

GEOCRES No. 30M5-156DIST. 4 REGION W.P. No. CONT. No. W.O. No. 2000-11026STR. SITE No. HWY. No. LOCATION BURLINGTON STREET
RECONSTRUCTIONNo. of PAGES - 1OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

SUPPLEMENTARY INVESTIGATION
PROPOSED BURLINGTON STREET
RECONSTRUCTION
HAMILTON, ONTARIO.
FOR
THE REGIONAL MUNICIPALITY OF
HAMILTON-WENTWORTH
c/o PARKER CONSULTANTS

Distribution:

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Job No. 80 F 240/241

February, 1981.

GEO. No. 30M5-156



PETO MacCALLUM LTD.

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Job No. 80F240/241

February 4, 1981.

The Regional Municipality of
Hamilton-Wentworth,
c/o Parker Consultants,
1400 Rymal Road East,
Hamilton, Ontario.
L0R 1P0

Attention: Mr. J. W. Disher, P. Eng.,
Project Manager.

Re: Supplementary Investigation,
Proposed Burlington St. Reconstruction,
Hamilton, Ontario.

Gentlemen:

We are pleased to present the results of the supplementary geotechnical investigation carried out at the above noted site. Authorization for the work described in the report was contained in The Regional Municipality of Hamilton-Wentworth Purchase Order No's R32183 dated June 24, 1980 and R32639 dated August 29, 1980.

A preliminary geotechnical investigation was carried out in the summer of 1979 and the results presented in Peto MacCallum Ltd. report 79F59, dated October, 1979. The investigation revealed the presence of cobbles and boulders which may adversely affect piles during driving. Secondly, a buried valley was identified in the bedrock





surface in the vicinity of bents 19 to 23, however, the limits of the valley were not well defined during this phase of the work. Thirdly, a significant range in the founding level for a deep foundation system, together with a variation in the bearing material, very dense silt till or shale were identified.

Subsequent to issuance of the preliminary report, the proposed bridge structure was redesigned and the length extended some 400 m to the west.

The purpose of the present investigation was to determine:

- a) the subsurface conditions within the area of the 400 m westerly extension
- b) the driveability of the proposed pile, particularly within areas of boulders identified during the preliminary investigation
- c) the type of bearing material which will be supporting the pile cognizant of the driving resistance encountered together with the recommended pile type and capacity

Two other phases of work carried out concurrently with this investigation include a detailed pavement evaluation and full scale preconstruction pile load tests, described respectively under separate cover in Peto MacCallum Ltd. reports 80F239 and 80F240A.

It was previously recommended that the piles be driven from holes preaugered to a depth of 6 m to minimize disturbance of underground services. Therefore, any obstructions which may exist in the surficial fills should not affect pile driving procedures. Further, the results of the investigation indicate that the



cobbles and boulders detected during the preliminary field work are generally located within the very dense basal silt till unit. Since the driven piles are expected to meet practical refusal within this unit, in areas where it is encountered, the cobbles and boulders are not expected to adversely affect the pile driving operations. Consequently, no problems are anticipated with respect to driveability of the proposed piles.

The proposed pile type, a 324 X 6.3 mm (12.75 X 0.250 in.) steel pipe filled with 20 MPa (3000 psi) concrete driven from a 300 mm diameter hole preaugered to 6.0 m depth, was defined on the basis of a comprehensive economic evaluation by Parker Consultants of alternative foundation systems presented in our preliminary report.

The founding depth at each pier and abutment along the 1433 m long elevated bridge structure was evaluated. The approximate founding level is indicated by a line defined as final refusal on Drawing 1 enclosed with the report. Further details and comments in this regard are presented in tabular format in the report. In general, it is anticipated the proposed 324 X 6.3 mm (12.75 X 0.250 in.) steel pipe piles will meet practical refusal at 10 to 13 m depth (elevation 67 to 69) at the west abutment, and bents 1 to 13, at about 12 to 13 m depth, (elevation 65 to 67) from bent 14 to 26 and at about 8 to 12 m depth (elevation 67 to 70) from bent 27 to 39 and the east abutment.

Piles will be driven into and bear on either the very dense basal silt till or weathered shale bedrock. The



very high driving resistance offered by the basal silt till during dynamic cone tests, and the difficulty of drilling in this material suggest it is equivalent to the shale bedrock with respect to bearing capacity for the pile size and load under consideration.

Based on the preliminary results from pile load tests conducted on 324 X 6.3 mm (12.75 X 0.250 in.) concrete filled pipe piles, a design capacity of 1160 kN (130 T) is recommended for piles founded both on very dense basal till and shale bedrock. It is anticipated a slightly greater penetration will be required during pile driving operations to obtain an equivalent set and capacity. Further comments regarding the pile driving and installation operations is contained in our report 80F240A.

We believe this report has been completed within our terms of reference and trust that the geotechnical information provided herein will be sufficient for your present purposes. If you have any questions, or if we may be of further service during the construction phase of the project, please do not hesitate to call our office.

Yours very truly,
PETO MacCALLUM LTD.

JFW/BRG/rf

Brian R. Gray, P. Eng.,
Manager,
Geotechnical Services.



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INTRODUCTION

Peto MacCallum Ltd. was retained by The Regional Municipality of Hamilton-Wentworth to carry out a supplementary geotechnical investigation for the proposed Burlington Street Reconstruction in Hamilton, Ontario.

Details of the preliminary geotechnical investigation carried out for the project were provided in Peto MacCallum Ltd. report 79F59 dated October, 1979.

Subsequent to issuance of the initial report, the west abutment of the proposed elevated bridge structure was relocated to the west of the original design location by some 400 m. Consequently, additional drilling was required to define subsurface information in that area.

It is understood the proposed elevated bridge structure will extend over a length of some 1433 m from the west to east abutments. Individual spans will vary from 28 to 40 m involving a total of thirty-nine bents typically supported on two piers with three piers to be used in the area of access ramps.

As a result of a comprehensive economic evaluation of the alternate deep foundation systems for the structure presented in our preliminary report, it is understood all pier and abutment loads will be supported on 324 X 6.3 mm (12.75 X 0.250 in.) driven steel pipe piles. Further, the piles will be installed in 300 mm diameter preaugered holes extending to a depth of 6 m.



The objectives of this geotechnical study were to determine:

- a) the subsurface conditions within the area of the 400 m westerly extension
- b) the driveability of the proposed piles, particularly within areas of boulders identified during the preliminary investigation
- c) the length of pile required at each pier and abutment location
- d) the type of bearing material which will be supporting the pile cognizant of the driving resistance encountered together with the recommended pile type and capacity

Reference is made within the body of this report to two preconstruction pile load tests which were carried out in conjunction with the current geotechnical investigation. The final analysis and report on the load tests will be presented under separate cover (Peto MacCallum Ltd. report 80F240A).

In addition, further studies were carried out with respect to road pavement design and construction which will be described under separate cover in Peto MacCallum Ltd. report 80F239.

INVESTIGATION PROCEDURE

The field work for the investigation was carried out during the period October 1 to November 5, 1980. The investigation programmed initially involved a total of six (6) sampled boreholes together with 1.5 m of rock core at each hole. In addition, forty-eight (48)



dynamic cone penetration tests were programmed which would be conducted in 6.0 m deep preaugered holes to simulate pile driving operations and driven to refusal (100 blows/0.3 m).

It was anticipated that premature refusal within the clay till would be experienced at some of the test locations which would be easy to identify by examination of the driving records. A second dynamic cone penetration test would then be conducted at the same location following preaugering to the initial refusal level. Ultimately it was expected that refusal, which would be recognized by an abrupt change in driving resistance, would occur in the very dense/hard till or the shale bedrock.

The results of the initial dynamic cone tests were somewhat different from that expected. The cones were refusing prematurely in the very stiff clay till and it became necessary to repeat the dynamic cone penetration test and preaugering process several times at each test location. Consequently, it became necessary to revise the field methodology as follow:

- a) Conduct the dynamic cone penetration test preaugering process a maximum of 3 times at each test location. Refer to Note 3 on Drawing No. 1 for further comments in this regard.
- b) Drill additional boreholes with conventional sampling at regular intervals below the level of first refusal of the dynamic cone penetration in order to determine the strata in which refusal was occurring.
- c) Conduct a combination of a) and b) as noted above.



The completed field work actually comprised twenty-four (24) dynamic cone probes (numbered C1 to C24), sixteen (16) sampled boreholes (numbered 16 to 32) and nine (9) dynamic cone tests carried out in conjunction with these sampled boreholes identified by the suffix "C" after the borehole number. Boreholes 1 to 15 were presented in our previous report 79F59.

The locations of all boreholes, dynamic cone probes and preconstruction test pile locations are shown on the site plan, Drawing 1, Sheets 1 and 2.

The boreholes and dynamic cones were advanced using a truck mounted CME-55 drillrig supplied and operated by the Client. The field work was supervised throughout by members of our engineering staff who directed the drilling and sampling operations, prepared the stratigraphic Log of the Boreholes and cared for the recovered overburden samples and rock core specimens. A representative from Parker Consultants recorded the dynamic cone penetration tests.

Standard penetration tests were conducted during sampling operations at regular intervals within the overburden for the entire exploration depth at boreholes 16 and 17 (revised location for west abutment), and generally below the depth of initial refusal at all other sampled borehole locations. At borehole 30C and 31C, however, single samples were taken at termination of drilling to identify bearing stratum. Pocket penetrometer tests were carried out on the cohesive soils at boreholes 16 and 17 in order to determine the undrained shear strength of the clayey soils.



At a number of locations where the borehole penetrated the existing roadway, details of the pavement construction were recorded, and are presented in the appended Log of Borehole sheets. The pavement construction is discussed in Peto MacCallum Ltd. report 80F239 under separate cover.

Rotary diamond drilling techniques were used to obtain 1.5 m of BXL core of the shale bedrock at boreholes 16, 17, 25 and 27.

Groundwater observations made in the open boreholes during and following the completion of drilling are also reported on the borehole Logs.

The location and ground surface elevations at the boreholes were established in the field by a survey crew from Parker Consultants. This information was forwarded to our office on December 2, 1980. It is assumed that the ground surface elevations are related to geodetic datum. Peto MacCallum Ltd. obtained all necessary underground utility and ground surface clearances at the proposed borehole locations and carried out all requisite traffic channelization.

All samples obtained during the investigation were brought to our laboratory for detailed examination and routine classification testing to confirm field visual identification. Natural moisture contents were made on all recovered samples and the results shown on the appended Log of Borehole sheets.



SUMMARIZED SUBSURFACE CONDITIONS

We recommend that Peto MacCallum Ltd. report 79F59 dated October, 1979, which provides details concerning the site description and geologic background as well as further details of the groundwater conditions and engineering properties of the soil units, be read in conjunction with this report.

