results,<br>Hole No. 849-2           |
| Plate XII   | - | Summary of Drilling and Test Results,<br>Hole No. 849-3           |
| Plate XIII  | - | Summary of Drilling and Test Results,<br>Hole No. 849-4           |
| Plate XIV   | - | Summary of Drilling and Test Results,<br>Hole No. 849-5           |
| Plate XV    | - | Summary of Drilling and Test Results,<br>Hole No. 849-6           |
| Plate XVI   | - | Determination of Origin of "P-e" Curves                           |
| Plate XVII  | - | Consolidation Test, Hole No. 849-3,<br>Sample Elevation 484 Feet. |
| Plate XVIII | - | Consolidation Test, Hole No. 849-3<br>Sample Elevation 554 Feet.  |

Appendix C -- 2

- Plate XIX        - Consolidation Test, Hole No. 849-3  
Sample Elevation 534 Feet.
- Plate XX        - Allowable Net Bearing Pressures for  
Footings of Different Sizes and  
Depths.

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT Department of Highways of Ontario JOB No. 849  
 PROJECT Highway 2 Crossing Highway 401 (WP-165-58) HOLE No. 849-1  
 SITE Tilbury East SHEET No. 1 OF 4  
 CONTRACTOR: F.E. Johnston Drilling Co. Ltd. STARTED 4:00 P.M. December 14 1959  
 FINISHED 5:30 P.M. December 22 1959  
 METHOD OF SOIL Modified Wash Boring CASING DIAM. BX  
 DRILLING: ROCK Diamond Drill CORE DIAM. BX  
 LOCATION: EARTHDE CH 202 + 81 ELEVATIONS: DATUM G.S.C.  
 DEPARTURE 42 feet left DRILL PLATFORM ---  
 BEARING --- GROUND SURFACE 583.9  
 INITIAL DIP 90 degrees ROCK SURFACE 468.9  
 OTHER DIPS --- BOTTOM OF HOLE 458.4  
 WATER TABLE 580.0

DEPTH	SOIL TYPE	DESCRIPTION, COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC	S A M P L E					PENETRATION TEST
			NO	TYPE*	SIZE	DEPTH	RET'D	
0.0	Top soil	Black organic soil, dry, hard.	1	A.C.	2	Inches	Feet	Blows
1.0						5.0		13
						5.5		25
						6.0		56
	Clay till	Brown and grey, uniform, dry to slightly moist, fissured but intact, very stiff, with scattered pebbles which are partially rounded and composed of black shale and limestone fragments.	2	A.C.	2	10.0		9
						10.5		22
						11.0		32
						11.5	18"	
			3	A.C.	2	15.0		12
						15.5		15
						16.0		20
32.0	Clay till	Brown and grey, stiff and tenacious, with hard band at 53.0 to 54.0	4	B.C.	2	17.5		pushed to
50.0						18.0		6" refusal
	Clay till	Grey, uniform, firm and tenacious with scattered pebbles which are mostly angular.	5	B.C.	2	20.0		pushed to
						20.25		refusal
						20.75	9"	27 blows
82.3			6	A.C.	2	25.0		7
						25.5		12
						26.0		20
						26.5	Nil	

**SAMPLING METHOD**

A - SPLIT TUBE  
 B - THIN WALL TUBE  
 C - PISTON SAMPLER  
 D - CORE BARREL

E - AUGER  
 F - WASH

**SHIPPING CONTAINER**

M - INSERT  
 O - TUBE  
 P - WATER CONTENT TIN  
 Q - GLASS JAR

R - CLOTH BAG  
 S - PAPER BAG  
 Z - DISCARDED

INSPECTOR G. Wilson

LOGGED BY G. Wilson

APPROVED

*A. H. MacDonald*

DATE

January 29, 1960

H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS  
 NIAGARA FALLS, CANADA

**DRILLING REPORT**

CLIENT Department of Highways of Ontario

JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (WP-165-58)

HOLE No. 849-1

SITE Tilbury East

SHEET No. 2 OF 4

DEPTH	SOIL TYPE	DESCRIPTION: COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC	S A M P L E					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RET'D	
					Inches	Feet		
88.3	Clay till	Light grey, stiff and tenacious..	7	B.O.	2	30.0		pushed to
		Contains lenses or layers of both harder and softer material.				31.0	12"	refusal
		The harder materials are probably lenses of sandy till.			Vane test at	35.0		pushed
		Contains very few pebbles.	8	B.O.	2	35.0		pushed to
						36.5	18"	refusal
		Hard bands at:						
		88.3 to 89.0			Vane test at	43.2		pushed
		111.25 to 112.0						
		114.5 to 115.0	10	B.O.	2	50.0		
115.0						51.5	18"	pushed
	Bedrock	Grey fossiliferous limestone,			Vane test at	53.0		pushed
	(Hamilton	horizontally bedded,						
	Shale	only moderately hard						(hard for
	Formation)	but intact, becoming	11	B.Z.	2	60.0		top 6")
		softer towards the				61.7	Nil	pushed
		bottom.						
119.5			12	C.Z.	2	62.0		
						64.0	Nil	pushed
	(Hamilton	Grey shale, ("soapstone")						
	Shale	laminated and horizontally	13	C.O.	2	64.0		
	Formation)	bedded, generally intact				66.0	24"	pushed
		and dry; forms a mud			Vane test at	68.0		pushed
		slurry when drilled;						
		too hard to be sampled	14	C.O.	2	85.0		
		except by diamond				86.7	21"	pushed
		drill, highly						
		fossiliferous.			Vane test at	88.5		pushed to
125.5	End of hole							refusal
			15	C.O.	2	99.6		
						101.4	22"	pushed
					Vane test at	102.6		pushed
			16	C.O.	2	110.0		pushed to
						111.2	15"	refusal
					Vane test at	112.7		pushed

[illegible]



H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS  
NIAGARA FALLS, CANADA

DRILLING REPORT

CLIENT Department of Highways of Ontario

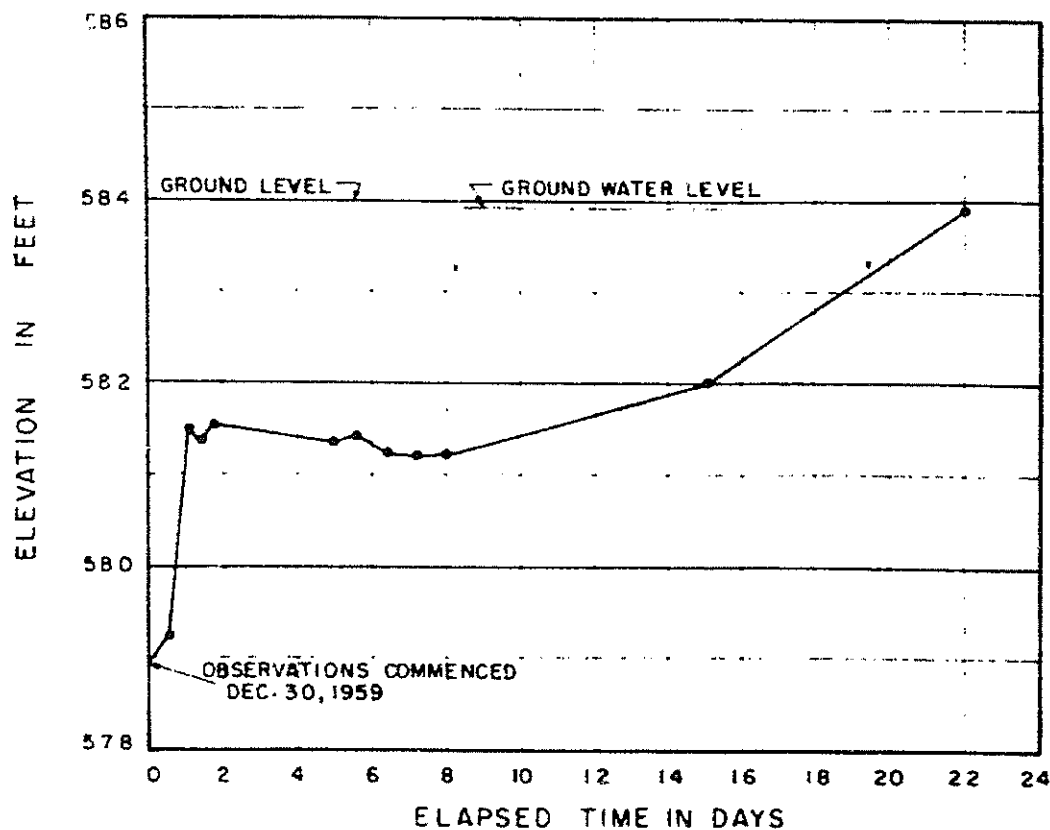
JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (WP-165-58)

HOLE No. 849-1

SITE Tilbury East

SHEET No. 2 OF 4



RECORD OF PIEZOMETER OBSERVATIONS  
IN HOLE No. 849-1

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT Department of Highways of Ontario JOB No. 849  
 PROJECT Highway 2 Crossing Highway 401 (NP-165-58) HOLE No. 849-2  
 SITE Tilbury East SHEET No. 1 OF 2

CONTRACTOR: F.E. Johnston Drilling Co. Ltd. STARTED 8:00 A.M. December 29 1959  
 FINISHED 5:00 P.M. December 31 1959

METHOD SOIL Pendrill to 100 feet (4" Auger) CASING DIAM. BX for Diamond  
 OF Drilling  
 DRILLING: ROCK Diamond Drill CORE DIAM. BX

LOCATION: LATITUDE CH 200 + 78 ELEVATIONS: DATUM G.S.C.  
 DEPARTURE 53 feet right DRILL PLATFORM --  
 BEARING -- GROUND SURFACE 584.4  
 INITIAL DIP 90 degrees ROCK SURFACE 469.9  
 OTHER DIPS -- BOTTOM OF HOLE 461.4  
 WATER TABLE --

DEPTH	SOIL TYPE	DESCRIPTION, COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RET'D	
0'	Road shoulder material	Mixture of black earth and gravel, compact.	1	B.O.	2" diam	15.0		machine
						16.5	18"	pushed
0.75		Mottled brown and rust coloured, stiff, weathered, fissured but intact.	2	B.O.	2"	30.0		machine
						31.5	18"	pushed
	Clay till	moist, nonstratified, containing scattered pebbles which are slightly rounded.	3	B.O.	2"	42.0		machine
						44.7	21"	pushed
10.0			4	B.O.	2"	60.0		
						61.5	18"	pushed
	Clay till	Gray and brown stiff and tenacious, slightly weathered with rust coloured streaks, moist.				Vane test at 63.0		pushed
			5	B.O.	2"	75.0		
						76.5	18"	pushed
45.0			6	B.O.	2"	90.0		
	Clay till	Grey, firm and tenacious with only very few small pebbles.				91.5	18"	pushed
			7	B.O.	2"	100.0		
						101.5	18"	pushed
87.0								
	Clay till	Light grey, stiff, probably stratified with firm bands and sand lenses especially towards the bottom.						
114.5								

**SAMPLING METHOD**

A - SPIGOT TUBE  
 B - THIN WALL TUBE  
 C - PISTON SAMPLER  
 D - CORE BARREL

E - AUGER  
 F - WASH

**SHIPPING CONTAINER**

N - INSERT  
 O - TUBE  
 P - WATER CONTENT TIN  
 Q - GLASS JAR  
 R - CLOTH BAG  
 S - PLYOILM BAG  
 Z - DISCARDED

INSPECTOR G. Wilson

LOGGED BY G. Wilson

APPROVED

*D. H. Macdonald*

DATE

January 29, 1960

**H. G. ACRES & COMPANY LIMITED    CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**  
**DRILLING REPORT**

CLIENT      Department of Highways of Ontario

JOB No.    849

PROJECT      Highway 2 Crossing, Highway 401 (WP-165-58)

HOLE No.    849-2

SITE          Tilbury East

SHEET No.    2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION: COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTION, WATER LOSS OR GAIN, ETC.	S A M P L E					PENETRATION TEST
			NO.	TYPE	SIZE	DEPTH	RET'D	
					Inches	Feet		
114.5	Bedrock	Grey fossiliferous limestone,						
	(Hamilton Shale Formation)	Horizontally bedded, sound, intact.	8	D.R.	BX	114.5		Drills as
						115.0	100%	soft rock
115.0		Grey shale ("Soapstone")	9	D.Z.	BX	115.0		Drills as
	(Hamilton Shale Formation)	laminated and horizontally bedded, generally intact and dry.	10	D.Z.	BX	115.5	20%	soft rock
		Too hard to be sampled except by diamond drill.	11	A.Z.	2	121.0		Blows
				*		121.5		25
						122.0		30
						122.5	18"	35
123.0	End of hole:		(* Split tube driven to test "Soapstone" shale but penetrates only sludge collected in hole)					
			12	A.S.	2	122.5		Blows
						123.0	6"	100
Notes:								
	1.	Penetration Test:						
		This is the number of blows of a 140-lb weight falling 30 inches required to advance the sampler to distance indicated.						
	2.	No noticeable water loss or gain during drilling (augered hole remained dry). After drilling water stands at 3'-0" below ground level.						
	3.	Hole filled in and plugged January 7, 1960.						

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT ..... Department of Highways of Ontario ..... JOB No. 849  
 PROJECT ..... Highway 2 Crossing Highway 401 (WP-165-58) ..... HOLE No. 849-3  
 SITE ..... Tilbury East ..... SHEET No. 1 OF 2

CONTRACTOR: F.E. Johnston Drilling Co. Ltd. STARTED 11:00 A.M. December 30 1959  
 FINISHED 12:00 P.M. January 4 1960

METHOD OF DRILLING: SOIL ..... Pendrill (4" Auger) ..... CASING DIAM. ---  
 ROCK ..... CORE DIAM. ---

LOCATION: ~~EASTING~~ CH 201 + 91 ..... ELEVATIONS: DATUM ..... G.S.C.  
 DEPARTURE 54 feet left ..... DRILL PLATFORM ---  
 BEARING --- ..... GROUND SURFACE 584.0  
 INITIAL DIP 90 degrees ..... ROCK SURFACE ---  
 OTHER DIPS --- ..... BOTTOM OF HOLE 481.2  
 --- ..... WATER TABLE ---

DEPTH	SOIL TYPE	DESCRIPTION: COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	S A M P L E					PENETRATION TEST
			NO.	TYPE *	SIZE	DEPTH	RET'D	
0.0	Road shoulder material	Compact black earth and gravel mixture, dry.	1	B.L.	2	5.0		
						5.5		pushed
0.5	Clay till	Yellow and rust coloured, weathered, dry, fissured but intact, very stiff,	2	B.O.	2	10.0		12
						10.5		pushed
7.0	Clay till	Brown (with rusty streaks) weathered, fissured but intact, moist, very stiff.	3	B.O.	2	15.0		24
						15.5		6
						16.0		14
						16.5	8"	21
12.0	Clay till	Grey, very stiff.	4	B.O.	2	20.0		5
						20.5		11
25.0	Clay till	Grey, stiff.	5	B.O.	2	25.0		15
						25.5		
						26.0		
45.0						26.5	18"	pushed

**SAMPLING METHOD**

A — SPLIT TUBE  
 B — THIN WALL TUBE  
 C — PISTON SAMPLER  
 D — CORE BARREL

E — AUGER  
 F — WASH

**SHIPPING CONTAINER**

N — INSERT  
 O — TUBE  
 P — WATER CONTENT TIN  
 Q — GLASS JAR

R — CLOTH BAG  
 S — PLIOFILM BAG  
 Z — DISCARDED

INSPECTOR G. Wilson

LOGGED BY G. Wilson

APPROVED

*D.H. MacDonald*

DATE

January 29, 1960

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**  
**DRILLING REPORT**

CLIENT Department of Highways of Ontario

JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (HP-165-58)

HOLE No. 849-3

SITE Tilbury East

SHEET No. 2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RETD	
					Inches	Feet		
45.0			6	B.O.	2	30.0		
						31.5	18"	pushed
	Clay till	Grey, firm, tenacious (Probably large pebble at 61'-6" preventing vane penetration).	7	E.O.	2	35.0		
						36.5	18"	pushed
70.0					Vane test at	37.7		pushed
	Clay till	Grey, stiff, tenacious partially stratified with firm and stiff bands.	8	B.O.	2	40.0		
						41.5	18"	pushed
			9	B.O.	2	50.0		
102.75	End of hole					51.5	18"	pushed
					Vane test at	52.7		pushed
			10	B.O.	2	60.0		
						61.5	18"	pushed
					Vane test at	61.5		vane will not penetrate
					Vane test at	66.5		pushed
			11	B.O.	2	75.0		
						76.5	18"	pushed
	Notes:				Vane test at	77.7		pushed
	1. Penetration test:		12	E.O.	2	85.0		
		This is the number of blows of a 140-lb weight falling 30 inches required to advance the sampler to distance indicated.				86.5	18"	pushed
					Vane test at	87.7		pushed
			13	B.O.	2	100.0		
						101.5	18"	pushed
	2. No water struck during drilling but during weekend of December 31, 1959 to January 4, 1960, water collected to 37'-0" and hole caved in to 40'-0" below ground level.				Vane test at	102.7		pushed
	3. Hole filled in and plugged January 7, 1960							

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT	Department of Highways of Ontario	JOB No. 849
PROJECT	Highway 2 Crossing Highway 401 (WP-165-58)	HOLE No. 849-4
SITE	Tilbury East	SHEET No. 1 OF 3
CONTRACTOR: F.E. Johnston Drilling Co. Ltd		
STARTED 2:30 P.M. January 4 1960		
FINISHED 1:30 P.M. January 5 1960		
METHOD OF DRILLING:	SOIL Per-drill (4" Auger)	CASING DIAM. --
	ROCK --	CORE DIAM. --
LOCATION:	ELEVATIONS: DATUM G.S.C.	
	DRILL PLATFORM --	
	GROUND SURFACE 584.4	
	ROCK SURFACE --	
	BOTTOM OF HOLE 531.6	
	WATER TABLE --	

DEPTH	SOIL TYPE	DESCRIPTION, COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION TEST
			NO.	TYPE*	SIZE	DEPTH	RET'D	
0.0	Road shoulder material	Compact black earth and gravel mixture, dry.	1	B.O.	2	5.0		Blows
						5.5		8
0.5	Clay till	Yellow and rust coloured, weathered, fissured, moist but intact, compact and hard.				6.0		23
						6.5	16"	37
			2	B.O.	2	10.0		
7.0	Clay till	Brown with rust coloured streaks, moist, partially weathered, fissured but intact, very stiff.				10.5		6
						11.0		16
						11.5	14"	25
			3	B.O.	2	15.0		
						15.5		5
						16.0		8
12.0	Clay till	Grey, uniform, very stiff and tenacious				16.5	18"	14
						Vane test at 17.7		pushed
32.0	Clay till	Grey, uniform, stiff and tenacious	4	B.O.	2	20.5		pushed
						21.5	18"	hard
						Vane test at 22.7		pushed
52.75	End of hole		5	B.O.	2	23.0		pushed
						26.5	18"	hard
						Vane test at 27.7		pushed

**SAMPLING METHOD**

A - SPIG TUBE  
 B - THIN WALL TUBE  
 C - PISTON SAMPLER  
 D - CORE BARREL

E - AUGER  
 F - WASH

**SHIPPING CONTAINER**

N - INSERT  
 O - TUBE  
 P - WATER CONTENT TIN  
 Q - GLASS JAR

R - CLOTH BAG  
 S - PLASTIC BAG  
 Z - DISCARDED

INSPECTOR G. Wilson

LOGGED BY G. Wilson

APPROVED

*D. H. MacDonald.*

DATE

January 29, 1960



**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**  
**DRILLING REPORT**

CLIENT Department of Highways of Ontario

JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (WP-165-58)

HOLE No. 849-4

SITE Tertiary Sand

SHEET No. 2 OF 3

DEPTH	SOIL TYPE	DESCRIPTION COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC	S A M P L E					PENETRATION TEST
			NO	TYPE	SIZE Inches	DEPTH Feet	RETD	
			6	B.C.	2	30.0		
						31.5	18"	pushed
					Vane test at	32.7		pushed
			7	B.O.	2	32.0		
						36.5	18"	pushed
					Vane test at	37.7		pushed
			8	B.O.	2	40.0		
						41.5	12"	pushed
					Vane test at	42.7		pushed
		Notes:	9	B.C.	2	50.0		
		* 1. Penetration Test:				51.5	18"	pushed
		This is the number of blows of a 140-lb weight falling 30 inches required to advance the sampler to distance indicated.			Vane test at	52.7		pushed
		2. In appreciable water struck during drilling but with the hole at 23.0 feet, about 2 inches of water collected in bottom of hole overabundant.						
		When hole at 52.75 feet, water collected in bottom of hole to depth of 3'-0" between January 5, 1960 and January 7, 1960.						
		3. Carborundum piezometer tip installed at 25 feet below ground level.						

