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STR. SITE No. 36-60

HWY. No. Q.E.W.

LOCATION Burlington Bay Sluway

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976

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ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 210-79-00 DIST 4
HWY Q.E.W. S.B. STR SITE 36-60

Burlington Bay Skyway, S.B.

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FOUNDATION INVESTIGATION REPORT

For

W.P. 210-79-00, Site 36-60

Burlington Bay Skyway

Q.E.W. S.B., District 4

INTRODUCTION:

This report contains the results of a subsurface investigation carried out to obtain information required for the design of the proposed Burlington Bay Skyway. The field work was performed during the period from 81 05 15 - 07 08, utilizing continuous-flight auger machines, NX casing and BX core barrels. The field work consisted of 42 sampled boreholes/cone penetration tests. Bedrock was cored at 7 boreholes.

This report supersedes previous related correspondence.

SITE DESCRIPTION

Topography

The site is located on the narrow strip of land some 6.5 km in length which separates Hamilton Harbour from Lake Ontario and on which is built the Q. E. W.

The shipping channel harbour entrance is located in the centre portion of the beach strip. This is crossed by the Burlington High Level Bridge which carries the four lanes of the Q. E. W. and which extends from 1280 m north of the shipping channel to 1280 m south of the channel for a total length of 2560 m. The structure was constructed during the period 1955-1958. It is described in some detail below.

East of the Q.E.W., some 100 m distant, is a two to four lane road (and City street) known as Beach Boulevard. This road crosses the shipping channel by means of a steel lift bridge which also incorporates a single railway track on the east side to carry the C. N. R. over the shipping channel. The development along the beach strip is generally residential. On the west side of the Burlington High Level Bridge and immediately north of the shipping channel is the Canada Centre for Inland Waters.

This has been constructed entirely on reclaimed land of area about 400 m square built up to about el. 76.50. The new high level bridge will be built on the west side of the existing high level bridge approximately 23.95 m distant from it C/L to C/L. In this area the present ground surface lies between elevation 76.0 and 77.0, the average being about el. 76.5. Much of this area was reclaimed at the time of construction of the existing bridge. Prior to that time, most of the ground surface was covered with water roughly 2 m in depth. Between March and July of 1955, hydraulic fill material was pumped into the area from the bottom of Hamilton Bay using a 'sand sucker' dredge and was contained on the west side of the reclaimed area by a rock fill dyke located about 27 m west of the existing bridge C/L. On the east side of the reclaimed area, the fill was contained by the existing ground which was generally above el. 76.00. The crest of the rock fill dyke was built to about el. 76.00 and the reclaimed area was filled up to about the same level or slightly higher. The mean lake level at that time was 74.98 m.

Physiography

Physiographically, the strip of land described above is referred to as the Burlington bar and is a typical baymouth bar. According to Coleman (1936a) the Burlington bar was built up by easterly storms which shifted beach material from the south shore to cut off the west end of Lake Ontario and form what is now Hamilton Harbour. The entrance to the harbour used to be nearer the north end of the bar but for safer navigation, the present shipping channel was constructed and the old entrance has since filled up. About 8 km to the west and approximately parallel to the Burlington bar, there is another bar which cuts off Dundas Bay from Hamilton Harbour. This bar is about 35 m above the present water level of Lake Ontario and is believed to have formed in the ancient Lake Iroquois (Coleman 1936b). Following the draining of Lake Iroquois about 10,000 years ago (Karrow 1963), the ancient bar was left on dry land and the water level locally dropped to below the present lake level. Subsequently, the depth of water in Lake Ontario gradually increased about 60.0 m due to a rise in the level of its outlet. The Burlington bar was formed and grew in height as Lake Ontario rose to its present level. The sediments comprising the bar, therefore, are approximately 60 m in

maximum thickness. As described by Karrow (1963), the bar deposits are underlain at the north end by a series of silty clay tills of glacial origin. At the extreme north end of the site bedrock was encountered at approximately elev. 33.0 m. At the south end of the bar, Queenston shale bedrock was encountered 38 m below lake level at approximately elev. 37.0 m.

Existing Bridge - Superstructure

The main 150.87 m span with the two flanking spans is of steel cantilever truss construction with a six panel suspended span. Steel truss spans (eleven on each side of the canal) are used with spans of 76.20 m, 60.96 m and 48.77 m. Near the abutments, where the roadway is close to the ground, the short spans use 0.9144 m rolled steel beams. There are sixteen of these spans on each side of the canal. Nine steel plate girder spans on each side of the canal are used as a transition from truss to rolled beam spans. Because of predicted settlements (60 to 150 mm) continuity was avoided in the longer truss spans. It was felt that the differential settlements between adjoining piers could be tolerated for continuous rolled beam and plate girder spans in the approaches. Provision was made in the design for convenient jacking and shimming. However, in the 23 years the bridge has been in service, neither shimming nor jacking has been necessary since the predicted settlements did not occur.

Existing Bridge - Substructure

The substructure of this bridge consists of 74 piers and two abutments. The individual piers are designated as N1 to N37 commencing from the north side of the canal with increasing numbers to the north, and S1 to S37 commencing from the south side of the canal with increasing numbers to the south. The method of foundation support is as follows:

Unit

Foundation Details

Piers N1 and S1

Founded on cellular type concrete caissons at el. 64.61. These are on steel H piles (12 BP @ 53) driven to el. 49.38. The piles were designed only to prevent uplift of the caisson during construction in the event that a failure of the well point dewatering system occurred. Design pile capacity (against uplift) - 200 kN/pile. Net design pressure - 95.76 kPa.

Piers N2 and S2

Founded on cellular type concrete caissons at el. 71.01.
Net design pressure - 95.76 kPa.

Piers N10 to N29 incl.

Founded on Size 36 untreated timber piles driven about 5.50 m below pile cap bases. Elevations of pile cap bases are 73.38 for N10 to N27 and 72.54 for N28 and N29.
Average design capacity - 160 kN/pile
Maximum design capacity - 200 kN/pile

Piers N3 to N9 incl.
N30 to N37 incl.

Founded on spread footings at el.
71.62 - 73.15

North Abutment

Net design pressure - 95.76 kPa.

Piers S3 to S37 incl.
South Abutment

Founded on spread footings at el.
72.54 - 73.15
Net design pressure - 95.76 kPa

SUBSURFACE CONDITIONS

General

The Record of Borehole Sheets, Appendix, illustrate the conditions at the borehole locations. The locations and elevations of the borings, and estimated stratigraphical profiles based on the borehole data, are shown on Drawings No. 2107900 -A-B-C-D-E.

The investigation area extends from 1313 m north, to 1277 m south of the shipping channel centre-line along the alignment of the proposed structure and its approaches.

The general sequences of materials across the entire site (sequentially from the surface downwards) is indicated in the following table:

MATERIAL	THICKNESS	
	Range	Average
Fill Material	2.4 - 8.5	N/A
Sand to Silty Sand	6.1 - 14.6 m	11.6 m
Silty Sand to Sandy Silt	9.8 - 21.9 m	17.4 m
Sandy Silt to Silt	4.9 - 26.5 m	N/A
Silty Clay	2.6 - 34.0+m	N/A
Shale Bedrock	-	-

Below the surface fill, the material generally grades from sand through silty sand, sandy silt, silt and silty clay to the shale bedrock. The bedrock contours have influenced the depositional patterns, affecting the location and thickness of the material layers.

Groundwater

The groundwater elevation is consistent across the site at 75.0± m, approximately equal to the water level in Hamilton Harbour.

Fill Material

With the exception of an area between approximately Sta. 13+900 and Sta. 14+500, the surface material across the site is fill (which is bounded on the west side by a rockfill dyke with an estimated base width of 6 m, a depth of 3.0±m and 1:1 slopes). The thickness of the fill is generally less than 3.0±m. However, in the area of Sta. 13+600, the fill thickness increases to over 8.5 m, probably at the location of a previous natural channel through the bar. At most locations the fill material is sand to silty sand to gravel. However, between Sta. 13+150 and Sta. 13+800 silty clay fill was encountered at BH No. 3, 4, 5, 6, 11, 12 and 13. The denseness of the non-cohesive fill material ranges from loose to very dense. The consistency of the cohesive fill material ranges from soft to very stiff. At various locations waste concrete and slag were encountered within the fill material. Note also that material from the rockfill dyke (estimated to be boulders of various sizes) exists towards the west edge of the fill material. The physical characteristics of the fill materials vary and are indicated on the Record of Borehole Sheets. Figure 1 illustrates the range in grain size distributions for various fill materials.

Sand to Silty Sand; trace/some/with gravel, trace of clay

This material is at the surface between approximately Sta. 13+900 and Sta. 14+500 and immediately beneath the surface fill across the rest of the site. The material was also encountered beneath the Sandy Silt to Silt layer at BH No.4 (Sta. 13+275), BH No.30 (Sta. 14+965), and BH No.37 (Sta. 15+347). It is predominantly sand, although it becomes finer with depth, grading into silty sand. The gravel content varies across the site. The denseness ranges from loose to very dense. Figure 2 illustrates the typical grain size distribution for this material.

Silty Sand to Sandy Silt; trace of gravel and clay

This material extends across the entire site immediately under the Sand to Silty Sand layer. It is predominantly silty sand, although it becomes finer with depth, grading into sandy silt. A deposit of organic

material (3.1 m in thickness) was encountered within this deposit at BH No.13 (Sta. 13 + 742). The denseness of the material ranges from loose to very dense. Figure 3 illustrates the typical grain size distribution for this material.

Sandy Silt to Silt; trace of clay

This material extends across the entire site immediately under the Silty Sand to Sandy Silt layer. It is predominantly sandy silt, although it becomes finer with depth, grading into silt (and in some cases plastic silt). The denseness ranges from loose to very dense. Figure 4 illustrates the typical grain size distribution for this material.

Silty Clay; trace of gravel and sand (possible glacial till)

This material extends across the entire site immediately under the Sandy Silt to Silt layer and immediately above the bedrock. The shale content increases with depth as the material grades into weathered shale. The consistency of the material also increases with depth ranging from stiff to very hard. The material has low plasticity.

Physical properties of the material, as determined from field and laboratory tests are summarized below.

	Range	Average
Natural Moisture Content (w)	17.4 - 20.9 %	19.3 %
Liquid Limit (W_L)	25.0 - 33.5 %	31.0 %
Plastic Limit (W_p)	13.5 - 16.0 %	15.4 %
Shear Strength		
- unconfined compression	27.6 kPa (1 test)	

Bedrock

There is a bedrock trough centred at approximately Sta. 13+715 where the bedrock elevation is estimated to be -62.0 m. From this trough, the bedrock slopes upward both to the north (to elev. 33.4 at Sta. 13+027) and to the south (to elev. 7.9 at Sta. 14+642 and to elev. 36.4 at Sta.

15+433). This indicates that the overburden thickness ranges from over 138 m at the location of the trough to less than 40 m at the extreme north and south ends of the site. The bedrock is red and green shale with occasional layers of shaly, silty limestone. It is overlain by transitional zones grading from silty clay with shaly layers to weathered shale. Refer to the Record of Borehole Sheets for specific bedrock elevations.

RECOMMENDATIONS

General

It is proposed to construct a new high level bridge at this site on the west side of the existing Burlington Skyway with about 6 m clearance between the two decks. The highest profile grade of the proposed new structure will be elev. 117.899 m, 1.284 m above that of the existing structure and the total width will be 21.15 m. The proposed bridge will carry five lanes of the Q. E. W. which, when all construction is complete, will become the southbound lanes. The existing bridge extends from Sta. 13+056 to Sta. 15+616 for a total length of 2560 m. However, for the proposed new bridge, it is intended to build longer approach embankments than for the existing one, thus reducing the length of bridge that will be required. It will be necessary to contain these embankments on the side adjacent to the existing bridge by means of a retaining wall.

Foundations

A variety of methods of foundation support for the new structure are possible. It will be necessary to carry out cost estimates for the various methods in order to determine which is the most economical. The most economical method should be adopted.

Following are the methods which we consider to be technically feasible for the new bridge foundations:

1. Spread Footings:

All piers and abutments except the piers carrying the main central span may be supported on spread footings founded at or below elev. 73.00. A net safe pressure of 150 kPa may be assumed for design purposes. A friction coefficient of 0.5 may be assumed to apply between the foundation soil and the footing base. A dewatering scheme will be necessary to prevent 'boiling' of the non-cohesive foundation soil. The footing base may be raised to elev. 74 and the net safe pressure of the soil increased to 300 kPa by using the technique of compacting by deep vibrators. In this case, the area to be treated should be 1.5 x footing width, and the depth to be treated also 1.5 x footing width. The area densified by one probe is 4.0 m² and the estimated compaction cost per linear metre is about \$16.00. If this compaction method is to be adopted, full scale field testing will be required, and during construction, strict control by geotechnical engineers will be necessary. Vibration probes should not operate within 8 m of an existing structure. For purposes of the O.H.B.D.C. the following is applicable:

Footings at elev. 73 (Without Compaction)

Factored bearing capacity at U. L. S.	900 kPa
Bearing capacity at S. L. S. Type II	150 kPa

Footings at elev. 74 (With Deep Compaction)

Factored bearing capacity at U. L. S.	1300 kPa
Bearing capacity at S. L. S. Type II	300 kPa

Material from the rockfill dyke will probably be encountered in portions of all the footing excavations. If the rockfill is encountered under only a portion of the footing excavation, the rockfill in this portion should be removed for a depth of 0.6 m and replaced with compacted granular material.

2. Displacement Caisson Piles (Franki)

Over the entire alignment of the proposed new bridge, the upper 15 m of subsoil is ideally suitable for the installation of displacement caisson piles. These piles, therefore, would be suitable to support all piers and abutments except for the piers supporting the central span which would require to obtain their support from soil below the channel bed (elev. 64.75). The standard Franki type pile has a shaft diameter of 0.508 m and is designed to carry about 1.00 MN. It is estimated that this capacity would be achieved by forming the pile bases at approximate elev. 67 thus requiring a shaft length of about 6 m. The minimum recommended spacing between the piles is 1.372 m. For purposes of the new O.H.B.D.C., the following is applicable.

Factored capacity at U. L. S.	1.80 MN per pile
Capacity at S. L. S. Type II	1.00 MN per pile

If these piles are to be used, it would be advantageous to carry out loading tests prior to construction.

3. Timber Piles

Size 36 timber piles were used extensively in the existing structure. A pile load test carried out in advance of the bridge construction showed the ultimate capacity of the test pile to be in excess of 700 kN. A design load of 160 kN per pile was used for the structure. It is our recommendation that for the new structure Size 36 timber piles be considered as being suitable for all piers and abutments other than the piers supporting the main spans. A design load of 350 kN per pile should be achieved by driving to approximate elev. 64. Piles must be treated to prevent decay unless they are completely below the present and future groundwater level. For purposes of the new O.H.B.D.C. the following is applicable:

Factored capacity at U. L. S.	420 kN per pile
Capacity at S. L. S. Type II	350 kN per pile

4. Steel H Piles - End Bearing

Between Stas. 14+642 and 15+433 the depth to bedrock ranges from 68 m to 37 m and it is recommended that consideration be given to the use of end bearing steel H piles fitted with reinforced tips and driven to bedrock as a means of foundation support for the piers and abutment to be built between the above-mentioned stations. Depths to bedrock may be obtained by interpolation from the data on Drawings 2107900 D-E. Between Sta. 13+275 and Sta. 14+642 the bedrock is deeper than 68 m. For HP 310x110 Sections, a design capacity of 1150 kN per pile is recommended. For purposes of the O.H.B.D.C. the following is applicable:

Factored capacity at U. L. S.	1600 kN per pile
Capacity at S. L. S. Type II	1150 kN per pile

For H sections of different size, the various factored and other capacities may be assumed to be directly proportional to the cross sectional areas of the piles and may be computed accordingly.

5. Steel H Piles - Friction Piles

For all abutment and pier locations north of Sta. 14+642, the use of steel H piles driven into the compact to very dense silty sand to sandy silt to silt overburden should be considered. Such piles would derive most of their supporting capacity from skin friction. Based on our experience of load tests performed on H piles driven into non-cohesive deposits such as at Beach River Bridge near Minden, Ontario, we estimate that a design capacity of about 700 kN per pile can be achieved for HP 310x79 sections driven about 40 m below elev. 72. For purposes of the O.H.B.D.C., the following is applicable for HP 310x79 sections driven 40 m below elev. 72:

Factored capacity at U. L. S.	900 kN per pile
Capacity at S. L. S. Type II	700 kN per pile

Larger capacities up to about 1.0 MN could probably be achieved by driving the piles to a deeper level. It is estimated that a design capacity of about 1.0 MN per pile can be achieved for HP 310x79 sections driven about 60 m below elev. 72. For the purposes of the O.H.B.D.C.,

the following values are estimated for HP 310x79 sections driven 60 m below elev. 72:

Factored capacity at U. L. S.	1350 kN per pile
Capacity at S. L. S. Type II	1000 kN per pile

Uplift Geotechnical Capacity of Piles

The uplift geotechnical capacity of piles may be assumed to the 25% of the values recommended for axial loading.

Lateral Geotechnical Capacity of Piles

The lateral geotechnical capacity of piles should be computed in accordance with the requirements of the O.H.B.D.C. For this purpose it may be assumed that the coefficient of passive earth pressure resistance is equal to 3.0 for the foundation soil in the zone extending 3 metres below the pile caps. This is derived assuming an angle of internal friction $\phi = 30^\circ$.

Pile Testing

Note that all design loads recommended for the various pile foundation alternatives are estimates and that it is our intention to carry out pile loading tests in the field at actual locations where these piles will be used. The purpose of the pile testing will be to determine the required pile lengths and appropriate pile sections required to achieve the recommended design loadings.

Pile Driving

For Franki type displacement caissons of design capacity 1.0 MN, it should be specified on the drawings that during the forming of the pile bases, expelling of concrete must continue until a minimum of 20 blows from a hammer delivering an energy of 190,000 J per blow is required to expel the final 0.14 m³. Pile driving of timber piles and steel H piles, which are not required to be driven to bedrock, should be controlled in the field by means of M.T.C. Standards SS 103-10 and SS 103-11.

The rockfill dyke which was constructed in 1955 to contain the hydraulic fill material will probably be encountered in all of the footing excavations. The lowest level of the rockfill material will be about elev. 71. Thus if pile cap bases are designed above elev. 71, piles may encounter the rock material during driving. In this event, the rockfill material should be removed from the area where piles are to be driven and replaced with suitable non-cohesive fill material. A suitable Special Provision, warning of the existence of this material, should be included in the contract and provisions should be made for the removal of the rockfill material to be included in the price for driving the piles.

Retaining Walls

On the north and south approaches to the structure, it is intended to construct embankments contained on the side adjacent to the existing bridge by suitable retaining walls, where it can be shown to be less costly than bridging. For this purpose, we would recommend the use of reinforced earth walls as designed by the Reinforced Earth Co. Ltd. For costing purposes, we would suggest a figure of \$470 per square metre which includes the cost of granular backfill to a width of 0.7 H behind the wall where H is the wall height. For all concrete retaining walls (i.e. other than the reinforced earth retaining walls) earth pressures should be computed as per Subsection 6.6.1.2.2 of the O.H.B.D.C. assuming a non-yielding foundation condition with $K_0 = 0.5$.

Backfill

Compacted Granular 'A' should be placed for a minimum width of 1.0 m behind the north and south abutments and the reinforced earth retaining walls. The rest of the required material should be compacted Granular 'C'. The following properties for the granular materials can be assumed for design purposes:

<u>Material</u>	Unit Weight γ	Angle of Internal Friction ϕ
Granular 'A'	22.78 kN/m ³	35°
Granular 'C'	21.21 kN/m ³	35°

Frost Protection

All pile caps and footings, including those for the front faces of reinforced earth walls, should have a minimum earth cover of 1.3 m in order to provide suitable protection against frost action.

Embankment Erosion Protection

The west slope of the structure approach embankments will be adjacent to Hamilton Harbour and in consequence will require some form of protection against erosion by wave action.

Unwatering

At the time of the subsurface investigation, the groundwater was found at elev. 75+ m. A de-watering scheme will be required if footings or pile caps are constructed below the prevailing groundwater level at the time of construction. This scheme should be designed to prevent any boiling or disturbance of the foundation soil. Note that non-cohesive soil is highly susceptible to conditions of unbalanced hydrostatic heads. It is our recommendation that an item - 'Unwatering Structure Excavations' should be included, together with a Special Provision which describes the soil and groundwater conditions and the effects of unbalanced hydrostatic heads on the foundation soil.

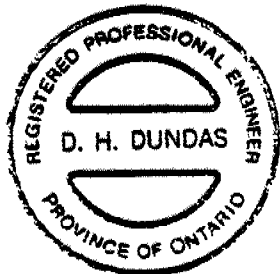
Settlement

Regardless of the type of foundation support, the structure should be designed to accommodate differential settlements. For design purposes, it should be assumed that a maximum total settlement of 30 mm, and a maximum differential settlement of 15 to 20 mm, will occur under the loading conditions recommended for the various foundation alternatives.

MISCELLANEOUS

The field work for this project was carried out under the supervision of Mr. D. H. Dundas, Project Foundations Engineer, and Mr. P. Goodman (student field technician). The report was written by Mr. K. G. Selby, Senior Foundations Engineer and Mr. D. H. Dundas, and reviewed by Mr. K. G. Selby.

The equipment used was owned and operated by Atcost Soil Drilling Inc., Master Soil Investigation Ltd., and Eastern Soil Investigations Ltd.



D. H. Dundas
D. H. Dundas, P. Eng.
Project Foundations Engineer

K. G. Selby
K. G. Selby, P. Eng.
Senior Foundations Engineer



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RECORD OF BOREHOLE No 1 METRIC

W P 210-79-00 LOCATION Sta. 13 + 027 32+Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 12 - 17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
76.2	Ground Level										
0.0	Sand to Silty Sand with Gravel Some Clay and Organics Very Dense		1	SS	61						
73.8	(Fill Material)										
2.4	Sand to Silty Sand Trace of Gravel and Clay Very Loose to Loose		2	SS	6						0 74 (26)
			3	SS	2						0 55 (45)
70.7	Organic Material (OB)										
5.5	Soft		4	SS	3						
69.2											
7.0			5	SS	11						0 94 (6)
			6	SS	37						
	Sand to Silty Sand Trace of Gravel and Clay Compact to Dense		7	SS	20						1 85 (14)
			8	SS	25						
63.1											
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		9	SS	23						
			10	SS	13						
			11	SS	30						
			12	SS	13						
			13	SS	23						
			14	SS	44						
45.7	Cont'd										

30.5

3, x 5 Numbers refer to Sensitivity

15 20 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 1 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 027 32m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 12-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.7	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	63												0 63 29 8
	Sand to Silty Sand		16	SS	44												
41.1																	
35.1	Sandy Silt to Silt Some Gravel Trace of Clay Very Dense		17	SS	136												
			18	SS	107												17 35 40 8
36.0																	
40.2	Silty Clay (CL) Trace of Gravel and Sand Hard																
33.4			19	SS	100/12												
42.8	Probable Bedrock (Weathered) End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 2

METRIC

W P 210-79-00 LOCATION Sta. 13 + 115 25mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY U.S.
DATUM Geodetic DATE 81 06 12-16 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	15 30 45					
76.3	Ground Level													GR SA SI CL
0.0	Gravel Some Sand Trace of Silt and Clay Loose (Fill Material) — — Some Silt and Clay		1	SS	5		76							80 15 (5)
72.3			2	SS	10		74							
4.0	Some Organics Sand to Silty Sand Trace of Gravel and Clay, Loose to Very Dense With Gravel — — Some Gravel — — Some Gravel		3	SS	5		72							
			4	SS	14		70							
			5	SS	79		68							31 33 14 2
			6	SS	89		66							
			7	SS	21		64							
			8	SS	36		62							10 65 19 6
			9	SS	50		60							
			10	SS	64		58							
59.5							56							
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		11	SS	25		54							2 54 38 6
			12	SS	33		52							
			13	SS	24		50							
			14	SS	60		48							0 63 32 5
45.4			15	SS	62									

30.9 End of Borehole

3, x²: Numbers refer to
Sensitivity

15 5 (% STRAIN AT FAILURE
10



Ministry of
Transportation and
Communications
Ontario

RECORD OF BOREHOLE No 3

METRIC

W P 210-79-00

LOCATION Sta. 13 + 184 30mRt.