We refer to the Log of Borehole sheets appended for details of the drilling work, including soil classifications, inferred stratigraphy, standard penetration "N" values, groundwater observations during and following the completion of drilling, laboratory moisture content determinations and dynamic cone test results.

For illustrative purposes, we have included on the site plans, Drawing 1, Sheets 1 and 2, a summarized stratigraphic profile of the major soil units contacted along the section of Burlington Street scheduled for reconstruction.

Information obtained from borehole 6, Peto Associates Ltd. report 66F166 and boreholes 1 to 8, Peto MacCallum Ltd. report 79F59 have been included on the drawing. It is noteworthy that the interpreted stratigraphy and contact elevations for boreholes 1 to 8 as reported previously have been modified somewhat cognizant of the more detailed field information now available.

The majority of the testholes drilled during the preliminary investigation were unsampled auger probes



extended to refusal with the stratigraphy inferred by observations during drilling. The presence of cobbles and small boulders were identified during this unsampled drilling operation. The detailed information obtained during the current work reveals that all cobbles or boulders encountered which caused any significant drilling difficulties, are located within the very dense basal till unit.

As discussed previously in report 79F59, the surficial soil units are dependent upon the location of the boreholes in the limits of road pavement or boulevard areas. The asphaltic concrete pavement, granular base courses, slag fill, clay fill, topsoil or alluvium which comprise the surficial materials are identified as unit 1. Routinely, these materials extended to depths of 1.5 m below existing ground surface with local variations to 0.3 m at borehole 5 and 3.7 and 6.0 m depth at boreholes 17 and 4 respectively. Local increases in the thickness of fill may be attributed variously to proximity to manholes, utility trench backfill or infilling of old inlet areas. These surficial deposits overlie the generally stiff to very stiff silty clay till (unit 2) which is the major overburden unit encountered at the site.

The clay till was penetrated typically at depths of 8.5 to 10.4 m and overlies shale bedrock from the west abutment to bent 8 (borehole 19). Between bents 8 and 28 (boreholes 19 and 28C) through the centre of the site, the clay till overlies a relatively thick deposit of very dense silt till which was contacted at depths of 11.6 to 12.3 m. East of bent 28 (bore-



hole 28C) the thickness of the silt till generally decreases, and it was contacted at depths of 7.0 to 11.5 m.

The very dense basal till (unit 3) encountered through the central and eastern portion of the site varied from silty sand to sandy silt to clayey silt. This unit was encountered throughout the site east of bent 8 (borehole 19). As noted previously, the till varied significantly in thickness.

It was typically 1.2 to 1.8 m thick between bent 8 and a point immediately west of bent 17 (borehole 19 to 24), 3.0 m to 9.6 m thick from just west of bent 17 to bent 28 (borehole 24 and 28C) where it has infilled a buried valley in the bedrock surface, and 1.0 to 2.5 m thick through the remaining eastern portion of the site, bent 28 to the east abutment.

The clay and silt till units overlie Queenston shale bedrock throughout the site which exists as a shale till complex (unit 4), weathered shale (unit 5) and sound shale (unit 6).

Two dashed lines are included on the stratigraphic profile to indicate selected dynamic cone test penetration levels:

----- Initial Refusal
— — — Final Refusal

These two lines were constructed on the basis of dynamic cone penetration data defined by the initial and final refusal levels as described below:



- a) The initial refusal level is defined as the depth at which first refusal of the dynamic cone test, conducted from a borehole preaugered to 6.0 m depth, encountered a resistance of 100 blows/0.3 m.
- b) The secondary refusal level is defined as the depth at which a dynamic cone test, conducted from a borehole preaugered to the initial refusal level, encountered a resistance of 100 blows/0.3 m.
- c) The final refusal level is defined as the depth at which a dynamic cone test, conducted from a borehole preaugered to the secondary refusal level, encountered a resistance of 100 blows/0.3 m.

The initial refusal level generally occurred at varying depths within the clay till while the final refusal level is generally believed to occur within 1 to 2 m of the upper boundary of the very dense basal till or weathered shale bedrock.

It should be noted that these refusal definitions were selected following evaluation of the progress of the field work after the initial dynamic cone tests had been carried out. At several locations the holes were preaugered to a significant depth below the "initial" or "secondary" refusal levels prior to commencement of the subsequent dynamic cone penetration test, e.g. C16. In these cases, as with those where several successive cone tests were conducted at the same location, e.g. C12, the definition of "final" refusal level was not satisfied and is therefore not indicated on the stratigraphic profile or the Logs.



ENGINEERING CONSIDERATIONS

It was pointed out in the introduction that the purpose of this supplementary investigation is to:

- a) predict the length to which piles will be driven prior to meeting practical refusal
- b) assess their driveability, and
- c) estimate their capacity.

We understand the proposed bridge structure will be supported on 324 X 6.3 mm (12.75 X 0.250 in.) steel pipe piles filled with 20 MPa (3000 psi) concrete.

Pile Length

Based on the subsurface information revealed during the present investigation, our general experience and knowledge with refusal depths for driven piles in similar materials as well as the penetration of the two piles driven for load testing purposes, it is our opinion that the proposed piles will meet practical refusal at a depth close to the line noted as "final refusal" on Drawing No. 1. The anticipated pile length and founding level and material which the pile is expected to meet practical refusal in, along with any other pertinent comments for each pile location is indicated on Table I.

It is worthwhile to note that the driven piles for the two load tests met practical refusal within 0.4 m of the "final refusal" as interpreted from dynamic cone tests conducted in the immediate area and shown on



Drawing 1. Further, the line is based on actual final refusal levels as previously defined at 22 points only and is interpreted for intermediate locations.

Local variations in cross fall from south to north of the final refusal level across the width of the structure, as noted on Table I, should not be ruled out. These do not appear to be as significant as corresponding cross falls in the bedrock surface.

Driveability

It was previously recommended that the design locations for installation of each of the driven piles be pre-augered to a depth of 6 m below ground surface to minimize disturbance of underground services during the pile driving operations. Hence, any obstructions which may exist in the fills should not affect the installation procedures.

Due to the cobbles and boulders detected during the preliminary field work carried out for the proposed bridge structure, it was expected that some difficulties may be experienced during the pile driving operations. The results of the present investigation, however, reveal that the cobbles and boulders are present in the basal till unit. Further, the driven piles are expected to meet practical refusal within this very dense silt till encountered over the central and eastern portions of the proposed bridge or in the shale bedrock on the west end of the site. Therefore, the cobbles and boulders are not expected to adversely affect the pile driving operations.



Pile Capacity

Based on the results of the dynamic cone and standard penetration tests and the preliminary results of two preconstruction pile load tests, it is considered that the proposed 324 X 6.3 mm (12.75 X 0.250 in.) concrete filled steel pipe piles driven closed end will support a working load of 1160 kN (130 T).

It is recommended that the piles are installed using a pile driver capable of developing at least 33 kJ (24,000 ft.lb.) energy per stroke. Care should be exercised to ensure the piles are not overdriven since damage to the pile may occur. The pile driving and installation operations should be closely supervised and the pile penetration correlated with the anticipated founding level presented in Table I and approximated by the "final" refusal line noted on Drawing No. 1.

Further comments regarding the pile design and installation operations will be presented in our report, 80F240A, which is in progress.

PETO MacCALLUM LTD.

John F. Wright, B. Sc.,
Geologist.

Dennis W. Kerr, P. Eng.,
Regional Geotechnical Engineer.



JFW/DWK/rf

TABLE 1

ANTICIPATED PILE LENGTHS

Proposed Burlington Street Reconstruction
Kenilworth Avenue to Parkdale Avenue
Hamilton, Ontario.

Pier Number	Anticipated Pile Length (m)	Founding Elevation	Founding Material	Remarks
1N	10.3	69.0	Shale	4
1S	10.3	69.3	Shale	4
2N	10.5	68.6	Shale	2
2S	10.5	69.0	Shale	4
3N	11.2	68.1	Shale	3
3S	10.9	68.6	Shale	4
4N	11.2	68.2	Shale	4
4S	11.0	68.3	Shale	4
5N	11.3	68.3	Shale	4
5S	11.3	68.1	Shale	2 & 3
6N	11.4	67.9	Shale	4
6C	11.4	68.3	Shale	4
6S	11.7	68.0	Shale	4
7N	11.5	67.7	Shale	3
7C	11.8	68.9	Shale	4
7S	12.0	68.0	Shale	4
8N	11.5	67.8	Till/Shale	4
8C	12.0	67.8	Till/Shale	4
8S	12.4	67.9	Till/Shale	3
9N	11.5	67.9	Till/Shale	2
9S	12.3	67.6	Till/Shale	4

1. Pier is identified by substructure unit number as provided on Drawing No. 1 followed by suffix N, C or S to denote north, central or south respectively.
2. Based on dynamic cone penetration test data.
3. Based on stratigraphic information.
4. Based on extrapolation from adjacent boreholes (ground surface elevation not confirmed).

TABLE I - CONT'D

ANTICIPATED PILE LENGTHS

Proposed Burlington Street Reconstruction
Kenilworth Avenue to Parkdale Avenue
Hamilton, Ontario.

Pier Number	Anticipated Pile Length (m)	Founding Elevation	Founding Material	Remarks
10N	11.8	67.7	Till/Shale	4
10S	13.0	67.3	Till/Shale	3
11N	12.5	67.4	Till/Shale	4
11S	12.5	67.4	Till/Shale	4
12N	12.4	67.4	Till/Shale	4
12S	12.1	67.4	Till/Shale	2
13N	12.7	67.2	Till/Shale	3
13S	12.6	67.1	Till/Shale	4
14N	12.8	67.0	Till/Shale	4
14S	12.5	67.3	Till/Shale	4
15N	12.8	66.7	Till/Shale	2
15S	12.6	67.1	Till/Shale	4
16N	13.1	66.2	Till/Shale	4
16S	12.8	66.9	Till/Shale	2
17N	13.3	66.0	Till	2
17S	13.6	64.5	Till	3
18N	13.1	66.1	Till	4
18S	13.2	65.8	Till	4
19N	13.0	66.3	Till	4
19S	13.3	66.5	Till	2
20N	12.8	66.4	Till	2
20S	12.9	66.3	Till	4

1. Pier is identified by substructure unit number as provided on Drawing No. 1 followed by suffix N, C or S to denote north central or south respectively.
2. Based on dynamic cone penetration test data.
3. Based on stratigraphic information.
4. Based on extrapolation from adjacent boreholes (ground surface elevation not confirmed).

TABLE I - CONT'D

ANTICIPATED PILE LENGTHS

Proposed Burlington Street Reconstruction
Kenilworth Avenue to Parkdale Avenue
Hamilton, Ontario.