H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS  
NIAGARA FALLS, CANADA

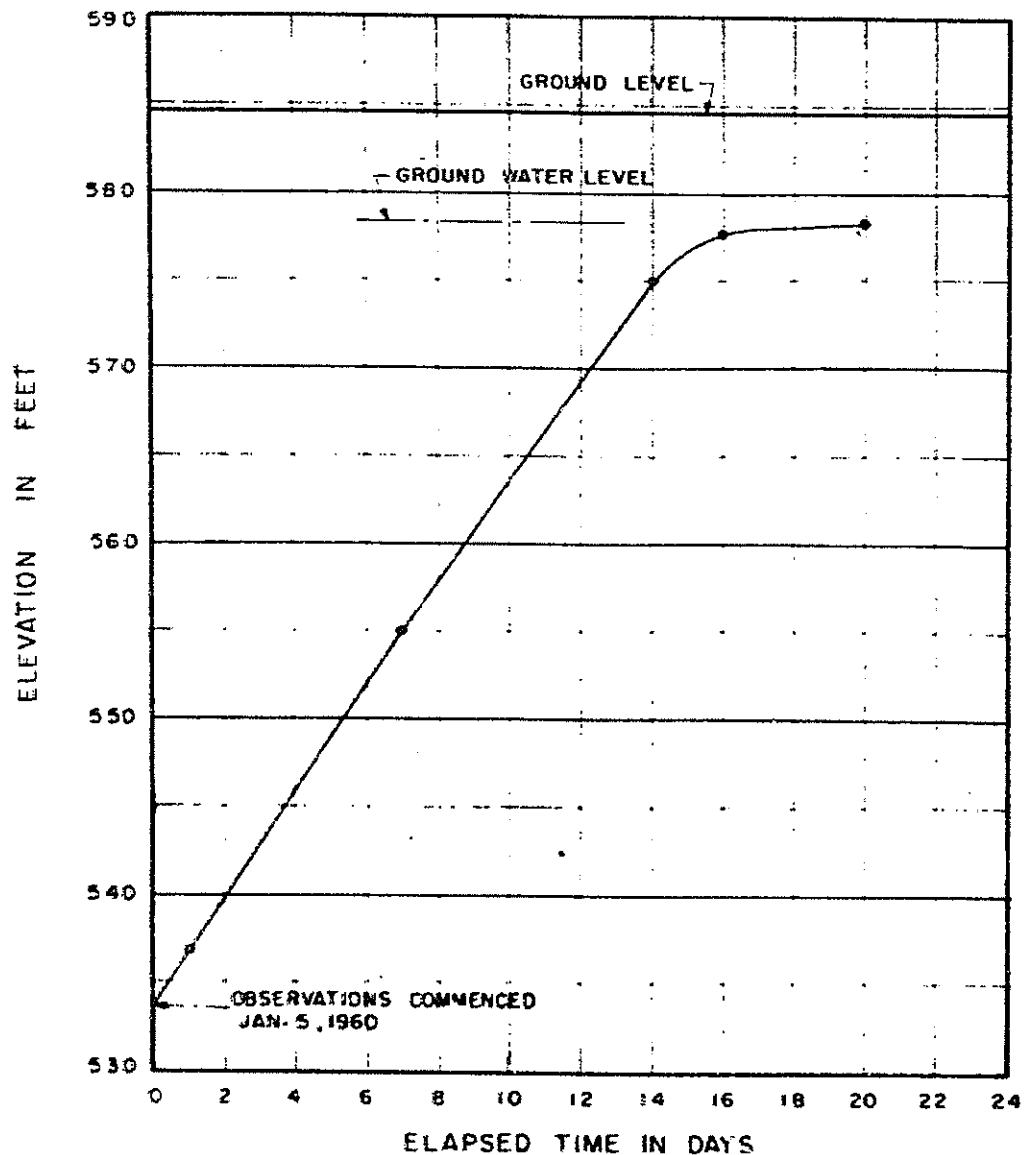
DRILLING REPORT

CLIENT Department of Highways of Ontario  
PROJECT Highway 2 Crossing Highway 401 (WP-165-58)  
SITE Tilbury East

JOB No. 849

HOLE No. 849-4

SHEET No. 3 OF 3



RECORD OF PIEZOMETER OBSERVATIONS  
IN HOLE No. 849-4

**H. G. ACRES & COMPANY LIMITED - CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT Department of Highways of Ontario JOB No. 849  
 PROJECT Highway 2 Crossing Highway 401 (HP-165-58) HOLE No. 849-5  
 SITE Milbury East SHEET No. 1 OF 2

CONTRACTOR: F.E. Johnston Drilling Co. Ltd. STARTED 2:30 P.M. January 5 1960  
 FINISHED 12:00 P.M. January 6 1960

METHOD SOIL Fenirill (4" Auger)  
 OF CASING DIAM. ---  
 DRILLING: ROCK -- CORE DIAM. ---

LOCATION: LATITUDE DE 200 + 30 ELEVATIONS: DATUM G.S.C.  
 DEPARTURE 164 feet right DRILL PLATFORM ---  
 BEARING --- GROUND SURFACE 584.3  
 INITIAL DIP 90 degrees ROCK SURFACE ---  
 OTHER DIPS -- BOTTOM OF HOLE 534.3  
 WATER TABLE --

DEPTH	SOIL TYPE	DESCRIPTION, COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC	SAMPLE					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RETD	
0'-0"	Road shoulder material	Brown earth and gravel mixture, compact, dry.	1	B.O.	Inches 2	2.0		# 1 Blows
						5.5		9
						6.0		30
						6.5	8"	39
0'-6"	Clay till	Yellow and rust coloured, weathered, fissured, dry but intact, compact and hard	2	B.O.	2	10.0		
						10.5		9
						11.0		18
						11.5	12"	24
7'-0"	Clay till	Brown, weathered, slightly moist, very stiff, fissured but intact and uniform.			Vane test at	11.5	(vane did not penetrate soil)	
			3	B.O.	2	15.0		
						15.5		3
						16.0		9
17'-0"	Clay till	Grey, slightly moist, stiff, and tenacious, uniform, except for occasional thin interbedded sand lenses and pockets, 1/2-inch thick			Vane test at	18.0		pushed
		compact, coarse, sharp graded and saturated sand lenses at 41.2 to 41.7, and 37.5 to 38.0.	4	B.O.		20.0		
						20.5		
						21.0		pushed-
47'-0"	Clay till	Grey, firm and tenacious, uniform.			Vane test at	23.0		pushed
						21.5	18"	hard
50.0	End of hole							

**SAMPLING METHOD**

A - DRILL TUBE  
 B - MIN. WALL TUBE  
 C - PISTON SAMPLER  
 D - CORE BARREL

1 - AUGER  
 2 - WASH

**SHIPPING CONTAINER**

N - INSERT  
 O - TUBE  
 P - WATER CONTENT TIN  
 Q - GLASS JAR

R - CLOTH BAG  
 S - PISTON BAG  
 T - DISCARDED

INSPECTOR G. Wilson

LOGGED BY G. Wilson

APPROVED

*H. MacDonald*

DATE

January 29, 1960

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**  
**DRILLING REPORT**

CLIENT Department of Highways of Ontario

JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (J.P-165-58)

HOLE No. 849-5

SITE Tilbury East

SHEET No. 2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTION, WATER LOSS OR GAIN, ETC.	S A M P L E					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RETD	
					Inches	Feet		
			5	E.O.	2	25.0		
						26.5	13"	pushed
					Vane test at	27.7		pushed
			6	E.O.	2	30.0		
						31.5	9"	pushed
					Vane test at	32.7		pushed
			7	E.O.	2	35.0		
						36.5	18"	pushed
					Vane test at	37.7		pushed
			8	E.O.	2	40.0		
						41.5	17"	pushed
					Vane test at	42.7		pushed
			9	E.O.	2	50.0		
						51.5	18"	pushed
					Vane test at	52.7		pushed
		* 1. Penetration Test: This is the number of blows of a 140-lb weight falling 30 inches required to advance the sampler to distance indicated.						
		2. No water struck during drilling. Hole still dry 24 hours afterwards.						
		3. Hole filled in and plugged January 7, 1960.						

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**  
**DRILLING REPORT**

CLIENT Department of Highways of Ontario

JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (J.P-165-58)

HOLE No. 849-5

SITE Tilbury East

SHEET No. 2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTION, WATER LOSS OR GAIN, ETC.	SAMPLE				PENETRATION TEST
			NO.	TYPE	SIZE Inches	DEPTH Feet	
			5	B.O.	2	25.0	
						26.5	13" pushed
				Vane test at		27.7	pushed
			6	B.O.	2	30.0	
						31.5	9" pushed
				Vane test at		32.7	pushed
			7	B.O.	2	35.0	
						36.5	18" pushed
				Vane test at		37.7	pushed
			8	B.O.	2	40.0	
						41.5	17" pushed
				Vane test at		42.7	pushed
	Notes:		9	B.O.	2	50.0	
						51.5	18" pushed
		* 1. Penetration Test:		Vane test at		52.7	pushed
		This is the number of blows of a 140-lb weight falling 30 inches required to advance the sampler to distance indicated.					
		2. no water struck during drilling. Hole still dry 24 hours afterwards.					
		3. hole filled in and plugged January 7, 1960.					

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT	Department of Highways of Ontario	JOB No. 849
PROJECT	Highway 2 Crossing Highway 401 (HP-165-58)	HOLE No. 849-6
SITE	Tilbury East	SHEET No. 1 OF 2
CONTRACTOR:	F.E. Johnston Drilling Co. Ltd.	STARTED 1:30 P.M. January 6 1960 FINISHED 10:30 A.M. January 7 1960
METHOD OF DRILLING:	SOIL Pendrill (4" Auger)	CASING DIAM. —
	ROCK —	CORE DIAM. —
LOCATION:	LATITUDE 43° 20' 48" N DEPARTURE 21 feet right BEARING — INITIAL DIP 90 degrees OTHER DIPS —	
	ELEVATIONS: DATUM G.S.C. DRILL PLATFORM — GROUND SURFACE 584.1 ROCK SURFACE — BOTTOM OF HOLE 526.8 WATER TABLE —	

DEPTH	SOIL TYPE	DESCRIPTION, COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RETD	
					Inches	Feet		# 1 Blows
0.1	Road shoulder material	Compact black earth and gravel mixture, dry.						
0.5	Clay till	Brown and rust coloured hard, weathered, fissured but intact, dry.	1	A.O.	2	5.0		8
						5.5		16
						6.0		20
7.0	Clay till	Gray, very stiff and tenacious, slightly moist, uniform.	2	A.O.	2	10.0		7
						10.5		13
						11.0	18"	22
22.0	Clay till	Gray, stiff and tenacious	3	B.O.	2	15.0		7
						15.5		13
45.0	Clay till	Gray, firm and tenacious with very few scattered pebbles.	4	B.O.	2	16.0	18"	18
						16.5		
					Vane test at	17.7		
						20.0		5
						20.5		10
57.75	End of hole					21.0		16
						21.5	12"	
					Vane test at	22.7		pushed

**SAMPLING METHOD**

A - SPIG TUBE  
 B - TRIPLE WASTE TUBE  
 C - PISTON SAMPLER  
 D - CORE BARREL

1 - AUGER  
 2 - WASH

**SHIPPING CONTAINER**

M - INSERT  
 O - TUBE  
 P - WATER CONTENT TIN  
 Q - GLASS JAR

R - CLOTH BAG  
 S - PNEUMATIC BAG  
 Z - DISCARDED

INSPECTOR G. Wilson  
 LOGGED BY G. Wilson

APPROVED

*D. H. MacDonald*

DATE

January 29, 1960



**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**  
**DRILLING REPORT**

CLIENT Department of Highways of Ontario

JOB No. 849

PROJECT Highway 2 Crossing Highway 401 (W-165-58)

HOLE No. 849-6

SITE Tilbury East

SHEET No. 2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTION, WATER LOSS OR GAIN, ETC	SAMPLE					PENETRATION TEST
			NO	TYPE	SIZE	DEPTH	RETD	
					Inches	Feet		
			5	B.Z.	2	25.0		
						26.5	Nil	pushed
			6	B.O.	2	28.0		
						29.5	18"	pushed
					Vane test at	30.7		pushed
			7	B.O.	2	34.0		
						35.5	18"	pushed
					Vane test at	36.7		pushed
			8	B.Z.	2	40.0		
						41.5	Nil	pushed
			9	B.O.	2	45.0		
						46.5	18"	pushed
					Vane test at	47.7		pushed
			10	B.O.	2	55.0		
						56.5	18"	
		Notes:			Vane test at	57.7		pushed
		1. Penetration Test:						
		This is the number of blows of a 140-lb weight falling 30 inches required to advance the sampler the distance indicated.						
		2. No water struck during drilling. Hole remained dry overnight January 6, 1960 to January 7, 1960.						
		3. Hole filled in and plugged January 7, 1960.						

## DRILLING REPORT

JOB No. 849

HOLE No. 849-7

SHEET No. 1 OF 1

FINISHED 3:00 P.M. December 29 1959

CASING DIAM. --

SOIL D.E.O. Cone Penetration Test

ROCK

CORE DIAM. —

ELEVATIONS: DATUM G.S.C.

DRILL PLATFORM --

GROUND SURFACE 563.9

ROCK SURFACE --

BOTTOM OF HOLE 574.5

WATER TABLE --

FD-302 (Rev. 11-27-70)

**H. G. ACRES & COMPANY LIMITED — CONSULTING ENGINEERS**  
**NIAGARA FALLS, CANADA**

**DRILLING REPORT**

CLIENT	Department of Highways of Ontario	JOB No.	849
PROJECT	Highway 2 Crossing Highway 401 (HP-165-58)	HOLE No.	849-8
SITE	Tilbury East	SHEET No.	1 OF 1
CONTRACTOR:	F.E. Johnston Drilling Co. Ltd	STARTED	9:00 AM. December 30 1959
		FINISHED	10:00 AM. December 30 1959
METHOD OF DRILLING:	SOIL D.H.C. Cone Penetration Test	CASING DIAM.	--
	ROCK	CORE DIAM.	--
LOCATION:	LATITUDE CH 202 + 83 DEPARTURE 158 feet left BEARING -- INITIAL DIP 90 degrees OTHER DIPS --		
	ELEVATIONS: DATUM G.S.C. DRILL PLATFORM -- GROUND SURFACE 584.4 ROCK SURFACE -- BOTTOM OF HOLE 573.9 WATER TABLE --		

DEPTH	SOIL TYPE	DESCRIPTION COLOUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION TEST * Blows
			NO	TYPE*	SIZE	DEPTH	RET'D	
		<u>Remarks:</u>				Feet		
		The stiff crust of the clay				0		
		till cannot be penetrated by				1		3
		driving a standard penetration				2		6
		cone.				3		10
						4		13
						5		18
						6		23
						7		24
						8		44
						9		49
						10		112
						11.5		200
								refusal
		* D.H.C. Cone Penetration Test:						
		Number of blows of a 140-lb						
		weight falling 30 inches						
		required to advance the						
		cone one foot.						

SAMPLING METHOD

A - SPLIT TUBE  
 B - THIN WALL TUBE  
 C - PISTON SAMPLER  
 D - CORE BARREL

E - AUGER  
 F - WASH

SHIPPING CONTAINER

N - INSERT  
 O - TUBE  
 P - WATER CONTENT TIN  
 Q - GLASS JAR  
 R - CLOTH BAG  
 S - PULP BAG  
 Z - DISCARDED

INSPECTOR U. Wilson

LOGGED BY U. Wilson

APPROVED

*D. H. MacDonald*

DATE

January 29, 1960

SOIL DESCRIPTION AND SAMPLE LOCATION		ELEV IN FT	WATER CONTENT, %					UNDRAINED SHEAR STRENGTH, K.S.F										REMARKS	
			10	20	30	40	50	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6			
GROUND SURFACE		590																	
		580																	
CLAY TILL	1																		
	2																		
		570																	
	3																		
		560																	
	7																		
	V	550																	
	8																		
	9																		
	V	540																	
SAND SEAM	10																		
	V	530																	
CLAY TILL		520																	
	V																		
		510																	
		500																	
SAND SEAM	14																		
	V																		
CLAY TILL		490																	
		480																	
SAND SEAMS	16																		
	V	470																	
BEDROCK AT ELEV. 468.9		460																	
		450																	
		440																	
		430																	
		420																	
		410																	

[S] SOIL SAMPLE OR VANE TEST  
 [O] NATURAL WATER CONTENT  
 [L] LIQUID LIMIT  
 [P] PLASTIC LIMIT

[C] UNDRAINED COMPRESSION TEST  
 [A] FIELD VANE TEST

[N] NATURAL STRENGTH  
 [R] REMOULDED STRENGTH

0  
 15 10 5  
 FAILURE STRAIN

H G ACRES & COMPANY LIMITED  
 CONSULTING ENGINEERS  
 MISSISSAUGA, ONT. CANADA

SUMMARY OF DRILLING AND TEST  
 RESULTS

HOLE No. 849-1

DEPARTMENT OF HIGHWAYS OF ONTARIO

APPROVED

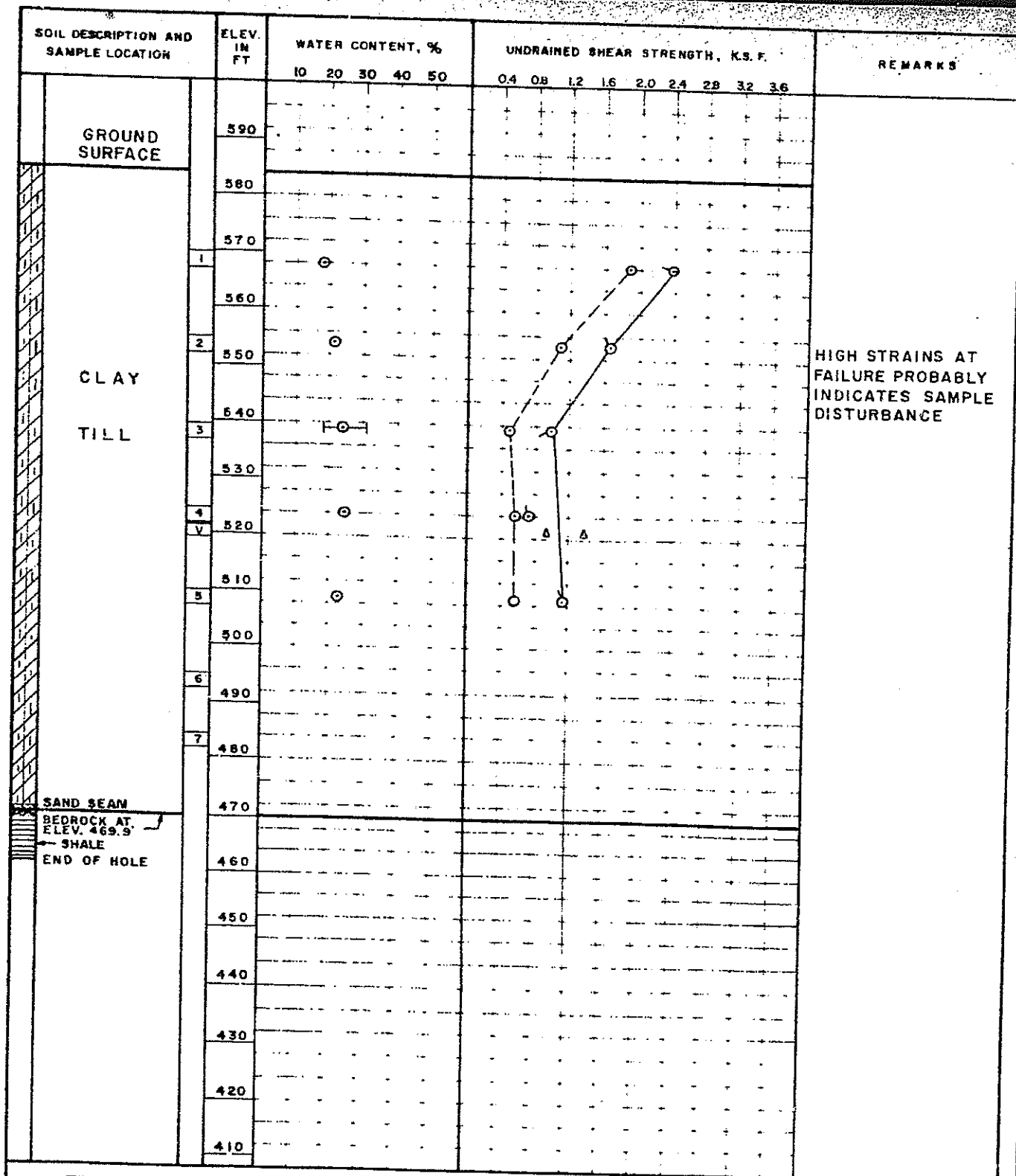
DATE JAN 29, 1960

HWY. 2 CROSSING HWY 401 (WP 165-58)