ORIGINATED BY D.D.

DIST 4 HWY Q.E.W.

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY O.J.

DATUM Geodetic

DATE 81 06 12-15

CHECKED BY D.D.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
77.3	Ground Level											
0.0	Silty Clay (CL) Some Gravel and Sand Firm to Stiff (Fill Material)		1	SS	8							
74.9	Sand to Silty Sand Trace of Gravel and Clay, Loose to Dense Some Gravel		2	SS	5							1 86 (13)
2.4			3	SS	5							15 59 22 4
			4	SS	2							0 97 (3)
			5	SS	10							
			6	SS	8							
			7	SS	32							8 79 (13)
			8	SS	31							1 87 (12)
64.2	Silty Sand to Sandy Silt Trace of Clay Loose to Compact		9	SS	20							
13.1			10	SS	24							
			11	SS	16							
			12	SS	19							
			13	SS	7							
			14	SS	13							0 56 39 5
46.4			15	SS	26							
30.9	End of Borehole											

Numbers refer to
Sensitivity

15 20 5 (%) STRAIN AT FAILURE
10



Ministry of
Transportation and
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Ontario

RECORD OF BOREHOLE No 4 METRIC

W P 210-79-00 LOCATION Sta. 13 + 275 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
77.0	Ground Level												
0.0	Silty Clay (CL) with Sand, Some Gravel Firm to Stiff (Fill Material)		1	SS	5		76						5 27 54 14
73.6			2	SS	13		74						37 31 26 6
3.4			3	SS	5		72						19 67 (14)
	Some Gravel		4	SS	11		70						
	Sand to Silty Sand Trace of Gravel and Clay Loose to Dense		5	SS	11		68						8 88 (4)
			6	SS	14		66						
			7	SS	35		64						4 87 (9)
	Trace of Organics		8	SS	15								
63.9			9	SS	28		62						
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		10	SS	14		60						
			11	SS	24		58						
			12	SS	23		56						0 25 73 2
			13	SS	24		54						
			14	SS	30		52						
							50						0 25 68 7
							48						
46.5	Cont'd												

30.5

+3, x5 : Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



Ministry of
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Communications
Ontario

RECORD OF BOREHOLE No 4 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 275 20+Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY C.J.
DATUM Cedotic DATE 81 06 16-17 CHECKED BY n.n.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH • UNCONFINED • FIELD VANE • QUICK TRIAXIAL • LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 20 45	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA S CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	W VALUES						
46.5	Cont'd										
30.5	Silty Sand to Sandy Silt Compact to Very Dense		15	SS	25		46				
							44				
			16	SS	23						0 71 23 6
42.0							42				
35.0	Sandy Silt to Silt Trace of Clay Dense to Very Dense		17	SS	39		40				
							38				
			18	SS	50						0 3 96 1
35.9							36				
41.1	Sand to Silty Sand Trace of Clay Compact to Very Dense		19	SS	26		34				
							32				
30.8			20	SS	74						0 72 24 4
46.2	End of Borehole						30				

+3, +5 : Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 5 METRIC

W P 210-79-00 LOCATION Sta. 13 + 311 20^mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 17-18 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
77.0	Ground Level															
	Silty Clay (CL) With Sand, Some Gravel Very Stiff (Fill Material)		1	SS	24											
73.0			2	SS	26											7 39 40 14
4.0	Trace of Gravel		3	SS	40											5 54 36 5
	Sand to Silty Sand Some Gravel Trace of Clay Loose to Very Dense		4	SS	7											
			5	SS	15											20 70 (10)
			6	SS	40											
			7	SS	48											14 72 (14)
			8	SS	71											
	With Gravel		9	SS	59											
	Trace of Gravel		10	SS	46											
60.2																
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	21											
			12	SS	19											
			13	SS	30											
			14	SS	33											
16.1			15	SS	30											
30.9	End of Borehole															

+3, x5: Numbers refer to
Sensitivity 15 20
5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 6 METRIC

W P 210-79-00 LOCATION Sta. 13 + 356 18-Mt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 16-19 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
77.2	Ground Level									15	30	45		GR SA SI CL
0.0	Silty Clay (CL) with Sand, Some Gravel													
	Soft to Firm													
74.8	(Fill Material)		1	SS	4									
2.4			2	SS	35									35 51 (14)
	and Sand		3	SS	80									57 35 (8)
	Gravel with Sand Trace of Silt and Clay		4	SS	33									
70.2	Dense to Very Dense (Probable Fill Mater.)		5	SS	24									91 61 7 1
7.0			6	SS	43									
	With Gravel		7	SS	85									1 95 (4)
	Sand to Silty Sand Trace of Gravel and Clay		8	SS	64									
	Compact to Very Dense		9	SS	30									
			10	SS	18									
60.4														
16.8	Silty Sand to Sandy Silt													
	Trace of Clay		11	SS	18									
	Compact to Very Dense													
			12	SS	30									
			13	SS	48									
			14	SS	26									
46.3			15	SS	51									

30.9 End of Borehole

+3, x3: Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10



Ministry of
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RECORD OF BOREHOLE No 7 METRIC

W P 210-79-00 LOCATION Sta. 13 + 403 18mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 19-22 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER								
77.4	Ground Level										
0.0	Gravel with Sand										
	Trace of Silt and Clay		1	SS	28						
	Loose to Compact (Fill Material)		2	SS	8						53 39 (8)
73.4											
4.0	Some Organics, Loose		3	SS	5						0 84 (16)
	Sand to Silty Sand		4	SS	21						0 91 (9)
	Trace of Gravel and Clay		5	SS	19						
	Compact to Very Dense		6	SS	20						
	Some Organics		7	SS	29						4 92 (4)
			8	SS	32						1 90 (9)
			9	SS	54						
			10	SS	29						
60.6											
16.8	Silty Sand to Sandy Silt										
	Trace of Gravel and Clay		11	SS	25						
	Compact to Very Dense		12	SS	35						
			13	SS	12						
			14	SS	58						
48.4											
29.0	Sandy Silt to Silt										
	Trace of Clay										
46.5	Very Dense		15	SS	55						
30.9	End of Borehole										

+3, x5: Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



Ministry of
Transportation and
Communications
Ontario

RECORD OF BOREHOLE No 8 METRIC

W P 210-79-00 LOCATION Sta. 13 + 454 17_m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 22-23 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
76.7	Ground Level													
0.0	Gravel													
	Some Sand, Silt and Clay		1	SS	36									
74.3	Dense (Fill Material)													
2.4	Trace of Organics		2	SS	8									
	Sand to Silty Sand		3	SS	21									
	Trace of Gravel and Clay		4	SS	21									
	Loose to Very Dense		5	SS	31									
	Some Gravel		6	SS	48									
			7	SS	83									
	with Gravel		8	SS	63									
			9	SS	32									
			10	SS	24									
59.9														
16.8	Silty Sand to Sandy Silt													
	Trace of Gravel and Clay		11	SS	11									
	Compact to Dense													
			12	SS	20									
			13	SS	31									
			14	SS	36									
45.8			15	SS	28									

30.9 End of Borehole

+3, x5: Numbers refer to
Sensitivity

15 ÷ 5 (%) STRAIN AT FAILURE
10



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Ontario

RECORD OF BOREHOLE No 9 METRIC

W P 210-79-00 LOCATION Sta. 13 + 503 16^mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23-24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.8	Ground Level												
0.0	Gravel												
	Some Sand, Silt and Clay		1	SS	54								
	Dense to Very Dense		2	SS	44								
	(Fill Material)		3	SS	50								
71.3													
5.5			4	SS	24								
			5	SS	12								
			6	SS	48								
	Some Gravel		7	SS	28								
			8	SS	37								
	Sand to Silty Sand		9	SS	72								
	Trace of Gravel and Clay		10	SS	29								
	Compact to Very Dense												
60.0													
16.8	Silty Sand to Sandy Silt		11	SS	34								
	Trace of Gravel and Clay												
	Compact to Very Dense		12	SS	19								
			13	SS	31								
			14	SS	57								
47.8													
29.0	Sandy Silt to Silt												
	Trace of Clay												
45.9	Dense		15	SS	40								

30.9 End of Borehole

+3, x5 : Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 10 METRIC

W P 210-79-00 LOCATION Sta. 13 + 552 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 17-18 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
76.8	Ground Level													
0.0	Gravel													
	Some Sand, Silt and Clay		1	SS	25									
	Loose to Compact (Fill Material)		2	SS	4									
			3	SS	19									
			4	SS	21									
			5	SS	16									
68.3			6	SS	36									
8.5	with Gravel		7	SS	37									
	Sand to Silty Sand		8	SS	51									
	Trace of Gravel and Clay		9	SS	38									
	Dense to Very Dense		10	SS	23									
62.2			11	SS	17									
14.6	Silty Sand to Sandy Silt		12	SS	17									
	Trace of Gravel and Clay		13	SS	19									
	Compact		14	SS	12									
47.8														
29.0	Sandy Silt to Silt													
	Trace of Clay													
46.3	Compact to Very Dense													

30.5 Cont'd

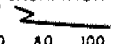
+3, x5; Numbers refer to Sensitivity 15 ± 5 (%) STRAIN AT FAILURE 10




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Ontario

RECORD OF BOREHOLE No 10 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 552 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 17-18 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60					
46.3	Cont'd		15	SS	45		46								
30.5	Sandy Silt to Silt Trace of Clay Compact to Very Dense						44								
			16	SS	24		42								
			17	SS	35		40								
			18	SS	51		38								
			19	SS	45		36								
							34								
							32								
30.6			20	SS	32										
46.2	End of Borehole														

*³, x⁵: Numbers refer to
Sensitivity 15  5 (%) STRAIN AT FAILURE
10



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Ontario

RECORD OF BOREHOLE No 11 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 617 14th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 19-22 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
46.1	Cont'd												
30.5	Silty Sand to Sandy Silt		15	SS	19		46						
44.6													
32.0	Sandy Silt to Silt						44						
	Trace of Clay												
	Compact to Dense		16	SS	36		42						
			17	SS	28		40						
			18	SS	43		38						
			19	SS	72		36						
							34						
							32						
30.4													
46.2	End of Borehole		20	SS	39		30						

+3, x5: Numbers refer to 20
Sensitivity 15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 12 METRIC

W P 210-79-00 LOCATION Sta. 13 + 680 14_mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 23-25 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
76.4	Ground Level													
0.0	Silty Clay (CL) Some Gravel and Sand Very Stiff (Fill Material)		1	SS	29									
74.0			2	SS	3									
2.4	Some Organics Very Loose		3	SS	20									
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		4	SS	21									
	Some Gravel		5	SS	21									
			6	SS	46									
			7	SS	98									
			8	SS	58									
			9	SS	59									
61.8			10	SS	41									
14.6	Sandy Silt to Silty Sand Trace of Gravel and Clay Compact to Very Dense		11	SS	23									
			12	SS	35									
			13	SS	43									
			14	SS	66									
45.9	Cont'd													

30.5

+3, x5: Numbers refer to
Sensitivity

15 20
5 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 12 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 680 14-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23-25 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
45.9	Cont'd		15	SS	28								
30.5	Sandy Silt to Silty Sand												
44.4													
32.0	Sandy Silt to Silt												
	Trace of Clay												
	Compact to Dense		16	SS	15								
			17	SS	38								
			18	SS	69								
33.3			19	SS	86								
43.1	End of Borehole												

+³, x⁵: Numbers refer to
Sensitivity
15 20
5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 13 METRIC

W P 210-79-00 LOCATION Sta. 13 + 742 14th Rte. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80	100	SHEAR STRENGTH			WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
76.6	Ground Level																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

+3, x5 : Numbers refer to 15 20
Sensitivity 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 13 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 742 14m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.1	Cont'd																
30.5	Sandy Silt to Silt		15	SS	25												
			16	SS	14												
			17	SS	28												
	Compact to Dense		18	SS	30												
			19	SS	45												
30.4			20	SS	41												
46.2	End of Borehole																

+3, x5: Numbers refer to 15-20
Sensitivity 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 14 METRIC

W P 210-79-00 LOCATION Sta. 13 + 809 17^mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 24-25 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
76.6	Ground Level													
0.0	Gravel Some Sand, Silt and Clay Trace of Organics													
74.2	Compact (Fill Material)		1	SS	20									
2.4	Sand to Silty Sand													
	Trace of Gravel and Clay		2	SS	19									
	Compact to Very Dense		3	SS	19									
			4	SS	40									
			5	SS	38									
			6	SS	45									
			7	SS	45									
			8	SS	44									
63.5														
13.1	Silty Sand to Sandy Silt		9	SS	49									
	Trace of Gravel and Clay		10	SS	29									
	Compact to Dense													
			11	SS	22									
			12	SS	24									
			13	SS	30									
			14	SS	31									
46.1	Cont'd													

30.5

+3, x5: Numbers refer to
Sensitivity

15 20
5 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 14 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 809 17m Rt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 24-25 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	VALUES		20	40	60	80	100					
46.1	Cont'd															
30.5	Silty Sand to Sandy Silt		15	SS	23											
44.6																
32.0	Sandy Silt to Silt															
	Trace of Clay															
	Compact to Dense		16	SS	20											
			17	SS	23											
			18	SS	40											
	Slight Plasticity															
			19	SS	16											
30.4			20	SS	42											
46.2	End of Borehole															

+3, x5 Numbers refer to 15 \pm 5 (%) STRAIN AT FAILURE
Sensitivity 10

RECORD OF BOREHOLE No 15 METRIC

W P 210-79-00 LOCATION Sta. 13 + 875 16th Rd. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 26-29 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100					
76.7	Ground Level												
0.0	Gravel Some Sand, Silt and Clay Trace of Organics Compact (Fill Material)		1	SS	27								
74.3			2	SS	10								0 95 (5)
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		3	SS	27								1 93 (6)
			4	SS	47								
			5	SS	52								0 86 (14)
			6	SS	59								
			7	SS	61								1 88 (11)
			8	SS	46								1 89 (10)
63.6			9	SS	44								
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		10	SS	25								
	Loose to Compact		11	SS	15								
			12	SS	30								
			13	SS	31								
			14	SS	32								
46.2	Cont'd												

30.5

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



Ministry of
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RECORD OF BOREHOLE No 15 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 875 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 26-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100					
46.2	Cont'd		15	SS	35												
30.5	Silty Sand to Sandy Silt																
44.7																	
32.0	Sandy Silt to Silt																
	Trace of Clay																
	Compact		16	SS	17												
			17	SS	17												
			18	SS	13												
	Slight Plasticity		19	SS	15												
30.5			20	SS	27												
46.2	End of Borehole																

+3, x5 : Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 16 METRIC

W P 210-79-00 LOCATION Sta. 13 + 935 17m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 29-30 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
75.6	Ground Level										
0.0	Gravel Some Sand, Silt & Clay Trace of Organics Compact (Fill Material)		1	SS	28		76				
74.2			2	SS	9		74				
2.4	some organics loose		3	SS	24		72				
	Sand to Silty Sand Trace of Gravel & Clay Compact to very dense		4	SS	32		70				
	some Gravel		5	SS	37		68				
			6	SS	40		66				
			7	SS	82		64				
			8	SS	35		62				
63.5			9	SS	53		60				
13.1	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to very dense		10	SS	23		58				
			11	SS	20		56				
			12	SS	33		54				
			13	SS	26		52				
			14	SS	31		50				
							48				
46.1	Cont'd										

30.5

+3, x5: Numbers refer to
Sensitivity 15 → 5 (%) STRAIN AT FAILURE
10



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Communications
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RECORD OF BOREHOLE No 16 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 935 17^m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 29-30 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.1	Cont'd		15	SS	23		46										
30.5	Silty Sand to Sandy Silt																
44.3																	
32.3	Sandy Silt to Silt Trace of Clay Compact to dense		16	SS	18		44										
							42										
			17	SS	20		40										
							38										
			18	SS	22		36										
							34										
			19	SS	19		32										
30.4																	
46.2	End of Borehole		20	SS	36		30										

+3, x5: Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 17 METRIC

W P 210-79-00 LOCATION Sta. 13 + 999 16mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 30 - 07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N. VALUES			20	40	60	80	100					
76.5	Ground Level																
0.0	Sand to Silty Sand Trace of Gravel & Clay		1	SS	6		76										
			2	SS	6		74										0 87 (13)
	Trace of Organics Loose		3	SS	19		72										2 95 (3)
	Compact to Very Dense		4	SS	43		70										
			5	SS	28		68										0 91 (9)
			6	SS	35		66										
			7	SS	55		64										0 87 (13)
			8	SS	65		62										1 80 (19)
63.4	Silty Sand to Sandy Silt		9	SS	63		60										
13.1	Trace of Gravel and Clay		10	SS	24		58										
	Compact to Very Dense		11	SS	9		56										
	Loose		12	SS	30		54										
			13	SS	29		52										
			14	SS	29		50										
							48										
66.0	Cont'd																

30.5

+3, x 5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 17 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 999 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 30-07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.0	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	19												
44.5																	
32.0	Sandy Silt to Silt																
	Trace of Clay																
	Compact to Dense		16	SS	15												
			17	SS	22												
			18	SS	21												
	Slight Plasticity		19	SS	31												
30.3			20	SS	21												
46.2	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

15 - 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 18 METRIC

W P 210-79-00 LOCATION Sta. 14 + 064 18 Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 07 02-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.4	Ground Level												
0.0													
	Some Gravel		1	SS	17								
	Sand to Silty Sand Trace of Gravel & Clay, Compact to very dense		2	SS	10								
	Some Gravel		3	SS	21								
			4	SS	35								
			5	SS	50								
			6	SS	47								
			7	SS	35								
			8	SS	35								
63.3													
13.1	Silty Sand to Sandy Silt		9	SS	30								
	Trace of Gravel and Clay		10	SS	27								
	Compact to Dense												
			11	SS	16								
			12	SS	22								
			13	SS	30								
			14	SS	28								
45.9													

30.5

+3, x⁵ : Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



W P 210-79-00 LOCATION Sta. 14 + 064 18m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 07 02-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	'UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
45.9	Cont'd													
30.5	Silty Sand to Sandy Silt		15	SS	33									
44.4														
32.0	Sandy Silt to Silt Trace of Clay Compact to dense						44							
			16	SS	22		42							
							40							
			17	SS	20		38							
							36							
			18	SS	38		34							
							32							
			19	SS	10									
30.2			20	SS	20									
46.2	End of Borehole						30							

+3, x5; Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 19 METRIC

W P 210-79-00 LOCATION Sta. 14 + 126 18th Rt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 07 07-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
76.7	Ground Level											
0.0												
	Some Gravel		1	SS	18							
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		2	SS	14							1 93 (6)
			3	SS	21							5 87 (8)
	Some Gravel		4	SS	40							
			5	SS	56							2 80 (18)
			6	SS	62							
			7	SS	60							0 86 (14)
63.6			8	SS	56							
13.1	Silty Sand to Sandy Silt		9	SS	47							
	Trace of Gravel and Clay		10	SS	34							
	Compact to Dense		11	SS	25							
			12	SS	23							
			13	SS	21							
			14	SS	33							
46.2	Cont'd											

30.5

+3, x5 : Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 19 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 126 18mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 07 07-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED * FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
46.2	Cont'd						46							
30.5	Silty Sand to Sandy Silt		15	SS	24									
44.7														
32.0	Sandy Silt to Silt Trace of Clay Compact to Dense		16	SS	27		44							
							42							
			17	SS	30		40							
							38							
			18	SS	37		36							
							34							
			19	SS	45		32							
30.5			20	SS	17									
46.2	End of Borehole						30							

+3, *5: Numbers refer to
Sensitivity

20
15 ± 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 20 METRIC

W P 210-79-00 LOCATION Sta. 14 + 187 18_{th} Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 30-07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.7	Ground Level												
0.0	Sand to Silty Sand												
	Trace of Gravel and Clay												
	Compact to Very Dense		1	SS	21								
			2	SS	14								
			3	SS	15								
			4	SS	27								
			5	SS	59								
			6	SS	37								
			7	SS	84								
			8	SS	66								
63.6			9	SS	41								
13.1	Silty Sand to Sandy Silt		10	SS	26								
	Trace of Gravel and Clay		11	SS	24								
	Compact to Very Dense		12	SS	14								
			13	SS	22								
			14	SS	22								
			15	SS	22								
			16	SS	19								
			17	SS	42								
			18	SS	54								
			19	SS	46								
46.2	Cont'd												

30.5

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 20 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 187 18mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY Q.J.
DATUM Geodetic DATE 81 06 30-07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
46.2	Cont'd											
30.5	Silty Sand to Sandy		20	SS	24		40					
45.3	Silt											
31.4	Sandy Silt to Silt		21	SS	36		44					
	Trace of Clay		22	SS	20		42					
	Compact to Very Dense		23	SS	27		40					
			24	SS	57		38					
			25	SS	22		36					
			26	SS	50		34					
			27	SS	50		32					
			28	SS	52							
			29	SS	39							
30.5			30	SS	36							
46.2	End of Borehole						30					

+3, x5 : Numbers refer to
Sensitivity
15 20
5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 21 METRIC

W P 210-79-00 LOCATION Sta. 14 + 266 19.Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 25-26 and 81 07 02-06 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH						WATER CONTENT (%)
76.5	Ground Level													GR SA SI CL	
0.0	Some Gravel Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		1	SS	35		76								14 76 (10)
			2	SS	17		74								3 89 (8)
			3	SS	27		72								2 92 (6)
			4	SS	62		70								7 80 (13)
			5	SS	94		68								
			6	SS	77		66								
			7	SS	137		64								17 74 (9)
			8	SS	83		62								4 67 23 6
			9	SS	44		60								5 81 (14)
61.9	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		10	SS	47		58								
14.6			11	SS	31		56								
			12	SS	28		54								0 42 (58)
			13	SS	43		52								0 53 42 5
			14	SS	35		50								0 28 66 6
			15	SS	44		48								0 28 (72)
			16	SS	30										
			17	SS	42										
			18	SS	36										
			19	SS	34										
46.0	Cont'd														