Pier Number	Anticipated Pile Length (m)	Founding Elevation	Founding Material	Remarks
21N	12.5	66.6	Till	4
21S	13.1	66.1	Till	3
22N	12.1	66.8	Till	2
22S	12.6	66.2	Till	4
23N	12.3	66.6	Till	4
23S	12.4	66.3	Till	4
24N	12.4	66.2	Till	3
24S	12.4	66.3	Till	4
25N	12.6	66.2	Till	4
25S	12.4	66.2	Till	3
26N	12.8	66.2	Till	2
26S	12.1	66.8	Till	4
27N	12.4	66.6	Till	4
27S	11.8	67.3	Till	2
28N	11.9	67.0	Till	4
28S	13.2	66.0	Till	3
29N	11.5	67.4	Till	2
29S	12.5	66.4	Till	4
30N	11.3	67.4	Till	2
30S	11.9	67.1	Till	4
31N	11.5	67.3	Till	4
31S	11.5	67.4	Till	2

1. Pier is identified by substructure unit number as provided on Drawing No. 1 followed by suffix N, C or S to denote north central or south respectively.
2. Based on dynamic cone penetration test data.
3. Based on stratigraphic information.
4. Based on extrapolation from adjacent boreholes (ground surface elevation not confirmed).

TABLE I - CONT'D

ANTICIPATED PILE LENGTHS

Proposed Burlington Street Reconstruction
Kenilworth Avenue to Parkdale Avenue
Hamilton, Ontario.

Pier Number	Anticipated Pile Length (m)	Founding Elevation	Founding Material	Remarks
32N	11.6	67.1	Till/Shale	2
32C	11.4	67.3	Till/Shale	4
32S	11.2	67.4	Till/Shale	4
33N	11.7	67.0	Till/Shale	2
33C	11.3	67.2	Till/Shale	4
33S	10.8	67.4	Till/Shale	3
34N	10.9	67.3	Till/Shale	4
34C	10.3	68.0	Till/Shale	4
34S	9.7	68.5	Till/Shale	2
35N	9.8	68.1	Till/Shale	2
35S	9.5	68.7	Till/Shale	4
36N	9.8	68.3	Till/Shale	4
36S	9.3	69.0	Till/Shale	3
37N	9.1	68.5	Till/Shale	2
37S	9.0	69.1	Till/Shale	4
38N	9.0	68.7	Till/Shale	4
38S	8.4	69.3	Till/Shale	2
39N	9.0	68.9	Till/Shale	4
39S	8.4	69.6	Till/Shale	4

1. Pier is identified by substructure unit number as provided on Drawing No. 1 followed by suffix N, C or S to denote north central or south respectively.
2. Based on dynamic cone penetration test data.
3. Based on stratigraphic information.
4. Based on extrapolation from adjacent boreholes (ground surface elevation not confirmed).

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N', - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 0.3m INTO THE SUBSOIL. DRIVEN BY MEANS OF A 63.5kg HAMMER FALLING FREELY A DISTANCE OF 0.76m.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 51mm, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS. 0.3m INTO THE SUBSOIL. THE DRIVING ENERGY BEING 475j 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>'N' BLOWS/0.3 m</u>	<u>c kPa</u>	<u>DENSENESS</u>	<u>'N' BLOWS/0.3 m</u>
VERY SOFT	0 - 2	0 - 12	VERY LOOSE	0 - 4
SOFT	2 - 4	12 - 25	LOOSE	4 - 10
FIRM	4 - 8	25 - 50	COMPACT	10 - 30
STIFF	8 - 15	50 - 100	DENSE	30 - 50
VERY STIFF	15 - 30	100 - 200	VERY DENSE	> 50
HARD	> 30	> 200		
W.T.P.L.	WETTER THAN PLASTIC LIMIT		D.T.P.L.	DRIER THAN PLASTIC LIMIT
	A.P.L.		ABOUT PLASTIC LIMIT	

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W	THINWALL OPEN
W.S	WASHED SAMPLE	T.P	THINWALL PISTON
S.B	SCRAPER BUCKET SAMPLE	O.S	OESTERBERG SAMPLE
A.S	AUGER SAMPLE	F.S	FOIL SAMPLE
C.S	CHUNK SAMPLE	R.C	ROCK CORE
S.T	SLOTTED TUBE SAMPLE		
	P.H	SAMPLE ADVANCED HYDRAULICALLY	
	P.M	SAMPLE ADVANCED MANUALLY	

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL		



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C1

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 21, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		PLASTIC LIMIT W_P		WATER CONTENT W		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION * STANDARD PENETRATION TEST *				WATER CONTENT %		
							BLOWS/0.3m 20 40 60 80				10 20 30		
	GROUND ELEVATION: 79.07												
0.00	ASPHALTIC CONCRETE												
0.30	CONCRETE												
1.5	Unsampled (probable clay till)		78										
			77										
3.0			76										
4.5			75										
			74										
6.0	Dynamic Cone Test		73										
			72										
7.5			71										
			70										
8.84	Augered to 8.84 m					102							Initial refusal 8.53 m
9.0	Dynamic Cone Test					100/200 mm							
9.45	Augered to 9.45 m					100/200 mm							Final refusal 9.65 m
9.65	Dynamic Cone Test												
	Test hole terminated at 9.65 m												
10.5	Soil description based on auger cuttings.												
12.0													
13.5													
15.0													
16.5													
18.0													

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY

370





LOG OF BOREHOLE No. c2

JOB No. 80 F 240

BORING DATE Oct. 9, 1980

ENGINEER J.F.Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

[illegible]

NOTES Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY



PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c3

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 23, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD										Dynamic Cone Test										TECHNICAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
SOIL PROFILE										SAMPLES										SHEAR STRENGTH C_u										LIQUID LIMIT W_L										PLASTIC LIMIT W_p										WATER CONTENT W										GROUNDWATER OBSERVATIONS AND 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DESCRIPTION										LEGEND										ELEVATION										NUMBER										TYPE										BLOWS/0.3m N-VALUES										DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST										WATER CONTENT 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NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY

JFW





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C4

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 14, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD - Dynamic Cone Test										SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS	
SOIL PROFILE			LEGEND	ELEVATION	SAMPLES		BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		PLASTIC LIMIT W_P		WATER CONTENT %			
DEPTH METERS	DESCRIPTION	GROUND ELEVATION: 79.43			NUMBER	TYPE		20	40	60	80	10	20		30
	Unsampled (probable fill over clay till)		79												
			78												
			77												
			76												
			75												
			74												
6.10	Dynamic Cone Test		73												
			72												
			71												
			70												
10.06	Augered to 10.06 m													Initial refusal 10.06 m	
	Dynamic Cone Test		69												
10.97	Augered to 10.97 m													Final refusal 11.25 m	
11.25	Dynamic Cone Test		68												
	Test hole terminated at 11.25 m														

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY

224





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C5

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 2, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD Dynamic Cone Test													
SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u			LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT %			
							BLOWS/0.3m			WATER CONTENT %			
							20	40	60	80	10		20
	GROUND ELEVATION: 79.15		79										
	Unsampled (probable fill over clay till)		78										
			77										
1.5			76										
3.0			75										
4.5			74										
6.0			73										
6.36	Dynamic Cone Test		73										
	Augered to 10.67 m Dynamic Cone Test		72										
			71										
			70										
			69			103							
10.6			68			101/50 mm							
	Augered to 12.19 m. WEATHERED SHALE		67										
12.19	Test hole terminated at 12.19 m												
	Soil description based on auger cuttings.												
13.5													
15.0													
16.5													
18.0													

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY 3710





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c6

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario

BORING DATE Oct. 29, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT %		
							20	40	60		80
	GROUND ELEVATION: 79.35										
0.10	ASPHALTIC CONCRETE		79								
0.61	FILL: Dense fine to coarse sand and gravel, slag										
1.5	Unsampled (probable fill over clay till)		78								
3.0			77								
4.5			76								
6.0			75								
7.5			74								
9.0			73								
10.06	Augered to 10.06 m Dynamic Cone Test		72								
10.5			71								
11.28	Augered to 11.28 m Dynamic Cone Test		70								
11.48	Test hole terminated at 11.48 m		69			105				Initial refusal 10.06 m	
12.0			68			100/250 mm 100/200 mm				Final refusal 11.48 m	
13.5											
15.0											
16.5											
18.0											

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY: 43W



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C7

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 6, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS					
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION = STANDARD PENETRATION TEST			WATER CONTENT %				
							BLOWS/0.3m			WATER CONTENT %				
	GROUND ELEVATION: 79.67						20	40	60	80	10	20	30	
	Unsampled (probable fill over clay till)		79											
1.5			78											
2.14														
2.74	Coarse gravel or cobbles		77											
3.0			76											
4.5			75											
6.0			74											
6.34	Dynamic Cone Test		73											
7.5			72											
9.0			71											
10.5			70											
11.28	Augered to 11.28 m		69											
11.28	Dynamic Cone Test		68											Initial refusal 10.97 m
12.0														
12.19	Augered to 12.19 m													
12.19	Dynamic Cone Test													
12.78	Test hole terminated at 12.78 m		67											Final refusal 12.78 m
13.5														
15.0														
16.5														
18.0														

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY gfw





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. cs

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 6, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD <u>Dynamic Cone Test</u>										TEST NUMBER <u> </u>									
SOIL PROFILE					SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS			
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST				PLASTIC LIMIT W_p								
											WATER CONTENT %								
	GROUND ELEVATION: 79.32						20	40	60	80	10	20	30						
	Unsampled (probable fill over clay till)		79																
			78																
1.5			77																
3.0			76																
		Coarse gravel or cobble		75															
4.5			74																
			73																
6.0	Dynamic Cone Test			72															
				71															
7.5			70																
9.0			69																
10.5			68																
11.28	Augered to 11.28 m																		
11.28	Dynamic Cone Test													Initial refusal 11.28 m					
12.0			67																
12.80	Augered to 12.80 m																		
12.80	Dynamic Cone Test													Final refusal 13.31 m					
13.31	Test hole terminated at 13.31 m																		
15.0																			
16.5																			
18.0																			

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY gfu



PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C9

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 7, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS				
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWING 3m N - VALUES	DYNAMIC CONE PENETRATION * STANDARD PENETRATION TEST *			PLASTIC LIMIT W_p		WATER CONTENT %	
							20 40 60 80			W_p W W_L		10 20 30	
	GROUND ELEVATION: 79.81												
1.5	Unsampled (probable fill over clay till)		79										
3.0			78										
4.5			77										
6.0			76										
7.5			75										
9.0			74										
10.5	Dynamic Cone Test		73										
12.0			72										
13.5			71										
15.0			70										
16.5	Augered to 10.67 m		69										Initial refusal 10.36 m
18.0	Dynamic Cone Test		68										
19.5			67										
21.0	Augered to 12.80 m		66										Final refusal 13.34 m
22.5	Dynamic Cone Test												
24.0	Test hole terminated at 13.34 m												