*D. H. Macdonald*  
 H.G. ACRES & COMPANY LTD

JOB No. 849

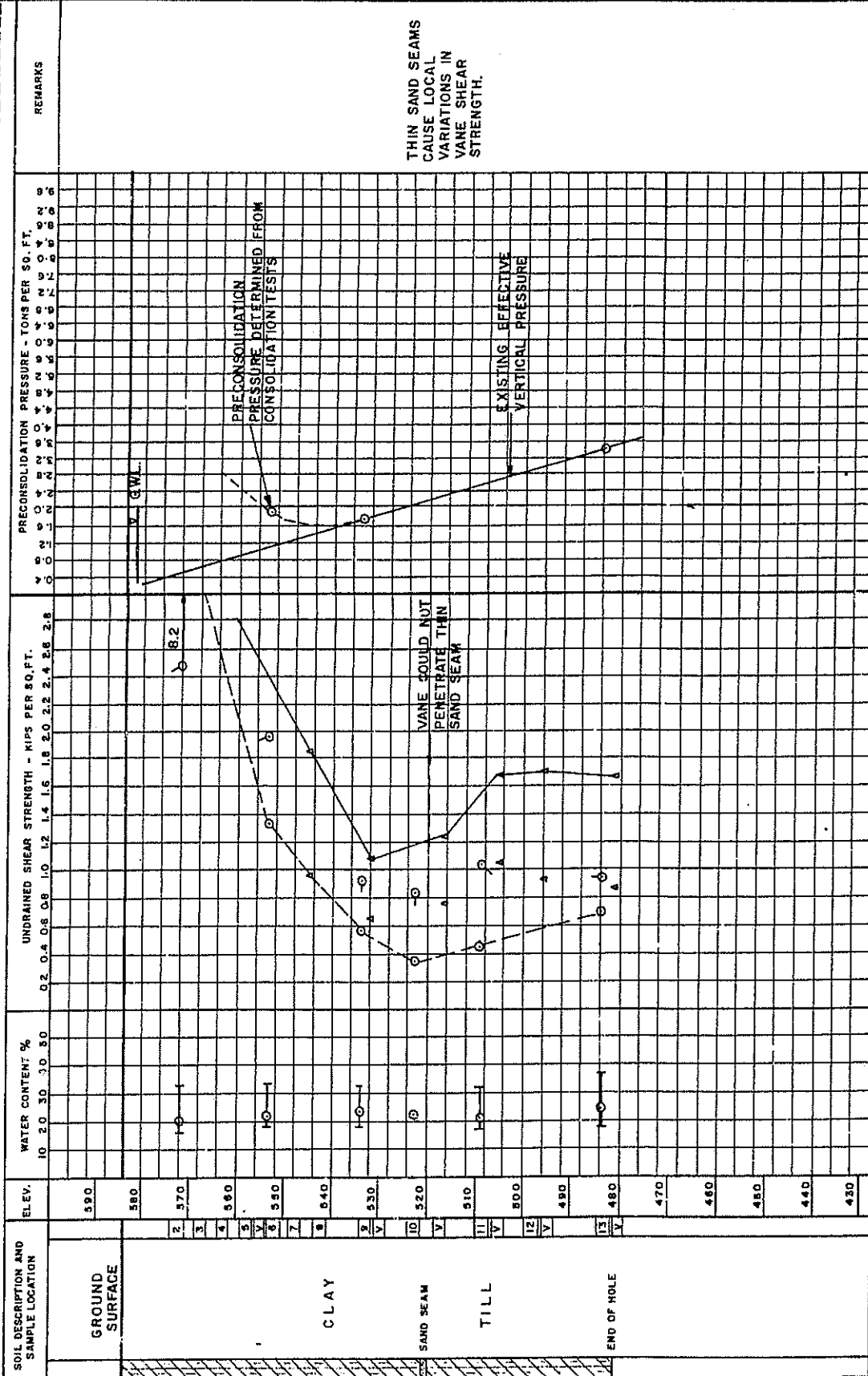
PLATE X



3 SOIL SAMPLE OR VANE TEST ○ NATURAL WATER CONTENT T LIQUID LIMIT T PLASTIC LIMIT		○ UNDRAINED COMPRESSION TEST △ FIELD VANE TEST — NATURAL STRENGTH - - - REMOULDED STRENGTH		0 15 — ○ — 5 10 FAILURE STRAIN	
H. G ACRES & COMPANY LIMITED CONSULTING ENGINEERS NIAGARA FALLS CANADA			SUMMARY OF DRILLING AND TEST RESULTS HOLE No. 849-2		
DEPARTMENT OF HIGHWAYS OF ONTARIO			APPROVED <i>D. H. Macdonald</i> H.G ACRES & COMPANY LTD.		
HWY. 2 CROSSING HWY 401 (W.P. 165-58)			DATE JAN. 29, 1960 JOB No. 849 PLATE XI		

H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS NIAGARA FALLS CANADA  
SUMMARY OF DRILLING & TEST RESULTS

CLIENT DEPARTMENT OF HIGHWAYS OF ONTARIO JOB NO. 849  
PROJECT HIGHWAY 2 CROSSING HIGHWAY 401 (W.P. 165-58) HOLE NO. 849-3  
SITE TILBURY EAST SHEET 1 OF 1  
LOCATION CH. 201+91; 54 FT. LEFT ELEVATION DATUM G.S.C.



APPROVED A. H. Macdonald  
DATE JAN. 29, 1960  
PLATE XII

15-0-5 FAILURE STRAIN  
10 NATURAL STRENGTH  
--- REMOULDED STRENGTH

○ UNCONFINED COMPRESSION TEST  
△ FIELD VANE TEST  
□ SOIL SAMPLE - SEE DRILLING REPORTS

○ NATURAL WATER CONTENT  
— LIQUID LIMIT  
— PLASTIC LIMIT



SOIL DESCRIPTION AND SAMPLE LOCATION		ELEV IN FT	WATER CONTENT, %					UNDRAINED SHEAR STRENGTH, K.S.F.										REMARKS		
			10	20	30	40	50	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6				
	GROUND SURFACE	590																		
		580																		
CLAY TILL	1																			
	2																			
	3	570																		
	4																			
	5	560																		
	6																			
	7	550																		
	8																			
	9	540																		
	10																			
END OF HOLE		530																		
		520																		
		510																		
		500																		
		490																		
		480																		
		470																		
		460																		
		450																		
		440																		
		430																		
		420																		
		410																		

3 SOIL SAMPLE OR VANE TEST  
 ○ NATURAL WATER CONTENT  
 — LIQUID LIMIT  
 — PLASTIC LIMIT

○ UNDRAINED COMPRESSION TEST  
 △ FIELD VANE TEST  
 — NATURAL STRENGTH  
 — REMOULDED STRENGTH

15 — 5  
 10  
 FAILURE STRAIN

H G ACRES & COMPANY LIMITED  
 CONSULTING ENGINEERS  
 NIAGARA FALLS CANADA

SUMMARY OF DRILLING AND TEST RESULTS

HOLE No. 849-4

DEPARTMENT OF HIGHWAYS OF ONTARIO

APPROVED

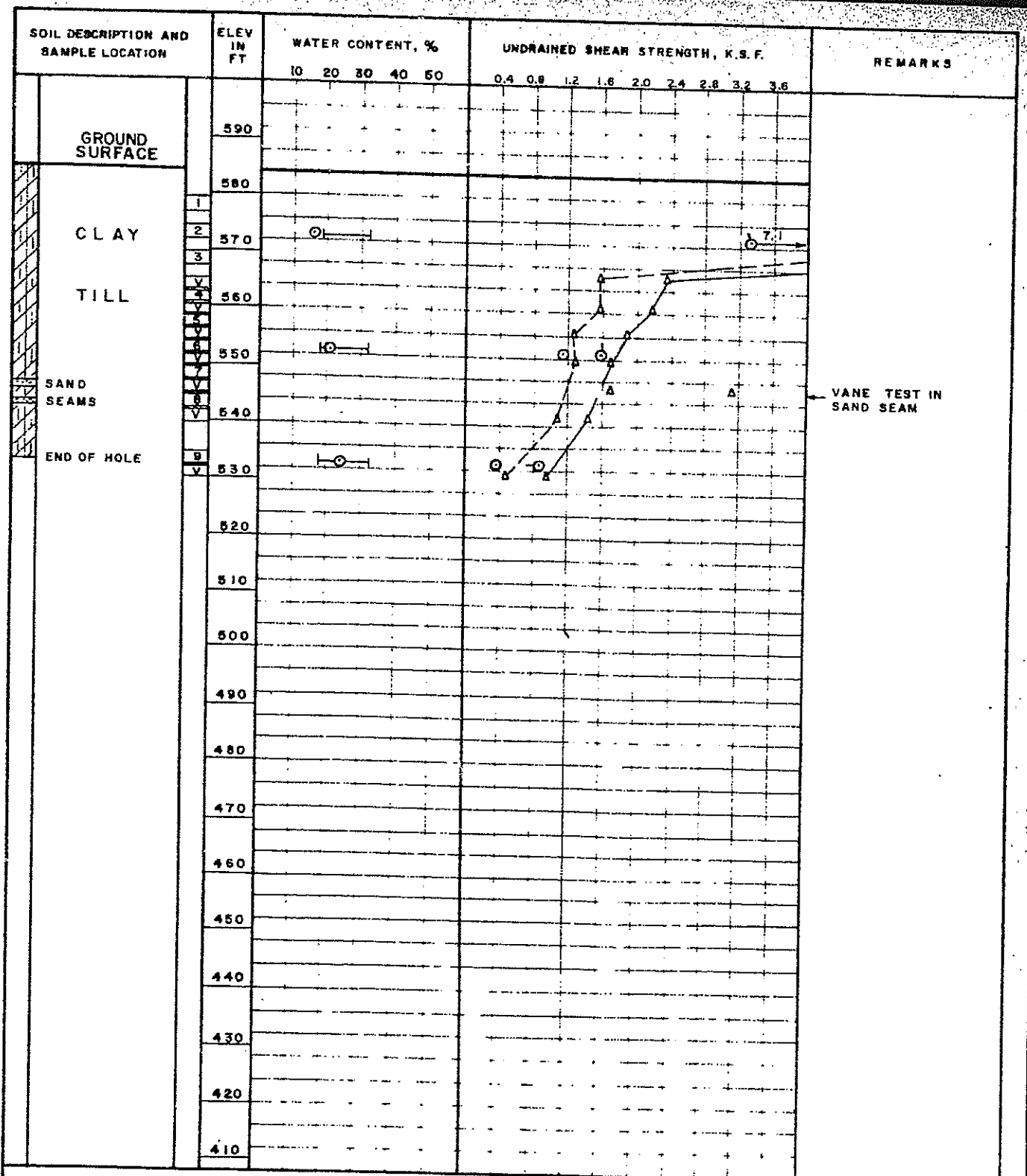
DATE JAN. 29, 1960

HWY. 2 CROSSING HWY. 401 (W.P. 165-58)

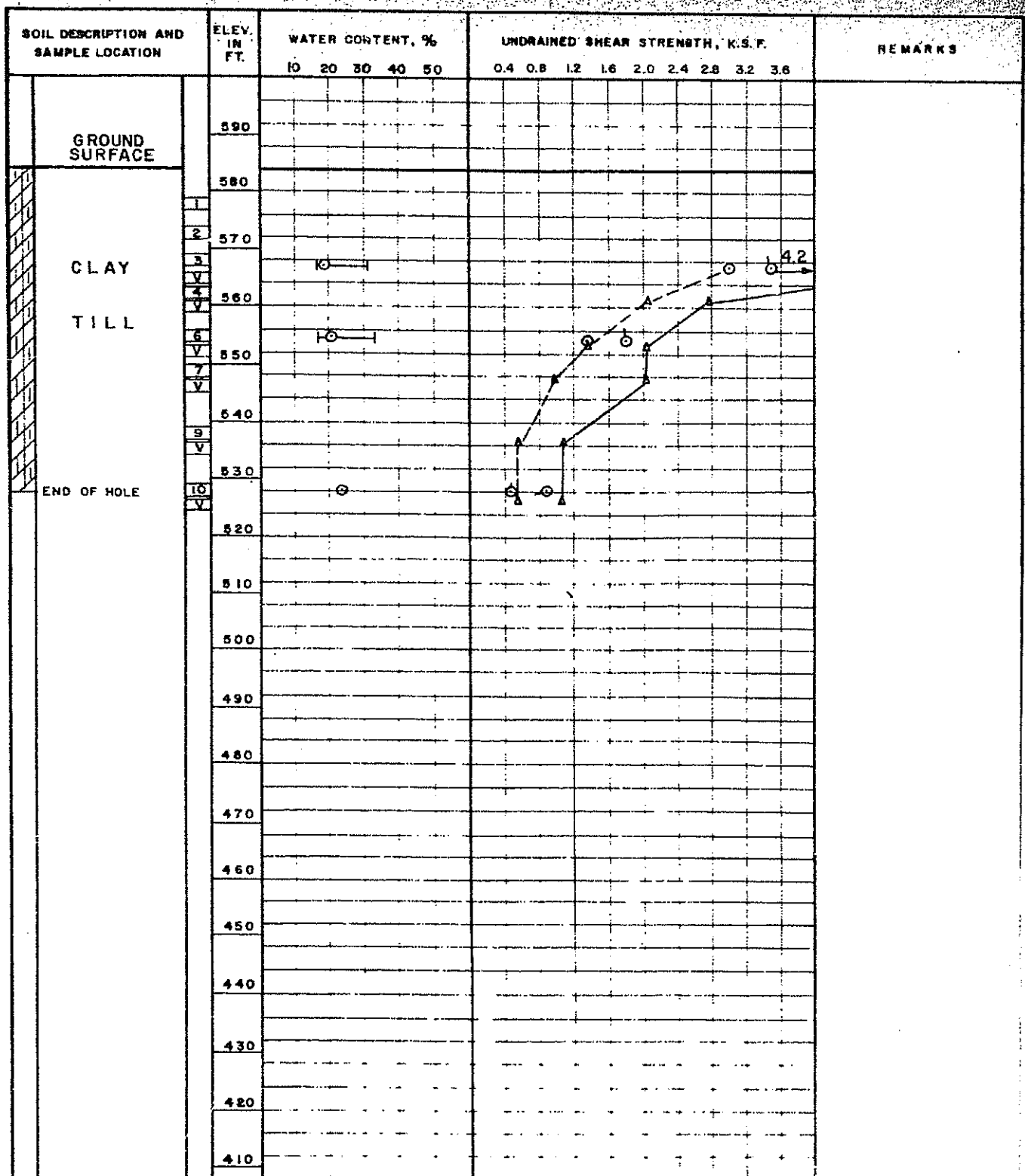
*D. H. Macdonald*  
 H G ACRES & COMPANY LTD.

JOB No 849

PLATE XIII



3 SOIL SAMPLE OR VANE TEST ○ NATURAL WATER CONTENT T LIQUID LIMIT L PLASTIC LIMIT		○ UNDRAINED COMPRESSION TEST △ FIELD VANE TEST — NATURAL STRENGTH --- REMOULDED STRENGTH		15 0 5 10 FAILURE STRAIN	
H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS NIAGARA FALLS CANADA			SUMMARY OF DRILLING AND TEST RESULTS HOLE No. 849-5		
DEPARTMENT OF HIGHWAYS OF ONTARIO			APPROVED <i>D. H. Macdonald</i> H.G. ACRES & COMPANY LTD.		
HWY. 2 CROSSING HWY. 401 (W.P. 165-58)			DATE JAN. 29, 1960 JOB No 849 PLATE XIV		



3

SOIL SAMPLE OR VANE TEST

○

NATURAL WATER CONTENT

—

LIQUID LIMIT

—

PLASTIC LIMIT

○

UNDRAINED COMPRESSION TEST

△

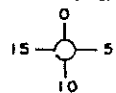
FIELD VANE TEST

—

NATURAL STRENGTH

---

REMOULDED STRENGTH



FAILURE STRAIN

H. G. ACRES & COMPANY LIMITED  
CONSULTING ENGINEERS  
NIAGARA FALLS CANADA

DEPARTMENT OF HIGHWAYS OF ONTARIO

HWY. 2 CROSSING HWY 401 (W.P. 165-58)

SUMMARY OF DRILLING AND TEST  
RESULTS

HOLE No. 849-6

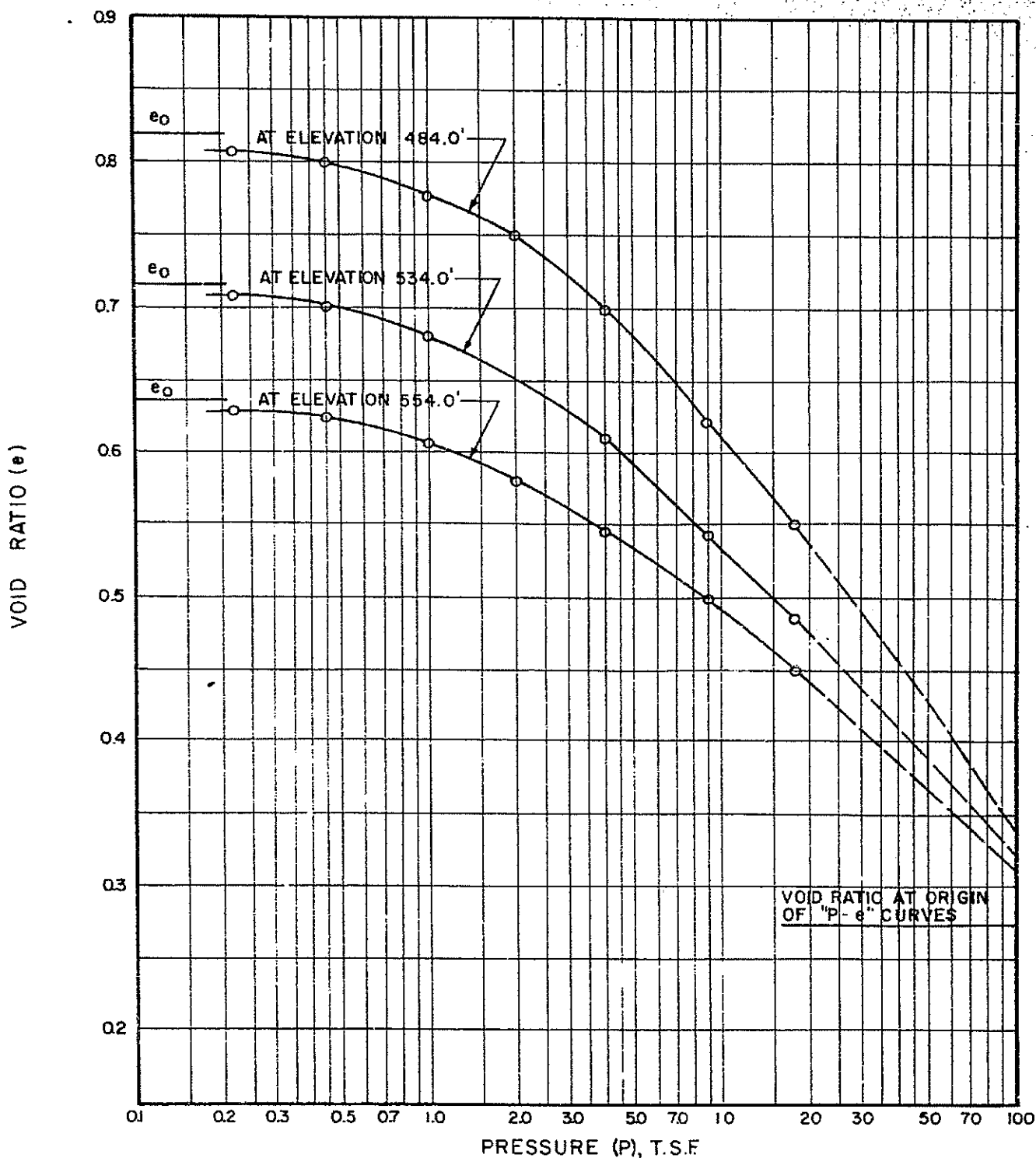
APPROVED

*H. G. Acres*  
H. G. ACRES & COMPANY LTD.