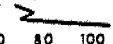
+3, x5: Numbers refer to Sensitivity 15 20 5 (%) STRAIN AT FAILURE 10



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RECORD OF BOREHOLE No 21 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 266 19-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 25-26 and 81 07 02-06 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100		
46.0	Cont'd												
30.5	Silty Sand to Sandy Silt		20	SS	75								
43.6			21	SS	58								
32.9	Sandy Silt to Silt												
	Trace of Clay		22	SS	42								0 16 (84)
	Compact to Very Dense		23	SS	29								
			24	SS	39								
			25	SS	74								0 9 82 9
			26	SS	75								
			27	SS	50								
			28	SS	34								0 2 89 9
			29	SS	44								
			30	SS	22								
			31	SS	13								
18.6													
57.9	Silty Clay (CL)												
	Trace of Gravel and Sand												
	Very Stiff to Hard												
15.5	Cont'd												
61.0													

*3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 21 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 266 19mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 25-26 and 81 07 02-06 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
15.5	Cont'd											
61.0			32	SS	28		14		15 30 45		3 12 49 36	
	Silty Clay						12					
	Trace of Gravel and Sand						10					
			33	SS	59		8					
							6					
	Very Stiff to Hard						4					
			34	SS	45		2				0 3 50 47	
							0					
			35	SS	51		-2					
							-4					
							-6					
							-8					
			36	SS	61		-10				0 4 53 43	
							-12					
							-14					
-15.4			37	SS	80							

91.9 End of Borehole

+3, x5: Numbers refer to
Sensitivity

15 20 30 40 50 60 70 80 90 100
10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 22 METRIC

W P 210-79-00 LOCATION Sta. 14 + 434 20mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 22-25 and 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIMIT MOISTURE LIMIT		UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE			20 40 60 80 100		W _p W W _L			
76.3	Ground Level										GR SA SI CL
0.0	Sand to Silty Sand										
	Trace of Gravel and Clay	1	SS	11							1 92 (8)
	Loose to Very Dense	2	SS	9							
		3	SS	22							0 87 (13)
		4	SS	53							
		5	SS	40							6 83 (11)
		7	SS	54							3 80 (17)
		8	SS	41							
		9	SS	33							
61.7		10	SS	40							
14.6	Silty Sand to Sandy Silt	11	SS	23							
	Trace of Gravel and Clay	12	SS	24							
	Compact to Dense	13	SS	24							
		14	SS	32							
		15	SS	26							
		16	SS	24							
		17	SS	21							
		18	SS	19							
		19	SS	17							
45.8	Cont'd										
30.5											

+3, x5: Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 22 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 434 20m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 22-25 and 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
45.8	Cont'd												
30.5	Silty Sand to Sandy		20	SS	34								
44.9	Silt												
31.4	Sandy Silt to Silt												
	Trace of Clay		21	SS	25		44						
	Loose to Very Dense		22	SS	41		42						
			23	SS	33		40						
			24	SS	37		38						
			25	SS	31		36						
			26	SS	42		34						
			27	SS	56		32						
			28	SS	11		30						
			29	SS	5		28						
			30	SS	22		26						
			31	SS	17		24						
			32	SS	14		22						
18.4							20						
57.9	Silty Clay (CL)						18						
	Trace of Gravel and Sand						16						
	Hard												
15.3	Cont'd												

61.0

+3, x5: Numbers refer to
Sensitivity

20
15 x 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 22 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 434 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 22-25 and 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
15.3	Cont'd		33	SS	38		14					
61.0							12					
	Silty Clay (CL)						10					
	Trace of Gravel and Sand		34	SS	39		8					
							6					
	Hard						4					
			35	SS	26		2					
							0					
							-2					
			36	SS	67		-4					
							-6					
							-8					
			37	SS	72		-10					
							-12					
							-14					
-15.6			38	SS	109							

91.9 End of Borehole

Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 23 METRIC

W P 210-79-00 LOCATION Sta. 14 + 516 16th St. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 27-28 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.0	Ground Level											
	Some Gravel		1	SS	10							
	Sand to Silty Sand		2	SS	7							0 94 (6)
	Trace of Gravel and Clay Loose to Very Dense		3	SS	18							6 90 (4)
	Some Gravel		4	SS	47							4 86 (10)
			5	SS	31							
			6	SS	38							
			7	SS	39							2 80 (18)
			8	SS	34							
62.9												
13.1	Silty Sand to Sandy Silt		9	SS	27							
	Trace of Gravel and Clay		10	SS	20							5 57 (38)
	Compact		11	SS	20							
			12	SS	22							
			13	SS	21							
			14	SS	21							
45.5	Cont'd											
30.5												

+3, x5: Numbers refer to
Sensitivity 15-5 (% STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No. 23 cont. METRIC

W P 210-79-00 LOCATION Sca. 14 + 516 16_{mt} ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 27-28 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
45.5	Cont'd		15	SS	30		44							
30.5	Silty Sand to Sandy Silt													
44.0														
32.0	Sandy Silt to Silt													
	Trace of Clay													
	Dense		16	SS	35		42							
			17	SS	41		40							
			18	SS	34		38							
			19	SS	30		36							
							34							
							32							
29.8			20	SS	14		30							
46.2	End of Borehole													

+3, x5: Numbers refer to
Sensitivity 15 ÷ 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 24 METRIC

W P 210-79-00 LOCATION Sta. 14 + 592 12+Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 15-19 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER						
76.1	Ground Level								
0.0	Gravel With Sand, Some Organics, trace of Silt and Clay, Compact (Fill Material)		1	SS	14				
73.7			2	SS	13				1 94 (5)
2.4	Sand to Silty Sand Trace of Gravel and Clay, Compact to Very Dense some Gravel		3	SS	49				13 77 (10)
			4	SS	93				
			5	SS	65				19 71 (10)
			6	SS	61				
			7	SS	60				11 78 (11)
			8	SS	62				
			9	SS	32				
61.5			10	SS	44				
14.6	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to Very Dense		11	SS	17				
			12	SS	30				
			13	SS	32				
			14	SS	24				
			15	SS	29				
			16	SS	31				
			17	SS	21				
			18	SS	35				
			19	SS	50				
45.6	Cont.								
30.5									

+3, x5 : Numbers refer to Sensitivity
15 5 (%) STRAIN AT FAILURE
10

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RECORD OF BOREHOLE No. 24 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 592 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 15-19 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N VALUES			20 40 60 80 100							SHEAR STRENGTH			WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										
45.6	Cont.		20	SS	53													
30.5	Silty Sand to Sandy																	
44.7	Silt																	
31.4	Sandy Silt to Silt						44											
	Trace of Clay		21	SS	96													
	Dense to Very Dense																	
			22	SS	30		42											
			23	SS	77		40											
			24	SS	56													
							38											
			25	SS	48													
			26	SS	54		36											
			27	SS	46		34											
			28	SS	60													
32.5																		
43.6	Silty Clay (Cl)						32											
	Trace of Gravel and																	
	Sand, Hard		29	SS	56													
29.9			30	SS	58		30											
46.2	End of Borehole																	

+3, x5 : Numbers refer to
Sensitivity

20
15
10
3 [%] STRAIN AT FAILURE



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RECORD OF BOREHOLE No 25

METRIC

W P 210-79-00 LOCATION Sta. 14 + 642 12mRt. ORIGINATED BY D.D.
ST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 19-20 & 81 06 25-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
75.9	Ground Level												
0.0	Gravel with Sand, Trace of Silt and Clay, occ. Slag Fill, Very Dense (Fill Material)		1	SS	52								
73.5													
2.4	Sand to Silty Sand Trace of Gravel & Clay Compact to Very Dense Some Gravel		2	SS	14								
			3	SS	27								
			4	SS	34								
			5	SS	13								
			6	SS	42								
			7	SS	54								
			8	SS	30								
			9	SS	37								
61.3													
14.6	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to Very Dense		10	SS	28								
			11	SS	29								
			12	SS	22								
			13	SS	26								
			14	SS	29								
			15	SS	27								
			16	SS	25								
			17	SS	29								
			18	SS	31								
			19	SS	31								
45.4	Cont.												

+3, x5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10



W P 210-79-00 LOCATION Sta. 14 + 642 12-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 19-20 & 81 06 25-29 CHECKED BY n.n.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
45.4	Cont.												
30.5			20	SS	36								
44.5													
31.4	Sandy Silt to Silt Trace of Clay Compact to Very Dense		21	SS	34		44						
			22	SS	49		42						
			23	SS	26		40						
			24	SS	36		38						
			25	SS	51		36						
35.4			26	SS	34		34						
40.5	Silty Clay (CI) Trace of Gravel and Sand, Very Stiff to Hard		27	SS	29		32						
			28	SS	37		30						
			29	SS	27		28						
			30	SS	27		26						
			31	SS	17		24						
							22						
			32	SS	39		20						
							18						
14.9	Cont.						16						

+3, x5: Numbers refer to Sensitivity

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RECORD OF BOREHOLE No 25 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 642 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 19-20 & 81 06 25-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
14.9	Cont.		33	SS	63		14					
61.0	Silty Clay						12					
	occ. Shaly Layers						10					
7.9			34	SS	108		8					
68.0	Probable Bedrock End of Borehole											

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 26

METRIC

W P 210-79-00 LOCATION Sta. 14 + 708 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 20-22 & 81 06 19-24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
75.8	Ground Level										
0.0	Gravel with Sand Trace of Silt and Clay Occ. Slag Fill, Compact (Fill Material)		1	SS	16						
73.4											
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		2	SS	11						4 89 (7)
			3	SS	17						0 98 (2)
			4	SS	55						
			5	SS	52						7 88 (5)
			6	SS	66						
			7	SS	70						12 74 (14)
			8	SS	61						4 81 (15)
			9	SS	39						
			10	SS	26						
59.0											
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	38						
			12	SS	43						
			13	SS	45						
			14	SS	41						
45.3	Cont'd										

30.5

*3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

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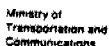
RECORD OF BOREHOLE No 26 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 708 12_{RE}. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 20-22 & 81 06 19-24 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAI PLOT	NUMBER	TYPE						
45.3	Cont'd		15	SS	29					
30.5			16	SS	43					
40.7			17	SS	37					
35.1	Sandy Silt to Silt Trace of Clay Dense to Very Dense		18	SS						
34.7			19	SS	60					
41.1	Silty Clay (CL) Trace of Gravel and Sand Hard		20	SS	42					
			21	SS	49					
15.8			22	SS	50					
60.0	Bedrock Shale		23	RC	100%					
14.8	Cont'd									
61.0										

+3, x⁵: Numbers refer to
Sensitivity

15 → 5 (%) STRAIN AT FAILURE
10



METRIC

W P	210-79-00	LOCATION	Sta. 14 + 708	12 Rt.	ORIGINATED BY	D.D.
DIST	4 HWY	Q.E.W.	BOREHOLE TYPE	Hollow Stem Auger, NX Casing	COMPILED BY	O.J.
DATUM	Geodetic	DATE	81 05 20-22 & 81 06 19-24		CHECKED BY	D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LQUID LIMIT W _c	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)			
14.8	Cont'd		23	RC	100%		14							
61.0	Bedrock Shale Sound		24	RC	73%									
12.7														
63.1	End of Borehole						12							

+3, x5: Numbers refer to Sensitivity



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RECORD OF BOREHOLE No 27 METRIC

W P 210-79-00 LOCATION Sta. 14 + 770 13_mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 27-28 & 81 06 24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W' LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.0	Ground Level											
0.0	Sand to Silty Sand With Gravel, Some Clay Compact (Fill Material)		1	SS	14							
73.6			2	SS	27							
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense with Gravel		3	SS	26							
			4	SS	58							
			5	SS	69							
			6	SS	68							
			7	SS	104							
			8	SS	45							
62.9			9	SS	41							
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		10	SS	31							
			11	SS	38							
			12	SS	40							
			13	SS	29							
			14	SS	37							
45.5	Cont'd											
30.5												

*3, *5: Numbers refer to
Sensitivity 15 → 5 (%) STRAIN AT FAILURE
10

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RECORD OF BOREHOLE No 27^{cont.} METRIC

W P 210-79-00 LOCATION Sta. 14 + 770 13mRt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 27-28 & 31 06 24 CHECKED BY D.D.

SOIL PROFILE		STRAT. PLT	SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE			'N' VALUES	20					
45.5	Cont'd												
30.5			15	SS	34								
44.0													
32.0	Sandy Silt to Silt Trace of Clay Dense to Very Dense												
			16	SS	54								
			17	SS	48								
			18	SS	34								
34.9													
41.1	Silty Clay (CL) Trace of Gravel and Sand Very Stiff to Hard												
			19	SS	38								
			20	SS	28								
	Occ. Shaly Layers												
			21	SS	69								
24.8			22	SS	120/3 cm								
51.2	Probable Bedrock End of Borehole												

*3, *5: Numbers refer to Sensitivity
15 *5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 28 METRIC

W P 210-79-00 LOCATION Sta. 14 + 833 13mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 28-29 & 81 06 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15, 30, 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
76.1	Ground Level										
0.0	Sand to Silty Sand Some Gravel Trace of Clay Compact (Fill Material)		1	SS	11		76				
73.7							74				
2.4	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		2	SS	7		72				7 85 (8)
			3	SS	25		70				6 88 (6)
			4	SS	31		68				11 80 (9)
	Some Gravel		5	SS	53		66				5 81 (14)
			6	SS	45		64				
			7	SS	45		62				
			8	SS	31		60				
63.0							58				
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact		9	SS	21		56				
			10	SS	26		54				
							52				
			11	SS	21		50				
							48				
			12	SS	21		46				
			13	SS	13						
			14	SS	15						
45.6	Cont'd										

OFFICE REPORT ON SOIL EXPLORATION

30.5

+3, x5 : Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10



Ministry of
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Communications
Ontario

RECORD OF BOREHOLE No 28 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 833 13-Rt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 28-29 & 81 06 01 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER			TYPE	'N' VALUES	20	40	60	80	100	W _p			W
45.6	Cont'd															
30.5	Silty Sand to Sandy Silt		15	SS	28											
44.1																
32.0	Sandy Silt to Silt Trace of Gravel Dense		16	SS	41											
			17	SS	48											
			18	SS	48											
35.0																
41.1	Silty Clay (CL) Trace of Gravel and Sand Occ. Shaly Layers Very Stiff		19	SS	27											
			20	SS	25											
			21	TW	PH											
28.9																
47.2	Bedrock Shale Sound		22	RC	93%											
			23	RC	100%											
25.8																
50.3	End of Borehole															

*3, *5: Numbers refer to Sensitivity
15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 29 METRIC

W P 210-79-00 LOCATION Sta. 14 + 897 13mRt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 29 - 06 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.4	Ground Level												
0.0	Gravel Some Sand Trace of Silt and Clay Occ. Slag Fill Dense (Fill Material)		1	SS	33								
74.0			2	SS	3								
2.4			3	SS	37								
	With Gravel		4	SS	34								
	Some Gravel		5	SS	51								
			6	SS	71								
			7	SS	69								
	Sand to Silty Sand Trace of Gravel and Clay Very Loose to Very Dense		8	SS	57								
61.8			9	SS	44								
14.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		10	SS	31								
			11	SS	36								
			12	SS	14								
			13	SS	71								
			14	SS	48								
45.9	Comp'd												
30.5													

3, x 5: Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 29 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 897 13mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 29 - 06 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.9	Cont'd		15	SS	61												
30.3			16	SS	24												
41.3			17	SS	23												
35.1	Sandy Silt to Silt Trace of Clay Compact to Very Dense		18	SS	55												
35.3			19	SS	46												
41.1	Silty Clay Trace of Gravel and Sand Hard		20	SS	125/25 cm												
30.2	Probable Bedrock End of Borehole																
46.2																	

+3, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (% STRAIN AT FAILURE



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RECORD OF BOREHOLE No 30 METRIC

W P 210-79-00 LOCATION Sta. 14 + 965 2nd Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 31 06 01-05 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			VALUES	20 40 60 80 100					
76.1	Ground Level												
0.0	Sand to Silty Sand With Gravel Trace of Silt and Clay Occ. Waste Concrete Loose. (Fill Material)		1	SS	9								
73.7			2	SS	18								0 96 (4)
2.4	Some Gravel		3	SS	44								17 74 (9)
			4	SS	52								
			5	SS	38								4 90 (6)
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		6	SS	46								
			7	SS	80								3 83 (14)
			8	SS	63								
			9	SS	52								
			10	SS	24								
59.3													
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		11	SS	19								
			12	SS	50								
			13	SS	18								
			14	SS	30								
47.1													
29.0	Sandy Silt to Silt Trace of Clay Compact												
45.6	Cont'd												

30.5

+3, x5: Numbers refer to
Sensitivity

20
15 x 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 30 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 965 2nd Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 01-05 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.6	Cont'd																
30.5	Sandy Silt to Silt		15	SS	21												
	Trace of Clay																
			16	SS	29												
	Sand to Silty Sand Very Dense		17	SS	108	25 cm											
38.0																	
38.1	Silty Clay (CL) Trace of Gravel and Sand Very Stiff to Hard		18	SS	20												
	Occ. Shaly Layers		19	SS	60	0.6 cm											
34.6																	
31.3	Probable Bedrock End of Borehole																

+3, x5: Numbers refer to
Sensitivity

15 - 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 31 METRIC

W P 210-79-00 LOCATION Sta. 15 + 023 12mRt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 31 06 01-03 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
76.3	Ground Level													
0.0	Sand to Silty Sand Trace of Gravel and Clay Loose to Compact		1	SS	10									
73.9	(Fill Material)													
2.4	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		2	SS	6									
	With Gravel		3	SS	38									
			4	SS	88									
			5	SS	66									
			6	SS	71									
			7	SS	69									
			8	SS	112									
			9	SS	43									
			10	SS	32									
59.5														
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	27									
			12	SS	33									
			13	SS	12									
			14	SS	23									
45.0	Cont'd													

OFFICE REPORT ON SOIL EXPLORATION

30.5

+3, +5: Numbers refer to 15 + 5 (%) STRAIN AT FAILURE
Sensitivity 10



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RECORD OF BOREHOLE No 31 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 023 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 01-03 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	SIRAT PLOT	NUMBER	TYPE	'N' VALUES								
45.8	Cont'd		15	SS	22								
30.5	Silty Sand to Sandy Silt												
44.3													
32.0	Sandy Silt to Silt Trace of Gravel Compact to Dense		16	SS	17		44						
							42						
			17	SS	48		40						
38.2													
38.1	Silty Clay Trace of Gravel and Sand Occ. Shaly Layers Hard		18	SS	95	27 cm	38						
							36						
34.2													
42.1	Bedrock Shale Sound		19	SS	65	0 cm	34						
			20	RC	97		32						
			21	RC	98								
30.6													
45.7	End of Borehole						30						

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 32 METRIC


W P 210-79-00 LOCATION Sta. 15 + 086 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 01-03 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp	NATURAL MOISTURE CONTENT W	LIQUID LIMIT Wl	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
76.3	Ground Level											
0.0	Gravel with Sand Trace of Silt and Clay occ. Cobbles, Dense (Fill Material)		1	SS	31							
73.9			2	SS	17							18 74 (8)
2.4			3	SS	36							9 85 (6)
			4	SS	55							
	Soma Gravel		5	SS	46							10 76 (14)
	Sand to Silty Sand Trace of Gravel and Clay, Compact to Very Dense		6	SS	49							
			7	SS	28							3 80 (17)
			8	SS	43							
			9	SS	28							
			10	SS	31							
59.5												
16.8	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to Dense		11	SS	17							
			12	SS	30							
			13	SS	14							
			14	SS	13							
45.8	Cont.											
30.3												

+3, x5 : Numbers refer to Sensitivity 15 20 5 (%) STRAIN AT FAILURE 10

RECORD OF BOREHOLE No 32 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 086 12mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 01-03 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100	Wp	W	W _L		
45.8	Cont'd															GR SA SI CL
30.5	Silty Sand to Sandy Silt		15	SS	22											
44.3																
32.0	Sandy Silt to Silt Trace of Clay Dense		16	SS	38											
			17	SS	39											
38.2																
38.1	Silty Clay (CL) Trace of Gravel and Sand Stiff to Hard		18	SS	11											
33.6			19	SS	39											
43.0	Bedrock															
32.5	Shale, Weathered		20	SS	60/8 cm											
43.8	End of Borehole															

³, ⁵: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 33

METRIC

W P 210-79-00 LOCATION Sta. 15 + 154 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-08 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER						
76.2	Ground Level								
0.0	Gravel with Sand Trace of Silt and Clay Compact (Fill Material)		1	SS	17				
73.8			2	SS	22				
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense Some Gravel		3	SS	38				4 88 (8)
			4	SS	26				3 89 (8)
			5	SS	17				
			6	SS	47				
			7	SS	25				2 86 (12)
			8	SS	56				
			9	SS	35				1 84 (15)
			10	SS	25				
59.4									
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	24				
			12	SS	26				
			13	SS	26				
			14	SS	30				
45.7	Cont'd								
30.5									

+3, x5: Numbers refer to
Sensitivity

20
15 ÷ 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 33 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 154 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.7	Cont'd		15	SS	43												
30.5																	
44.2																	
32.0	Sandy Silt to Silt Trace of Clay Dense to Very Dense		16	SS	48												
	Slight Elasticity																
			17	SS	51												
38.1																	
38.1	Silty Clay (CL) Trace of Gravel and Occ. Shaly Layers Stiff to Very Stiff		18	SS	7												
			19	SS	17												
31.4																	
44.8			20	RC	57												
	weathered sound																
	Bedrock		21	RC	80												
28.3	Shale																
47.9	End of Borehole																

3, 5: Numbers refer to
Sensitivity

20
15
10

5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 34 METRIC

W P 210-79-00 LOCATION Sta. 15 + 202 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-04 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
76.0	Ground Level													
0.0	Gravel with Sand Trace of Silt and Clay													
73.6	Compact (Fill Material)		1	SS	26									
2.4	Sand to Silty Sand													
	Trace of Gravel and Clay		2	SS	24									7 87 (6)
	Compact to Very Dense		3	SS	42									15 73 (12)
			4	SS	62									
			5	SS	67									15 78 (7)
			6	SS	53									
			7	SS	65									6 75 (19)
			8	SS	63									
62.9														
13.1	Silty Sand to Sandy Silt		9	SS	48									
	Trace of Gravel and Clay		10	SS	40									
	Compact to Very Dense													
			11	SS	51									
			12	SS	19									
			13	SS	29									
			14	SS	51									
45.5	Cont'd													

30.5

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 34 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 202 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-04 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.5	Cont'd		15	SS	42												
30.5																	
44.0							44										
32.0	Sandy Silt to Silt																
	Trace of Clay																
	Dense to Very Dense		16	SS	61		42										
			17	SS	59		40										
37.9																	
38.1	Silty Clay (CL)						38										
	Trace of Gravel & Sand																
36.3	Hard		18	SS	65	70.8 cm											
39.7	Probable Bedrock End of Borehole						36										

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 35 METRIC

W P 210-79-00 LOCATION Sta. 15 + 252 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 09-10 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
75.7	Ground Level													
0.0	Gravel with Sand Trace of Silt & Clay Very Dense (Fill Material)		1	SS	55									
73.3			2	SS	20									
2.4			3	SS	38									
	Some Gravel		4	SS	35									
	Sand to Silty Sand Trace of Gravel & Clay Compact to Very Dense		5	SS	52									
			6	SS	44									
			7	SS	50									
64.1			8	SS	33									
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		9	SS	36									
			10	SS	28									
			11	SS	33									
			12	SS	29									
			13	SS	32									
			14	SS	21									
45.2	Cont'd													
30.5														

+3, x5: Numbers refer to Sensitivity 15 → 5 (%) STRAIN AT FAILURE 10



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Ontario

RECORD OF BOREHOLE No 35 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 252 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY O.J.
DATUM Geodetic DATE 81 06 09, 10 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%). GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.2	Cont'd		15	SS	22												
30.3																	
43.7																	
32.0	Sandy Silt to Silt																
	Trace of Clay																
	Compact to Dense		16	SS	25												
			17	SS	47												
37.6																	
38.1	Silty Clay (CL)																
	Trace of Gravel, Sand and Organics		18	SS	17												
	Occ. Shaly layers																
	Very Stiff																
32.9			19	SS	70	10 cm											
42.8	Probable Bedrock End of Borehole																

+3, x3 : Numbers refer to
Sensitivity

20
15
10

5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



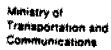
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Ontario

RECORD OF BOREHOLE No 36 METRIC

W P 210-79-00 LOCATION Sta. 15 + 298 12m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 05-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
76.3	Ground Level									
0.0	Sand to Silty Sand Trace of Gravel and Clay Occ. Organics Very Loose (Fill Material)		1	SS	2					
73.9										
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		2	SS	14					2 92 (6)
			3	SS	35					5 84 (11)
	Some Gravel		4	SS	30					
			5	SS	66					8 65 (17)
										2 84 (14)
			7	SS	61					1 79 (20)
			8	SS	91					
63.2										
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		9	SS	48					
			10	SS	29					
			11	SS	42					
			12	SS	36					
			13	SS	39					
			14	SS	58					
45.8	Cont'd									
30.5										

+3, x5: Numbers refer to Sensitivity
15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 36 cont. METRIC

W P	210-79-00	LOCATION	Sta. 15 + 298	12-Rt.	ORIGINATED BY	D.D.
DIST	4 HWY Q.E.W.	BOREHOLE TYPE	Hollow Stem Auger & NX Casing		COMPILED BY	G.J.
DATUM	Geodetic	DATE	81 06 05-08		CHECKED BY	D.D.