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY: gfw





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c10

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 6, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT w_L		PLASTIC LIMIT w_P		WATER CONTENT w		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH m METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT %		WATER CONTENT %		
							20	40	60	80	10	20	
	GROUND ELEVATION: 79.18		79										
1.5	Unsampled (probable fill over clay till)		78										
3.0			77										
4.5			76										
6.0			75										
7.5			74										
9.0	Dynamic Cone Test		73										
10.5	Augered to 10.06 m		72										
12.0	Dynamic Cone Test		71										
12.78	Augered to 12.19 m		70										
13.5	Dynamic Cone Test		69										
15.0	Test hole terminated at 12.78 m		68										
16.5			67										
18.0													

101

100/280

Initial refusal
9.75 m

Final refusal
12.78 m

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY 974



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c11

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 3, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD <u>Dynamic Cone Test</u>										SOIL PROFILE		SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST *				PLASTIC LIMIT W_p		WATER CONTENT %						
GROUND ELEVATION: 78.85							20	40	60	80	10	20	30						
			78																
1.5	Unsampled (probable fill)		77																
3.0			76																
4.5			75																
4.8	(Probable clay till)		74																
6.0			73																
6.3	Dynamic Cone Test		72																
7.5			71			100/280 mm									Initial refusal 7.60 m				
7.9	Augered to 7.92 m		70																
	Dynamic Cone Test		69																
9.0			68																
10.5			67			100/250 mm									Final refusal 12.14 m				
12.0			66																
13.5			65			100/75 mm													
13.7	Augered to 13.72 m																		
	Dynamic Cone Test																		
	Test hole terminated at 13.80 m																		
15.0																			
16.5																			
18.0																			

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY 474



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c12

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 2, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD		Dynamic Cone Test																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.
Soil description based on auger cuttings.

CHECKED BY JFW



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C13

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 3, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD										DYNAMIC CONE TEST										SHEAR STRENGTH C_u										LIQUID LIMIT w_L										PLASTIC LIMIT w_p										WATER CONTENT w										GROUNDWATER OBSERVATIONS AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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DEPTH METERS		DESCRIPTION			LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	BLOWS/0.3m					WATER CONTENT %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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J.F.W.





PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c14

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 7, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		PLASTIC LIMIT W_P		WATER CONTENT W		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-VALUES	DYNAMIC CONE PENETRATION * STANDARD PENETRATION TEST *				WATER CONTENT %		
							BLOWS/0.3m 20 40 60 80				WATER CONTENT % 10 20 30		
	GROUND ELEVATION: 79.10												
1.5	Unsampled (probable fill over clay till)		78										
			77										
3.0			76										
			75										
4.5			74										
6.0	Dynamic Cone Test		73										
			72										
7.5			71										
			70										
9.0			69										
10.5	Augered to 10.97 m Dynamic Cone Test		68			101							
11.76			67			100/180 mm							
12.0	Test hole terminated at 11.76 m												
13.5													
15.0													
16.5													
18.0													

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C15

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 3, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD Dynamic Cone Test													
SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u			LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			PLASTIC LIMIT W_P				
						BLOWS/0.3m N - VALUES	BLOWS/0.3m		WATER CONTENT %				
							20	40	60	80	10		20
	GROUND ELEVATION: 78.90												
	Unsampled (probable fill over clay till)		78										
1.5			77										
			76										
3.0			75										
			74										
4.5			73										
6.0	Dynamic Cone Test		72										
			71										
7.5			70										
9.0			69			106							Initial refusal 9.75 m
10.06	Augered to 10.06 m												
	Dynamic Cone Test		68			103							Secondary refusal 11.28 m
10.5			67										
12.0	Augered to 12.19 m												
12.19	Dynamic Cone Test					100/250 mm							
12.44	Test hole terminated at 12.44 m		66										
13.5													
15.0													
16.5													
18.0													

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY J.F. Wright



PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c16

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 2, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		PLASTIC LIMIT W_p		WATER CONTENT W		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION = STANDARD PENETRATION TEST *				WATER CONTENT %		
							BLOWS/0.3m 20 40 60 80				WATER CONTENT % 10 20 30		
	GROUND ELEVATION: 78.73												
1.5	Unsampled (probable fill over clay till)		78										
			77										
3.0			76										
			75										
4.5			74										
6.0			73										
6.6	Dynamic Cone Test		72										
7.5			71										
9.0			70										
9.75	Augered to 9.75 m		69										Initial refusal 9.45 m
10.5	Dynamic Cone Test		68										
12.0			67										
12.19	Augered to 12.19 m		66										
12.65	Dynamic Cone Test					100/250 mm							Secondary refusal 11.28 m
12.65	Test hole terminated at 12.65 m												
13.5													
15.0													
16.5													
18.0													

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c17

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 7, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD <u>Dynamic Cone Test</u>											
SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION = STANDARD PENETRATION TEST		PLASTIC LIMIT W_p		
							BLOWS/0.3m		WATER CONTENT %		
							20	40	60		80
GROUND ELEVATION: 78.88											
	Unsampled (probable fill over clay till)		78								
1.5			77								
3.0			76								
4.5			75								
6.0			74								
6.0	Dynamic Cone Test		73								
7.5	Augered to 9.14 m Dynamic Cone Test		72								
9.0			71								
9.0			70							Initial refusal 9.14 m	
10.5			69								
10.5	Augered to 10.67 m Dynamic Cone Test		68			103					
11.5	Test hole terminated at 11.51 m		67			100/230 mm				Final refusal 11.51 m	
12.0											
13.5											
15.0											
16.5											
18.0											

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C18

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 1, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

BORING METHOD Dynamic Cone Test										TEST NO.				
SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS				
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWN 3m N - VALUES	DYNAMIC CONE PENETRATION * STANDARD PENETRATION TEST *		PLASTIC LIMIT W_p					
							BLOWS/0.3m		WATER CONTENT %					
	GROUND ELEVATION: 78.65						20	40	60	80	10	20	30	
	Unsampled (probable fill over clay till)		78											
1.5			77											
			76											
3.0			75											
			74											
4.5			73											
6.0	Dynamic Cone Test		72											
7.5			71											
9.0	Augered to 8.53 m Dynamic Cone Test		70											Initial refusal 8.23 m
			69											
10.5	Augered to 10.67 m Dynamic Cone Test		68				107							
			67				130							Final refusal 11.58 m
12.0	Augered to 12.19 m Dynamic Cone Test		66				100/75 mm							
	Test hole terminated at 12.58 m													
13.5														
15.0														
16.5														
18.0														

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C19

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 1, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapany

BORING METHOD Dynamic Cone Test													
SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION * STANDARD PENETRATION TEST *		WATER CONTENT %				
							BLOWS/0.3m		Wp				
							20	40	60	80		10	20
	GROUND ELEVATION: 78.67												
	Unsampled (probable fill over clay till)		78										
1.5			77										
3.0			76										
4.5			75										
6.0			74										
6.0	Dynamic Cone Test		73										
7.5	Coarse gravel or cobbles		72										
			71										
			70										
9.0	Augered to 9.14 m												
9.0	Dynamic Cone Test		69										
10.5	Augered to 10.67 m					107							
10.5	Dynamic Cone Test		68										
12.0	Augered to 12.19 m		67			102/150 mm							
12.0	Dynamic Cone Test					77/100 mm							
12.0	Test hole terminated at 12.29 m												
13.5													
15.0													
16.5													
18.0													

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C20

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 8, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT w_L		GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT %	
							20	40		60	80
	GROUND ELEVATION: 78.16										
1.5	Unsampled (probable fill over clay till)		77								
3.0			76								
4.5			75								
6.0			74								
7.5			73								
9.0	Dynamic Cone Test		72								
9.73	Augered to 7.92 m Dynamic Cone Test		71			106				Initial refusal 7.92 m	
9.73	Augered to 9.45 m Dynamic Cone Test		70								
9.73	Test hole terminated at 9.73 m		69			106				Final refusal 9.73 m	
10.5											
12.0											
13.5											
15.0											
16.5											
18.0											

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

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PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c21

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 1, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rappey

SOIL PROFILE							SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT w_L		GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION * STANDARD PENETRATION TEST *		PLASTIC LIMIT w_p		WATER CONTENT %			
	GROUND ELEVATION: 77.56						20	40	60	80	10	20	30	
	Unsampled (probable fill over clay till)		77											
1.5			76											
			75											
3.0			74											
			73											
4.5			72											
6.0	6.10 Dynamic Cone Test		71											
7.5			70											
8.0	Augered to 8.07 m Dynamic Cone Test		69											Initial refusal 7.92 m
9.0			68											Secondary refusal 8.84 m
9.5	Augered to 9.75 m Dynamic Cone Test													
9.83	Test hole terminated at 9.83 m													
10.5														
12.0														
13.5														
15.0														
16.5														
18.0														

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY: *JFW*





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c22

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 8, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE		SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS				
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT %			
							20		40	60	80	10
	GROUND ELEVATION: 77.73											
	Unsampled (probable fill over clay till)		77									
1.5			76									
3.0			75									
4.5			74									
6.0			73									
6.10	Dynamic Cone Test		72									
7.1	Augered to 7.32 m		71									
7.32	Dynamic Cone Test		70									Initial refusal 7.32 m
8.23	Augered to 8.23 m					100/100						
8.38	Dynamic Cone Test					100/150						Final refusal 8.38 m
	Test hole terminated at 8.38 m		69									
9.0												
10.5												
12.0												
13.5												
15.0												
16.5												
18.0												

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY: JFW



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. c23

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 8, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH m METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT	
							20	40		60	80
	GROUND ELEVATION: 78.24		78								
1.5	Unsampled (probable fill over clay till)		77								
3.0			76								
4.5			75								
6.0			74								
7.5			73								
7.62	Dynamic Cone Test		72								
7.62	Augered to 7.62 m		71								
8.23	Dynamic Cone Test		70								
8.23	Augered to 8.23 m										
8.28	Dynamic Cone Test										
8.28	Test hole terminated at 8.28 m										
10.0											
11.5											
13.0											
14.5											
16.0											
17.5											
19.0											

100/280 mm
100/50 mm

Initial refusal
7.62 m
Final refusal
8.28 m

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY: 470



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. C24

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 8, 1980

ENGINEER J.F. Wright

BORING METHOD Dynamic Cone Test

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS				
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/30 cm N-VALUES	DYNAMIC CONE PENETRATION - STANDARD PENETRATION TEST		PLASTIC LIMIT W_p					
							BLOWS/30 cm		WATER CONTENT %					
	GROUND ELEVATION: 78.01						20	40	60	80	10	20	30	
1.5	Unsampled (probable fill over clay till)		77											
3.0			76											
4.5			75											
6.0			74											
7.5			73											
8.0	Dynamic Cone Test		72											
8.2	Augered to 7.62 m		71											
8.2	Dynamic Cone Test		70											
8.2	Test hole terminated at 8.20 m													
9.0														
10.5														
12.0														
13.5														
15.0														
16.5														
18.0														

NOTES

Refer to text and Note 3 on Drawing 1 for definition of refusal.