DATE JAN. 29, 1960

JCB No 849

PLATE XV



OVERBURDEN PRESSURE —  $P_0$  = \_\_\_\_\_ NATURAL WATER CONTENT \_\_\_\_\_  
 PRECONSOLIDATION PRESSURE —  $P_c$  = \_\_\_\_\_ LOADING INTERVAL \_\_\_\_\_

SAMPLE No. \_\_\_\_\_ TEST DATE \_\_\_\_\_  
 TEST No. \_\_\_\_\_ TESTED BY \_\_\_\_\_

H. G. ACRES & COMPANY LIMITED  
 CONSULTING ENGINEERS  
 NIAGARA FALLS CANADA

DEPARTMENT OF HIGHWAYS OF ONTARIO

HWY. 2 CROSSING HWY 401 (W.P. 165-58)

DETERMINATION OF VOID RATIO  
 AT ORIGIN OF "P-e" CURVES"

HOLE No. 849-3 SAMPLE ELEV. AS NOTED

APPROVED

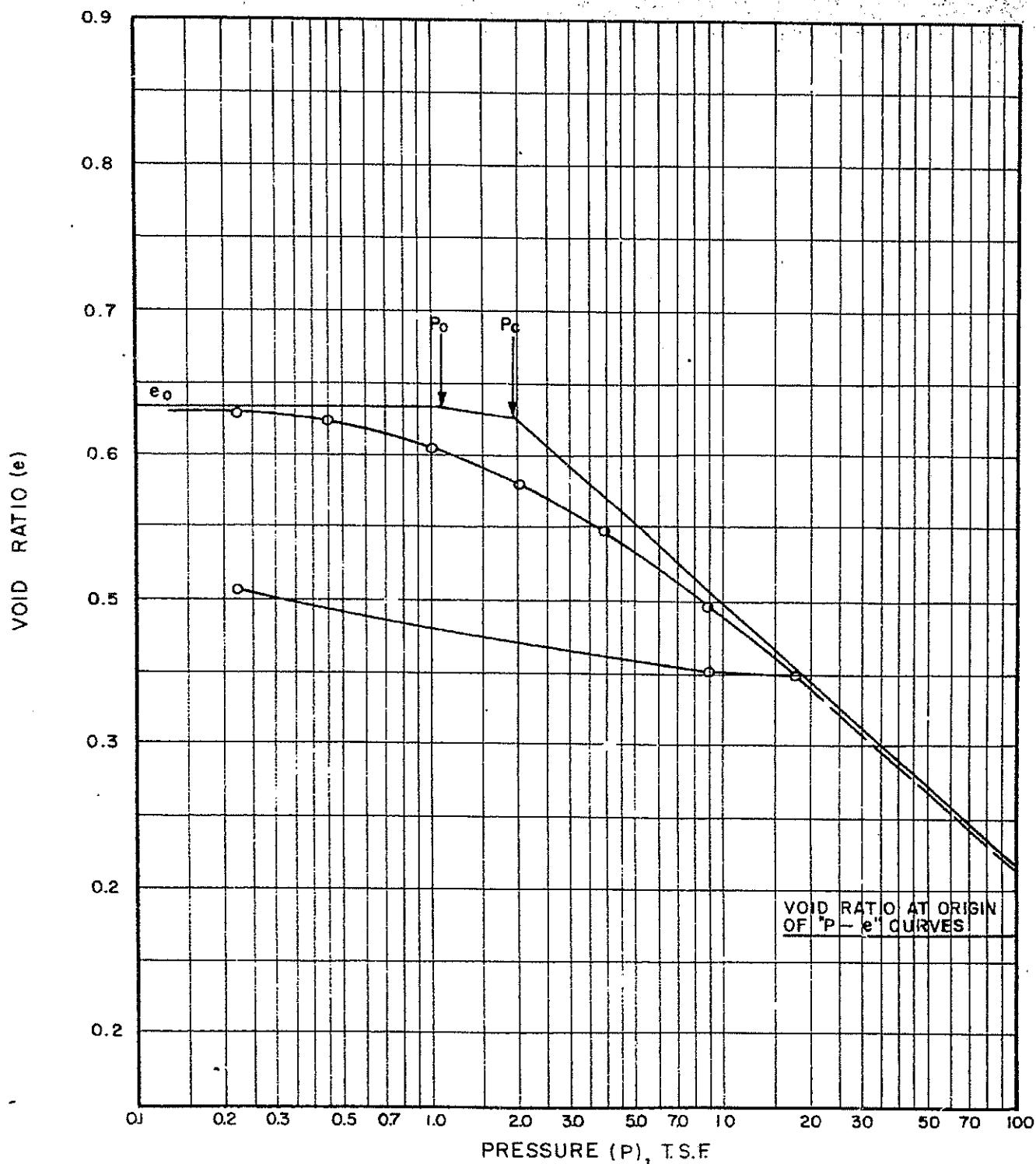
DATE: JAN. 29, 1960

*A. H. MacDonald*

JOB No. 849

H.G. ACRES & COMPANY LTD.

PLATE XVI



OVERBURDEN PRESSURE —  $P_0 = 1.09$  T.S.F.  
 PRECONSOLIDATION PRESSURE —  $P_c = 1.90$  T.S.F.

NATURAL WATER CONTENT —  $w_0 = 21.1\%$   
 LOADING INTERVAL — 25 MIN.

SAMPLE No. 849-B0-24

TEST DATE JAN. 13, 1960

TEST No. 849-9-1

TESTED BY R. G.

H. G. ACRES & COMPANY LIMITED  
 CONSULTING ENGINEERS  
 NIAGARA FALLS CANADA

CONSOLIDATION TEST

HOLE No. 849-3

SAMPLE ELEV. 554.0'

DEPARTMENT OF HIGHWAYS OF ONTARIO

APPROVED

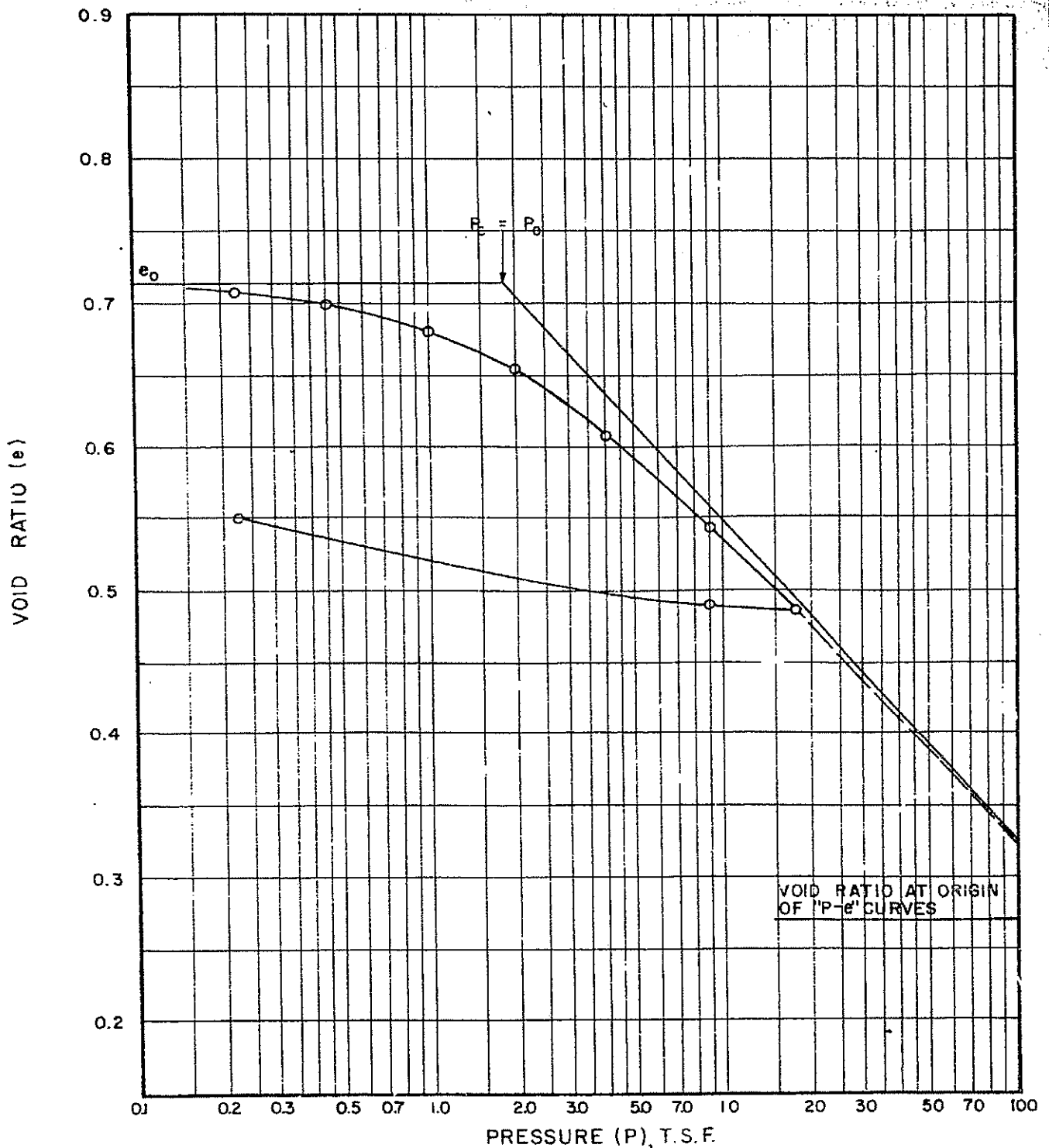
DATE: JAN. 29, 1960

HWY. 2 CROSSING HWY. 401 (W.P. 165-58)

*D. H. Macdonald*  
 H.G. ACRES & COMPANY LTD.

JOB No. 849

PLATE XVII



OVERBURDEN PRESSURE —  $P_0 = 1.75$  T.S.F.  
 PRECONSOLIDATION PRESSURE —  $P_c = 1.75$  T.S.F.

NATURAL WATER CONTENT —  $w_o = 24.9\%$   
 LOADING INTERVAL — 25 MIN.

SAMPLE No. 849-80-27

TEST DATE JAN. 13, 1960

TEST No. 849-9-2

TESTED BY R. G.

H. G. ACRES & COMPANY LIMITED  
 CONSULTING ENGINEERS  
 NIAGARA FALLS CANADA

CONSOLIDATION TEST

HOLE No. 849-3 SAMPLE ELEV. 534.0'

DEPARTMENT OF HIGHWAYS OF ONTARIO

APPROVED

DATE: JAN. 29, 1960

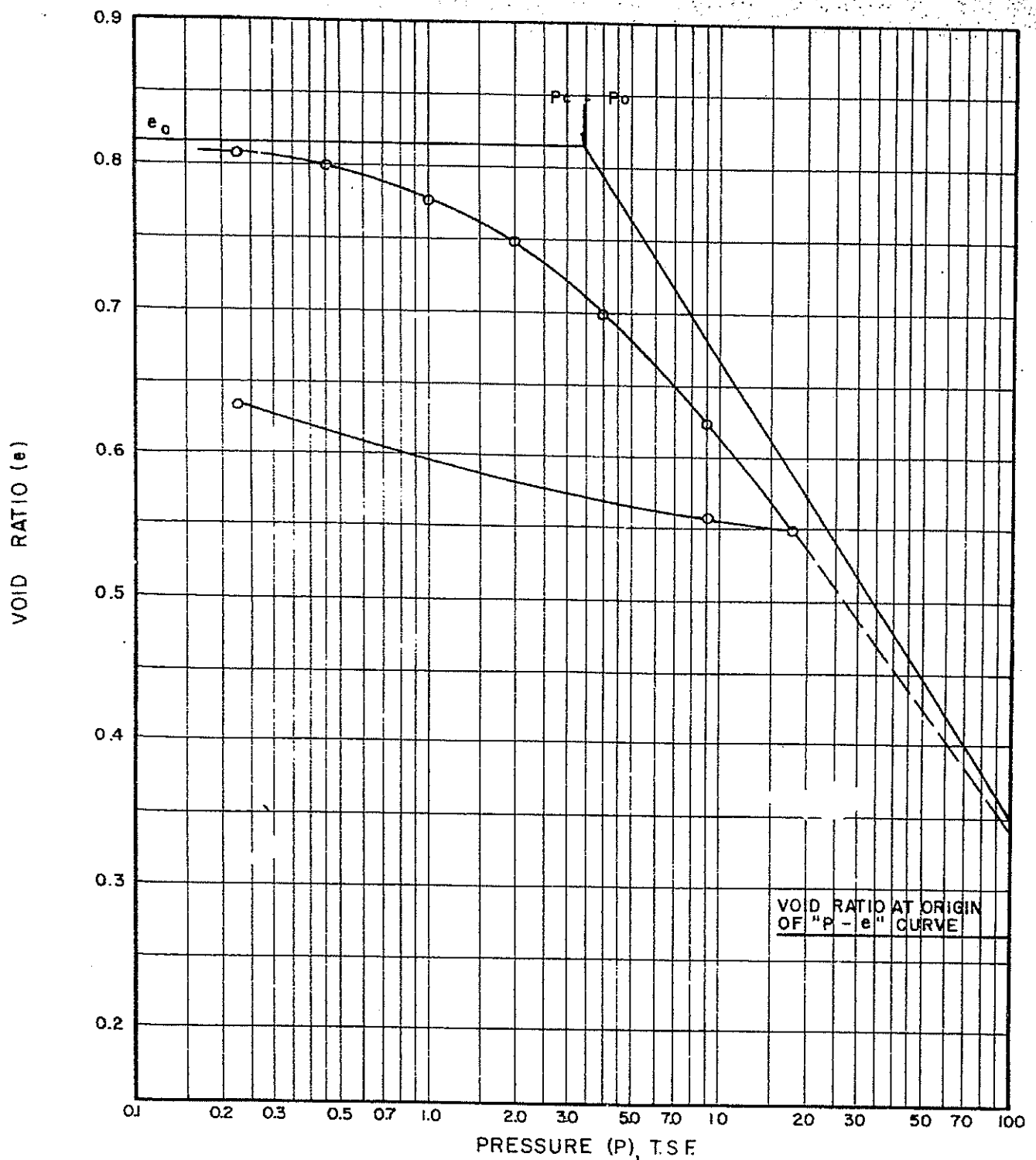
HWY. 2 CROSSING HWY. 401 (W.P. 165-58)

*D. H. Macdonald*  
 H. G. ACRES & COMPANY LTD.

JOB No. 849

PLATE XVIII





OVERBURDEN PRESSURE —  $P_0 = 3.40$  T.S.F.  
 PRECONSOLIDATION PRESSURE —  $P_c = 3.40$  T.S.F.

NATURAL WATER CONTENT —  $\omega_0 = 29.0\%$   
 LOADING INTERVAL — 25 MIN.

SAMPLE No. 849-B0-31

TEST DATE JAN. 14, 1960

TEST No. 849-9-3

TESTED BY R. G.

H. G. ACRES & COMPANY LIMITED  
 CONSULTING ENGINEERS  
 NIAGARA FALLS CANADA

CONSOLIDATION TEST

HOLE No. 849-3 SAMPLE ELEV. 484.0'

DEPARTMENT OF HIGHWAYS OF ONTARIO

APPROVED

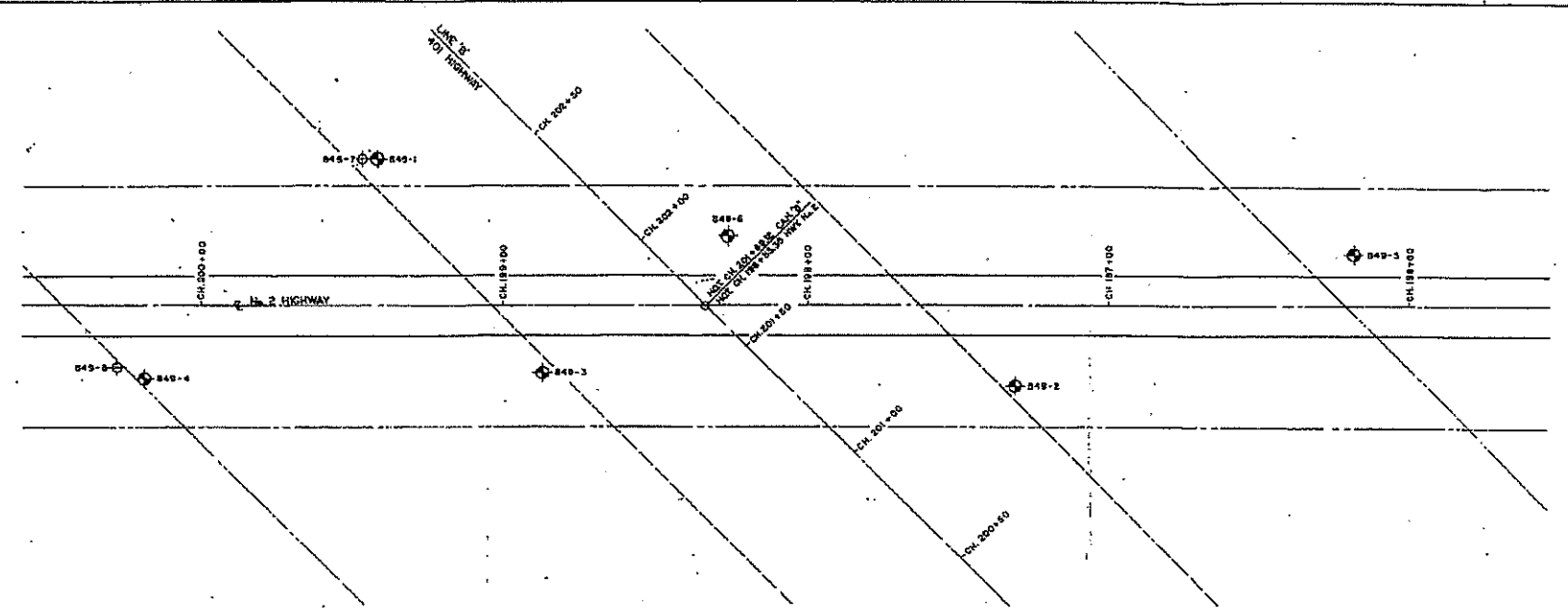
DATE: JAN. 29, 1960

HWY. 2 CROSSING HWY 401 (W.P. 165-58)

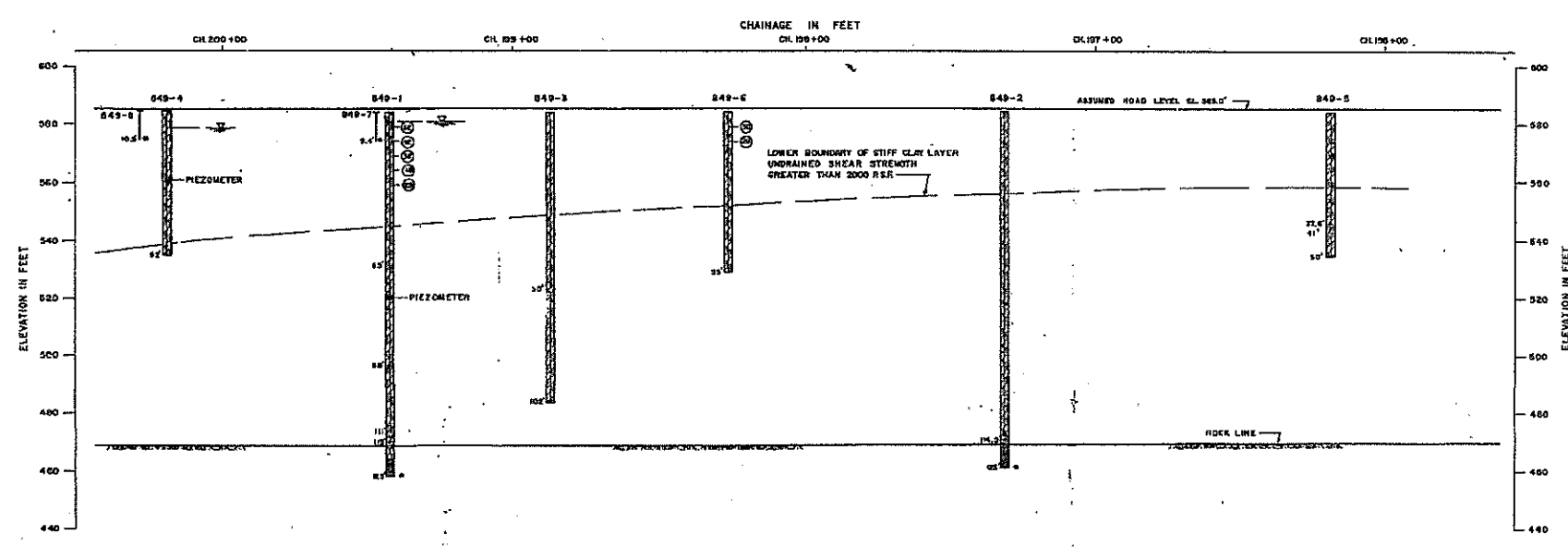
*D. H. Macdonald*  
 H.G. ACRES & COMPANY LTD.