[illegible]

+3, x5: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 37 METRIC

W P 210-79-00 LOCATION Sta. 15 + 347 11mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 09 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
76.5	Ground Level													
0.0	Gravel with Sand Trace of Silt & Clay Occ. Organics & Slag Compact (Fill Material)		1	SS	19		76							
74.1			2	SS	20		74							
2.4	Some Gravel		3	SS	22		72							
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		4	SS	54		70							
			5	SS	76		68							
	and Organic Silt (OL) Hard		6	SS	94		66							
			7	SS	50		64							
			8	SS	55		62							
			9	SS	19		60							
61.9			10	SS	19		58							
14.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Loose to Very Dense		11	SS	9		56							
			12	SS	19		54							
			13	SS	50		52							
50.6							50							
25.9	Sandy Silt to Silt Trace of Clay Dense to Very Dense		14	SS	37		48							
							46							
45.6	Occ. Sandy Layers		15	SS	130									
30.9	End of Borehole													

+3, x5: Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 38

METRIC

W P 210-79-00 LOCATION Sta. 15 + 398 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DATA	DESCRIPTION	SIRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p					
76.1	Ground Level													
0.0	Sand to Silty Sand Some Gravel, Trace of Clay Occ. Organics & Rag Very Loose (Fill Material)		1	SS	3									GR SA SI CL
73.7			2	SS	5									
2.4			3	SS	36									
	Some Gravel		4	SS	34									
	Sand to Silty Sand Trace of Gravel and Clay Very Loose to Very Dense		5	SS	54									
			6	SS	49									
			7	SS	35									
			8	SS	44									
63.0			9	SS	40									
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		10	SS	29									
			11	SS	32									
			12	SS	28									
53.2			13	SS	24									
22.9	Sandy Silt to Silt Trace of Clay Compact		14	SS	18									
			15	SS	29									
45.2														

+3, x5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 39

METRIC

W P 210-79-00 LOCATION Sta. 15 + 433 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp	NATURAL MOISTURE CONTENT W	LIQUID LIMIT Wl	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
76.0	Ground Level													
0.0	Gravel with Sand Trace of Silt and Clay Occ. Slag Fill Compact (Fill Material)	X	1	SS	21									
73.6														
2.4	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		2	SS	8									
			3	SS	35									
	Some Gravel		4	SS	68									
			5	SS	70									
			6	SS	58									
	Some Gravel		7	SS	38									
64.4														
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		8	SS	46									
			9	SS	42									
			10	SS	25									
			11	SS	35									
			12	SS	34									
53.1														
22.9	Sandy Silt to Silt Trace of Clay Dense to Very Dense		13	SS	33									
			14	SS	65									
45.5														
30.5	Cont'd													

+3, x5: Numbers refer to Sensitivity
15 20 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 39 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 433 12-Rt. ORIGINATED BY D.D.
 DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%)					
45.5	Cont'd																
30.5	Sandy Silt to Silt Trace of Clay Dense to Very Dense		15	SS	57		44										
			16	SS	43		42										
							40										
39.1			17	SS	55												
36.9	Silty Clay Trace of Gravel and Sand Hard						38										
36.4																	
39.6	Weathered		18	RC	205		36										
	Sound																
	Bedrock		19	RC	100%		34										
33.3	Shale																
42.7	End of Borehole						32										

+3, x5: Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 40 METRIC

W P 210-79-00 LOCATION Sta. 15 + 478 15mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
75.9	Ground Level												
0.0	Gravel Some Sand, Silt and Clay Compact (Fill Material)		1	SS	20		74						
73.5			2	SS	7		72						4 79 (17)
2.4	Some Gravel		3	SS	25		70						14 79 (7)
			4	SS	67								
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		5	SS	56		68						1 98 (1)
			6	SS	35		66						
			7	SS	32		64						7 92 (1)
			8	SS	27								
62.8			9	SS	22		62						
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact		10	SS	18								
60.2													
15.7	End of Borehole						60						

+3, x5: Numbers refer to
Sensitivity

20
15 x 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 41 METRIC

W P 210-79-00 LOCATION Sta. 15 + 544 13mRt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			VALUES	20 40 60 80 100					
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
76.2	Ground Level												
0.0	Gravel with Sand Trace of Silt and Clay Occ. Slag Fill Compact to Dense (Fill Material)		1	SS	46								
72.2			2	SS	15								
4.0			3	SS	24								
	With Gravel		4	SS	45								
	Some Gravel		5	SS	38								
			6	SS	28								
	Sand to Silty Sand Trace of Gravel and Clay Compact to Dense		7	SS	38								
64.6			8	SS	36								
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		9	SS	38								
			10	SS	22								
			11	SS	26								
			12	SS	34								
53.3			13	SS	29								
22.9	Sandy Silt to Silt Trace of Clay Compact to Very Dense		14	SS	43								
45.3			15	SS	52								

30.9 End of Borehole

3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 42 METRIC

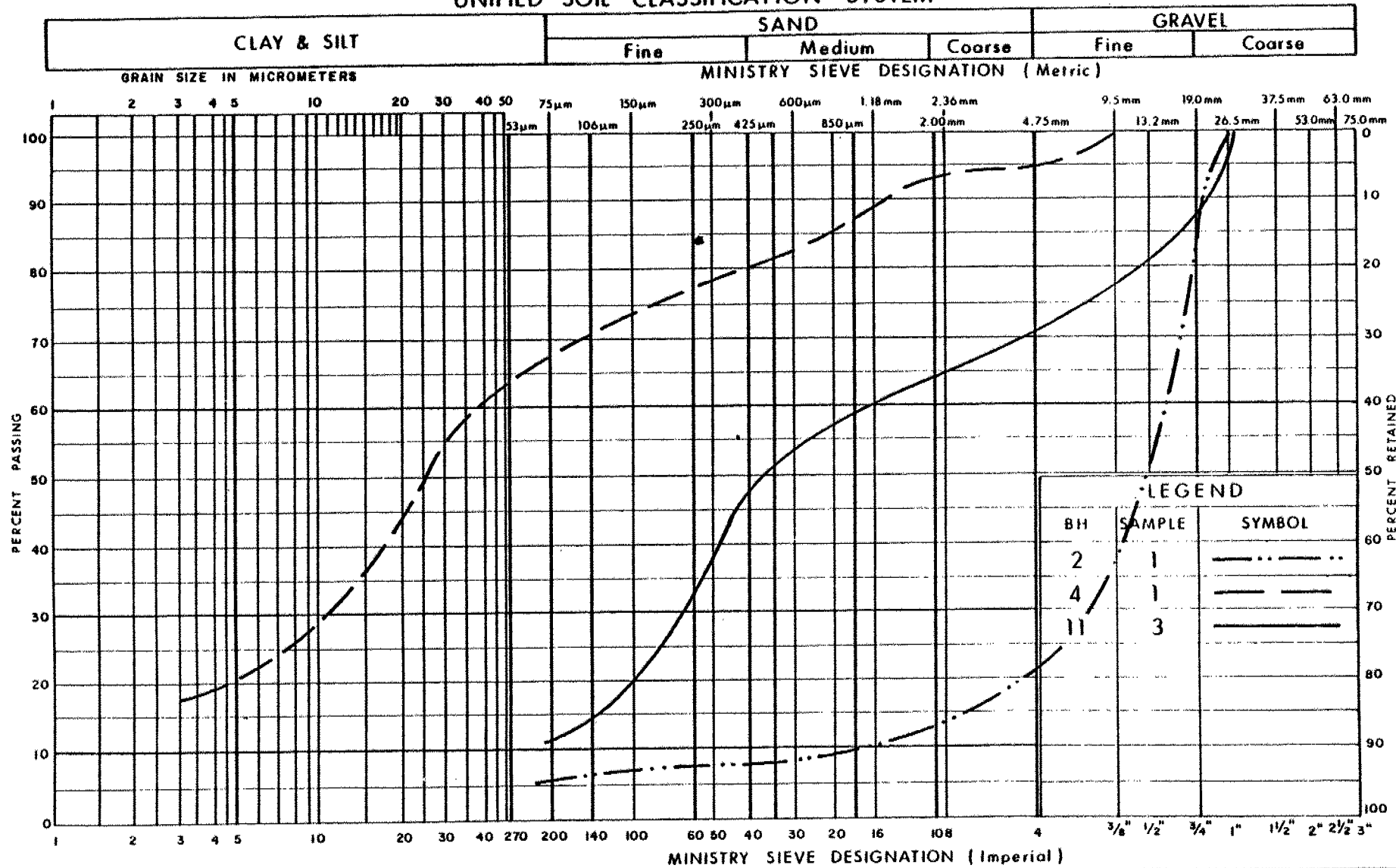
W P 210-79-00 LOCATION Sta. 15 + 617 18 Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 11-12 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	SINAT PLOT	NUMBER	TYPE	'N' VALUES								
76.7	Ground Level												
0.0	Gravel and Sand Trace of Silt and Clay Compact (Fill Material) with Sand		1	SS	12		76						
72.7			2	SS	19		74						51 40 (9)
4.0	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense with Gravel		3	SS	21		72						9 82 (9)
			4	SS	62		70						
			5	SS	32		68						24 68 (8)
			6	SS	79		66						
65.1			7	SS	27		64						13 74 (13)
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Dense to Very Dense		8	SS	54		62						
			9	SS	32								
61.0			10	SS	33								
15.7	End of Borehole						60						

+3, x5: Numbers refer to
Sensitivity
15 20
5 (%) STRAIN AT FAILURE
10

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



**GRAIN SIZE DISTRIBUTION
FILL MATERIAL**

FIG No 1

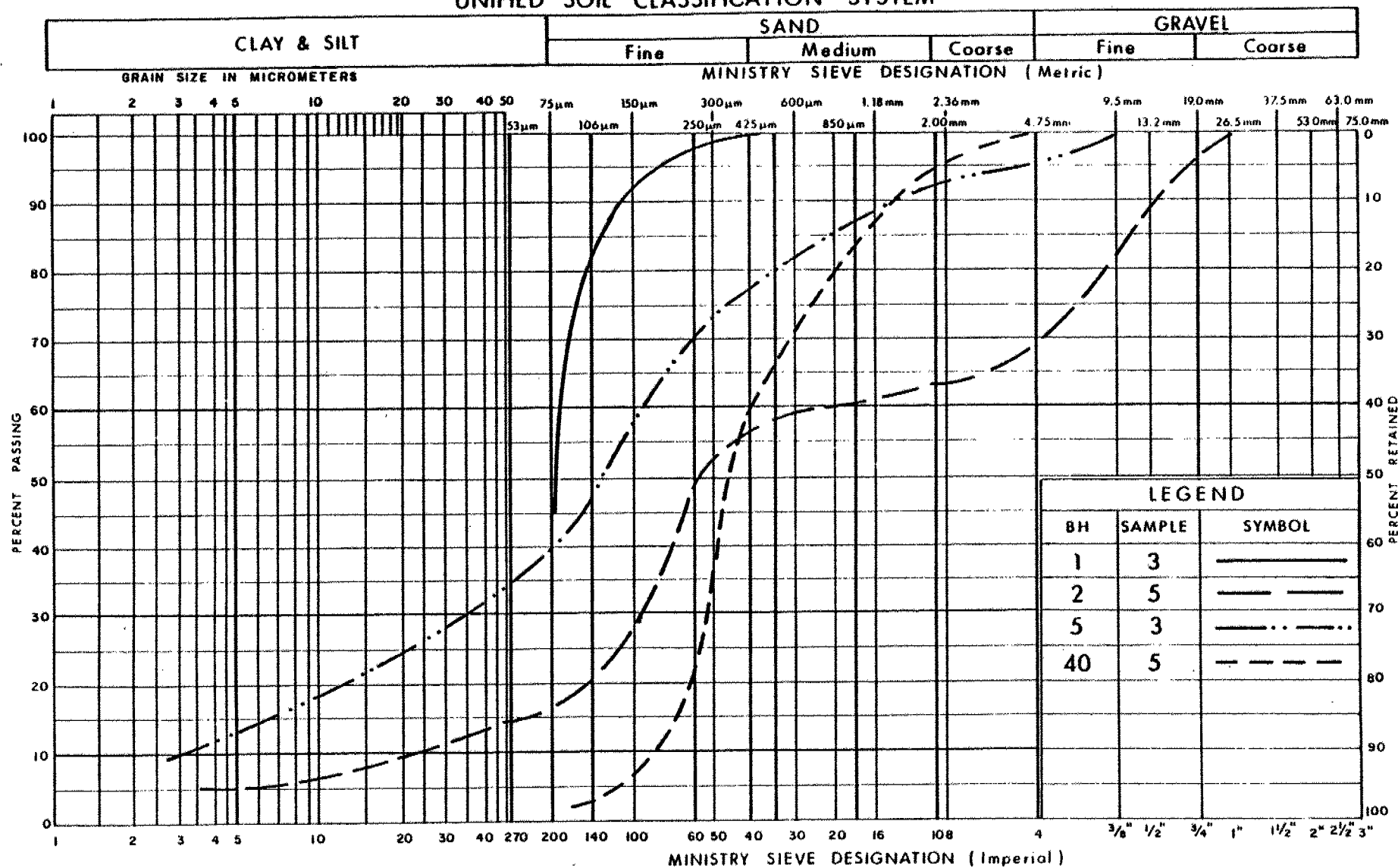
W P 210-79-00



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UNIFIED SOIL CLASSIFICATION SYSTEM



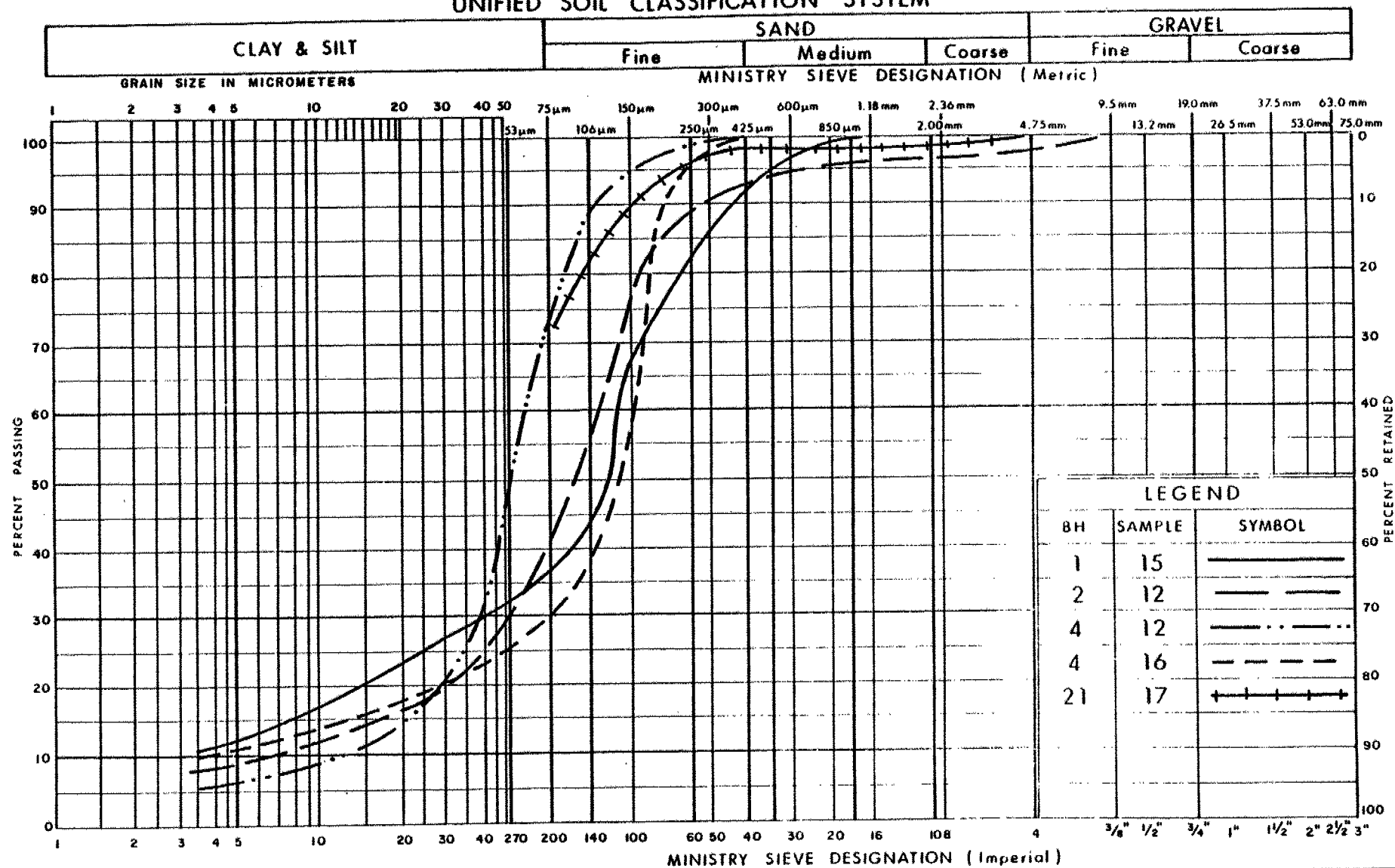
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GRAIN SIZE DISTRIBUTION
SAND TO SILTY SAND
TRACE, SOME, WITH GRAVEL TR. OF CLAY

FIG No 2

W P 210-79-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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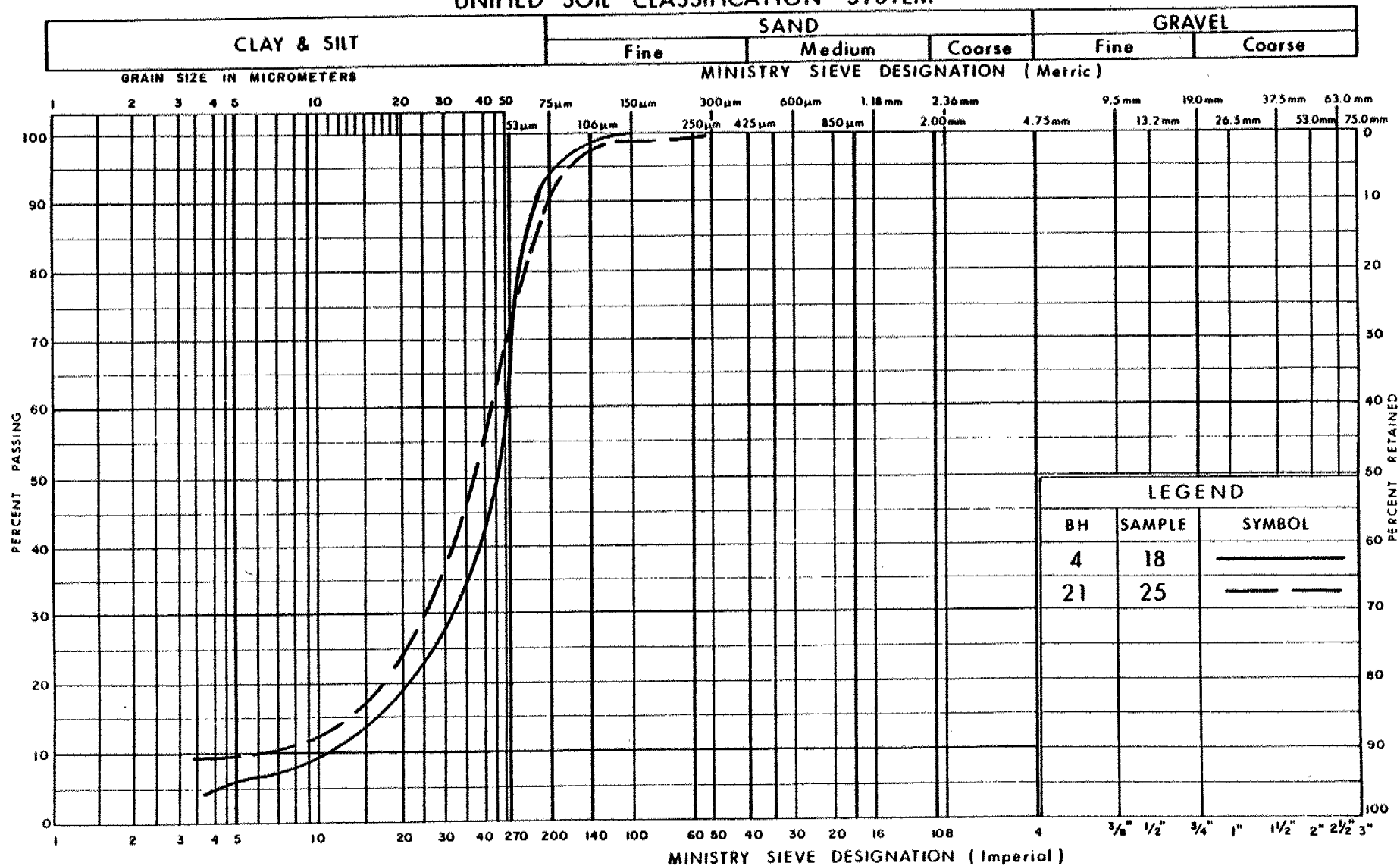
Ontario