CHECKED BY



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 16

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET (WEST ABUTMENT)

JOB No. 80 P 241

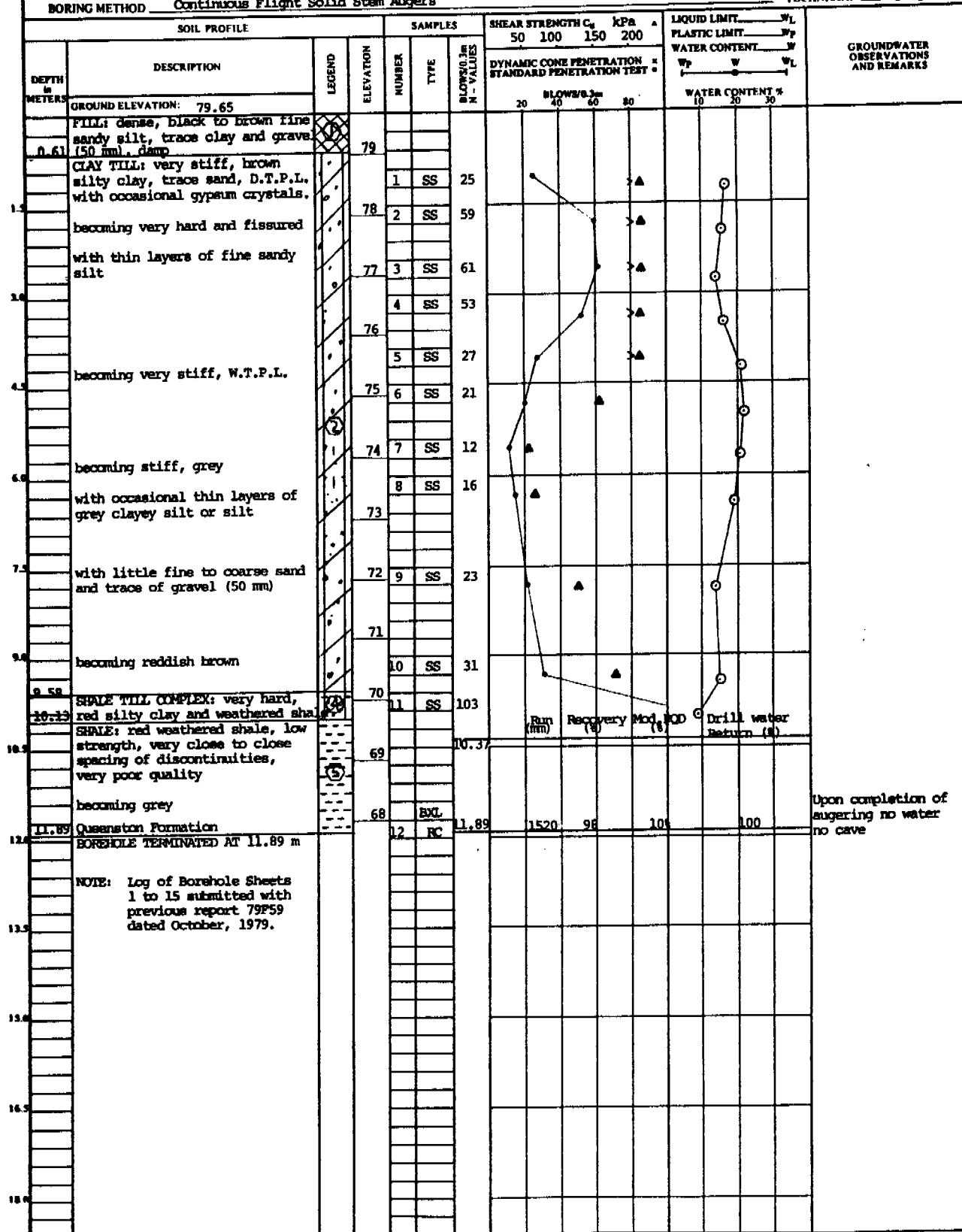
LOCATION Hamilton, Ontario,

BORING DATE Oct. 9/1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapney

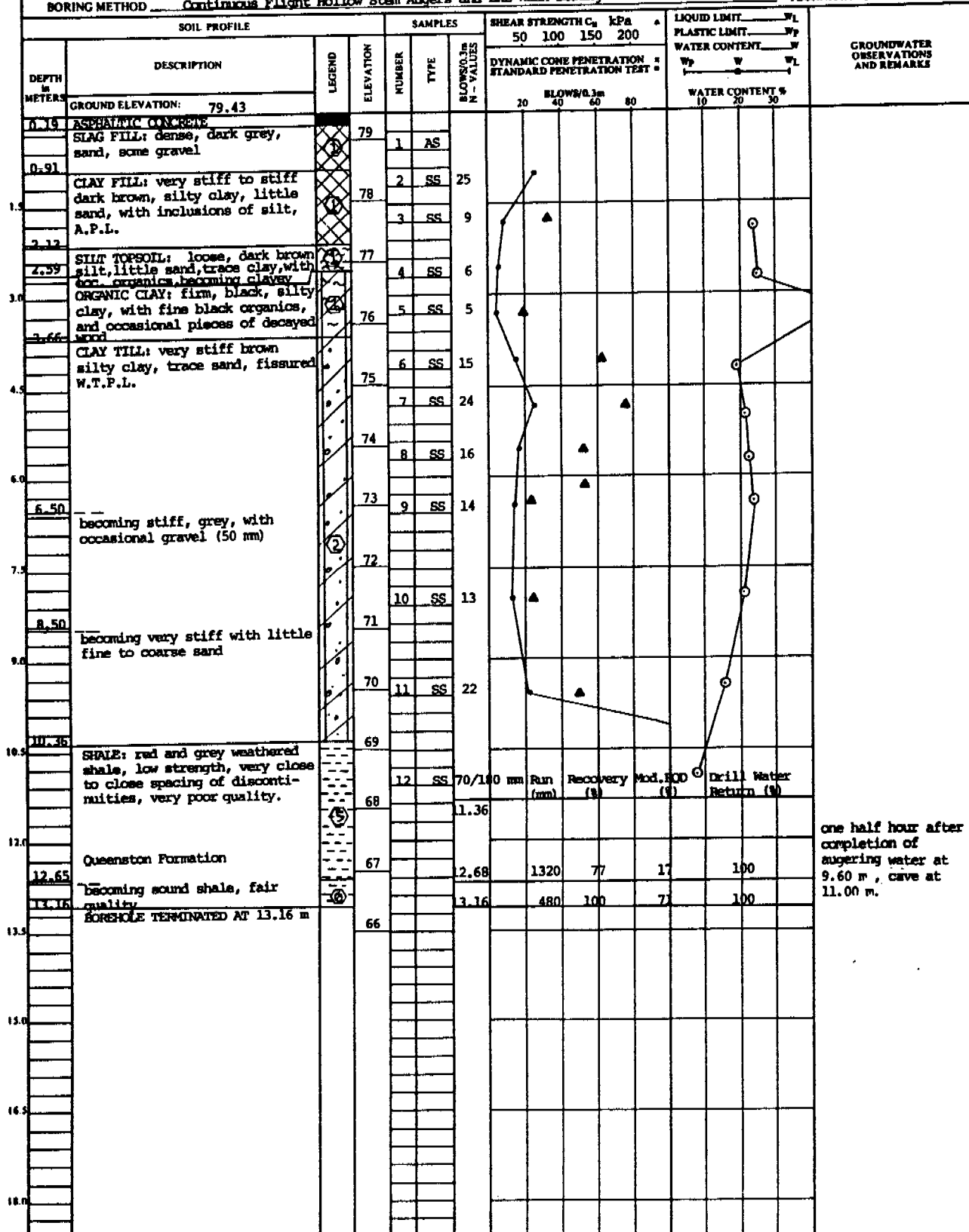




PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 17

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET (WEST ABUTMENT) JOB No. 80 P 241
LOCATION Hamilton, Ontario. BORING DATE Oct. 14, 1980 ENGINEER J.F. Wright
BORING METHOD Continuous Flight Hollow Stem Augers and BXL Wash Boring TECHNICIAN M. Raposa



one half hour after completion of augering water at 9.60 m, came at 11.00 m.

NOTES 1000 pcf = 47.88 kPa
* Undrained shear strength using pocket penetrometer
* Mod. R.Q.D. (Modified Rock Quality Designation) is the total length of BXL core longer than 100 mm that is sound and hard expressed as percent of drill run.
Refer to Log of Borehole C4 for Dynamic Cone Test Results

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CONSULTING ENGINEERS

LOG OF BOREHOLE No. 18 c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario

BORING DATE Nov. 4, 1980

ENGINEER J.P. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapney

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT w_L		PLASTIC LIMIT w_p		GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION = STANDARD PENETRATION TEST		WATER CONTENT		WATER CONTENT %		
							BLOWS/0.3m		WATER CONTENT %				
	GROUND ELEVATION: 79.34		79				20	40	60	80	10	20	
	Unsampled (probable fill over clay till)		78										
1.5			77										
3.0		⊙	76										
4.5			75										
6.0	6.10		74										
	Dynamic Cone Test		73										
7.5		⊙	72										
9.0			71										
9.45			70			104							Initial Refusal
10.35	CLAY TILL: very stiff grey silty clay, some sand, occasional gravel, W.T.P.L.	⊙	69	1	SS	25							9.45 m
10.85	SHALE: red weathered shale	⊙		2	SS	154/178 mm							Upon completion of augering, no water no cave
	BOREHOLE TERMINATED AT 10.85 m												
12.0													
13.5													
15.0													
16.5													
18.0													

NOTES

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PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 19

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 29, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Napsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH m METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/30 cm N-VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT %	
							20	40		60	80
	GROUND ELEVATION: 80.25										
0.11	ASPHALTIC CONCRETE		80								
	SLAG FILL: dense, brown fine to coarse sand, with gravel (to 100 mm), trace silt, damp		79								
1.57	Unsampled, (Probable Clay Till)		78								
			77								
			76								
			75								
			74								
			73								
8.00	Layers of saturated sand		72								
9.10	CLAY TILL: very stiff, brownish grey, silty clay, little sand, trace gravel (to 75 mm) W.T.P.L.		71	1	SS	19					
			70								
			69	2	SS	24					
11.60	SILT TILL: very dense, reddish brown, fine to coarse sandy silt, trace clay, some gravel (to 75 mm)		68	3	SS	137					
			67								
13.36	SHALE: red weathered shale			4	SS	100/4 mm					
13.72	BOREHOLE TERMINATED ON REFUSAL TO SPLIT SPOON AT 13.72 m										