JOB No. 849

PLATE XIX



PLAN

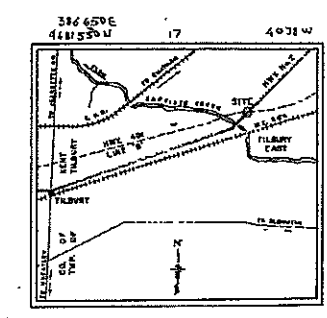


SECTION ALONG E OF N. 2 HIGHWAY

LEGEND

- ▽ WATER TABLE
- ⊕ EXPLORATORY DRILL HOLE
- ⊕ 2 IN. DIA. PENETRATION CONE TEST
- ⊕ 2 IN. DIA. PENETRATION CONE DRIVEN TO REFUSAL
- ⊕ BLOWS PER FOOT FOR 2 IN. SPLIT-SPOON SAMPLER
- CLAY TILL
- SAND
- LIMESTONE
- SHALE

NOTES:  
STANDARD PENETRATION TESTS AND CONE PENETRATION TESTS WERE PERFORMED USING A 140 POUND WEIGHT DROPPING 30 INCHES.

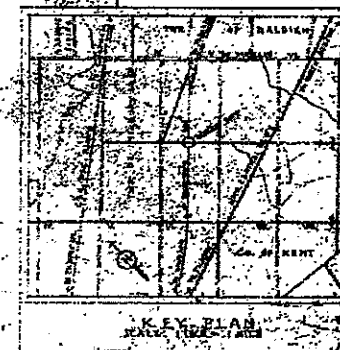


KEY PLAN  
SCALE 1 IN. = 1 MI.

H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS NIAGARA FALLS, CANADA	
DEPARTMENT OF HIGHWAYS OF ONTARIO	
HIGHWAY 2 CROSSING HIGHWAY 401 (HWP 165-501)	
EXPLORATORY HOLES PLAN AND SECTION	
APPROVED	DATE: JAN. 24, 1960
<i>D. H. Macdonald</i>	SCALE: 1 IN. = 20 FT. 845
PLATE - I	

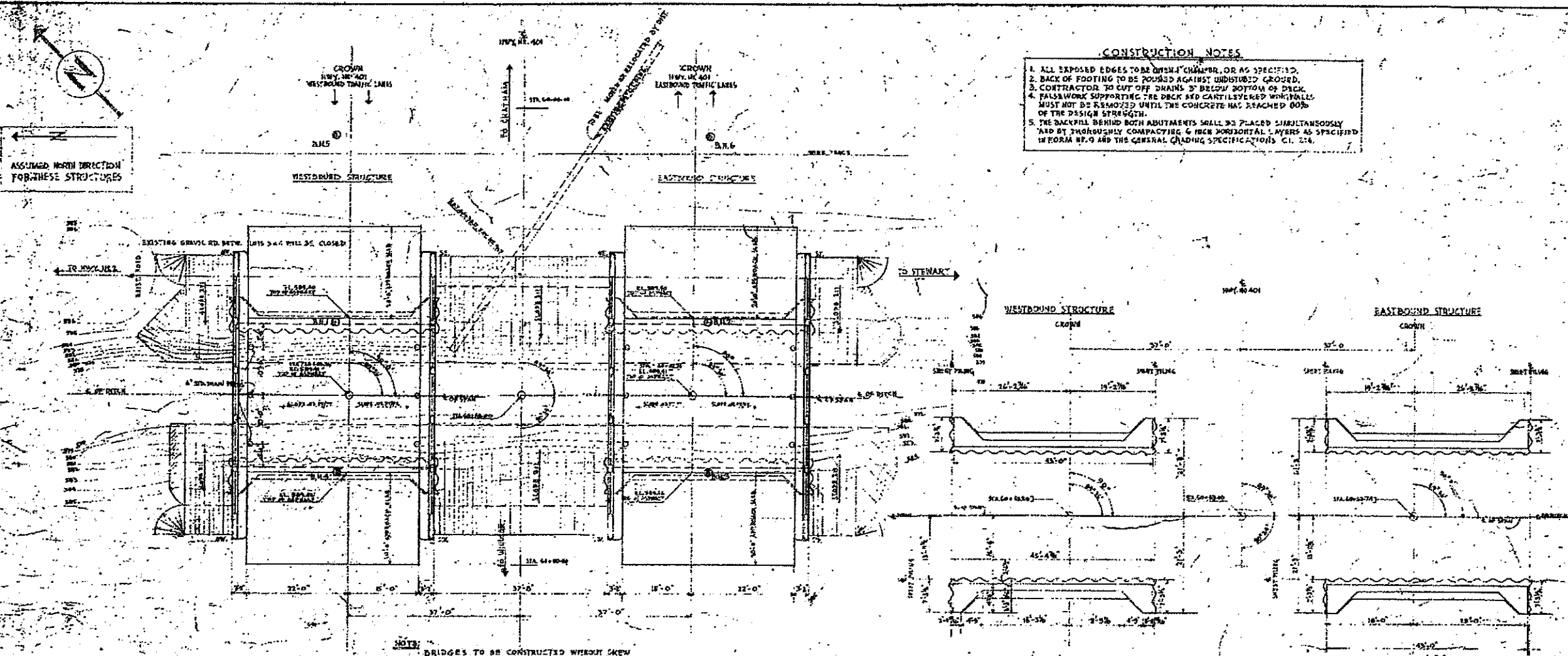


- (11) Contract Drawings for Tilbury East Township Bridge No. 4 (McDougall Drain Bridges), WP 9-59, TWP 104-190-1-A, dated October 1959.

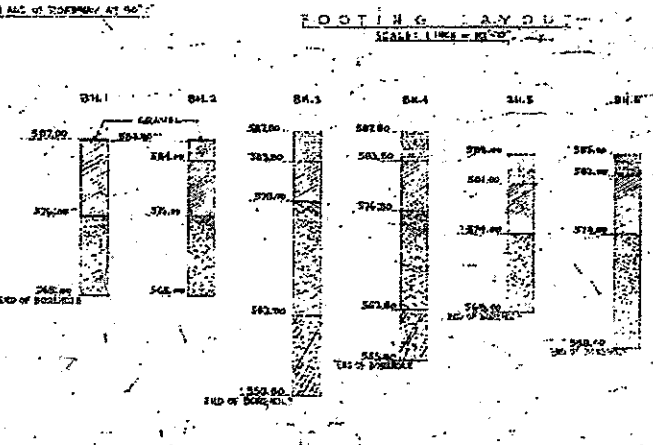
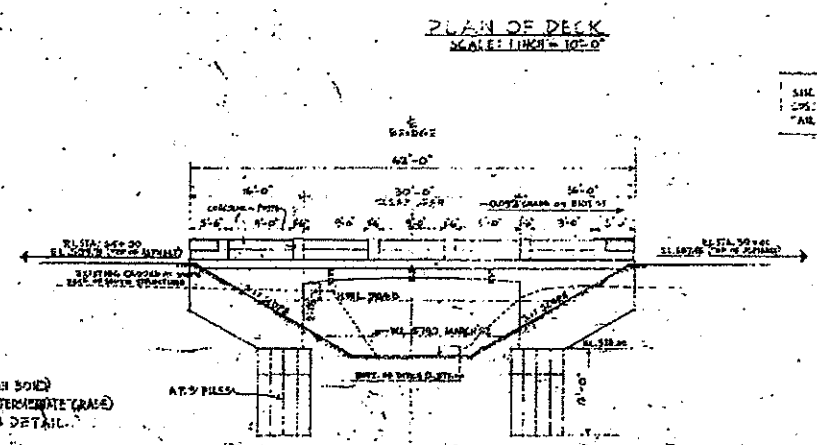
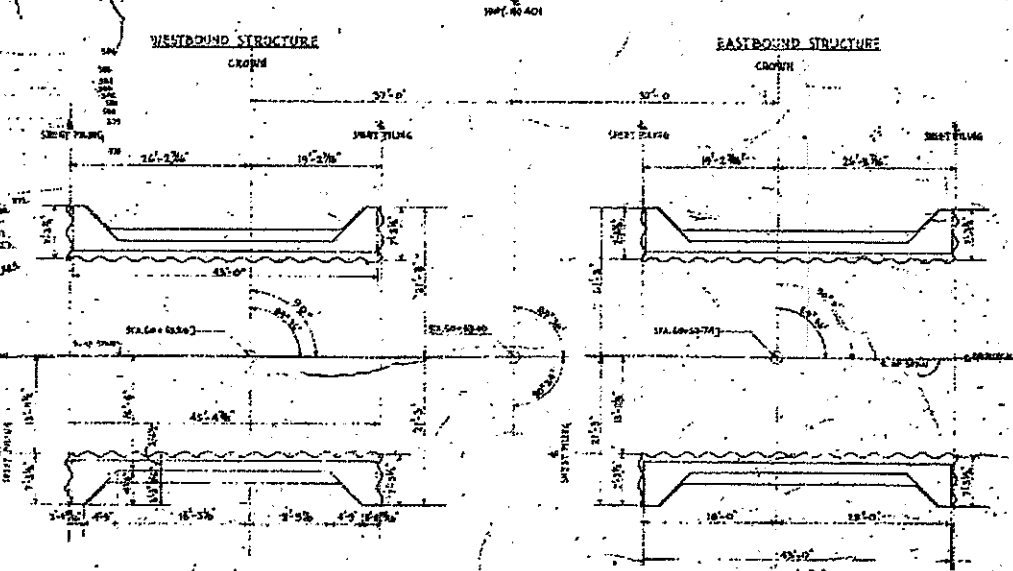


CONSTRUCTION NOTES

1. ALL EXPOSED EDGES TO BE 18" CHAMFER, OR AS SPECIFIED.
2. BACK OF FOOTING TO BE POLISHED AGAINST CURBSTONE TO BE MAINTAINED.
3. CONTRACTOR TO CUT OFF DRAINS 3" BELOW BOTTOM OF DECK.
4. FALSEWORK SUPPORTING THE DECK AND CANTILEVERED WHITEWALLS MUST NOT BE REMOVED UNTIL THE CONCRETE HAS REACHED 100% OF THE DESIGN STRENGTH.
5. THE BACKFILL BEHIND THE ABUTMENTS SHALL BE 3:1 GRADED SLOPES TO SLOPE AND BE THOROUGHLY COMPACTING & BEING HORIZONTAL LAYERS AS SPECIFIED IN FORM B.F. 0 AND THE GENERAL GRADING SPECIFICATIONS CL. 214.



NOTE: BRIDGES TO BE CONSTRUCTED WITHOUT OPEN



LIST OF DRAWINGS  
 DRAWING NO. 1 GENERAL LAYOUT  
 DRAWING NO. 2 REINFORCEMENT DETAILS  
 DRAWING NO. 3 REINFORCING STEEL TABLE (HIGH BOND)  
 DRAWING NO. 4 REINFORCING STEEL TABLE (INTERMEDIATE GRADE)  
 DRAWING NO. 5 APPROACH SLABS CURB DETAIL

LEGEND

1. BROWN SANDY CLAY.
2. GREY BROWN; SILTY CLAY.
3. SILTY GREY SILTY CLAY. APPROX.  
8% FINE TO MEDIUM GRAVEL.
4. SILTY TO MEDIUM SILTY CLAY.  
APPROX. 8% FINE TO MEDIUM GRAVEL.

DEPARTMENT OF HIGHWAYS, ONTARIO  
BRIDGE OFFICE, TORONTO

FILBURY EAST TWP. BRIDGE NO. 4

THE KENT MICHIGAN No. 401  
CO. KENT

## GENERAL LAYOUT

\_\_\_\_\_

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----



- (12) Foundation Investigation Report for Highway 401 and Drain (McDougall Drain Bridges) and Relocated Gravel Road Crossing, WP 9-59, W.J.F-59-12, dated March 16, 1959, Geocres No. 40J8-6 and 40J8-27.

TABLE I.

## SUMMARY OF FIELD &amp; LABORATORY TESTS

JOB F-59-12

W.P. 9-59

HOLE NO	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	T1	5 - 7	Stiff brown silty clay with some sand.	-	16.5	-	-	5620	132.3	Approximately 8% fine to medium gravel throughout.
	T2	10 - 12	Stiff grey silty clay.	31	15.3	-	-	-	135.2	
	T3	15 - 17	" " "	20	16.3	-	-	2970	131.6	
	T4	20 - 22	" " "	-	17.5	-	-	2450	131.6	
2	T1	5 - 7	Stiff brown silty clay.	28	15.1	-	-	9570	127.8	Approximately 8% fine to medium gravel throughout.
	T2	10 - 12	Stiff grey silty clay.	22	15.0	-	-	3550	133.7	
	T3	15 - 17	" " "	19	16.7	-	-	-	130.5	
	T4	20 - 22	" " "	-	17.1	-	-	2600	129.6	
3	S1	3 - 4 1/2	Brown sandy clay.	13	21.3	-	-	-	123.0	Approximately 8% fine to medium gravel throughout.
	T2	6 - 8	Stiff brown silty clay.	-	15.5	21.1	37.1	5760	129.2	
	T3	10 - 12	Stiff grey silty clay.	23	15.3	15.9	26.9	4860	133.5	
	T4	15 - 17	" " "	-	17.4	16.5	28.4	3330	132.2	
4	T5	20 - 22	" " "	-	18.2	15.5	26.8	2660	127.0	
	T6	27 - 29	Medium stiff grey silty clay.	-	21.3	16.1	28.5	937	125.5	
	T7	35 - 37	Soft " " "	-	28.9	16.9	29.3	527	121.0	
	T1	5 - 7	Stiff brown silty clay with stones.	12	16.2	-	-	-	124.5	
4	T2	10 - 12	Stiff brown silty clay with stones.	35	15.8	17.5	29.5	-	138.3	
	T3	15 - 17	Stiff grey silty clay.	23	16.4	16.1	27.4	3730	133.3	Approximately 8% fine to medium gravel throughout in the grey clay.
	T4	20 - 22	" " "	-	16.8	16.2	27.2	4330	133.7	
	T5	30 - 32	Soft " " "	-	18.8	-	-	-	130.0	

cont'd. /2 ...



DRILL RIG BENN DRILL JOHNSON OPERATION BORE \_\_\_\_\_ JOB F-50-12 WP 9-59 \_\_\_\_\_ BORING LT. STA. 60+48.40  
CASING \_\_\_\_\_ (standard samplers to fit unless noted) DATUM GEODETIC \_\_\_\_\_ DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES COMPILED BY J.J. CHECKED BY A.L. DATE BORING FEBRUARY 9 1959

## SAMPLE TYPES

**SAMPLE CONDITION**

C.S. - CHUNK	S.S. - SLEEVE SAMPLE
D.O. - DRIVE OPEN	P.S. - PISTON SAMPLE
D.F. - DRIVE FOOT VALVE	W.S. - WASHED SAMPLE
T.O. - THIN WALLED OPEN	R.C. - ROCK CORE

- 7 DISTURBED
- FAIR
- GOOD
- LOST

[illegible]

## DEPARTMENT OF HIGHWAYS - ONTARIO

DRILL RIG PENN. DRILL JOHNSTON COOPERATION. BORE JOB E-59-12 WP 9-59 BORING 2 STA. 60348 4017  
CASING \_\_\_\_\_ (standard samplers to fit unless noted) DATUM GEODETTIC DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES COMPILED BY IQ CHECKED BY AL DATE BORING FEBRUARY 9 1959

## SAMPLE TYPES

C.S. - CHUNK	S.S. - SLEEVE SAMPLE
D.O. - DRIVE OPEN	P.S. - PISTON SAMPLE
D.F. - DRIVE FOOT VALVE	W.S. - WASHED SAMPLE
T.O. - THIN WALLED OPEN	R.C. - ROCK CORE

- DISTURBED
- FAIR
- GOOD
- LOST

[illegible]

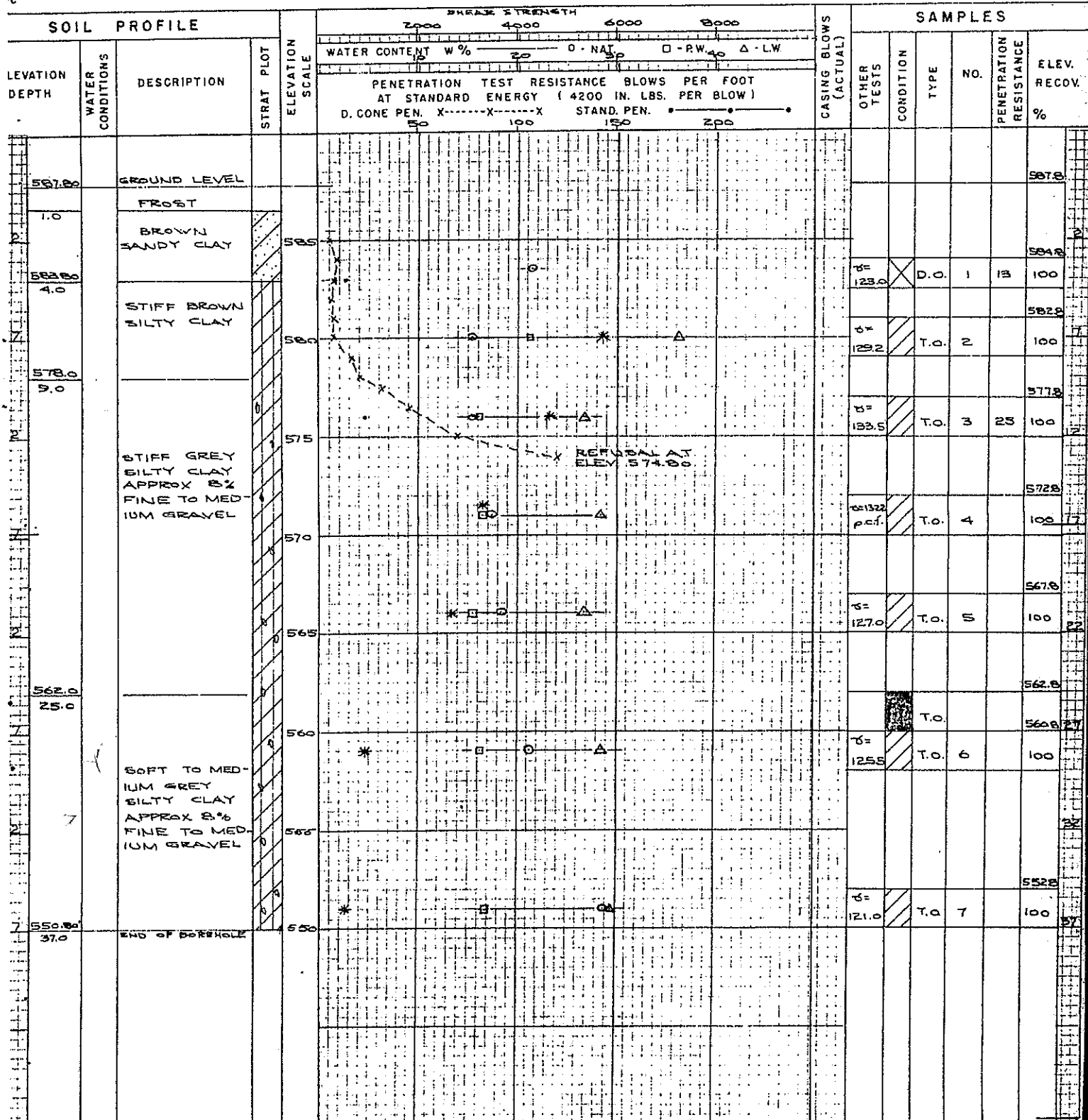
DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG PENN. DRILL JOHNSON CO OPERATION BORE # PENETRATION JOB F-59-12 WP 9-59 BORING 3 STA. 60+83 (40' LT)  
 CASING (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
 SAMPLER HAMMER WT. 132 LBS. DROP 30 INCHES COMPILED BY W. CHECKED BY A.L. DATE BORING FEBRUARY 5, 1959

**ABBREVIATIONS**  
 I - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY C.S. - CHUNK S.S. - SLEEVE SAMPLE  
 II - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION D.O. - DRIVE OPEN P.S. - PISTON SAMPLE  
 III - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING O.F. - DRIVE FOOT VALVE WS - WASHED SAMPLE  
 IV - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL U - UNIT WEIGHT T.O. - THIN WALLED OPEN R.C. - ROCK CORE