GRAIN SIZE DISTRIBUTION
SILTY SAND TO SANDY SILT
TRACE OF GRAVEL & CLAY

FIG No 3

W P 210-79-00

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

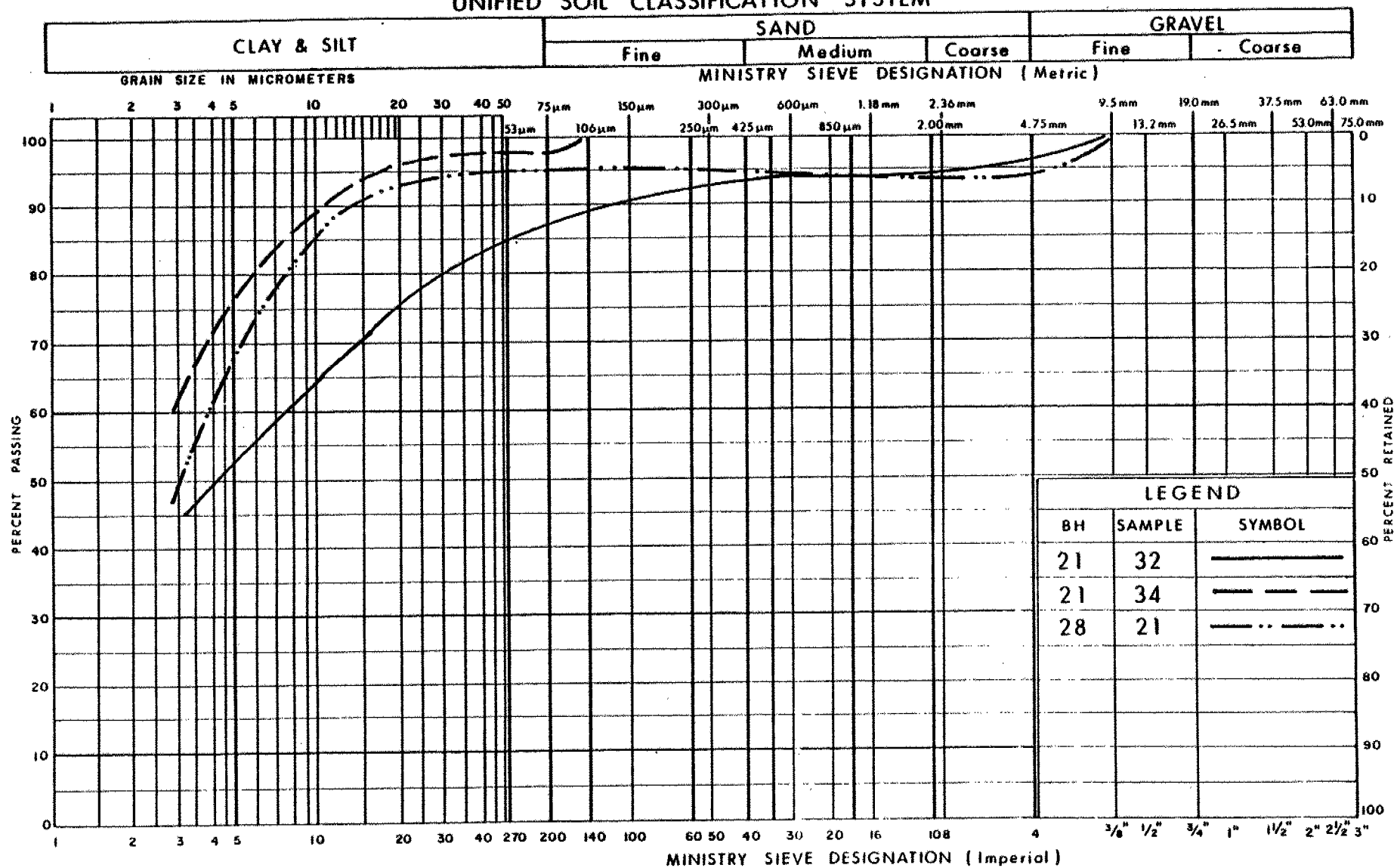
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GRAIN SIZE DISTRIBUTION
SANDY SILT TO SILT
TRACE OF CLAY

FIG No 4

W P 210-79-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION
SILTY CLAY
TRACE OF GRAVEL & SAND

FIG No 5

W P 210-79-00

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N_c .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON "A" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

CONSISTENCY: CORESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH AS FOLLOWS:

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSITY: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH DRILLED IN THAT CORING RUN.




MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

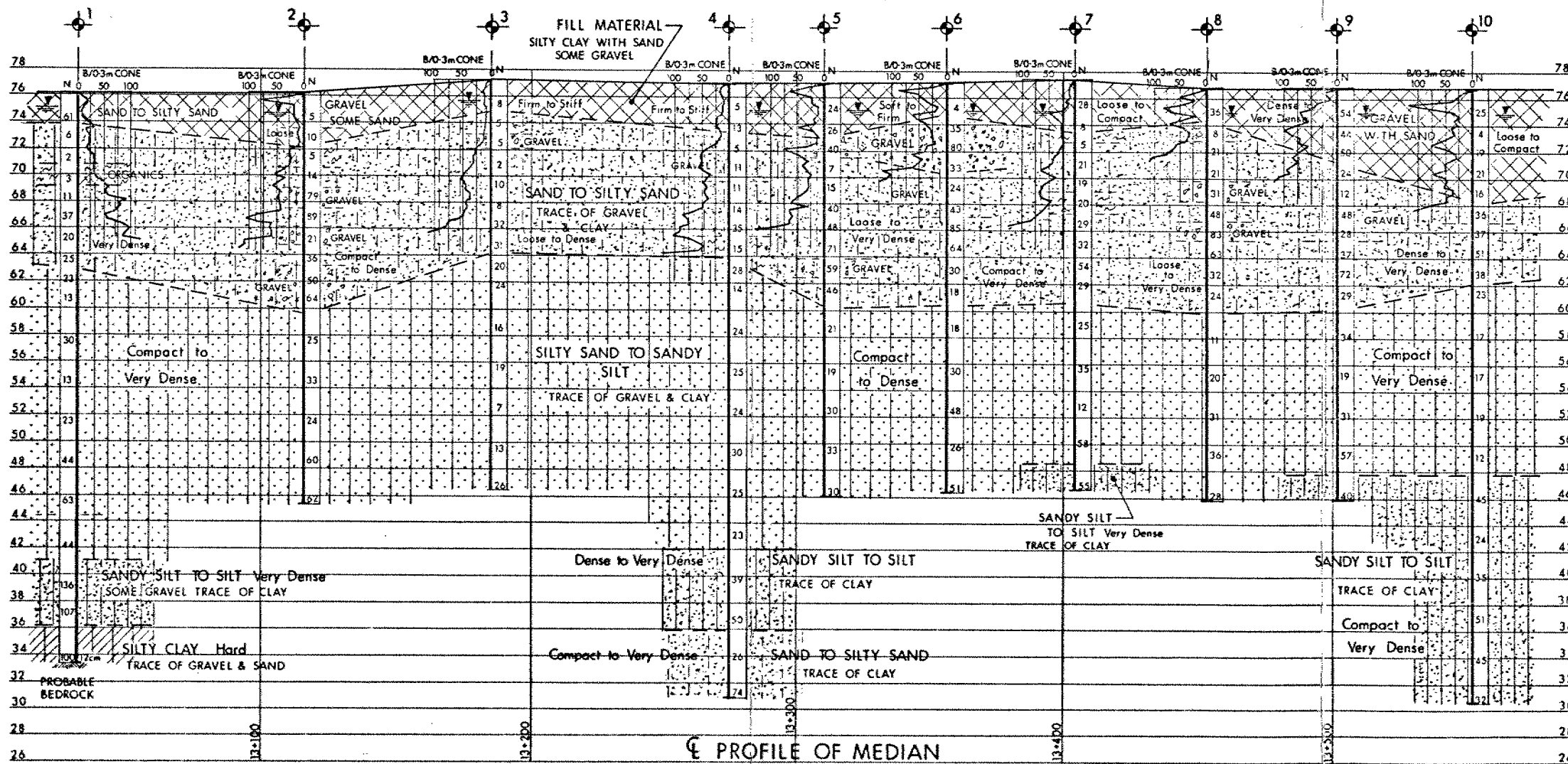
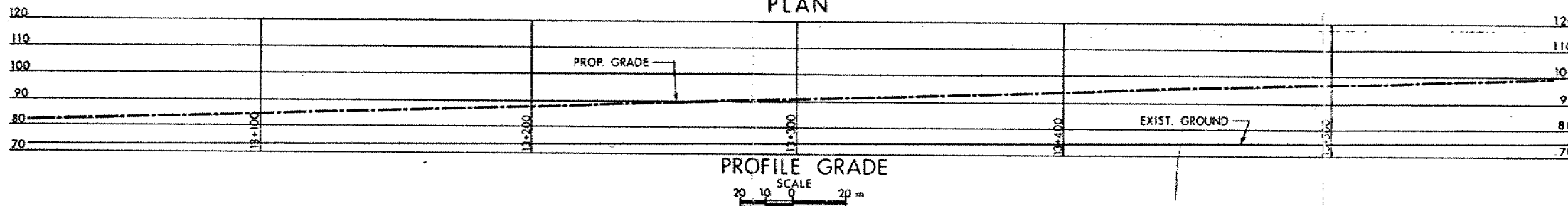
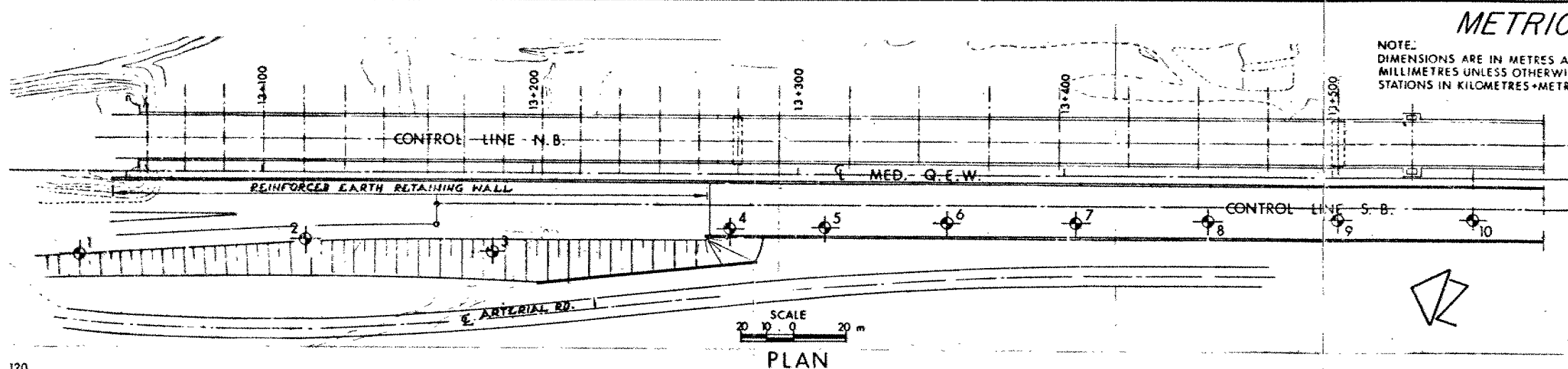
RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MED. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING		FIELD SAMPLING		EARTH PRESSURE TERMS	
TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE	CONSOLIDATED (C) OR NOT (U)	S S	SPLIT SPOON	μ	COEFFICIENT OF FRICTION
	ISOTROPICALLY (I) OR NOT (A)	W S	WASH SAMPLE	δ	ANGLE OF WALL FRICTION
AND SHEARED	DRAINED (D) OR UNDRAINED (U)	S T	SLOTTED TUBE SAMPLE	k_o	COEFFICIENT OF EARTH PRESSURE AT REST
WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS)		B S	BLOCK SAMPLE	k_A	COEFFICIENT OF ACTIVE EARTH PRESSURE
EG. CUU = CONSOLIDATED ISOTROPIC UNDRAINED		C S	CHUNK SAMPLE	k_p	COEFFICIENT OF PASSIVE EARTH PRESSURE
TRIAXIAL WITH PORE PRESSURE MEASUREMENT		T W	THINWALL OPEN	i	ANGLE OF INCLINATION OF SURCHARGE 
UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION		T P	THINWALL PISTON	w	SLOPE ANGLE-BACKFACE OF WALL 
		O S	OSTERBERG SAMPLE	β	ANGLE OF SLOPE 
		F S	FOIL SAMPLE	N_q, N_c	BEARING CAPACITY FACTORS
		R C	ROCK CORE	D_f	DEPTH OF FOOTING
		P H	T.W. ADVANCED HYDRAULICALLY	B, L	FOOTING DIMENSIONS
		F M	T.W. ADVANCED MANUALLY		
INDEX PROPERTIES		STRENGTH PARAMETERS		HYDRAULIC TERMS	
γ	UNIT WEIGHT OF SOIL (BULK DENSITY)	ϕ	ANGLE OF SHEARING RESISTANCE	h	HYDRAULIC HEAD OR POTENTIAL
γ_w	UNIT WEIGHT OF WATER	τ_f	PEAK SHEAR STRENGTH	q	RATE OF DISCHARGE
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)	τ_r	RESIDUAL SHEAR STRENGTH	v	VELOCITY OF FLOW
γ'	UNIT WEIGHT OF SUBMERGED SOIL	c	COHESION INTERCEPT	i	HYDRAULIC GRADIENT
G_s	SPECIFIC GRAVITY OF SOLIDS	$\sigma_1, \sigma_2, \sigma_3$	NORMAL PRINCIPAL STRESSES	j	SEEPAGE FORCE PER UNIT VOLUME
e	VOIDS RATIO	u	PORE WATER PRESSURE	η	COEFFICIENT OF VISCOSITY
e_o	INITIAL VOID RATIO	u_e	EXCESS u	k	COEFFICIENT OF HYDRAULIC CONDUCTIVITY
e_{max}	e IN LOOSEST STATE	f_u	PORE PRESSURE RATIO	k_h	k IN HORIZONTAL DIRECTION
e_{min}	e IN DENSEST STATE	q_u	UNCONFINED COMPRESSIVE STRENGTH	k_v	k IN VERTICAL DIRECTION
D_r	RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$	s_u	UNDRAINED SHEAR STRENGTH	m_v	COEFFICIENT OF VOLUME CHANGE
n	POROSITY	ϵ	LINEAR STRAIN	c_v	COEFFICIENT OF CONSOLIDATION
w	WATER CONTENT	γ	SHEAR STRAIN	C_c	COMPRESSION INDEX
w_L	LIQUID LIMIT	ν	POISSON'S RATIO	C_r	RECOMPRESSION INDEX
w_p	PLASTIC LIMIT	E	MODULUS OF ELASTICITY	d	DRAINAGE PATH DISTANCE
w_s	SHRINKAGE LIMIT	G	MODULUS OF SHEAR DEFORMATION	T_v	TIME FACTOR
I_p	PLASTICITY INDEX = $w_L - w_p$	k_s	MODULUS OF SUBGRADE REACTION	U	DEGREE OF CONSOLIDATION
L_L	LIQUIDITY INDEX = $\frac{w - w_p}{w_p - w_L}$	m, n	STABILITY COEFFICIENTS	O_c	OVERCONSOLIDATION RATIO (OCR)
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{w_p - w_L}$	A, B	PORE PRESSURE COEFFICIENTS		
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ Soil Fraction}}$	NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS: σ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE; σ'_v = EFFECTIVE NORMAL STRESS			
Om	ORGANIC MATTER CONTENT				
S_r	DEGREE OF SATURATION				
S	SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$				



METRIC

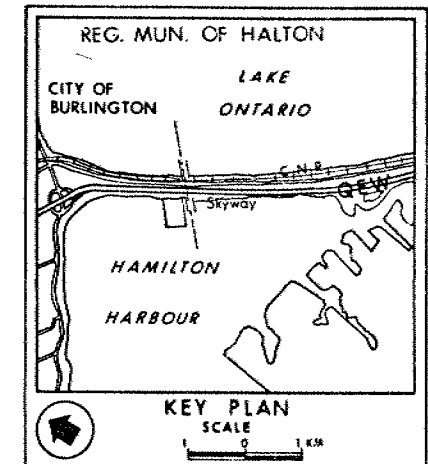
NOTE: DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN STATIONS IN KILOMETRES+METRES

CONT No
WP No 210-79-00

BURLINGTON BAY SKYWAY
Q.E.W. S.B.
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 81 06 12 to 18

No	ELEVATION	STATION	Q.E.W. OFFSET (m)
1	76.2	13+027	32 RT
2	76.3	13+115	25 RT
3	77.3	13+184	30 RT
4	77.0	13+275	20 RT
5	77.0	13+311	20 RT
6	77.2	13+356	18 RT
7	77.4	13+403	18 RT
8	76.7	13+454	17 RT
9	76.8	13+503	16 RT
10	76.8	13+552	16 RT

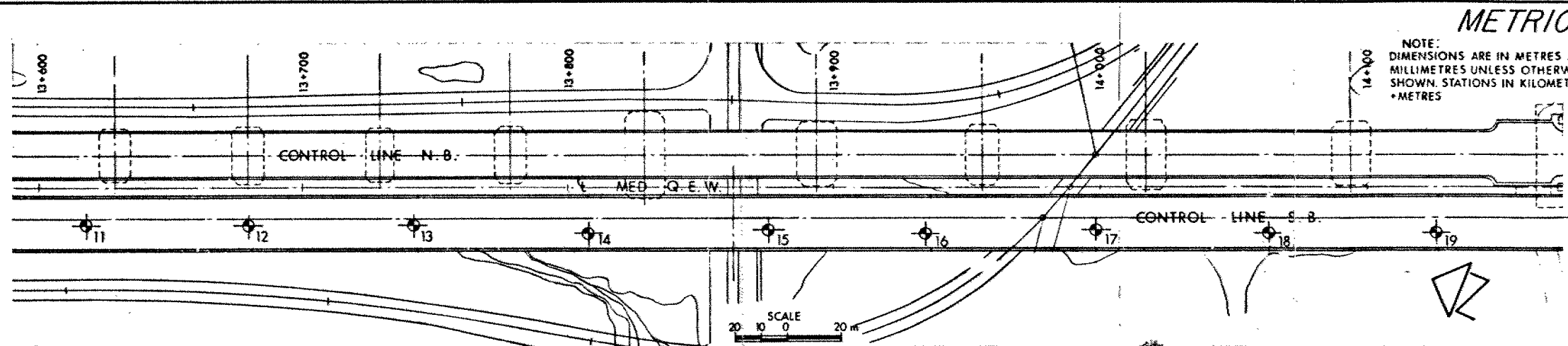
NOTE

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

DATE	BY	DESCRIPTION

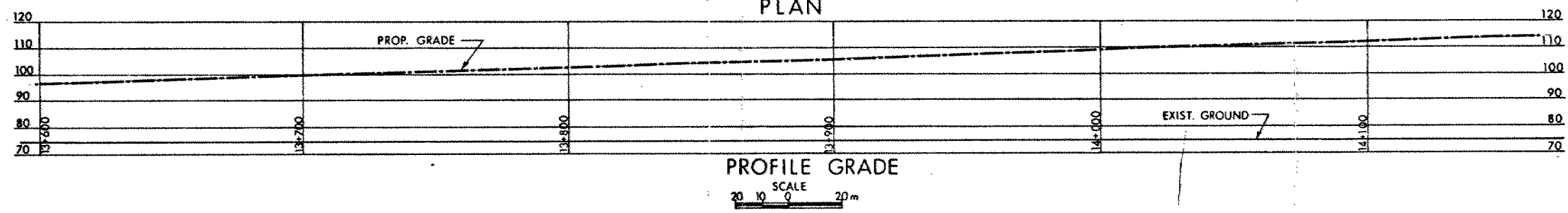
Geocres No 30M5-135

HWY No	Q.E.W.	DIST	4
SUBM'D D	CHECKED	DATE 82 05 18	SITE 35-60
DRAWN D	J. CHECKED	DATE 82 05 18	DWG 2107900-A



METRIC

NOTE:
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE
SHOWN. STATIONS IN KILOMETRES -
+ METRES

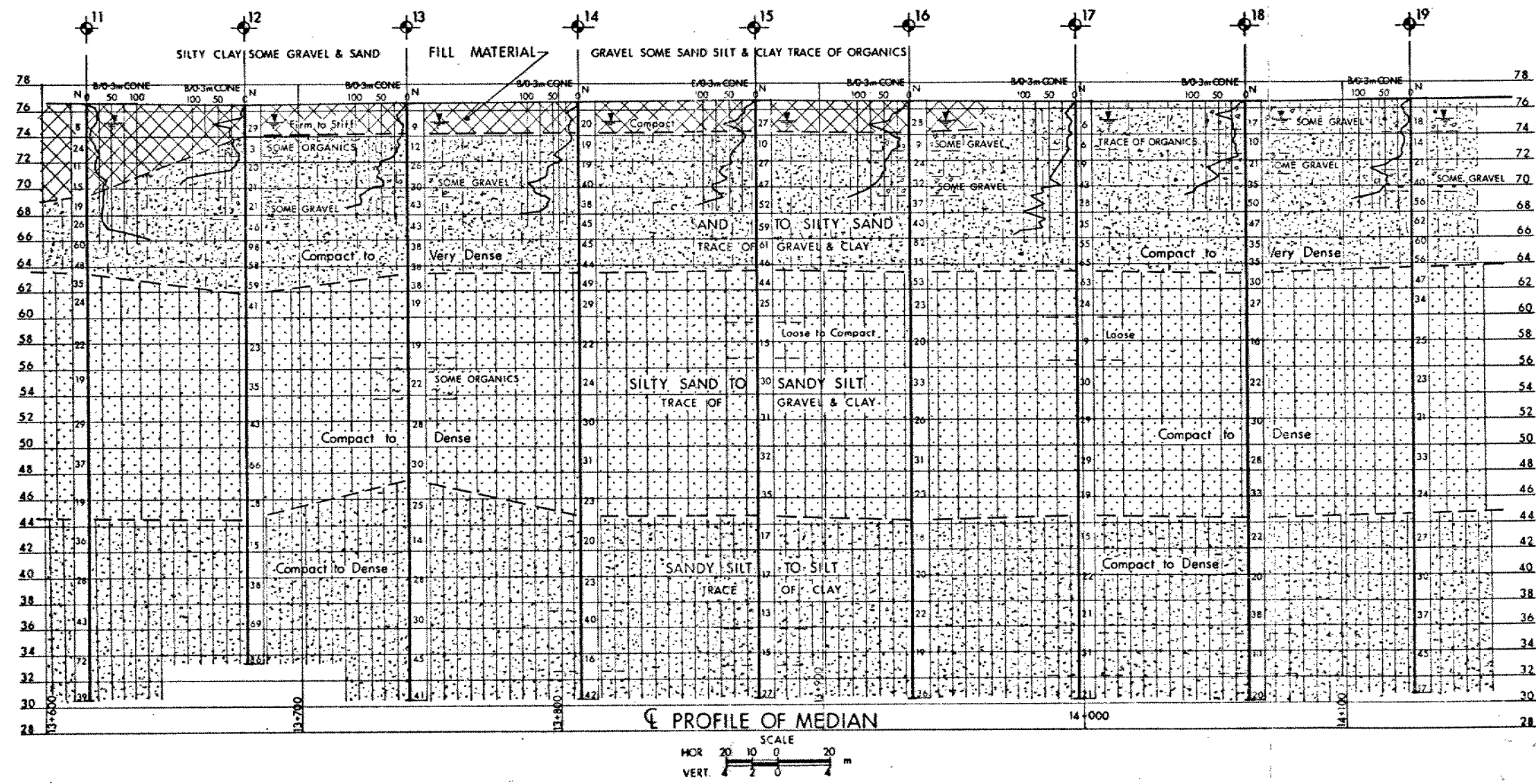
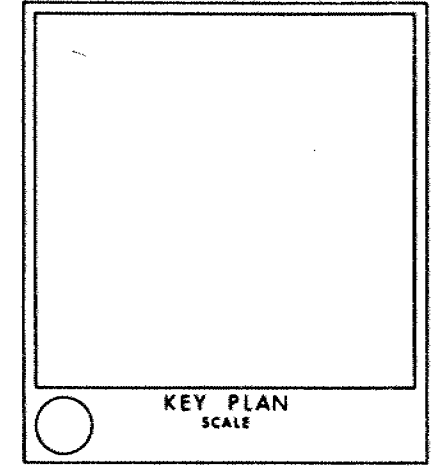