After sample 1
water at 8.20 m

Upon completion of
augering water and
cave at 13.27 m

NOTES

CHECKED BY JDW





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 20 c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Nov. 4, 1980

ENGINEER J.P. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS					
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT %				
							BLOWS/0.3m			WATER CONTENT %				
	GROUND ELEVATION: 80.29						20	40	60	80	10	20	30	
0.17	ASPHALTIC CONCRETE		80											Initial Refusal 10.96 m Upon completion of Augering no water no cave
1.06	BASE COURSE: dense, brown, slag (to 25 mm) and fine to coarse sand, little silt,		79											
1.52	FILL: compact black cinders													
	Unsampled (Probable Clay Till)													
			78											
			77											
			76											
			75											
4.10	Dynamic Cone Test		74											
			73											
			72											
			71											
			70											
11.43			69											
12.19	CLAY TILL: very stiff, grey silt/ clay, some sand, occasional gravel, W.T.P.L.		68	1	SS	28								
13.41	SILT TILL: very dense reddish brown sandy silt, boulders		67	2	SS	50/0 mm								
15.24	SHALE: red weathered shale		66	3	SS	138/80 mm								
	BORHOLE TERMINATED AT 15.24 m		65											

NOTES

CHECKED BY: J.P.W.



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 21c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Nov. 5, 1980

ENGINEER J.E. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapney

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS			
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT				
							BLOWS/0.3m		WATER CONTENT %				
	GROUND ELEVATION: 79.67						20	40	60	80	10	20	30
0.10	ASPHALTIC CONCRETE												
	FILL: dense brown gravel, rounded and crushed (to 25 mm size) and fine to coarse sand, little silt damp to moist		79										
1.5			78	1	AS	-							
2.13	Unsampled (Probable Clay Till)		77										
3.0			76										
4.5			75										
6.0			74										
6.30	Dynamic Cone Test		73										
7.5			72										
9.0			71										
10.5			70										
11.20	Augered to 11.28 m		69			102							
11.09	Dynamic Cone test		68			100/100 mm							
12.0	Dynamic Cone test		67	2	SS	129							
12.19	SILT TILL: very dense, reddish brown silt, some fine to coarse sand, trace clay, with some gravels.		66	3	SS	100/25 mm							
13.56	SHALES: red weathered shale												
13.75	BOREHOLE TERMINATED AT 13.75 m												
15.0													
16.5													
18.0													

NOTES Depth of fill likely reflects proximity of borehole to manhole.

CHECKED BY: JTW



PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No.22c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 29, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Ruppey

BORING METHOD		SOIL PROFILE		SAMPLES				SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT %			
							BLOWS/0.3m		WATER CONTENT %			
							20	40	60	80	10	
GROUND ELEVATION: 79.86												Minor seepage from about 1.5 m
0.00	ASPHALTIC CONCRETE		79									
1.22	FILL: dense, grayish brown, fine to coarse sand and gravel (to 75 mm), trace to little silt. (resembles Granular "A" slag)		78									
1.50	FILL: compact brown sand		77									
1.65	Unsampled (Probable Clay Till)		76									
			75									
			74									
6.10	Dynamic Cone Test		73									
			72									
			71									
			70									
10.64			69	1	SS	25						Initial Refusal 10.64 m
11.90	CLAY TILL: very stiff, grey silty clay, little sand and gravel (to 75 mm) W.T.P.L		68									
12.00	SILT TILL: very dense, reddish brown, silt, some sand, occasional gravel, D.T.P.L.		67	2	SS	128/380 mm						Upon completion of augering water and cave at 13.28 m
13.56	SHALE: red weathered shale		66	3	SS	50/0 mm						
13.72	BOREHOLE TERMINATED ON REFUSAL TO SPLIT SPOON AT 13.72 m											
15.00												
16.50												
18.00												

NOTES

CHECKED BY STW





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 23c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET
LOCATION Hamilton, Ontario.
BORING METHOD Continuous Flight Solid Stem Augers

JOB No. 80 P 240
BORING DATE Nov. 3, 1980
ENGINEER J.F. Wright
TECHNICIAN M. Papey

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/30 cm N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT		
							20	40	60		80
	GROUND ELEVATION: 79.50										
	Unsampled (probable fill over clay till)		79								
1.5			78								
3.0			77								
4.5			76								
6.0			75								
7.5			74								
9.0			73								
10.5	Dynamic Cone Test		72								
12.0			71								
13.5			70								
15.0			69			103					
16.5	Augered to 10.67 m Dynamic Cone Test		68								
18.0			67			122					
	Augered to 12.50 m Dynamic Cone Test		66			100					
	SHALE: red weathered shale		65								
			64								
			63								
			62								
			61								
			60								
			59								
			58								
			57								
			56								
			55								
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			31								
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			12								
			11								
			10								
			9								
			8								
			7								
			6								
			5								
			4								
			3								
			2								
			1								
			0								

NOTES

CHECKED BY: *gzw*



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 24

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 15, 1980

ENGINEER J.P. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Robey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH, kPa		LIQUID LIMIT w_L		GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION = STANDARD PENETRATION TEST		PLASTIC LIMIT w_p		
							20 40 60 80		10 20 30		
							BLOWS/0.3m		WATER CONTENT %		
							BLOWS/0.3m		WATER CONTENT %		
	GROUND ELEVATION: 78.05										
	Unsampled (probable fill over clay till)										
			77								
1.5			76								
3.0			75								
4.5			74								
6.0		⊙	73								
7.5			72								
9.0			71								
10.5			70								
12.0			69								
13.5			68								
15.0			67	1	SS	18					
16.5	CLAY TILL: very stiff, grey, silty clay, little fine to coarse sand and gravel, W.T.P.L.	⊙	66								
18.0			65	2	SS	73					
19.5	SILT TILL: very hard, reddish brown, clayey silt, some sand and gravel	⊙	64	3	SS	151					
21.0			63								
22.5	With boulder (.30 m)		62	4	SS	102/150 mm					
24.0	SHALE: red weathered shale	⊙	61	5	SS	100/75 mm					
25.5											
27.0	BOREHOLE TERMINATED UPON REFUSAL TO SPLIT SPOON AT 16.86 m.										Upon completion of augering no water no cave

NOTES 1000 pcf = 47.88 kPa

▲ Undrained shear strength- using pocket penetrometer

CHECKED BY: gfw



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 25

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

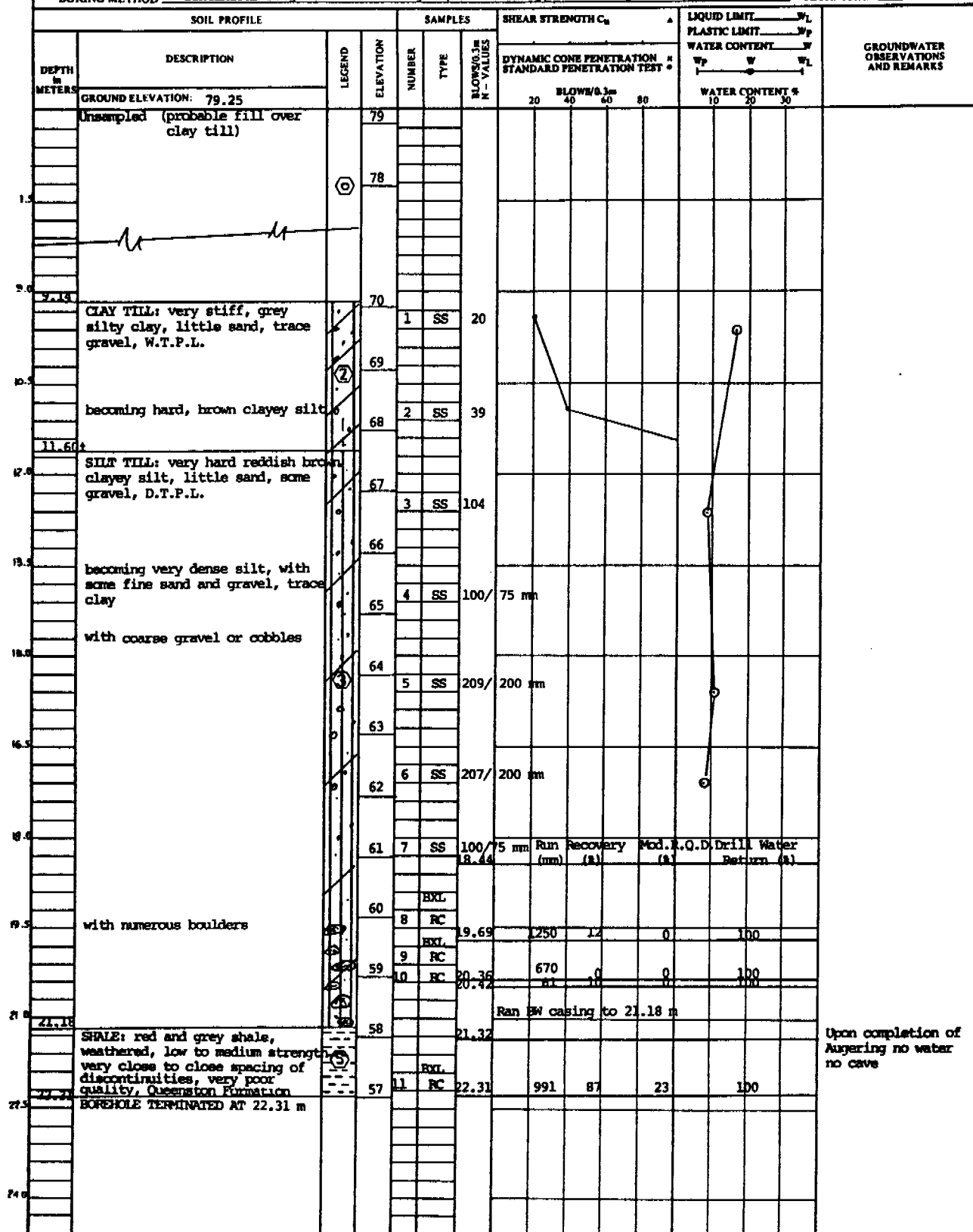
JOB No. 80 P 240

LOCATION Hamilton, Ontario.