**SAMPLE CONDITION**

- DISTURBED  
 - FAIR  
 - GOOD  
 - LOST



DRILL RIG OPEN DRILL JOINT OPERATION BORE PENETRATION NOB-59-12 WP 9-59 BORING 4 STA. 60+83 (43 FT)  
CASING --- (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES COMPILED BY L.J. CHECKED BY A.L. DATE BORING FEBRUARY 6, 1959

## SAMPLE TYPES

**SAMPLE CONDITION**

S.S. - SLEEVE SAMPLE

P.S. - PISTON SAMPLE

WS - WASHED SAMPLE

W.S. - WASHED SAND  
R.C. - ROCK CORE

- DISTURBED
- FAIR
- GOOD
- LOST

[illegible]

ABBREVIATIONS	
V - INSITU VANE SHEAR TEST	Q - TRIAXIAL QUICK
M - MECHANICAL ANALYSIS	S - TRIAXIAL SLOW
U - UNCONFINED COMPRESSION	WL - WATER LEVEL
Q - TRIAXIAL CONSOLIDATED QUICK	WT - WATER TABLE

**ABBREVIATIONS**

Q - TRIAXIAL QUICK	K - PERMIABILITY
S - TRIAXIAL SLOW	C - CONSOLIDATION
WL - WATER LEVEL IN CASING	CA - CASING
WT - WATER TABLE IN SOIL	W - UNIT WEIGHT

SAMPLE	TYPES
C.S. - CHUNK	S.S. - SLEEVE
D.O. - DRIVE OPEN	P.S. - PISTON
D.F. - DRIVE FOOT VALVE	W.S. - WASHER
T.O. - THIN WALLED OPEN	R.C. - ROD

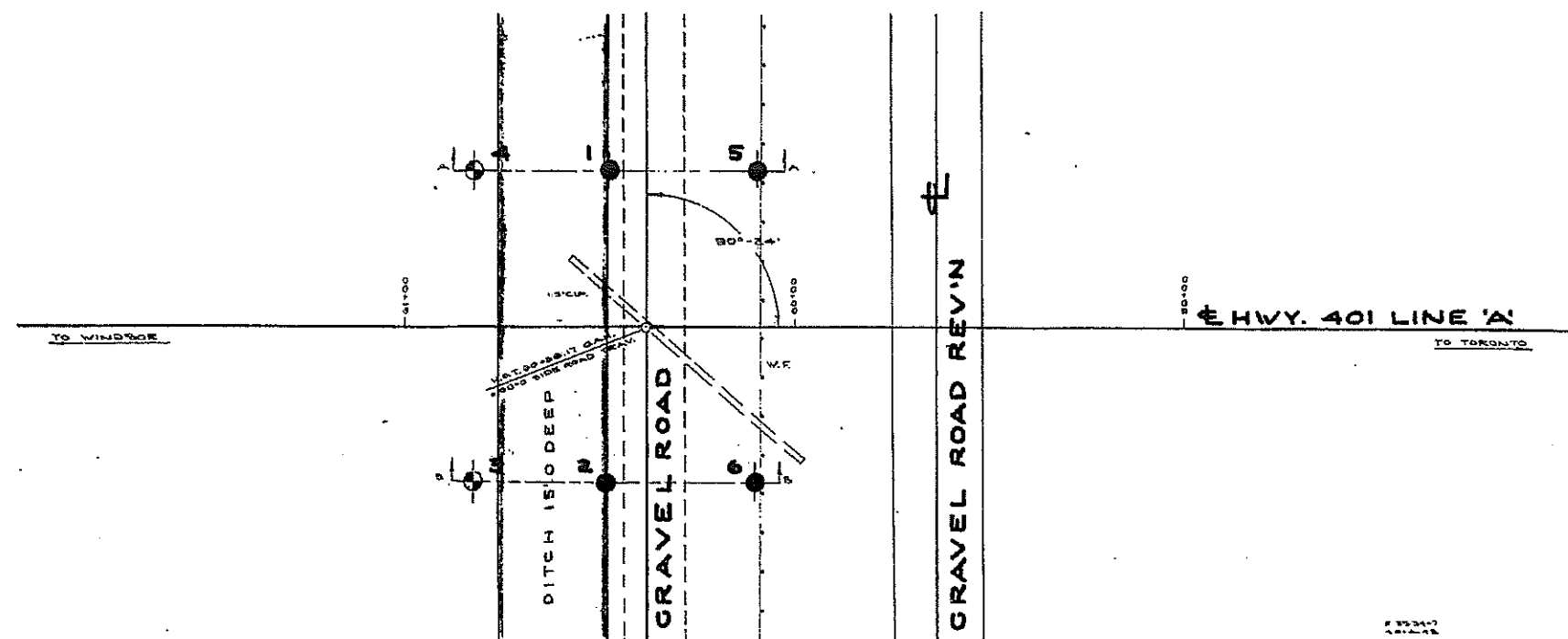
**TYPES**  
S.S. - SLEEVE SAMPLE  
P.S. - PISTON SAMPLE  
W.S. - WASHED SAMPLE  
R.C. - ROCK CORE

**SAMPLE CONDITION**

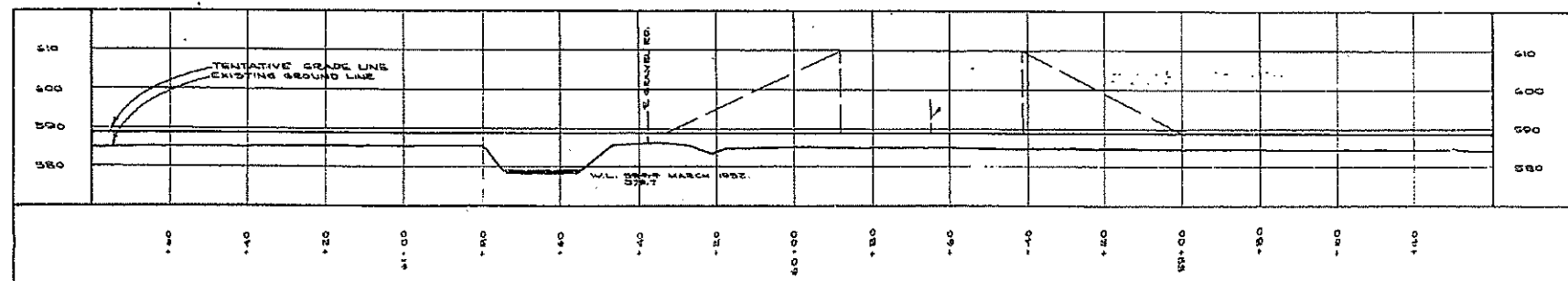
	- DISTURBED
	- FAIR
	- GOOD
	- LOST

[illegible]

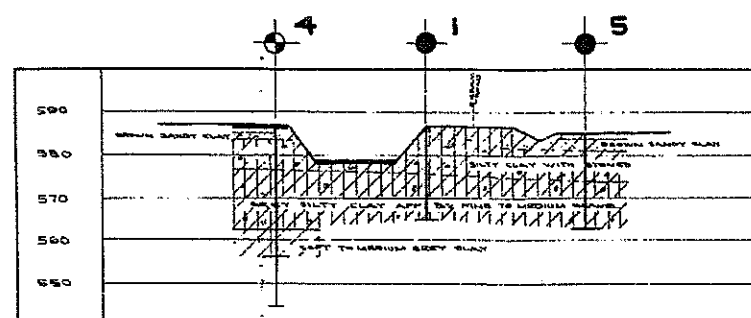




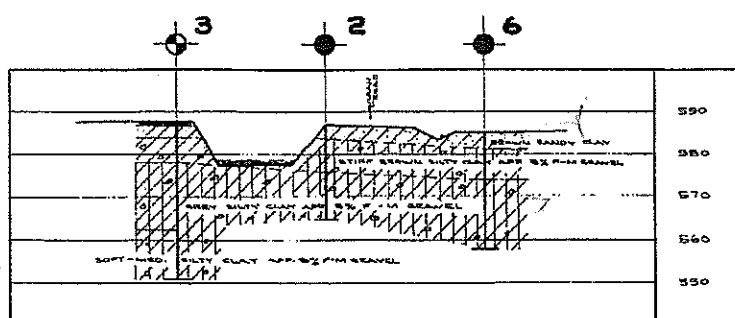
PLAN



PROFILE



A-A



B-B

LEGEND			
BORE HOLE			
PENETRATION HOLE			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1	587.0	60+45	40' RT
2	587.0	60+45	40' LT
3	587.5	60+85	40' LT
4	587.5	60+85	40' RT
5	585.0	60+10	40' RT
6	585.0	60+10	40' LT

DEPARTMENT OF HIGHWAYS-ONTARIO  
MATERIALS & DESIGN SECTION

**GRAVEL ROAD  
PROPOSED CROSSING**

SHOWING POSITIONS & ELEVATIONS OF HOLES

Hwy. 401 DISTRICT \_\_\_\_\_ COUNTY \_\_\_\_\_

TOWNSHIP \_\_\_\_\_ LOT \_\_\_\_\_ CON. \_\_\_\_\_

LOCATION \_\_\_\_\_

DRAWN BY T. MCGILLIS CHECKED BY \_\_\_\_\_

DATE MAR. 10/59 APPROVED BY \_\_\_\_\_

SCALE 1" = 20'

W.D. 2-59

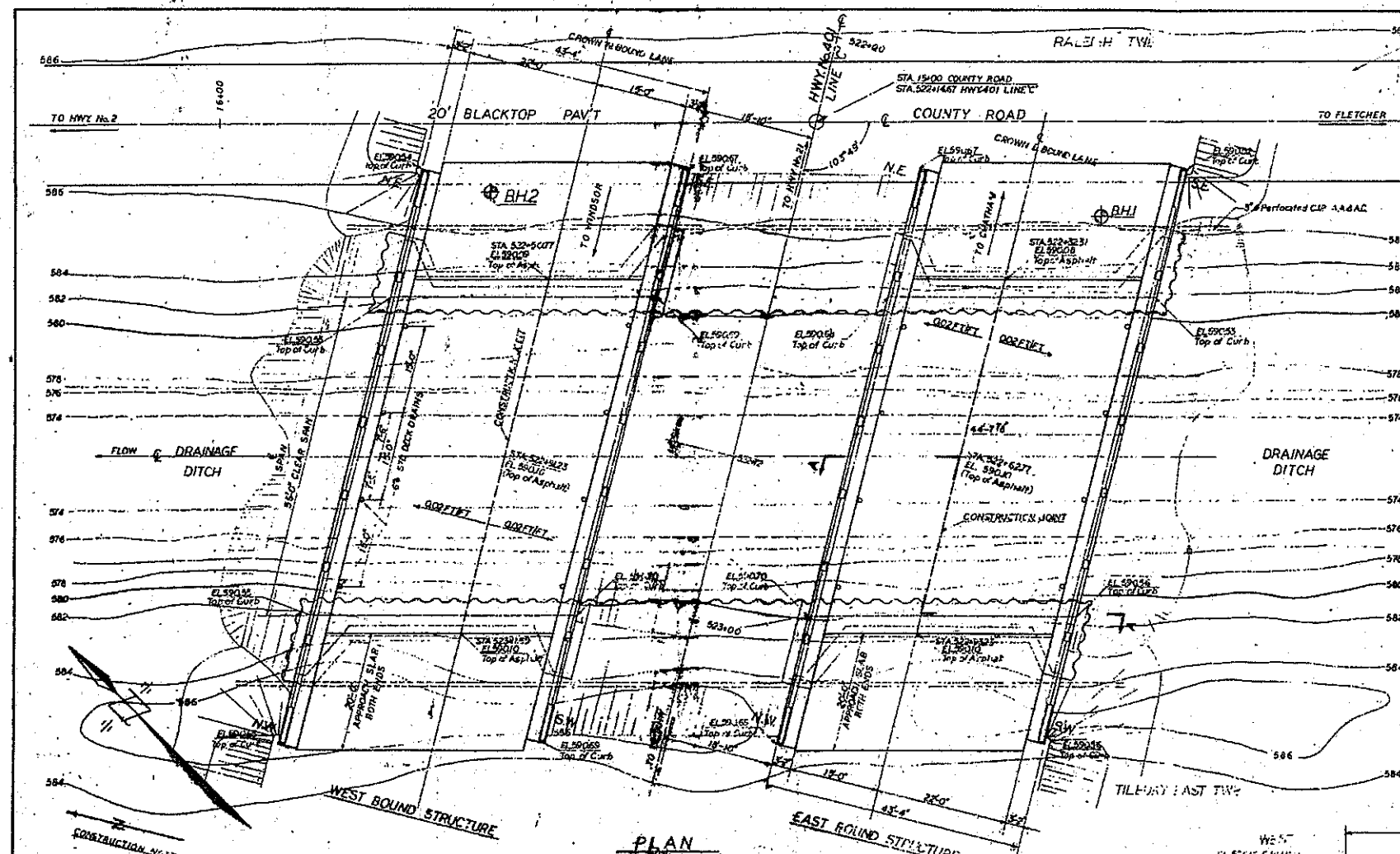
REVISIONS UP

**F59-12A**

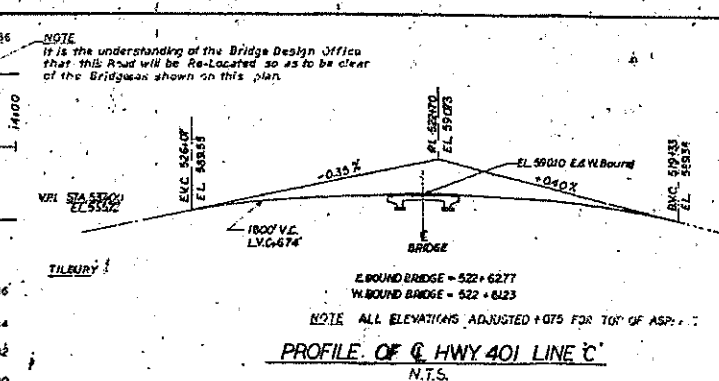




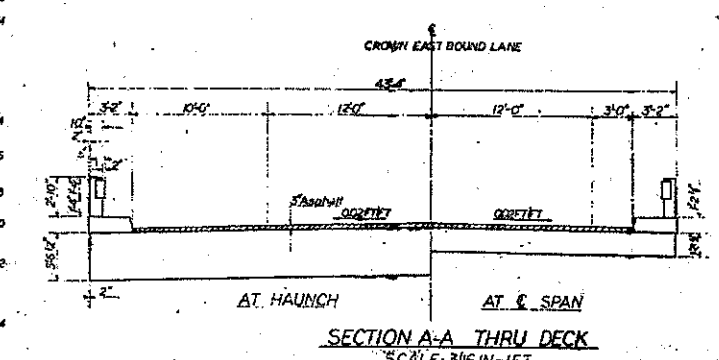
- (13) Contract Drawings for Tilbury East Township Bridge No. 2 (Government Drain No. 1 Bridges), WP 10-59, TWP 104-55-1-A, dated August 1959.



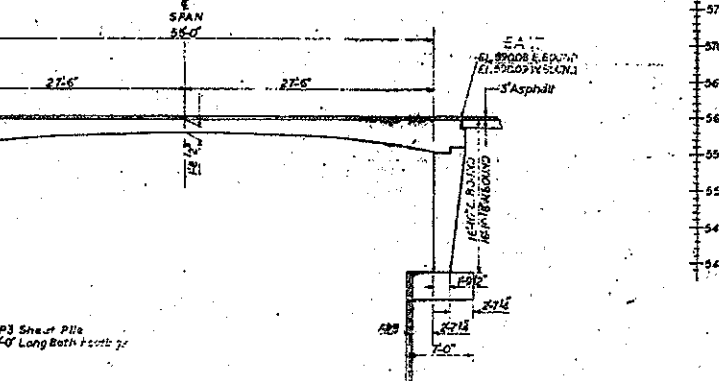
PLAN  
SCALE: 1"=100'



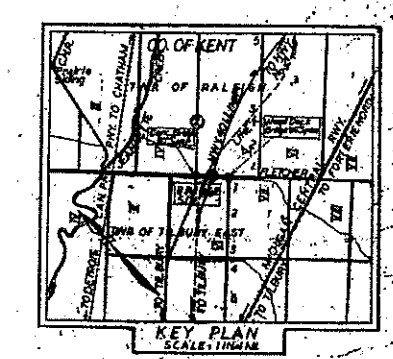
PROFILE OF Q. HWY 401 LINE 'C'  
N.T.S.



SECTION A-A THRU DECK  
SCALE: 3/16"=1'-0"

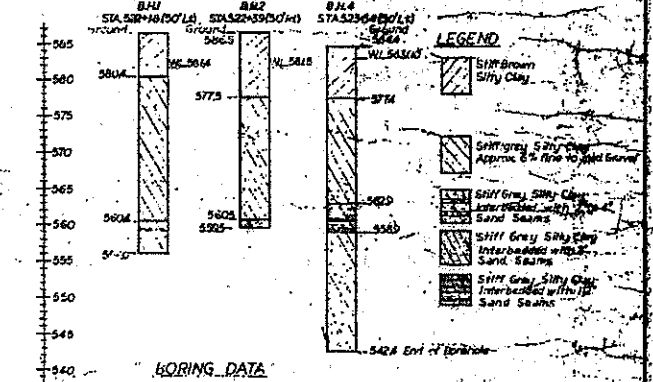


SECTION THRU C. CROWN RDWY  
SCALE: 1/2"=1'-0"

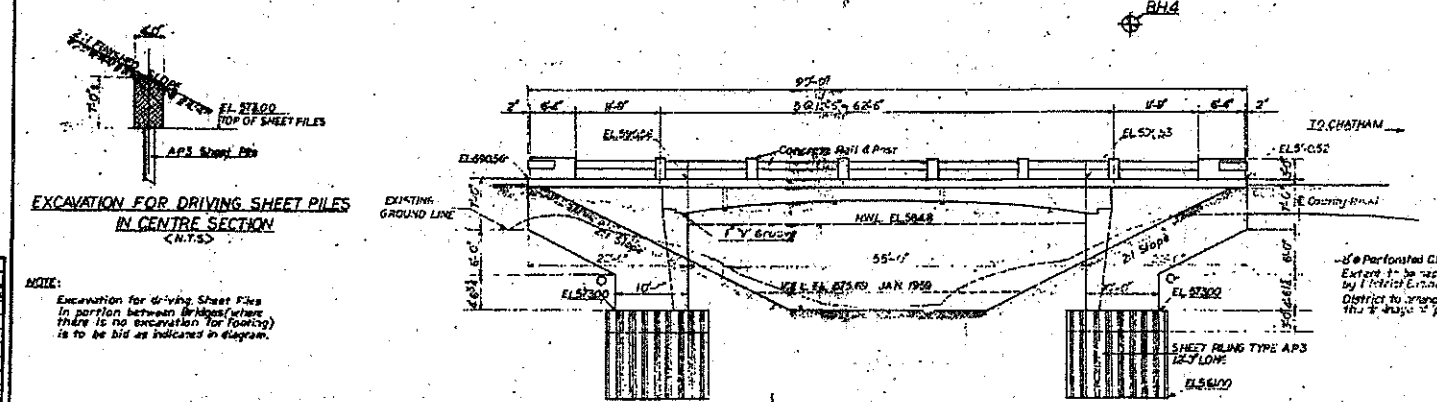


KEY PLAN  
SCALE: 1"=1/2 MI

**NOTES**  
CONSTRUCTION NOTES:  
1. All exposed edges to be chamfered unless otherwise stated.  
2. Footing concrete to be poured against undisturbed soil.  
3. Scaffolding supporting the deck must not be removed until backfill behind the abutments has been placed.  
4. Backfill should be placed simultaneously at both ends if possible.  
5. Do not remove falsework supporting wingwalls until curbs have been poured.  
6. 1" x 1" x 24" day strength.  
7. Contractor to cut off backfilling 3" below concrete.  
NOTE TO DISTRICT ENGINEER: Concrete work on this structure must not be commenced until monuments to the control points have been erected & checked by the Dist. Eng.  
NOTE TO CONTRACTOR: Structure to be built in accordance with Form No. 9 of the Special Provisions, copies of which may be obtained from the District Engineer.  
All construction joints must be approved by the Bridge Engineer.  
CONCRETE MIX: Minimum strength 3000 psi, Structure - 3000 psi, Footings - 2500 psi. Maximum size of aggregate: Deck 1" Footings 1 1/2". Admixture: 4% Retarder. An approved admixture supplied by the Dist. Eng. will be added to all concrete. In the amounts & as specified in the concrete mix designed by the Materials & Research Section, D.H.O.  
BORING DATA: The complete soil investigation report B-880 may be examined at the Bridge Office, 580 Davenport Road, Toronto. The Dist. Eng. does not guarantee the accuracy of this report or the abridged version shown on these plans.  
REINFORCING STEEL: (Minimum Cover): 3" to surface in contact with earth & 1 1/2" elsewhere. Deck & guardrail as shown.