CONT No
WP No 210-79-00

BURLINGTON BAY SKYWAY
Q.E.W. S.B.
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
81 06 19 to 81 07 08

No	ELEVATION	STATION	Q.E.W. OFFSET (m)
11	76.6	13+617	14 RT
12	76.4	13+680	14 RT
13	76.6	13+742	14 RT
14	76.6	13+809	17 RT
15	76.7	13+875	16 RT
16	76.6	13+935	17 RT
17	76.5	13+999	16 RT
18	76.4	14+064	18 RT
19	76.7	14+126	18 RT



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

DATE	BY	DESCRIPTION

Geocres No 30M5-135

HWY No	Q.E.W.	DIST	4
SUBMIT D.O. CHECKED	DATE 82 05 12	SITE	36-60
DRAWN J. CHECKED	DATE 82 05 12	OWG	2107900-5

METRIC

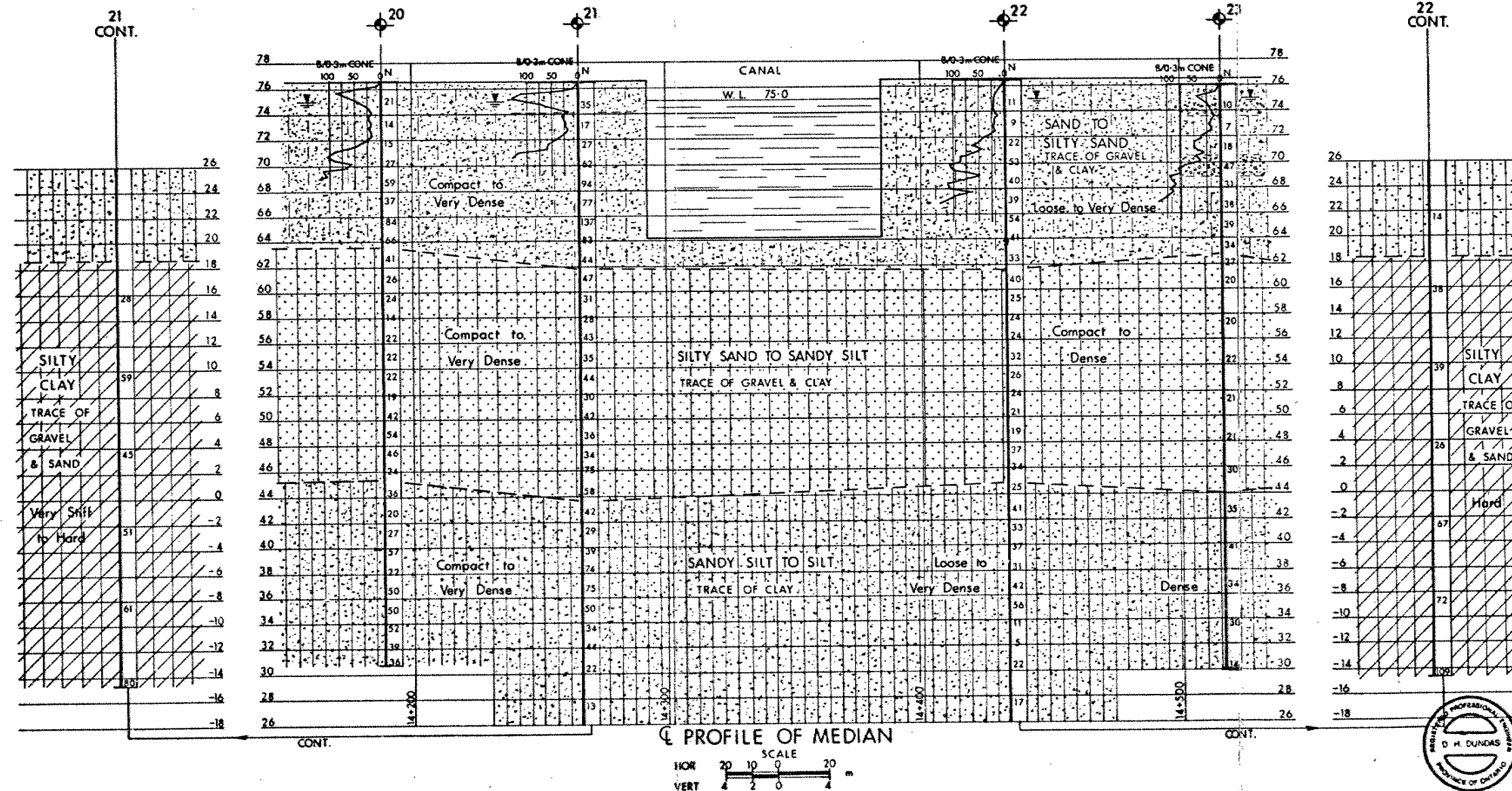
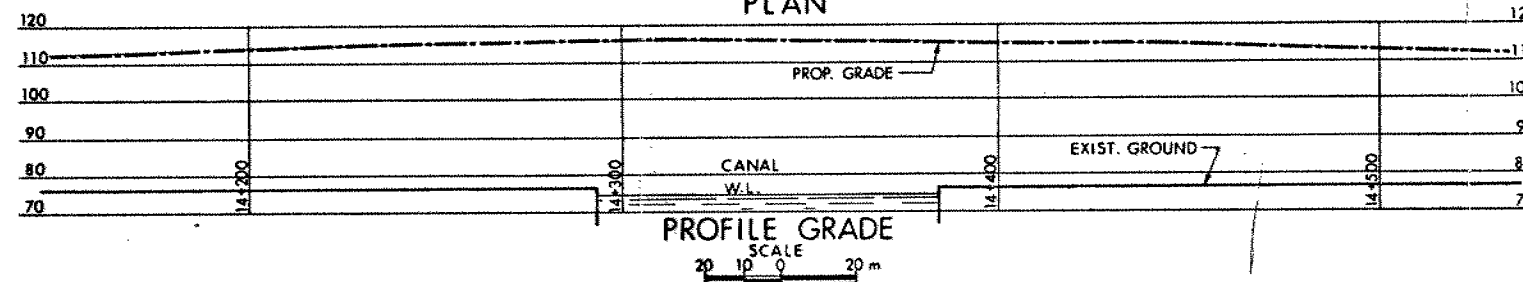
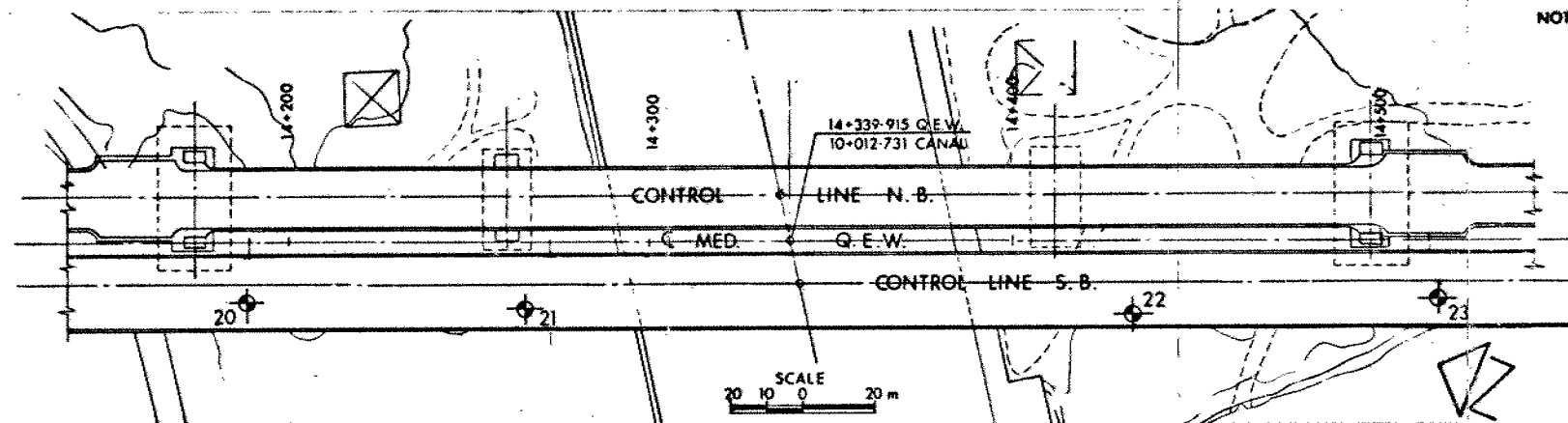
NOTE: DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES

CONT No
WP No 210-79-00

BURLINGTON BAY SKYWAY
Q.E.W. S.B.
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
81 05 22 to 81 07 06

No	ELEVATION	STATION	Q.E.W. MED OFFSET (m)
20	76.7	14+187	18 RT
21	76.5	14+266	19 RT
22	76.3	14+434	20 RT
23	76.0	14+516	16 RT

NOTE

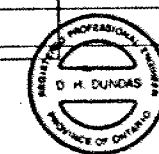
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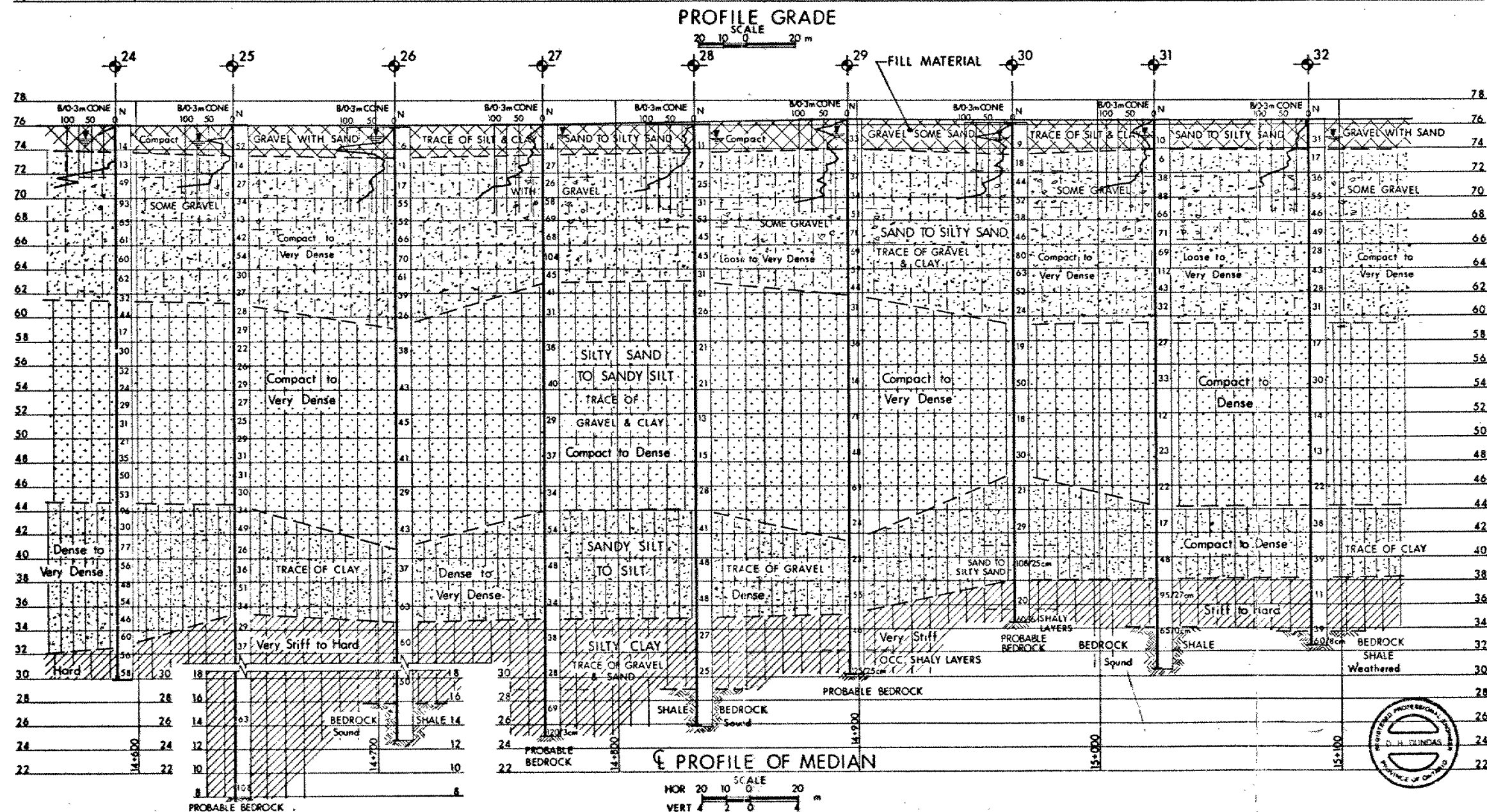
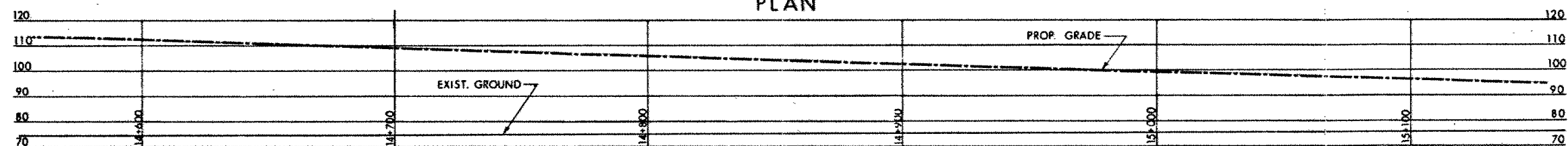
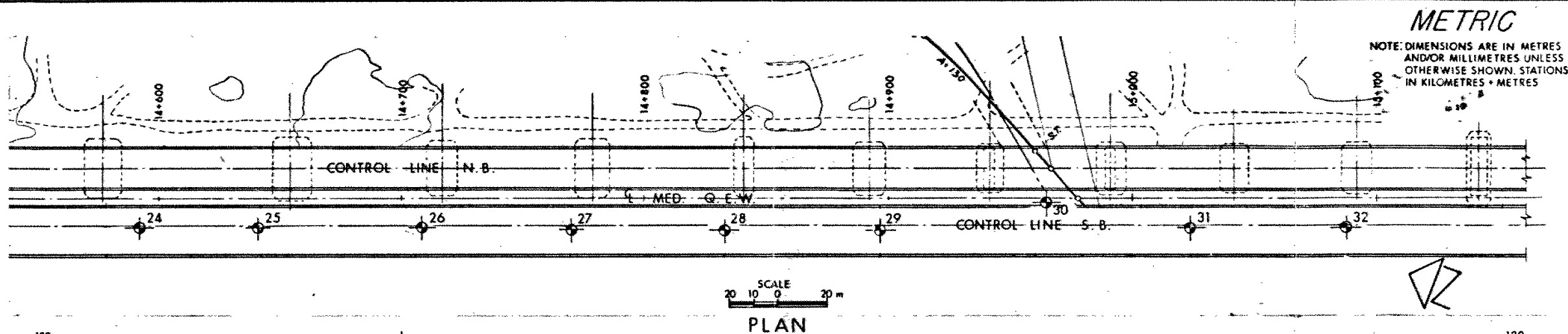
REVISIONS	DATE	BY	DESCRIPTION

Geocres No 30MS-135

HWY No	Q.E.W.	DIST	3
SUBMD	D	CHECKED	DATE 82 05 12
DRAWN	J	CHECKED	DATE 82 05 12

DATE 82 05 12 SITE 36-60
DWG 2137900-C



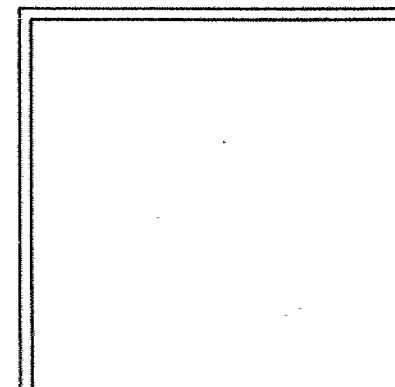


CONT No
WP No 210-79-00

BURLINGTON BAY SKYWAY
Q.E.W. S.B.
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



KEY PLAN
SCALE

LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
81 05 15 to 81 06 03

No	ELEVATION	STATION	Q.E.W. MED. OFFSET (m)
24	76.1	14+592	12 RT
25	75.9	14+642	12 RT
26	75.8	14+708	12 RT
27	76.0	14+770	13 RT
28	76.1	14+833	13 RT
29	76.4	14+897	13 RT
30	76.1	14+965	2 RT
31	76.3	15+023	12 RT
32	76.3	15+086	12 RT

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 30M5-135

HWY No	Q.E.W.	DIST	4
SUBAPP'D. D. CHECKED	DATE 82 05 24	SITE	35-60
DRAWNOL J. CHECKED	APPROVED	DWG	2107900-D

Geocres No 30M5-135

HWY No	Q E W.	DIST	4
SUBMD D	D	CHECKED	DATE 82 05 24
PREPARED	CHECKER	APPROVED	SITE 36-60

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<u>Page No.</u>	<u>Description</u>
1	Index
2	Abbreviations & Symbols
3-92	Foundation Investigation Report
	Burlington Bay Skyway W.P. 210-79-01
93-100	Addendum

Note: For purposes of the Contract this report and the Addendum supercedes all other foundation reports done by or for the Ministry in connection with this project.

EXPLANATION OF TERMS USED IN REPORT

2

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

	SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING		VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING		VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $\frac{w_L - w_p}{w - w_p}$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

For

W.P. 210-79-01, Site 36-60

Burlington Bay Skyway

Q.E.W. S.B., District 4INTRODUCTION:

This report contains the results of a subsurface investigation carried out to obtain information required for the design of the proposed Burlington Bay Skyway. The field work was performed during the period from 81 05 15 - 07 08, utilizing continuous-flight auger machines, NX casing and BX core barrels. The field work consisted of 42 sampled boreholes/cone penetration tests. Bedrock was cored at 7 boreholes. The report deals only with conditions which prevailed at the time of the fieldwork in 1981 and with pertinent events which occurred before that time, however, construction operations have occurred since 1981 which has resulted in fill material being placed within the limits of this present project. This new fill material is described only in the Addendum to this report and is not further referred to here.

SITE DESCRIPTIONTopography

The site is located on the narrow strip of land some 6.5 km in length which separates Hamilton Harbour from Lake Ontario and on which is built the Q. E. W.

The shipping channel harbour entrance is located in the centre portion of the beach strip. This is crossed by the Burlington High Level Bridge which carries the four lanes of the Q. E. W. and which extends from 1280 m north of the shipping channel to 1280 m south of the channel for a total length of 2560 m. The structure was constructed during the period 1955-1958. It is described in some detail below.

East of the Q.E.W., some 100 m distant, is a two to four lane road (and City street) known as Beach Boulevard. This road crosses the shipping channel by means of a steel lift bridge which also incorporates a single railway track on the east side to carry the C. N. R. over the shipping channel. The development along the beach strip is generally residential. On the west side of the Burlington High Level Bridge and immediately north of the shipping channel is the Canada Centre for Inland Waters.

This has been constructed entirely on reclaimed land of area about 400 m square built up to about el. 76.50. The new high level bridge will be built on the west side of the existing high level bridge approximately 23.95 m distant from it C/L to C/L. In this area the present ground surface lies between elevation 76.0 and 77.0, the average being about el. 76.5. Much of this area was reclaimed at the time of construction of the existing bridge. Prior to that time, most of the ground surface was covered with water roughly 2 m in depth. Between March and July of 1955, hydraulic fill material was pumped into the area from the bottom of Hamilton Bay using a 'sand sucker' dredge and was contained on the west side of the reclaimed area by a rock fill dyke located about 27 m west of the existing bridge C/L. On the east side of the reclaimed area, the fill was contained by the existing ground which was generally above el. 76.00. The crest of the rock fill dyke was built to about el. 76.00 and the reclaimed area was filled up to about the same level or slightly higher. The mean lake level at that time was 74.98 m. Since completion of the existing bridge in 1958 additional areas have been reclaimed on the west side of the bridge and what is now the Canada Centre for Inland Waters has been built. Along the entire boundary between the reclaimed land and the Hamilton Harbour, rock fill and slabs of concrete some exceeding a cubic metre in volume have been dumped as protection against wave erosion. Much of this material can be seen along the entire shoreline for the entire length of the bridge and approaches but boulders and concrete slabs have no doubt been buried during the reclaiming process and cannot now be seen.

Physiography

Physiographically, the strip of land described above is referred to as the Burlington bar and is a typical baymouth bar. According to Coleman (1936a) the Burlington bar was built up by easterly storms which shifted beach material from the south shore to cut off the west end of Lake Ontario and form what is now Hamilton Harbour. The entrance to the harbour used to be nearer the north end of the bar but for safer navigation, the present shipping channel was constructed and the old entrance has since filled up. About 8 km to the west and approximately parallel to the Burlington bar, there is another bar which cuts off Dundas Bay from Hamilton Harbour. This bar is about 35 m above the present water level of Lake Ontario and is believed to have formed in the ancient Lake Iroquois (Coleman 1936b). Following the draining of Lake Iroquois about

10,000 years ago (Karrow 1963), the ancient bar was left on dry land and the water level locally dropped to below the present lake level. Subsequently, the depth of water in Lake Ontario gradually increased about 60.0 m due to a rise in the level of its outlet. The Burlington bar was formed and grew in height as Lake Ontario rose to its present level. The sediments comprising the bar, therefore, are approximately 60 m in maximum thickness. As described by Karrow (1963), the bar deposits are underlain at the north end by a series of silty clay tills of glacial origin. There is a bedrock trough at the central portion of the site from which the bedrock elevations increase towards both the north and south. At the extreme north end of the site bedrock was encountered at approximately elev. 33.0 m. At the south end of the bar, Queenston shale bedrock was encountered 38 m below lake level at approximately elev. 37.0 m.