BORING DATE Oct. 15 & 22, 1980 ENGINEER J. F. Wright

BORING METHOD Continuous Flight Solid Stem Augers, Wash Boring, BXL coring

TECHNICIAN M. Rappey



NOTES *Mod. R.Q.D. (Modified Rock Quality Designation) is the total length of BXL core longer than 100 mm that is sound and hard expressed as per cent of drill run.

CHECKED BY: gfw



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CONSULTING ENGINEERS

LOG OF BOREHOLE No. 26

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario

BORING DATE Oct. 16 & 17, 1980

ENGINEER J.E. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapney

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u kPa			LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS	
						50	100	150	200	PLASTIC LIMIT W_P			
						DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT W				
						BLOWS/0.3m			WATER CONTENT %				
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m							
	GROUND ELEVATION: 78.63												
	Unsampled (probable fill over alluvium over clay till)		78										
		①	77										
9.14													
	CLAY TILL: very stiff, grey, silty clay, little sand and gravel, A.P.L.		69	1	SS	29							
	becoming hard, brown	②	68	2	SS	32							
11.60			67										
	SILT TILL: very hard, brown clayey silt, little sand and gravel, D.T.P.L.		66	3	SS	140							
			65										
	becoming very dense, non plastic	③	64	4	SS	152/230 mm							
			63	5	SS	100/150 mm							
	with cobbles or boulders		62										
	becoming reddish brown, silt and fine to coarse sand, some gravel; damp		61	6	SS	158/300 mm							
17.70			60	7	SS	245/200 mm							
	SHALE TILL COMPLEX: very dense reddish brown silt, little fine sand, dry.	④	59										
			58	8	SS	188/100 mm							
20.70			57										
	SHALE: red weathered shale	⑤	56										
22.86													
	BOREHOLE TERMINATED AT 22.86 m												

NOTES

▲ Undrained shear strength using pocket penetrometer.

CHECKED BY

JRW





PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 27

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 F 240

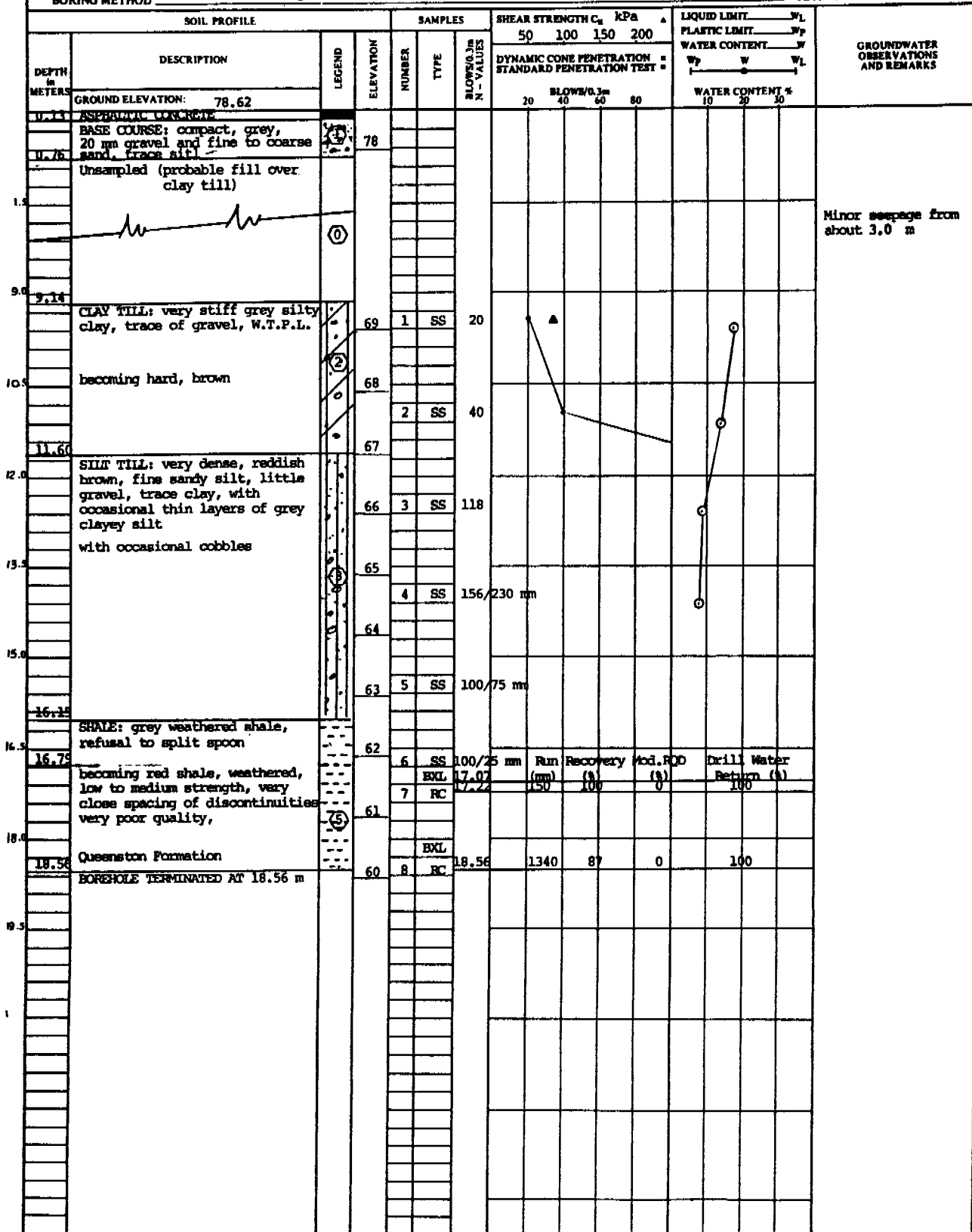
LOCATION Hamilton, Ontario.

BORING DATE Oct. 16 & 23, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers, Wash Boring, BXL Coring

TECHNICIAN M. Rapsey



NOTES 1000 psf = 47.88 kPa

▲ Undrained shear strength - using pocket penetrometer

* Mod. R.Q.D. (modified rock quality designation) is the total length of BXL core longer than 100 mm that is sound and hard expressed as percent of drill run.

CHECKED BY: AW



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 28c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario

BORING DATE Oct. 21, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Reedy

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH m METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT %	
							BLOWS/0.3m			WATER CONTENT %	
							20	40		60	80
	GROUND ELEVATION: 79.10										
	Unsampled (probable fill over clay till)		78								
1.5			77								
3.0		⊙	76								
4.5			75								
6.0	6.10		74								
	Dynamic cone test		73								
7.5		⊙	72								
9.0			71								
10.5	10.67		70			106					
			69							Initial Refusal 9.75 m	
12.0	11.90		68	1	SS	31					
	CLAY TILL: hard brown silty clay little sand, trace gravel, W.T.P.L.	⊙	67								
13.5			66	2	SS	70					
	SILT TILL: very hard brown clayey silt, becoming silt with some fine sand, trace clay and gravel	⊙	65	3	SS	191/280 mm					
15.0	15.09		64	4	SS	100/80 mm				Upon completion of augering, water and cave at 14.78 m	
	SHALE: RED WEATHERED SHALE	⊙									
	BOREHOLE TERMINATED AT 15.29 m										
16.5											
18.0											

NOTES

CHECKED BY gfu

PMI/SMA MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA



PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 29

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P. 240

LOCATION Hamilton, Ontario,

BORING DATE Oct. 15, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapsey

BORING METHOD		SOIL PROFILE		SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		PLASTIC LIMIT W_P		WATER CONTENT W		GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST				WATER CONTENT %				
							20	40	60	80	10	20	30		
	GROUND ELEVATION: 78.24		78												
	Unsampled (probable fill over clay till)		77												
1.5			76												
3.0			75												
4.5			74												
6.0			73												
7.5	coarse gravel or cobble		72												
			71												
			70												
9.0	9.24		69												
	CLAY TILL: hard brown silty clay, some sand and gravel, A.P.L.	②		1	SS	67									
10.00			68												
10.5	SILT TILL: very dense, reddish brown silt, little fine sand, trace clay with numerous gravel sizes	③													
			67	2	SS	83/150 mm									
11.28															
	SHALE: red weathered shale	④													
12.0	12.22		66	3	SS	100/25 mm									
	BOREHOLE TERMINATED UPON REFUSAL TO SPLIT SPOON AT 12.22 m														
13.5															
15.0															
16.5															
18.0															

NOTES

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PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 30c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario

BORING DATE Oct. 7, 1980
Nov. 3, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapsey

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS				
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION - STANDARD PENETRATION TEST *		PLASTIC LIMIT W_P					
							BLOWS/0.3m		WATER CONTENT %					
	GROUND ELEVATION: 77.90						20	40	60	80	10	20	30	
	Unsampled (probable fill over clay till)		77											
1.5			76											
3.0			75											
4.5			74											
6.0			73											
6.0			72											
6.0	Dynamic Cone Test		71											
7.5			70											
8.0	Augered to 8.84 m		69			100/280 mm								Initial Refusal
9.0	Dynamic cone test													8.81 m
9.0	Augered to 9.75 m		68			75/75 mm								Final Refusal
9.0	Dynamic cone test													9.83 m
10.0	SHALE: red weathered shale		67	1	SS	100/0 mm								Upon completion of augering, no water, no cave.
10.0	BOREHOLE TERMINATED AT 10.67 m													
11.5														
13.0														
13.5														
15.0														
16.5														
18.0														

NOTES

CHECKED BY: gfw



PETO MACCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 31c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario

BORING DATE Oct. 30, 1980

ENGINEER J.F. Wright

BORING METHOD Continuous Flight Hollow Stem Augers

TECHNICIAN M. Rapney

SOIL PROFILE			SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS		
DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOW/0.3m N-VALUE	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST			WATER CONTENT	
							BLOWS/0.3m			WATER CONTENT %	
							20	40		60	80
	GROUND ELEVATION: 78.29		78								
	FILL: loose silty sand, wet, contaminated with gasoline	⊗	77								
1.5			76								
3.0	Unsamed (Probable Clay Till)	⊙	75								
4.5			74								
6.0			73								
6.30	Dynamic Cone Test	⊙	72								
7.5			71								
8.5			70								
9.0	SILT TILL: very dense, reddish brown silt, some sand, trace clay with some gravel.	⊗	69	1	SS	125/150					
9.29	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AND SPLIT SPOON AT 9.29 m										
10.5											
12.0											
13.5											
15.0											
16.5											
18.0											

NOTES

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CONSULTING ENGINEERS

LOG OF BOREHOLE No. 32c

JOB NAME PROPOSED RECONSTRUCTION OF BURLINGTON STREET

JOB No. 80 P 240

LOCATION Hamilton, Ontario.