BORING DATA



SOUTH ELEVATION (E. BOUND LANE)  
SCALE: 1/2"=1'-0"

**LIST OF DRAWINGS**  
D-4367-1: GENERAL PLAN & ELEVATION  
D-4367-2: FOOTING & WINGWALL & ABUTMENTS  
D-4367-3: FRAMED CURB, APPROACH SLAB & HANDRAILS  
D-4367-4: REINFORCING STEEL SCHEDULE  
D-4367-5: DO

**EXCAVATION FOR DRIVING SHEET PILES IN CENTRE SECTION (N.T.S.)**

NOTE: Excavation for driving Sheet Piles in portion between Bridges (where there is no excavation for footing) is to be bid as indicated in diagram.

W.P. 10-59

DEPARTMENT OF HIGHWAYS, ONTARIO  
BRIDGE OFFICE - TORONTO

**TILBURY EAST TOWNSHIP BRIDGE No. 2**

THE KING'S HIGHWAY No. 401 DIST. No. 1  
CO. KENT  
TWP. TILBURY EAST LOT 1 CON. VI

**GENERAL PLAN & ELEVATION**

APPROVED: *Amey*  
DESIGN ENGINEER

DESIGNED BY: *Amey*  
BRIDGE ENGINEER

NO.	NAME	DATE	REVISION
1	A.W.	1959	F. G.
2	A.W.	1959	F. G.
3	A.W.	1959	F. G.

DATE: AUGUST 1959

TWP 104-55-1-A



- (14) Foundation Investigation Report for Highway 401, Line 'C' and Drainage Canal (Government Drain No. 1 Bridges) and Realigned County Road Crossing (Merlin Road Underpass), WP 10-59 and 69-59, W.J.F-59-13, dated May 1959, Geocres No. 40J8-7.

**DEPARTMENT OF HIGHWAYS - ONTARIO**  
**MATERIALS AND RESEARCH SECTION**

W.P. 10-59. BORE HOLE NO. 1.  
JOB F-59-13 STATION 522+18 (50' Lt.)  
DATUM Geodetic COMPILED BY B.K.  
BORING DATE Feb. 12/59. CHECKED BY A.L.

2" DIA SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA CONE  
2" SHELBY  
CASING

**LEGEND**

BSS 1/2 UNCONFINED COMPRESSION  
BTW VANE TEST (C) AND SENSITIVE  
NATURAL MOISTURE AND  
LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				CONSISTENCY		
				2000	4000	6000	8000	MOIST. CONTENT	W. DRY WT.	
	Ground Level.	536.4		50	100	150	200	10	20	30
	Stiff brown silty clay.	W.L. 521.4								
	Stiff grey silty clay - Approx. 6% fine to med. gravel.	532.4	10							
			20							
	Interbedded with 2" to 4" sand seams.	530.4	30							
	End of Borehole.	526.0	40							

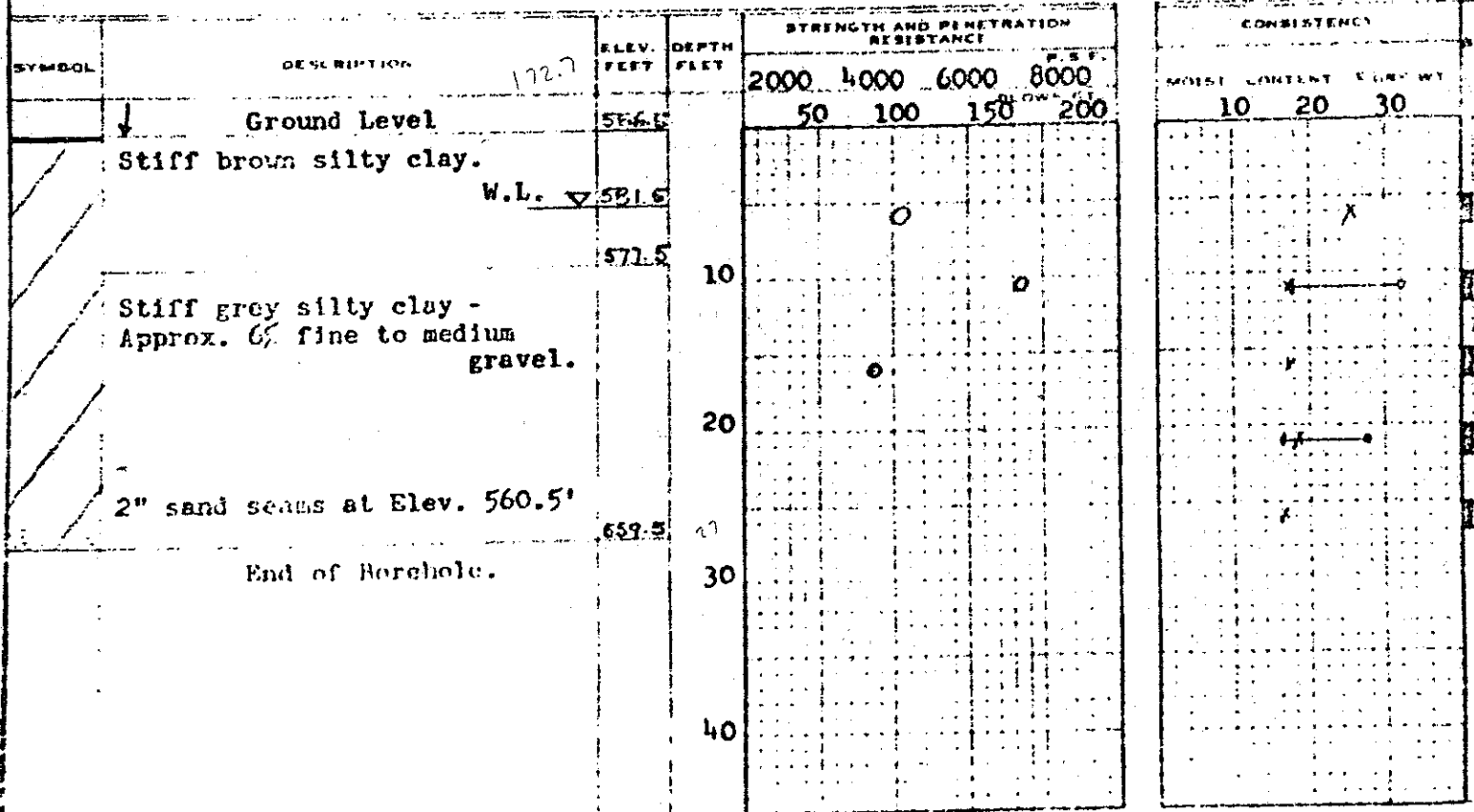
# DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS AND RESEARCH SECTION

W.P. 10-59 BORE HOLE NO. 2.  
 JOB F-59-13 STATION 522+39 (50' Rt.)  
 DATUM Geodetic COMPILED BY B.K.  
 BORING DATE Feb. 12/59. CHECKED BY A.L.

### LEGEND

SS 1/2 UNCONFINED COMPRESSION  
 TW VANE TEST (C) AND SENSITIVITY  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



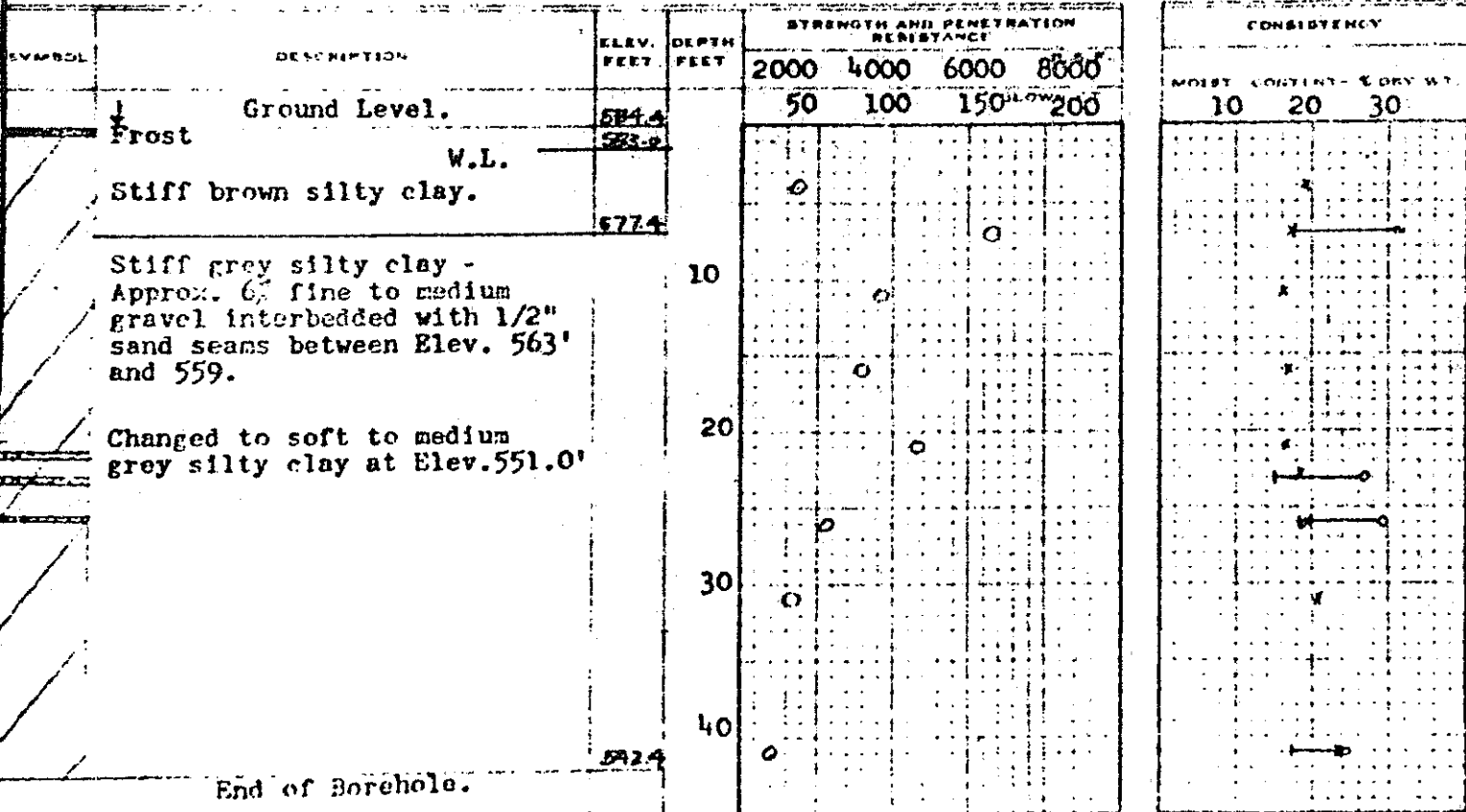
**DEPARTMENT OF HIGHWAYS - ONTARIO**  
**MATERIALS AND RESEARCH SECTION**

W.P. 10-59. BORE HOLE NO. 4  
 JOB F-59-13 STATION 523+34 (50' Lt.)  
 DATUM Geodetic COMPILED BY B.K.  
 BORING DATE Feb. 12/59 CHECKED BY A.L.

**LEGEND**

2" DIA SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA CONE  
 2" SHELBY  
 CASING

SS UNCONFINED COMPRESSION  
 TW VANE TEST (C) AND SENSITIVE  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



**DEPARTMENT OF HIGHWAYS - ONTARIO**  
**MATERIALS AND RESEARCH SECTION**

W.P. 10-59

BORE HOLE NO. 5.

JOB F-59-13

STATION 521/70 (50' Rt.)

DATUM Goodetic

COMPILED BY B.K.

BORING DATE Feb. 9/59. CHECKED BY A.L.

**LEGEND**

BSS 1/2 UNCONFINED COMPRESSION  
 BTW VANE TEST (AND SENSITIVE)  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				CONSISTENCY		
				2000	4000	6000	8000	MOIST. CONTENT - % DRY WT		
	Ground Level	521.2		50	100	150	200	10	20	30
	Stiff brown silty clay.	517.2								
		517.2	10							
	Stiff grey silty clay - Approx. 6% fine to med. gravel interbedded with 1/2" to 2" sand seams between Elev. 557' and 550'.		20							
	Changed to soft to medium grey silty clay at Elev. 547'.		30							
			40							
	End of Borehole.	540.0								



**DEPARTMENT OF HIGHWAYS - ONTARIO**  
**MATERIALS AND RESEARCH SECTION**

W.P. 10-59 BORE HOLE NO. 6.  
 JOB F-52-13. STATION 521/70 (50' Lt.)  
 DATUM Geodetic COMPILED BY B.K.  
 BORING DATE Feb. 12/59 CHECKED BY A.L.

**LEGEND**

BSS 1/2 UNCONFINED COMPRESSION  
 BTW VANE TEST (C) AND SENSITIVE  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				CONSISTENCY		
				2000	4000	6000	8000	MOIST. CONTENT	FLUIDITY	W. T.
	Ground Level	582.0		50	100	150	200	10	20	30
	W.L.	581.0								
	Stiff brown silty clay with some gravel.		10							
		570.0								
	Stiff grey silty clay - Approx. 6% fine to medium gravel.		20							
		560.0								
	End of Borehole.		30							
			40							

## SUMMARY OF FIELD &amp; LABORATORY TESTS

JOB 59

W.P. 10

SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI.	UNIT WEIGHT P.C.F.	REMARKS
T1	7'-9'	Stiff brown silty clay.	-	21.1	-	-	2310	123.0	Approximately medium gravel
T2	10'-12'	Stiff grey silty clay.	-	16.8	-	-	5240	127.0	
T3	15'-17'	" " " "	-	16.6	-	-	3980	132.0	
T4	20'-22'	" " " "	-	17.7	-	-	3180	129.0	
S5	27'-28'6"	Stiff grey silty clay interbedded with 2" to 4" sand seams.	48	13.6	-	-	-	-	
S6	29'-30'6"		35	14.0	-	-	-	-	
T1	5'-7'	Stiff brown silty clay.	-	25.6	-	-	4100	117.0	Approximately medium gravel
T2	10'-12'	Stiff grey silty clay.	37	16.7	17.7	32.0	6780	130.0	
T3	15'-17'	" " " "	20	17.8	-	-	3510	128.0	
T4	20'-22'	" " " "	-	18.3	16.1	27.2	-	127.0	
T5	25'-27'	Stiff grey silty clay interbedded with 2" sand seams at 26'.	35	16.0	-	-	-	130.0	
T1	3'-5'	Stiff brown silty clay.	-	19.5	-	-	1526	126.7	Approximately medium gravel
T2	6'-8'	Stiff grey silty clay.	56	17.2	17.7	30.5	6300	135.0	
T3	10'-12'	" " " "	31	15.8	-	-	3800	132.6	
T4	15'-17'	" " " "	-	16.0	15.1	26.8	3120	133.3	
T5	20'-22'	Stiff grey silty clay interbedded with 1/2" sand seams	23 for 6"	16.4	-	-	3320	130.8	
S6	22'-23'6"	between 21'6" and 25'6".	29	18.4	15.1	26.8	-	142.2	

cont'd.

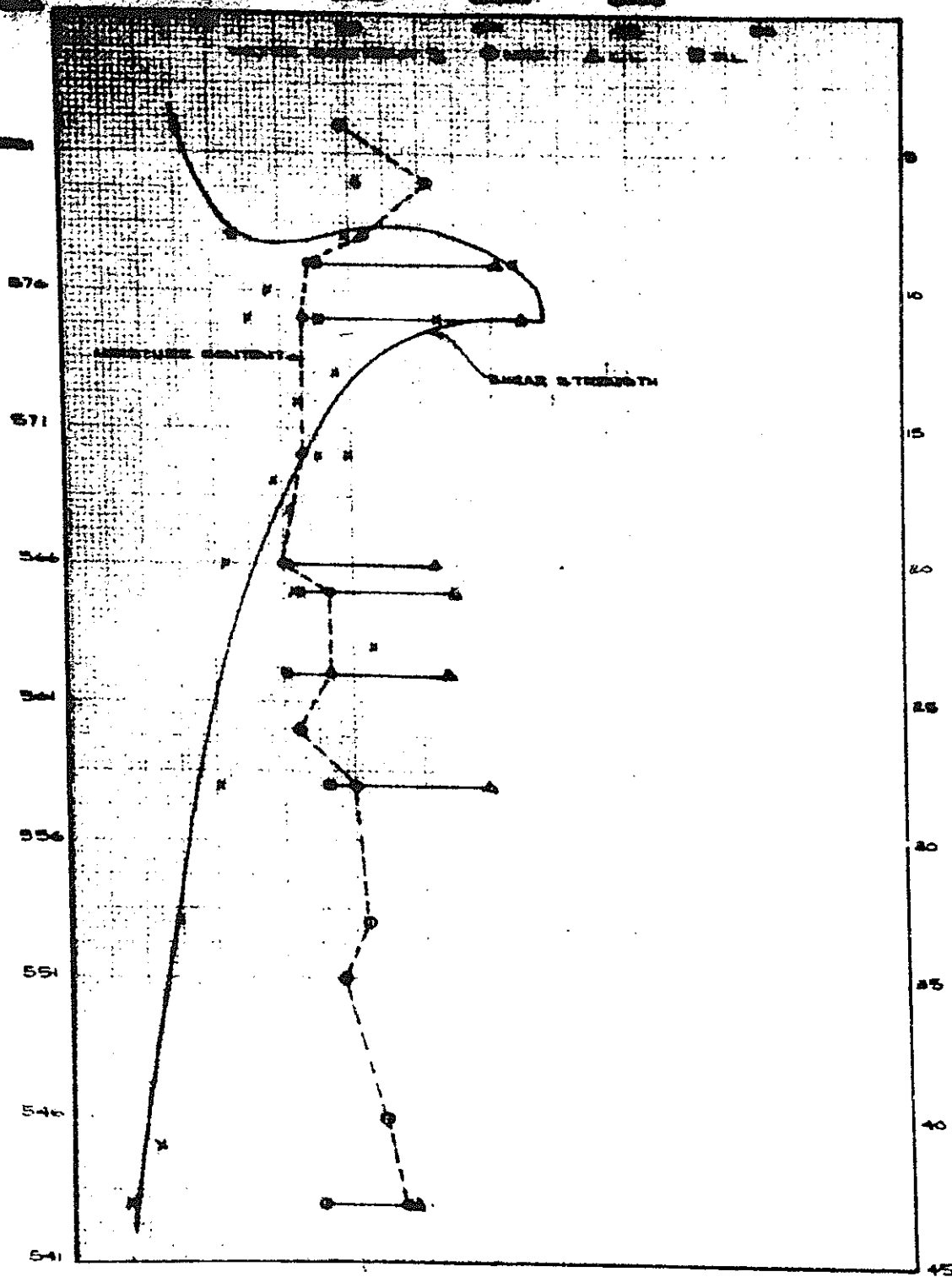
## SUMMARY OF FIELD &amp; LABORATORY TESTS

JOB 59-1

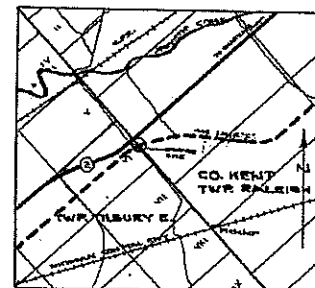
W.P. 10-5

SAMP NO.	SAMPLE DEPTH FEET	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
T7	25'-27'	Stiff grey silty clay.	-	19.9	18.1	29.6	2074	128.0	
T8	30'-32'	Medium stiff grey silty clay.	-	20.9	-	-	1448	126.5	
T9	40'-42'	Soft to medium grey silty clay	-	23.8	17.5	24.0	767	128.0	
T1	5'-7'	Stiff brown silty clay.	-	12.5	-	-	2820	126.0	Approximately medium gravel
T2	12'-14'	Stiff grey silty clay.	23	16.8	-	-	2880	132.0	
T3	15'-17'	" " " "	-	15.8	15.8	25.8	7000	133.0	
T4	20'-22'	" " " "	-	17.4	-	-	-	132.0	
T5	25'-27'	Stiff grey silty clay inter- ) bedded with 1/2" to 2" sand )	-	15.8	-	-	-	-	
T6	30'-31'6"	seams between 25'-0" to 32'-0"	17	19.4	-	-	-	131.6	
T7	35'-36'0"	Medium stiff grey silty clay.	20	22.2	-	-	-	-	
T8	40'-42'	Soft to med. grey silty clay.	-	21.4	-	-	1250	122.2	
T1	3'-5'	Stiff brown silty clay.	-	18.8	-	-	3950	128.0	Approximately medium gravel
T2	6'-8'	" " " "	-	19.4	-	-	2540	127.4	
T3	9'-11'	" " " "	45	21.2	-	-	3240	124.5	
T4	15'-17'	Stiff grey silty clay.	-	18.1	-	-	2150	128.2	
T5	20'-22'	" " " "	-	17.2	15.0	27.6	-	132.0	
T1 - denotes thin walled Shelby sample. T3 - denotes split spoon sample.									
Consolidation Characteristics:-									
Depth: 0'-35' - Coefficient of volume compressibility ..... 0.007 sq. f Coefficient of consolidation ..... 0.14 sq. f Depth: 35' and below - Compression Index ..... 0.18 Coefficient of consolidation ..... 0.0875 sq. f Preconsolidation pressure ..... Submerged u x depth (no c									

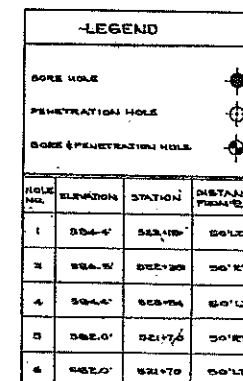
ELEVATION IN FEET



DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT



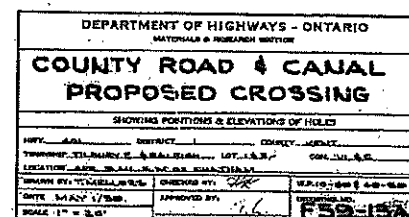
**KEY PLAN**  
SCALE, (1/32" = 1'-0").