Existing Bridge - Superstructure

The main 150.87 m span with the two flanking spans is of steel cantilever truss construction with a six panel suspended span. Steel truss spans (eleven on each side of the canal) are used with spans of 76.20 m, 60.96 m and 48.77 m. Near the abutments, where the roadway is close to the ground, the short spans use 0.9144 m rolled steel beams. There are sixteen of these spans on each side of the canal. Nine steel plate girder spans on each side of the canal are used as a transition from truss to rolled beam spans. Because of predicted settlements (60 to 150 mm) continuity was avoided in the longer truss spans. It was felt that the differential settlements between adjoining piers could be tolerated for continuous rolled beam and plate girder spans in the approaches. Provision was made in the design for convenient jacking and shimming. However, in the 23 years the bridge has been in service, neither shimming nor jacking has been necessary since the predicted settlements did not occur.

Existing Bridge - Substructure

The substructure of this bridge consists of 74 piers and two abutments. The individual piers are designated as N1 to N37 commencing from the north side of the canal with increasing numbers to the north, and S1 to S37 commencing from the south side of the canal with increasing numbers to the south. The method of foundation support is as follows:

UnitFoundation Details

Piers N1 and S1

Founded on cellular type concrete caissons at el. 64.61. These are on steel H piles (12 BP @ 53) driven to el. 49.38. The piles were designed only to prevent uplift of the caisson during construction in the event that a failure of the well point dewatering system occurred. Design pile capacity (against uplift) - 200 kN/pile. Net design pressure - 95.76 kPa.

Piers N2 and S2

Founded on cellular type concrete caissons at el. 71.01.
Net design pressure - 95.76 kPa.

Piers N10 to N29 incl.

Founded on Size 36 untreated timber piles driven about 5.50 m below pile cap bases. Elevations of pile cap bases are 73.38 for N10 to N27 and 72.54 for N28 and N29.
Average design capacity - 160 kN/pile
Maximum design capacity - 200 kN/pile

Piers N3 to N9 incl.

Founded on spread footings at el.
71.62 - 73.15

N30 to N37 incl.

North Abutment

Net design pressure - 95.76 kPa.

Piers S3 to S37 incl.

Founded on spread footings at el.
72.54 - 73.15

South Abutment

Net design pressure - 95.76 kPa

SUBSURFACE CONDITIONS

General

The Record of Borehole Sheets, contained in the report appendix, illustrate the conditions at the borehole locations. The locations and elevations of the borings, and estimated stratigraphical profiles based on the borehole data, are shown on Sheet Nos. 96 to 96-5 and 197 to 197-5 of the Contract Drawings.

The investigation area extends from 1313 m north, to 1277 m south of the shipping channel centre-line along the alignment of the proposed structure and its approaches.

The general sequences of materials across the entire site (sequentially from the surface downwards) is indicated in the following table:

<u>MATERIAL</u>	<u>THICKNESS</u>	
	Range	Average
Fill Material	2.4 - 8.5	N/A
Sand to Silty Sand	6.1 - 14.6 m	11.6 m
Silty Sand to Sandy Silt	9.8 - 21.9 m	17.4 m
Sandy Silt to Silt	4.9 - 26.5 m	N/A
Silty Clay	2.6 - 34.0+m	N/A
Shale Bedrock	-	-

Below the surface fill, the material generally grades from sand through silty sand, sandy silt, silt and silty clay to the shale bedrock. The bedrock contours have influenced the depositional patterns, affecting the location and thickness of the material layers.

Groundwater

The groundwater elevation is consistent across the site at 75.0± m, approximately equal to the water level in Hamilton Harbour.

Fill Material

With the exception of an area between approximately Sta. 13+900 and Sta. 14+500, the surface material across the site is fill (which is bounded on the west side by a rockfill dyke with an estimated base width of 6 m, a depth of 3.0±m and 1:1 slopes). The thickness of the fill is generally less than 3.0±m. However, in the area of Sta. 13+600, the fill thickness increases to over 8.5 m, probably at the location of a previous natural channel through the bar. At most locations the fill material is sand to silty sand to gravel. However, between Sta. 13+150 and Sta. 13+800 silty clay fill was encountered at BH No. 3, 4, 5, 6, 11, 12 and 13. The denseness of the non-cohesive fill material ranges from loose to very dense. The consistency of the cohesive fill material ranges from soft to very stiff. At various locations waste concrete and slag were encountered within the fill material. Note also that material from the rockfill dyke (estimated to be boulders of various sizes) exists towards the west edge of the fill material. The physical characteristics of the fill materials vary and are indicated on the Record of Borehole Sheets. Figure 1 illustrates the range in grain size distributions for various fill materials.

Sand to Silty Sand; trace/some/with gravel, trace of clay

This material is at the surface between approximately Sta. 13+900 and Sta. 14+500 and immediately beneath the surface fill across the rest of the site. The material was also encountered beneath the Sandy Silt to Silt layer at BH No.4 (Sta. 13+275), BH No.30 (Sta. 14+965), and BH No.37 (Sta. 15+347). It is predominantly sand, although it becomes finer with depth, grading into silty sand. The gravel content varies across the site. The denseness ranges from loose to very dense. Figure 2 illustrates the typical grain size distribution for this material.

Silty Sand to Sandy Silt; trace of gravel and clay

This material extends across the entire site immediately under the Sand to Silty Sand layer. It is predominantly silty sand, although it becomes finer with depth, grading into sandy silt. A deposit of organic

material (3.1 m in thickness) was encountered within this deposit at BH No.13 (Sta. 13 + 742). The denseness of the material ranges from loose to very dense. Figure 3 illustrates the typical grain size distribution for this material.

Sandy Silt to Silt; trace of clay

This material extends across the entire site immediately under the Silty Sand to Sandy Silt layer. It is predominantly sandy silt, although it becomes finer with depth, grading into silt (and in some cases plastic silt). The denseness ranges from loose to very dense. Figure 4 illustrates the typical grain size distribution for this material.

Silty Clay; trace of gravel and sand (possible glacial till)

This material extends across the entire site immediately under the Sandy Silt to Silt layer and immediately above the bedrock. The shale content increases with depth as the material grades into weathered shale. The consistency of the material also increases with depth ranging from stiff to hard. The material has low plasticity.

Physical properties of the material, as determined from field and laboratory tests are summarized below.

	Range	Average
Natural Moisture Content (w)	17.4 - 20.9 %	19.3 %
Liquid Limit (W_L)	25.0 - 33.5 %	31.0 %
Plastic Limit (W_p)	13.5 - 16.0 %	15.4 %
Shear Strength		
- unconfined compression	27.6 kPa (1 test)	

Figure 5 illustrates the typical grain size distribution for this material.

Bedrock

There is a bedrock trough centred at approximately Sta. 13+715 where the bedrock elevation is estimated to be -62.0 m. From this trough, the bedrock slopes upward both to the north (to elev. 33.4 at Sta. 13+027) and to the south (to elev. 7.9 at Sta. 14+642 and to elev. 36.4 at Sta.

15+433). This indicates that the overburden thickness ranges from over 138 m at the location of the trough to less than 40 m at the extreme north and south ends of the site. The bedrock is red and green shale with occasional layers of shaly, silty limestone. It is overlain by transitional zones grading from silty clay with shaly layers to weathered shale. Refer to the Record of Borehole Sheets for specific bedrock elevations.



D. H. Dundas

D. H. Dundas, P. Eng.
Project Foundations Engineer

K. G. Selby

K. G. Selby, P. Eng.
Senior Foundations Engineer

APPENDIX



Ministry of
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Ontario

RECORD OF BOREHOLE No 1 METRIC

W P 210-79-00

LOCATION Sta. 13 + 027

32+Rt.

ORIGINATED BY D.D.

DIST 4 HWY O.E.W.

BOREHOLE TYPE Hollow Stem Auger, NX Casing

COMPILED BY O.J.

DATUM Geodetic

DATE 81 06 12 - 17

CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.2	Ground Level											
0.0	Sand to Silty Sand with Gravel Some Clay and Organics Very Dense		1	SS	61							
73.8	(Fill Material)											
2.4	Sand to Silty Sand Trace of Gravel and Clay Very Loose to Loose		2	SS	6							0 74 (26)
70.7			3	SS	2							0 55 (45)
5.5	Organic Material (OH) Soft		4	SS	3							
69.2												
7.0			5	SS	11							0 94 (6)
	Sand to Silty Sand Trace of Gravel and Clay Compact to Dense		6	SS	37							
			7	SS	20							1 85 (14)
			8	SS	25							
63.1												
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		9	SS	23							
			10	SS	13							
			11	SS	30							
			12	SS	13							
			13	SS	23							
			14	SS	44							
45.7	Cont'd											

OFFICE REPORT ON SOIL EXPLORATION

30.5

+3, x5: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 1 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 027 32 Rt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 12-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.7	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	63											0 63 29 8	
	Sand to Silty Sand		16	SS	44												
41.1																	
35.1	Sandy Silt to Silt Some Gravel Trace of Clay Very Dense		17	SS	136												
			18	SS	107											17 35 40 8	
36.0																	
40.2	Silty Clay (CL) Trace of Gravel and Sand Hard																
33.4																	
42.8	Probable Bedrock (Weathered) End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 x 5 (%) STRAIN AT FAILURE
10



Ministry of
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RECORD OF BOREHOLE No 2

METRIC

W P 210-79-00

LOCATION Sta. 13 + 115 25m Rt.

ORIGINATED BY D.D.

DIST 4 HWY Q.E.W.

BOREHOLE TYPE Hollow Stem Auger, NX Casing

COMPILED BY O.J.

DATUM Geodetic

DATE 81 06 12-16

CHECKED BY D.E.

SOIL PROFILE

SAMPLES

GROUND WATER CONDITIONS

ELEVATION SCALE

DYNAMIC CONE PENETRATION RESISTANCE PLOT

20 40 60 80 100
SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x LAB VANE

PLASTIC LIMIT
W_p
NATURAL MOISTURE
CONTENT
W
LIQUID LIMIT
W_L
WATER CONTENT (%)
15 30 45

UNIT WEIGHT γ

REMARKS
&
GRAIN SIZE
DISTRIBUTION
(%)
GR SA SI CL

ELEV
DEPTH

DESCRIPTION

STRAT PLOT

NUMBER

TYPE

N° VALUES

76.3

Ground Level

0.0

Gravel
Some Sand
Trace of Silt and
Clay
Loose
(Fill Material) ---
Some Silt and Clay

1

SS

5

2

SS

10

72.3

4.0

Some Organics

3

SS

5

Sand to Silty Sand
Trace of Gravel and
Clay, Loose to Very
Dense

4

SS

14

With Gravel

5

SS

79

6

SS

89

Some Gravel

7

SS

21

8

SS

36

Some Gravel

9

SS

50

10

SS

64

59.5

16.8

Silty Sand to Sandy
Silt
Trace of Gravel and
Clay
Compact to Very Dense

11

SS

25

12

SS

33

13

SS

24

14

SS

60

45.4

30.9 End of Borehole

3, x5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 3

METRIC

W P 210-79-00

LOCATION Sta. 13 + 184

30mRt.

ORIGINATED BY D.D.

DIST 4

HWY Q.E.W.

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY O.J.

DATUM Geodetic

DATE 81 06 12-15

CHECKED BY D.D.

SOIL PROFILE

SAMPLES

GROUND WATER CONDITIONS

ELEVATION SCALE

DYNAMIC CONE PENETRATION RESISTANCE PLOT

20 40 60 80 100

SHEAR STRENGTH

○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x LAB VANE

PLASTIC LIMIT

NATURAL MOISTURE CONTENT

LIQUID LIMIT

W_p

W

W_L

WATER CONTENT (%)

15 30 45

UNIT WEIGHT

γ

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

77.3 Ground Level
0.0 Silty Clay (CL)
Some Gravel and Sand
Firm to Stiff
(Fill Material)

74.9 Sand to Silty Sand
2.4 Trace of Gravel and
Clay, Loose to Dense
Some Gravel

64.2 Silty Sand to Sandy
13.1 Silt
Trace of Clay
Loose to Compact

46.4
30.9 End of Borehole

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 4

METRIC

W P 210-79-00

LOCATION Sta. 13 + 275 20m Rte.

ORIGINATED BY D.D.

DIST 4 HWY Q.E.W.

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY O.J.

DATUM Geodetic

DATE 81 06 16-17

CHECKED BY D.D.

SOIL PROFILE

SAMPLES

GROUND WATER
CONDITIONS

ELEVATION SCALE

DYNAMIC CONE PENETRATION RESISTANCE PLOT

20 40 60 80 100

SHEAR STRENGTH

○ UNCONFINED + FIELD VANE

● QUICK TRIAXIAL x LAB VANE

PLASTIC LIMIT
W_p

NATURAL MOISTURE
CONTENT
W

LIQUID LIMIT
W_L

WATER CONTENT (%)

UNIT
WEIGHT
γ

REMARKS
&
GRAIN SIZE
DISTRIBUTION
(%)
GR SA SI CL

ELEV
DEPTH

DESCRIPTION

STRAT PLOT

NUMBER

TYPE

'N' VALUES

77.0

Ground Level

0.0

Silty Clay (CL)

with Sand, Some Gravel

Firm to Stiff

(Fill Material)

73.6

3.4

Some Gravel

Sand to Silty Sand
Trace of Gravel and
Clay
Loose to Dense

Trace of
Organics

63.9

13.1

Silty Sand to Sandy

Silt

Trace of Gravel and

Clay

Compact to Dense

1

SS

5

2

SS

13

3

SS

5

4

SS

11

5

SS

11

6

SS

14

7

SS

35

8

SS

15

9

SS

28

10

SS

14

11

SS

24

12

SS

25

13

SS

24

14

SS

30

76

74

72

70

68

66

64

62

60

58

56

54

52

50

48

5 27 54 14

37 31 26 6

19 67 (14)

8 88 (4)

4 87 (9)

0 25 73 2

0 25 68 7

46.5 Cont'd

30.5

+3, x5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 4 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 275 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY C.J.
DATUM Geodetic DATE 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.5	Cont'd																
40.5	Silty Sand to Sandy Silt		15	SS	25		46										GR SA SI CL
	Compact to Very Dense																
							44										0 71 23 6
			16	SS	23												
42.0																	
35.0	Sandy Silt to Silt						42										
	Trace of Clay																
	Dense to Very Dense		17	SS	39		40										
							38										0 3 96 1
			18	SS	50												
35.9							36										
41.1	Sand to Silty Sand																
	Trace of Clay																
	Compact to Very Dense		19	SS	26		34										
							32										
30.8																	
46.2	End of Borehole		20	SS	74												0 72 24 4
							30										

3, 5 : Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 5 METRIC

W P 210-79-00

LOCATION Sta. 13 + 311 20_hRt.

ORIGINATED BY D.D.

DIST 4 HWY Q.E.W.

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY O.J.

DATUM Geodetic

DATE 81 06 17-18

CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100					
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
77.0	Ground Level												
	Silty Clay (CL) With Sand, Some Gravel Very Stiff (Fill Material)		1	SS	24								
			2	SS	26								7 39 40 14
73.0			3	SS	40								5 54 36 5
4.0	Trace of Gravel		4	SS	7								
	Sand to Silty Sand Some Gravel Trace of Clay Loose to Very Dense		5	SS	15								20 70 (10)
			6	SS	40								
			7	SS	48								14 72 (14)
			8	SS	71								
	With Gravel		9	SS	59								
	Trace of Gravel		10	SS	46								
60.2													
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	21								
			12	SS	19								
			13	SS	30								
			14	SS	33								
30.9	End of Borehole		15	SS	30								

+3, x5: Numbers refer to Sensitivity 15-5 (%) STRAIN AT FAILURE 10



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RECORD OF BOREHOLE No 6 METRIC

W P 210-79-00 LOCATION Sta. 13 + 356 18-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 16-19 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	VALUES			20 40 60 80 100	SHEAR STRENGTH					
77.2	Ground Level													
0.0	Silty Clay (CL) with Sand, Some Gravel													
74.8	Soft to Firm (Fill Material)		1	SS	4									
2.4			2	SS	35									
	and Sand		3	SS	80									35 51 (14)
	Gravel with Sand Trace of Silt and Clay		4	SS	33									57 35 (8)
70.2	Dense to Very Dense (Probable Fill Mater.)		5	SS	24									
7.0			6	SS	43									31 61 7 1
	With Gravel		7	SS	85									
	Sand to Silty Sand Trace of Gravel and Clay		8	SS	64									1 95 (4)
	Compact to Very Dense		9	SS	30									
			10	SS	18									
60.4														
16.8	Silty Sand to Sandy Silt		11	SS	18									
	Trace of Clay													
	Compact to Very Dense		12	SS	30									
			13	SS	48									
			14	SS	26									
46.3			15	SS	51									

30.9 End of Borehole

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 7 METRIC

W.P. 210-79-00 LOCATION Sta. 13 + 403 18mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 19-22 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT Wp W WL			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			WATER CONTENT (%) 15 30 45		
77.4	Ground Level													
0.0	Gravel with Sand													
	Trace of Silt and Clay		1	SS	28									
	Loose to Compact (Fill Material)		2	SS	8									53 39 (8)
73.4														
4.0	Some Organics, Loose		3	SS	5									0 84 (16)
	Sand to Silty Sand		4	SS	21									0 91 (9)
	Trace of Gravel and Clay		5	SS	19									
	Compact to Very Dense		6	SS	20									
	Some Organics		7	SS	29									4 92 (4)
			8	SS	32									1 90 (9)
			9	SS	54									
			10	SS	29									
60.6														
16.8	Silty Sand to Sandy Silt													
	Trace of Gravel and Clay		11	SS	25									
	Compact to Very Dense		12	SS	35									
			13	SS	12									
			14	SS	58									
48.4														
29.0	Sandy Silt to Silt													
	Trace of Clay		15	SS	55									
46.5	Very Dense													
30.9	End of Borehole													

+3, x5: Numbers refer to Sensitivity 15 20 5 (%) STRAIN AT FAILURE 10



RECORD OF BOREHOLE No 8 METRIC

W P 210-79-00 LOCATION Sta. 13 + 454 17th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 22-23 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
76.7	Ground Level													
0.0	Gravel													GR SA SI CL
74.3	Some Sand, Silt and Clay Dense (Fill Material)		1	SS	36									
2.4	Trace of Organics		2	SS	8									
	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		3	SS	21									
	Some Gravel		4	SS	21									
			5	SS	31									
			6	SS	48									
	with Gravel		7	SS	83									
			8	SS	63									
			9	SS	32									
			10	SS	24									
59.9														
16.8	Silty Sand to Sandy Silt													
	Trace of Gravel and Clay		11	SS	11									
	Compact to Dense													
			12	SS	20									
			13	SS	31									
			14	SS	16									
45.8			15	SS	28									

30.9 End of Borehole

³, x ⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 9 METRIC

W P 210-79-00 LOCATION Sta. 13 + 503 16.Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23-24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.8	Ground Level												
0.0	Gravel												
	Some Sand, Silt and Clay		1	SS	54								
	Dense to Very Dense (Fill Material)		2	SS	44								56 33 (11)
			3	SS	50								52 47 (1)
71.3			4	SS	24								
5.5			5	SS	12								
			6	SS	48								
	Some Gravel		7	SS	28								21 78 (1)
	Sand to Silty Sand		8	SS	37								
	Trace of Gravel and Clay		9	SS	72								
	Compact to Very Dense		10	SS	29								15 80 (5)
60.0													
16.8	Silty Sand to Sandy Silt												
	Trace of Gravel and Clay		11	SS	34								
	Compact to Very Dense												
			12	SS	19								
			13	SS	31								
			14	SS	57								
47.8													
29.0	Sandy Silt to Silt												
	Trace of Clay												
45.9	Dense		15	SS	40								
30.9	End of Borehole												

+3, x5: Numbers refer to
Sensitivity

15 20
10 5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 10 METRIC

W P 210-79-00 LOCATION Sta. 13 + 552 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 17-18 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.8	Ground Level											
0.0	Gravel											
	Some Sand, Silt and Clay		1	SS	25							
	Loose to Compact		2	SS	4							
	(Fill Material)		3	SS	19							
			4	SS	21							
			5	SS	16							
68.3			6	SS	36							
8.5	with Gravel		7	SS	37							
	Sand to Silty Sand		8	SS	51							
	Trace of Gravel and Clay		9	SS	38							
	Dense to Very Dense		10	SS	23							
62.2			11	SS	17							
14.6	Silty Sand to Sandy Silt		12	SS	17							
	Trace of Gravel and Clay		13	SS	19							
	Compact		14	SS	12							
47.8												
29.0	Sandy Silt to Silt											
	Trace of Clay											
46.3	Compact to Very Dense											
30.5	Cont'd											

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



W P 210-79-00 LOCATION Sta. 13 + 552 16-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 17-18 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES					
46.3	Cont'd						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					GR SA SI CL
30.5	Sandy Silt to Silt Trace of Clay Compact to Very Dense		15	SS	45	46						
			16	SS	24	44						
			17	SS	35	42						
			18	SS	51	40						
			19	SS	45	38						
			20	SS	32	36						
30.6	End of Borehole					34						
46.2						32						

+3, x5; Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



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Ontario

RECORD OF BOREHOLE No 11 METRIC

W P 210-79-00 LOCATION Sta. 13 + 617 14th Rt.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger ORIGINATED BY D.D.
DATUM Geodetic DATE 81 06 19-22 COMPILED BY O.J.
CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.6 0.0	Ground Level						76					
	Silty Clay (CL) Some Gravel and Sand Firm to Stiff		1	SS	8		74					33 56 (11)
	Sand to Silty Sand with Gravel Trace of Clay Compact		2	SS	24		72					29 59 (12)
	(Fill Material)		3	SS	11		70					
			4	SS	15		68					0 86 13 1
69.6 7.0	Sand to Silty Sand		5	SS	19		66					3 75 (22)
	Trace of Gravel and Clay		6	SS	26		64					0 68 (32)
	Compact to Very Dense		7	SS	60		62					
			8	SS	48		60					
63.5 13.1	Silty Sand to Sandy Silt		9	SS	35		58					
	Trace of Gravel and Clay		10	SS	24		56					
	Compact to Dense		11	SS	22		54					
			12	SS	19		52					
			13	SS	29		50					
			14	SS	37		48					
46.1 30.5	Cont'd											

+3, x⁵: Numbers refer to
Sensitivity 15 20
5 (%) STRAIN AT FAILURE
10

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Ontario

RECORD OF BOREHOLE No 11 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 617 14th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 19-22 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
46.1	Cont'd													
30.5	Silty Sand to Sandy Silt		15	SS	19		46							GR SA SI CL
44.6														
32.0	Sandy Silt to Silt													
	Trace of Clay						44							
	Compact to Dense		16	SS	36		42							
							40							
			17	SS	28		38							
							36							
			18	SS	43		34							
							32							
			19	SS	72									
30.4														
46.2	End of Borehole		20	SS	39		30							

+3, x5: Numbers refer to
Sensitivity

15 \div 5 (%) STRAIN AT FAILURE
10



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Communications
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RECORD OF BOREHOLE No 12 METRIC

W P 210-79-00 LOCATION Sta. 13 + 680 14th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23-25 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.4	Ground Level												
0.0	Silty Clay (CL) Some Gravel and Sand Very Stiff (Fill Material)		1	SS	29								GR SA SI CL
74.0			2	SS	3								
2.4	Some Organics Very Loose		3	SS	20								
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		4	SS	21								
	Some Gravel		5	SS	21								
			6	SS	46								
			7	SS	98								
			8	SS	58								
			9	SS	59								
61.8			10	SS	41								
14.6	Sandy Silt to Silty Sand Trace of Gravel and Clay Compact to Very Dense		11	SS	23								
			12	SS	35								
			13	SS	43								
			14	SS	66								
45.9	Cont'd												

30.5

*3, *5: Numbers refer to
Sensitivity

20
15 * 5 (%) STRAIN AT FAILURE
10



W P 210-79-00 LOCATION Sta. 13 + 680 14-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23-25 CHECKED BY D.D.