OCT. 8 &
BORING DATE Nov. 3, 1980

ENGINEER J.F. Wright

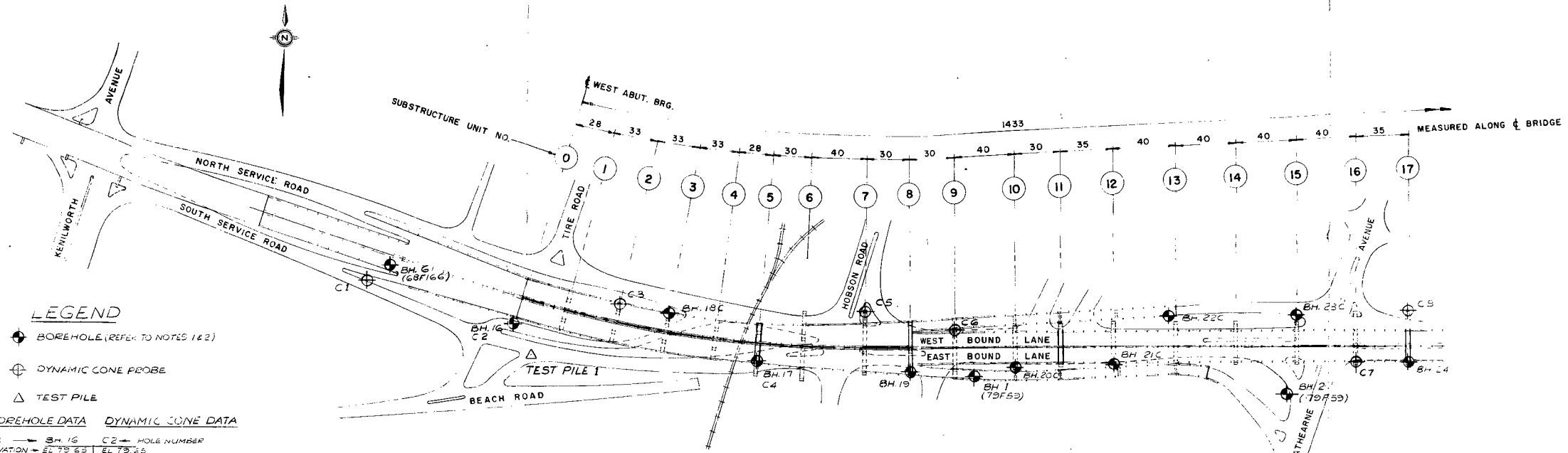
BORING METHOD Continuous Flight Solid Stem Augers

TECHNICIAN M. Rapcey

BORING METHOD		SOIL PROFILE		SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS			
DEPTH METERS	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/30 cm N - VALUES	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		PLASTIC LIMIT W_P					
									WATER CONTENT W					
	GROUND ELEVATION: 77.96						20	40	60	80	10	20	30	
	Unsampled (probable fill over clay till)		77											
1.5			76											
3.0		⊙	75											
4.5			74											
6.0			73											
6.30	Dynamic Cone Test		72											
7.5		⊙	71											
7.92	Augered to 7.92 m		70											Initial Refusal 7.92 m
8.84	Dynamic Cone Test													Secondary Refusal 8.93 m
9.0	SILT TILL: very dense, reddish brown silt, some fine sand and gravel (to 10 mm) damp	⊙	69	1	SS	100/90 mm 114/140 mm								
9.85	SHALE: red weathered shale	⊙	68											
10.67	BOREHOLE TERMINATED AT 10.67 m		67	2	SS	100/0 mm								Upon completion of Augering no water no cave.

NOTES

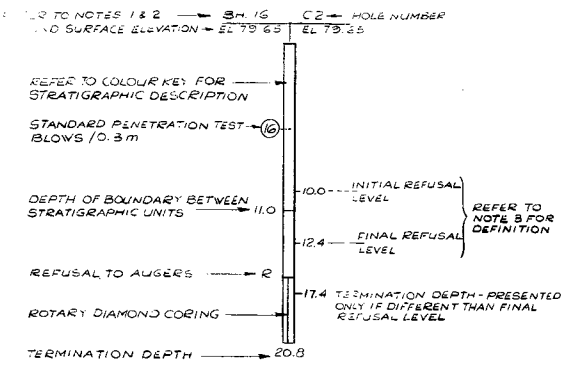
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LEGEND

- ⊕ BOREHOLE (REFER TO NOTES 1 & 2)
- ⊕ DYNAMIC CONE PROBE
- △ TEST PILE

SAMPLED BOREHOLE DATA DYNAMIC CONE DATA



COLOUR KEY

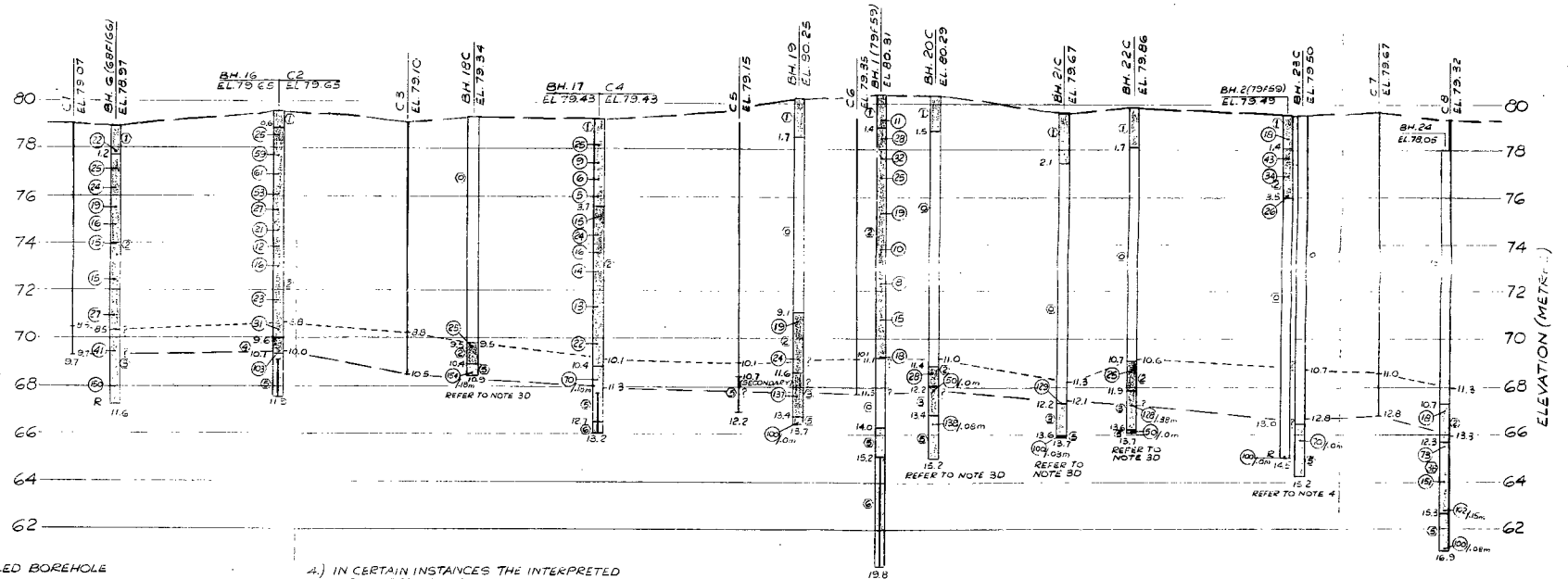
- ① NOT SAMPLED
- ② ROADWAY PAVEMENT/FILL/ALLUVIUM
- ③ STIFF TO HARD CLAY TILL
- ④ VERY DENSE SANDY SILT TILL A) VERY DENSE SILTY SAND TILL B) VERY HARD CLAYEY SILT TILL
- ⑤ HARD WEATHERED SHALE - TILL COMPLEX
- ⑥ WEATHERED QUEENSTON SHALE
- ⑦ SOUND QUEENSTON SHALE

NOTES

- 1) DYNAMIC CONE TEST CARRIED OUT IN CONJUNCTION WITH SAMPLED BOREHOLE IS DENOTED BY BOREHOLE NUMBER WITH SUFFIX 'C'
- 2) BH. 6 (68F166) REFERS TO BOREHOLE DRILLED AS PART OF PREVIOUS SUBSURFACE INVESTIGATION AND PRESENTED IN REPORT NO. 68F166
- 3) DYNAMIC CONE PENETRATION DATA
 - A) INITIAL DYNAMIC CONE TESTS WERE CONDUCTED IN BOREHOLES PREAUGERED TO 6.0m AND TERMINATED WHEN THE DYNAMIC CONE PROBE ENCOUNTERED RESISTANCE OF 100 BLOWS/0.3m DEFINED AS THE INITIAL REFUSAL LEVEL
 - B) A SECONDARY DYNAMIC CONE TEST WAS CONDUCTED IN EACH BOREHOLE AFTER PREAUGERING TO THE INITIAL REFUSAL LEVEL AND AGAIN TERMINATED WHEN THE DYNAMIC CONE PROBE ENCOUNTERED RESISTANCE OF 100 BLOWS/0.3m
 - C) A FINAL DYNAMIC CONE TEST WAS CONDUCTED IN EACH BOREHOLE AFTER PREAUGERING TO THE SECONDARY REFUSAL LEVEL AND AGAIN TERMINATED WHEN THE DYNAMIC CONE PROBE ENCOUNTERED RESISTANCE OF 100 BLOWS/0.3m DEFINED AS THE FINAL REFUSAL LEVEL
 - D) FOR LOCAL VARIATIONS IN THE METHODOLOGY, REFER TO THE LOG OF BOREHOLE SHEETS

- 4) IN CERTAIN INSTANCES THE INTERPRETED STRATIGRAPHY AND CONTACT ELEVATIONS FOR BH. 1 TO 6 AS REPORTED IN RML REPORT 79F59 HAVE BEEN MODIFIED COGNIZANT OF CURRENT FIELD INFORMATION.
- 5) REFER TO LOG OF BOREHOLE SHEETS FOR COMPLETE SOIL DETAILS AND DYNAMIC CONE PENETRATION DATA

PLAN



SOIL PROFILE

PETO MACCALLUM LTD.
CONSULTING ENGINEERS

				NOTES:	SCALES		APPROVED	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH		BURLINGTON STREET RECONSTRUCTION	
					HOR. 1:1500 VERT. 1:125 DIMENSIONS IN METERS (m) UNLESS NOTED			DEPARTMENT OF ENGINEERING		PLAN AND PROFILE SHOWING SUBSURFACE CONDITIONS	
No.	REVISIONS	DATE	INITIAL			DIRECTOR	COMMISSIONER OF ENGINEERING	DATE: DECEMBER 1980	PROJECT No. 80F240	DRAWING No. 1	SHEET 1 OF 2