### LEGEND

- NOTE -

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DETERMINED ONLY AT SOME SELECT LOCATIONS. BETWEEN SOME STRATA THE BOUNDARIES ARE DERIVED FROM CORRELATION AND MAY BE SUBJECT TO CONSIDERABLE ERROR.



COUNTY ROAD & CANAL  
PROPOSED CROSSING

SHOWING PORTIONS &amp; ELEVATIONS OF HOLE

HONY 401 DISTRICT            COUNTY             
 TOWNSHIP THIRTY E & A BISHOP LOT 125 COR. 111 & E  
 LOCATION STATE MAIL BOXES EIGHTH  
 DRAWN BY T. HALL CHECKED BY            S.E. 1/4 - 36 - 40 - 40  
 DATE MAY 1/80 APPROVED BY            COUNTY, MO.  
 SCALE 1" = 36'

403B-



- (15) Foundation Investigation Report for Government Drain No. 1 Bridge at Highway 2, North of Highway 401, WP 89-67-00, dated December 1974, Geocres No. 40J8-36.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

W.P. 89-67-00 LOCATION Sta. 0 + 16 o/s 38' Lt. ORIGINATED BY PJS  
DIST. 1 HWY. 2 BORING DATE December 11, 1974 COMPILED BY PJS  
DATUM Geodetic BOREHOLE TYPE HoTo w Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
585.6	Ground Level						1000	3000	5000			15	30	45		GR. SA. SI. CL.
0.0	Clayey silt to silty clay, some sand, trace of gravel.		1	SS	9	580										2 20 49 29
			2	SS	13											
			3	SS	37											
			4	SS	29	570										
	Stiff to Hard		5	SS	16											
			6	SS	20	560										0 32 35 33
			7	SS	19	550										
			8	SS	28	540										
			9	SS	22	530										0 19 56 25
510.6						520										
75.0	Fine Sand Some Silt Compact		10	SS	20	510										0 85 (15)
502.6	Clayey silt with sand.					500										
83.0	Hard															
493.1	Probable Bedrock															
92.5	End of Borehole					490										

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO.

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W.P. 89-67-00

LOCATION Sta. 0 + 16 o/s 44' Rt.

ORIGINATED BY PJS

DIST. 1 HWY. 2

BORING DATE December 13, 1974

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 1000 3000 5000	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ $w$ $w_L$ WATER CONTENT % 15 30 45	UNIT WEIGHT $\gamma$	REMARKS % GR. SA. SI. CL.
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
585.3	Ground Level									
0.0	Clayey silt to silty clay, some sand.		1	SS	20	580				0 5 46 49
			2	SS	14					
			3	SS	17					
	Stiff to Very Stiff		4	SS	21					
			5	TW	PH	570			130	0 20 50 30
			6	SS	21					
			7	TW	PH				133	0 20 48 32
			8	SS	22	560				
553.8			9	SS	20					0 20 50 30
31.5	End of Borehole					550				
	Note: Water Level not established.									

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE N<sup>o</sup> 3

W.P. 89-67-00

LOCATION Sta. 1 + 03. o/s 23' Lt.

ORIGINATED BY EJS

DIST. 1 HWY. 2

BORING DATE December 13, 1974

COMPILED BY EJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	SHEAR STRENGTH O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE				
585.2	Ground Level															
0.0	Clayey silt to silty clay, some sand.		1	SS	14	580										
			2	SS	11											
			3	SS	25											
			4	TW	PH											
	Stiff to Hard		5	SS	24	570										
			6	SS	24											
			7	SS	25	560										
553.7			8	SS	41											
31.5	End of Borehole					550										

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

W.P. 89-67-00 LOCATION Sta. 1 + 03 o/s 23' Rt. ORIGINATED BY RIS  
 DIST. 1 HWY. 2 BORING DATE December 16, 1974 COMPILED BY FJS  
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			UNIT WEIGHT $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$w_p$	$w$	$w_L$		
585.3	Ground Level															
0.0	Clayey silt to silty clay, some sand.		1	SS	19	580									132	0 18 48 34
			2	SS	11											
			3	TW	PH											
			4	SS	44											
			5	SS	21	570										
			6	SS	23											
			7	TW	PH										131	0 21 47 32
	Stiff to Hard		8	SS	15	560										
			9	SS	16											
						550										
			10	SS	15											0 20 49 31
						540										
			11	SS	21											
						530										
						520										
			12	SS	19											0 11 69 20
510.3						510										
75.0	Fine Sand															
	Compact															
502.3						500										
83.0	Clayey Silt with sand.															
	Hard															0 26 57 7
493.0			13	SS	70											
92.3	Limestone Bedrock															
488.8	Shale Layers					490										
96.5	End of Borehole															
	Note: Water Level not established.															

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

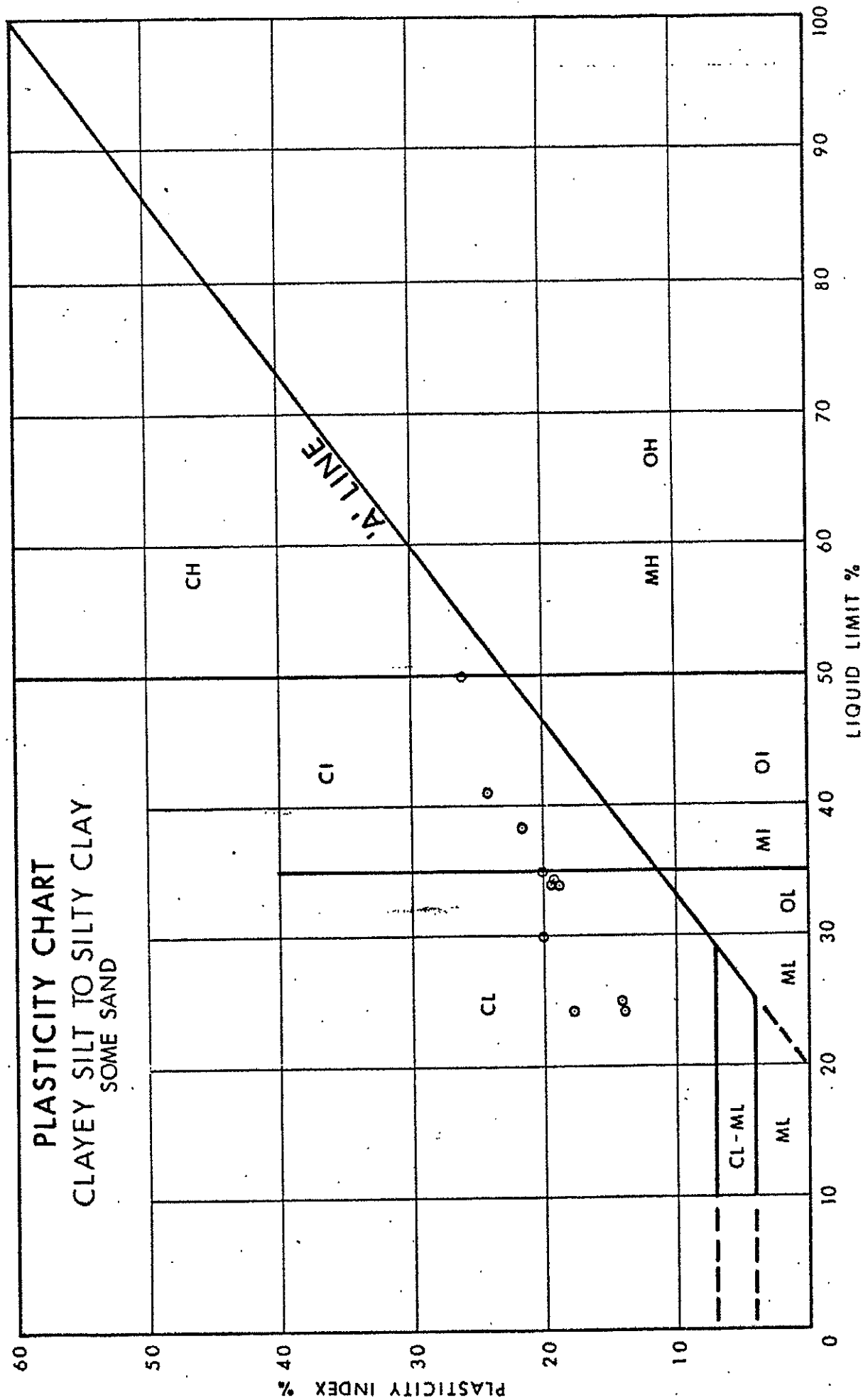


FIG. 1.

# GRAIN SIZE DISTRIBUTION

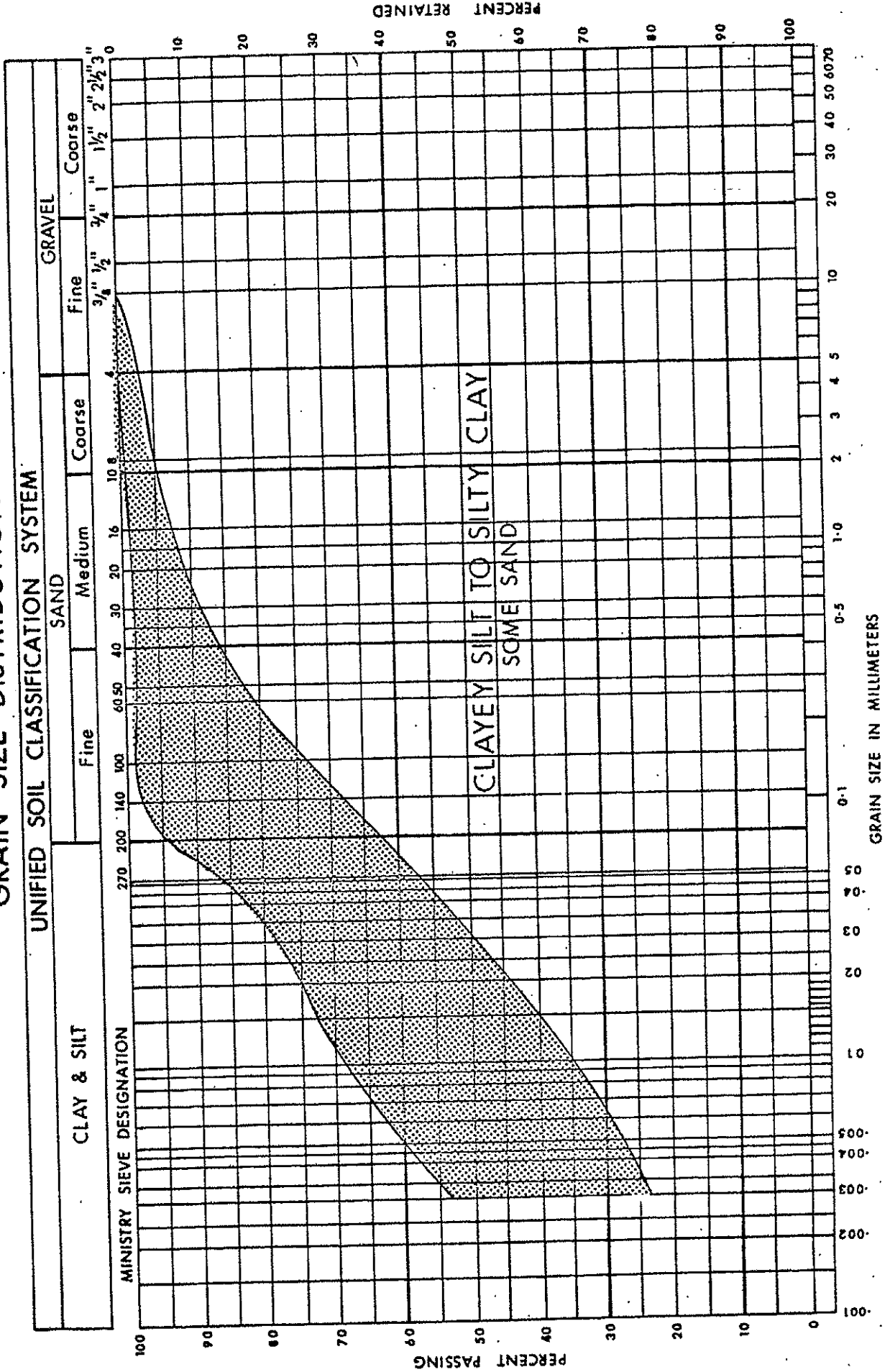


FIG. 2

## UNIFIED SOIL CLASSIFICATION SYSTEM



FD-9a (Rev. Jan)

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### PENETRATION RESISTANCE

'N' STANDARD PENETRATION RESISTANCE : - 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 :-

<u>CONSISTENCY</u>	<u>c LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

### TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

### SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" " ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		



# ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

## SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
$w_s$	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_c$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$c_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

IN TERMS OF  
EFFECTIVE STRESS  
 $\tau_f = c' + \sigma' \tan \phi'$

IN TERMS OF  
TOTAL STRESS  
 $\tau_f = c_u + \sigma \tan \phi$

## GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

## STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

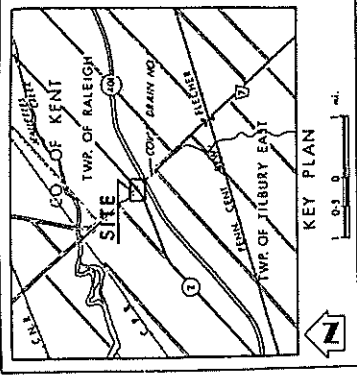
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

## FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

## SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



LEGEND		
⊙	Bore Hole	
⊕	Dynamic Cone Penetration Resistance Test	
⊙	Bore Hole & Case Test	
⊕	Water Levels established at time of field investigation (1 Dec 1974)	
⊕	No Water Levels established	
⊕	BN No. 2 & 6	

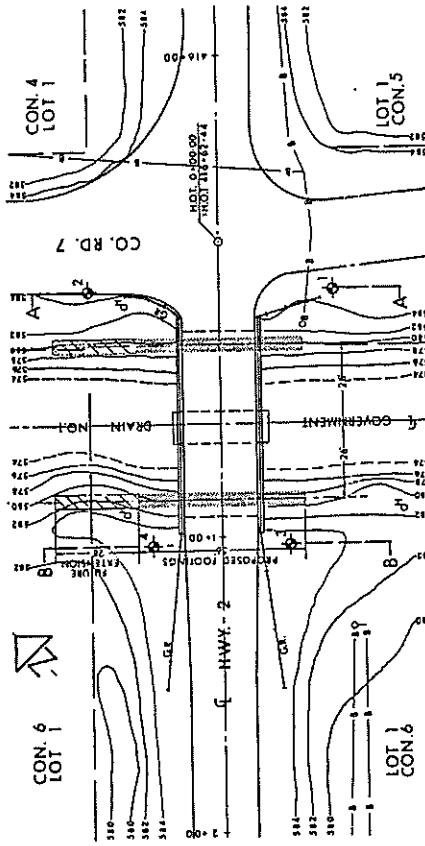
  

NO.	ELEVATION	STATION	OFFSET
1	585.6	0+16	38" E
2	585.3	0+16	44" E
3	585.2	1+03	23" E
4	585.3	1+03	23" E

NOTE: FOR CONTRACT DOCUMENTS  
The complete foundation investigation report for this project may be obtained from the Structural Office at the CRASHAM Office Building.

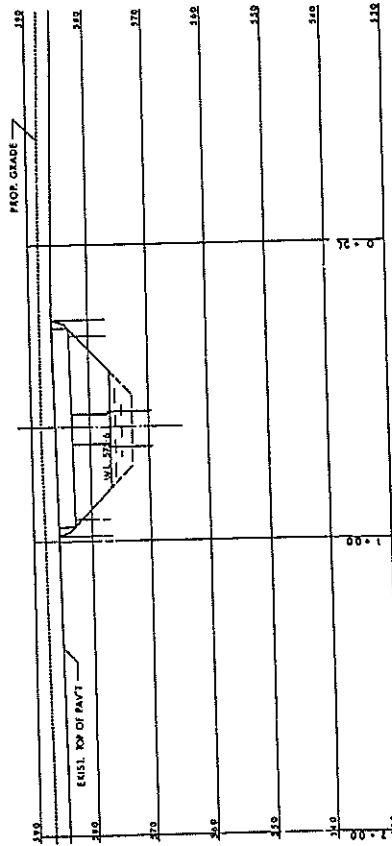
NOTE —  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geophysical evidence.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO  
HIGHWAY 101  
TWP. TILBURY, EAST 101 1 CON. 8  
BORE HOLE LOCATIONS & SOIL STRATA  
STATIONED P.S. CHECKED BY NO. 87-07-00 DRAWN BY 896700-A  
DATE 28 DEC 1974 1:1 NO. 896700-A-02  
APPROVED BY NO.



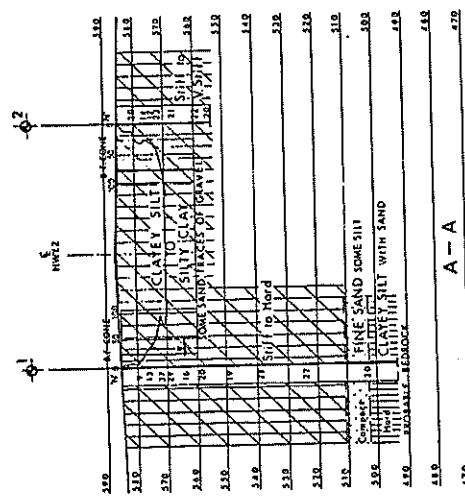
PLAN

SCALE 0 10 20 30 FT

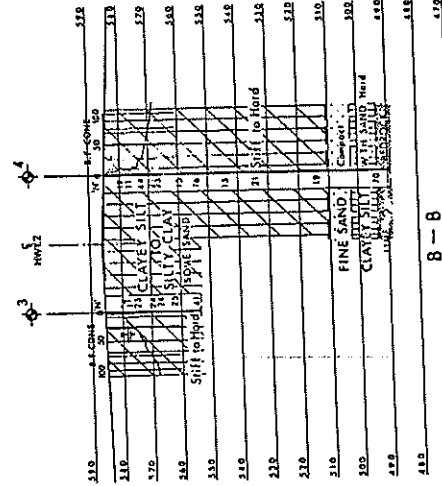


PROFILE

SCALE 0 10 20 30 FT



A - A



B - B

SECTION 5

SCALE 0 10 20 30 FT



- (16) Contract Drawings for Contract No. 78-55 for Hot Mix Paving from the east limits of Interchange No. 8 Tilbury easterly to the west limits of Interchange No. 10 Bloomfield Road (General data only - no additional soil data).



- (17) Contract Drawings for Contract No. 97-43 Hot Mix Paving from 0.7 km east of Highway 2 Easterly to 0.8 km West of County Road 27 (Bloomfield Road) (General data only - no additional soil data).