+³, x⁵: Numbers refer to Sensitivity

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RECORD OF BOREHOLE No 13 METRIC

W P 210-79-00 LOCATION Sta. 13 + 742 14th Rt.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger ORIGINATED BY D.D.
DATUM Geodetic DATE 81 06 23 COMPILED BY O.J.
CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60						80	100	WATER CONTENT (%)		
								SHEAR STRENGTH								15	30	45		

76.6	Ground Level														
0.0	Silty Clay (CL) Some Gravel and Sand Firm to Stiff (Fill Material)						76								GR SA SI CL
74.2			1	SS	9										
2.4	Sand to Silty Sand		2	SS	12		74								0 94 (6)
	Trace of Gravel and Clay		3	SS	26		72								25 67 (8)
	Compact to Dense		4	SS	30		70								
	Some Gravel		5	SS	43		68								0 89 (11)
			6	SS	43		66								
			7	SS	38		64								0 84 (16)
			8	SS	38		62								
63.5			9	SS	38		60								
13.1	Silty Sand to Sandy Silt		10	SS	19		58								
	Trace of Gravel and Clay		11	SS	19		56								
	Compact to Dense		12	SS	22		54								
			13	SS	28		52								
	Some Organics		14	SS	30		50								
47.6							48								
29.0	Sandy Silt to Silt														
46.1	Trace of Clay														
	Compact to Dense														
30.5	Cont'd														

+3, x5: Numbers refer to
Sensitivity

15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 13 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 742 14mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 23 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L	WATER CONTENT (%)					
46.1	Cont'd																
30.5	Sandy Silt to Silt		15	SS	25												
			16	SS	14												
			17	SS	28												
	Compact to Dense		18	SS	30												
			19	SS	45												
30.4			20	SS	41												
46.2	End of Borehole																

+3, x5 Numbers refer to 15 20
Sensitivity 5 10 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 14 METRIC

W P 210-79-00 LOCATION Sta. 13 + 809 17m Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 24-25 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p W W _L	WATER CONTENT (%)				
76.6	Ground Level													
0.0	Gravel Some Sand, Silt and Clay Trace of Organics													
74.2	Compact (Fill Material)		1	SS	20									
2.4	Sand to Silty Sand													
	Trace of Gravel and Clay		2	SS	19									
	Compact to Very Dense		3	SS	19									
			4	SS	40									
			5	SS	38									
			6	SS	45									
			7	SS	45									
			8	SS	44									
63.5														
13.1	Silty Sand to Sandy Silt		9	SS	49									
	Trace of Gravel and Clay		10	SS	29									
	Compact to Dense													
			11	SS	22									
			12	SS	24									
			13	SS	30									
			14	SS	31									
46.1	Cont'd													
30.5														

+3, x5: Numbers refer to Sensitivity 15-20 5 (%) STRAIN AT FAILURE 10

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RECORD OF BOREHOLE No 14 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 809 17th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY D.J.
DATUM Geodetic DATE 81 06 24-25 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.1	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	23		46										
44.6																	
32.0	Sandy Silt to Silt						44										
	Trace of Clay																
	Compact to Dense		16	SS	20		42										
			17	SS	23		40										
			18	SS	40		38										
							36										
	Slight Plasticity																
			19	SS	16		34										
							32										
30.4			20	SS	42												
46.2	End of Borehole						30										

*3, *5: Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 15 METRIC

W P 210-79-00 LOCATION Sta. 13 + 875 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 26-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.7	Ground Level											
0.0	Gravel Some Sand, Silt and Clay Trace of Organics Compact (Fill Material)		1	SS	27		76					
74.3			2	SS	10		74					0 95 (5)
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		3	SS	27		72					1 93 (6)
			4	SS	47		70					
			5	SS	52		68					0 86 (14)
			6	SS	59		66					
			7	SS	61		64					1 88 (11)
			8	SS	46		62					1 89 (10)
63.6			9	SS	44		60					
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		10	SS	25		58					
			11	SS	15		56					
			12	SS	30		54					
			13	SS	31		52					
			14	SS	37		50					
							48					
46.7	Cont'd											

30.5

3, x 5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10



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Ontario

RECORD OF BOREHOLE No 15 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 875 16_mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 26-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60					
46.2	Cont'd														
30.5	Silty Sand to Sandy Silt		15	SS	33										
44.7															
32.0	Sandy Silt to Silt														
	Trace of Clay														
	Compact		16	SS	17										
			17	SS	17										
			18	SS	13										
	Slight Plasticity		19	SS	15										
30.5			20	SS	27										
46.2	End of Borehole														

+3, x5: Numbers refer to Sensitivity
15 ± 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 16 METRIC

W P 210-79-00 LOCATION Sta. 13 + 935 17m Rt.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger
DATUM Geodetic DATE 81 06 29-30
ORIGINATED BY D.D.
COMPILED BY D.J.
CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
76.6	Ground Level													
0.0	Gravel Some Sand, Silt & Clay Trace of Organics Compact (Fill Material)		1	SS	28		76							
74.2			2	SS	9		74							
2.4	some organics loose		3	SS	24		72							
	Sand to Silty Sand Trace of Gravel & Clay Compact to very dense		4	SS	32		70							
	some Gravel		5	SS	37		68							
			6	SS	40		66							
			7	SS	82		64							
63.5			8	SS	35		62							
13.1	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to very dense		9	SS	53		60							
			10	SS	23		58							
			11	SS	20		56							
			12	SS	33		54							
			13	SS	26		52							
			14	SS	31		50							
46.1	Cont'd						48							

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30.5

3, x 5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10



W P 210-79-00 LOCATION Sta. 13 + 935 17th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 29-30 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
46.1	Cont'd														
30.5	Silty Sand to Sandy Silt		15	SS	23		46								
44.3															
32.3	Sandy Silt to Silt Trace of Clay Compact to dense		16	SS	18		44								
			17	SS	20		42								
			18	SS	22		40								
			19	SS	19		38								
			20	SS	36		36								
30.4							34								
46.2	End of Borehole						32								
							30								

+3, x5: Numbers refer to Sensitivity

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RECORD OF BOREHOLE No 17 METRIC

W P 210-79-00 LOCATION Sta. 13 + 999 16 Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 30 - 07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.5	Ground Level												
0.0	Sand to Silty Sand Trace of Gravel & Clay						76						
			1	SS	6								
	Trace of Organics Loose		2	SS	6		74						0 87 (13)
	Compact to Very Dense		3	SS	19		72						2 95 (3)
			4	SS	43		70						
			5	SS	28		68						0 91 (9)
			6	SS	35		66						
			7	SS	53		64						0 87 (13)
			8	SS	65		62						1 80 (19)
63.4	Silty Sand to Sandy Silt		9	SS	63		60						
13.1	Trace of Gravel and Clay		10	SS	24		58						
	Compact to Very Dense						56						
	Loose		11	SS	9		54						
			12	SS	30		52						
			13	SS	29		50						
			14	SS	29		48						
46.0	Cont'd												

30.5

3, x 5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 17 cont. METRIC

W P 210-79-00 LOCATION Sta. 13 + 999 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 30-07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.0	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	19		46										
44.5																	
32.0	Sandy Silt to Silt						44										
	Trace of Clay																
	Compact to Dense		16	SS	15		42										
			17	SS	22		40										
			18	SS	21		38										
							36										
	Slight Plasticity						34										
			19	SS	31		32										
30.3																	
46.2	End of Borehole		20	SS	21		30										

+3, x3 : Numbers refer to
Sensitivity

20
15 10 5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 18 METRIC

W P 210-79-00 LOCATION Sta. 14 + 064 18 Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 07 02-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.4 0.0	Ground Level						76					
	Some Gravel		1	SS	17		74					
	Sand to Silty Sand Trace of Gravel & Clay, Compact to very dense		2	SS	10		72					
	Some Gravel		3	SS	21		70					
			4	SS	35		68					
			5	SS	50		66					
			6	SS	47		64					
			7	SS	35		62					
			8	SS	35		60					
63.3 13.1	Silty Sand to Sandy Silt		9	SS	30		58					
	Trace of Gravel and Clay		10	SS	27		56					
	Compact to Dense		11	SS	16		54					
			12	SS	22		52					
			13	SS	30		50					
			14	SS	28		48					
45.9 30.5	Comp'd						46					

+3, x5: Numbers refer to
Sensitivity
15 20 10
5 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No 18 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 064 18mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 07 02-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.9	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	33												
44.4																	
32.0	Sandy Silt to Silt Trace of Clay Compact to dense						44										
			16	SS	22												
							42										
			17	SS	20		40										
							38										
			18	SS	38		36										
	Slight Plasticity						34										
			19	SS	10		32										
30.2			20	SS	20												
46.2	End of Borehole						30										

+3, x5: Numbers refer to 15-20 (10) STRAIN AT FAILURE
Sensitivity

RECORD OF BOREHOLE No 19 METRIC

W P 210-79-00 LOCATION Sta. 14 + 126 18mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 07 07-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
76.7	Ground Level													GR SA SI CL
0.0														
	Some Gravel		1	SS	18									
	Sand to Silty Sand		2	SS	14									1 93 (6)
	Trace of Gravel and Clay		3	SS	21									5 87 (8)
	Compact to Very Dense		4	SS	40									
	Some Gravel		5	SS	56									2 80 (18)
			6	SS	62									
			7	SS	60									0 86 (14)
			8	SS	58									
63.6			9	SS	47									
13.1	Silty Sand to Sandy Silt		10	SS	34									
	Trace of Gravel and Clay		11	SS	25									
	Compact to Dense		12	SS	23									
			13	SS	21									
			14	SS	33									
46.2	Cont'd													

30.5

+3, x5: Numbers refer to Sensitivity 15 5 (%) STRAIN AT FAILURE 10

RECORD OF BOREHOLE No 19 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 126 18_mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 07 07-08 CHECKED BY D.D.

[illegible]

+3, x5: Numbers refer to Sensitivity



RECORD OF BOREHOLE No 20 METRIC

W P 210-79-00 LOCATION Sta. 14 + 187 18_{th} Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 30-07 01 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER						
76.7	Ground Level								
0.0	Sand to Silty Sand								
	Trace of Gravel and Clay								
	Compact to Very Dense								
			1	SS	21				
			2	SS	14				
			3	SS	15				
			4	SS	27				
			5	SS	59				
			6	SS	37				
			7	SS	84				
			8	SS	66				
63.6									
13.1	Silty Sand to Sandy Silt								
	Trace of Gravel and Clay								
	Compact to Very Dense								
			9	SS	41				
			10	SS	26				
			11	SS	24				
			12	SS	14				
			13	SS	22				
			14	SS	22				
			15	SS	22				
			16	SS	19				
			17	SS	42				
			18	SS	54				
			19	SS	46				
46.2	Cont'd								
30.5									

+3, x5: Numbers refer to Sensitivity
15 20 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 20 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 187 18mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 30-07 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
46.2	Cont'd													
30.5	Silty Sand to Sandy		20	SS	24									
45.3	Silt													
31.4	Sandy Silt to Silt													
	Trace of Clay		21	SS	36									
	Compact to Very Dense		22	SS	20									
			23	SS	27									
			24	SS	57									
			25	SS	22									
			26	SS	50									
			27	SS	50									
			28	SS	32									
			29	SS	39									
30.5			30	SS	36									
46.2	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 21 METRIC

W P 210-79-00 LOCATION Sta. 14 + 266 19_{th} Rt.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing
DATUM Geodetic DATE 81 05 25-26 and 81 07 02-06
ORIGINATED BY D.D.
COMPILED BY Q.J.
CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100			
76.5	Ground Level														GR SA SI CL
0.0															
	Some Gravel		1	SS	35		76								14 76 (10)
	Sand to Silty Sand		2	SS	17		74								3 89 (8)
	Trace of Gravel and Clay		3	SS	27		72								2 92 (6)
	Compact to Very Dense		4	SS	62		70								7 80 (13)
			5	SS	94		68								
			6	SS	77		66								
			7	SS	137		64								17 74 (9)
			8	SS	83		62								4 67 23 6
			9	SS	44		60								5 81 (14)
61.9			10	SS	47		58								
14.6	Silty Sand to Sandy Silt		11	SS	31		56								
	Trace of Gravel and Clay		12	SS	28		54								
	Compact to Very Dense		13	SS	43		52								0 42 (58)
			14	SS	35		50								0 53 42 5
			15	SS	44		48								0 28 66 6
			16	SS	30										0 28 (72)
			17	SS	42										
			18	SS	36										
			19	SS	34										
46.0	Cont'd														
30.5															

+3, x5: Numbers refer to Sensitivity
20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 21 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 266 19mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 25-26 and 81 07 02-06 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
46.0	Cont'd																
30.5	Silty Sand to Sandy Silt		20	SS	75		46										
43.6			21	SS	58		44										
32.9	Sandy Silt to Silt		22	SS	42		42										0 16 (84)
	Trace of Clay		23	SS	29		40										
	Compact to Very Dense		24	SS	39		38										0 9 82 9
			25	SS	74		36										
			26	SS	75		34										0 2 89 9
			27	SS	50		32										
			28	SS	34		30										
			29	SS	44		28										
			30	SS	22		26										
			31	SS	13		24										
18.6							22										
57.9	Silty Clay (CL)						20										
	Trace of Gravel and Sand						18										
15.5	Very Stiff to Hard						16										
	Cont'd																
61.0																	

+3, x5 : Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 21 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 266 19 Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 25-26 and 81 07 02-06 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
15.5	Cont'd		32	SS	28								3 12 49 36
61.0							14						
	Silty Clay						12						
	Trace of Gravel and Sand						10						
			33	SS	59		8						
							6						
	Very Stiff to Hard						4						
			34	SS	45		2						0 3 50 47
							0						
			35	SS	51		-2						
							-4						
							-6						
							-8						
			36	SS	61		-10						0 4 53 43
							-12						
							-14						
-15.4			37	SS	80								

91.9 End of Borehole

+3, x5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 22

METRIC

W P 210-79-00

LOCATION

Sta. 14 + 434

20mRt.

ORIGINATED BY D.D.

DIST 4 HWY Q.E.W.

BOREHOLE TYPE

Hollow Stem Auger, NX Casing

COMPILED BY D.J.

DATUM Geodetic

DATE

81 05 22-25 and 81 06 16-17

CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
76.3	Ground Level									
0.0	Sand to Silty Sand									
	Trace of Gravel and Clay									
	Loose to Very Dense									
			1	SS		11				1 92 (8)
			2	SS		9				
			3	SS		22				0 87 (13)
			4	SS		53				
			5	SS		40				6 83 (11)
			7	SS		54				3 80 (17)
			8	SS		41				
			9	SS		33				
61.7										
14.6	Silty Sand to Sandy Silt		10	SS		40				
	Trace of Gravel and Clay		11	SS		25				
	Compact to Dense		12	SS		24				
			13	SS		24				
			14	SS		32				
			15	SS		26				
			16	SS		24				
			17	SS		21				
			18	SS		19				
			19	SS		37				
45.8	Cont'd									
30.5										

*3, x5 : Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 22 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 434 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 22-25 and 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W		
45.8	Cont'd											
30.5	Silty Sand to Sandy Silt		20	SS	34							
44.9												
31.4	Sandy Silt to Silt											
	Trace of Clay		21	SS	25		44					
	Loose to Very Dense											
			22	SS	41		42					
			23	SS	33		40					
			24	SS	37		38					
			25	SS	31		36					
			26	SS	42		34					
			27	SS	56		32					
			28	SS	11		30					
			29	SS	5		28					
			30	SS	22		26					
			31	SS	17		24					
							22					
			32	SS	14		20					
18.4							18					
57.9	Silty Clay (CL)											
	Trace of Gravel and Sand											
	Hard											
15.3	Cont'd						16					

61.0

+3, x²: Numbers refer to Sensitivity 15 \pm 5 (%) STRAIN AT FAILURE 10



Ministry of
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RECORD OF BOREHOLE No 22 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 434 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 22-25 and 81 06 16-17 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
15.3	Cont'd		33	SS	38		14					
61.0							12					
	Silty Clay (CL)						10					
	Trace of Gravel and Sand		34	SS	39		8					
	Hard						6					
			35	SS	26		4					
							2					
							0					
							-2					
			36	SS	67		-4					
							-6					
							-8					
			37	SS	72		-10					
							-12					
							-14					
-15.6			38	SS	109							

91.9 End of Borehole

Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 23 METRIC

W P 210-79-00 LOCATION Sta. 14 + 516 16mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 27-28 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
76.0	Ground Level										
	Some Gravel		1	SS	10						
	Sand to Silty Sand		2	SS	7						
	Trace of Gravel and Clay Loose to Very Dense		3	SS	18						
	Some Gravel		4	SS	47						
			5	SS	31						
			6	SS	38						
			7	SS	39						
			8	SS	34						
62.9											
13.1	Silty Sand to Sandy Silt		9	SS	27						
	Trace of Gravel and Clay		10	SS	20						
	Compact										
			11	SS	20						
			12	SS	22						
			13	SS	21						
			14	SS	21						
45.5	Cont'd										
30.5											

+3, x5: Numbers refer to Sensitivity
15 → 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 23 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 316 16_{th} St. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 27-28 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.5	Cont'd		15	SS	30												GR SA SI CL
30.5	Silty Sand to Sandy Silt																
44.0																	
32.0	Sandy Silt to Silt						44										
	Trace of Clay																
	Dense		16	SS	35		42										
			17	SS	41		40										
			18	SS	34		38										
			19	SS	30		36										
							34										
							32										
29.8			20	SS	14		30										
46.2	End of Borehole																

3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 24 METRIC

W P 210-79-00 LOCATION Sta. 14 + 592 12mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 15-19 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 15 30 45	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
76.1	Ground Level										
0.0	Gravel With Sand, Some Orga- nics, trace of Silt and Clay, Compact (Fill Material)		1	SS	14		76				
73.7			2	SS	13		74				
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense some Gravel		3	SS	49		72				1 94 (5)
			4	SS	93		70				13 77 (10)
			5	SS	65		68				19 71 (10)
			6	SS	61		66				
			7	SS	60		64				11 78 (11)
			8	SS	62						
61.3			9	SS	32		62				
14.6	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to Very Dense		10	SS	44		60				
			11	SS	17		58				
			12	SS	30		56				
			13	SS	32						
			14	SS	24		54				
			15	SS	29		52				
			16	SS	31		50				
			17	SS	21		48				
			18	SS	35						
			19	SS	50		46				
45.6	Cont.										
30.5											

*3, *5: Numbers refer to
Sensitivity 15-20
10 5 (%) STRAIN AT FAILURE



Ministry of
Transportation and
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Ontario

RECORD OF BOREHOLE No. 24 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 592 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 15-19 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.6	Cont.		20	SS	53												
30.5	Silty Sand to Sandy																
44.7	Silt																
31.4	Sandy Silt to Silt Trace of Clay Dense to Very Dense		21	SS	96		44										
			22	SS	30		42										
			23	SS	77		40										
			24	SS	56		38										
			25	SS	48		36										
			26	SS	54		34										
			27	SS	46		32										
			28	SS	60												
32.5			29	SS	56												
43.6	Silty Clay (Cl) Trace of Gravel and Sand, Hard		30	SS	58		30										
29.9																	
46.2	End of Borehole																

*³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



Ministry of
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RECORD OF BOREHOLE No 25 METRIC

W P 210-79-00 LOCATION Sta. 14 + 642 12mRt. ORIGINATED BY D.D.
ST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 19-20 & 81 06 25-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
75.9	Ground Level												
0.0	Gravel with Sand, Trace of Silt and Clay, occ. Slag Fill, Very Dense (Fill Material)		1	SS	52								
73.5													
2.4	Sand to Silty Sand Trace of Gravel & Clay Compact to Very Dense Some Gravel		2	SS	14								
			3	SS	27								
			4	SS	34								
			5	SS	13								
			6	SS	42								
			7	SS	54								
			8	SS	30								
			9	SS	37								
61.3													
14.6	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to Very Dense		10	SS	28								
			11	SS	29								
			12	SS	22								
			13	SS	26								
			14	SS	29								
			15	SS	27								
			16	SS	25								
			17	SS	29								
			18	SS	31								
			19	SS	31								
45.4	Cont.												

+3, x5: Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



Ministry of
Transportation and
Communications

RECORD OF BOREHOLE No 25 cont. METRIC

W P 210-79-00

LOCATION Sta. 14 + 642 12mRt.

ORIGINATED BY D.D.

DIST 4 HWY Q.E.W.

BOREHOLE TYPE Hollow Stem Auger & NX Casing

COMPILED BY G.J.

DATUM Geodetic

DATE 81 05 19-20 & 81 06 25-29

CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.4	Cont.		20	SS	30												GR SA SI CL
30.5																	
44.5																	
31.4	Sandy Silt to Silt Trace of Clay Compact to Very Dense		21	SS	34		44										
			22	SS	49		42										
			23	SS	26		40										
			24	SS	36		38										
			25	SS	51		36										
35.4			26	SS	34		34										
40.5	Silty Clay (Cl) Trace of Gravel and Sand, Very Stiff to Hard		27	SS	29		32										
			28	SS	37		30										
			29	SS	27		28										
			30	SS	27		26										
			31	SS	17		24										
							22										
			32	SS	39		20										
							18										
14.9	Cont.						16										

*3, x5: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 25 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 642 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 19-20 & 81 06 25-29 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100					
14.9	Cont.																
61.0	Silty Clay		33	SS	63		14										
	occ. Shaly Layers						12										
							10										
7.9			34	SS	108		8										
68.0	Probable Bedrock End of Borehole																

*³, x⁵: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 26

METRIC

W P 210-79-00 LOCATION Sta. 14 + 708 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 20-22 & 81 06 19-24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
75.8	Ground Level												
0.0	Gravel with Sand Trace of Silt and Clay Occ. Slag Fill, Compact (Fill Material)		1	SS	16								
73.4													
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		2	SS	11								4 89 (7)
			3	SS	17								0 98 (2)
			4	SS	55								
			5	SS	52								7 88 (5)
			6	SS	66								
			7	SS	70								12 74 (14)
			8	SS	61								4 81 (15)
			9	SS	39								
			10	SS	26								
59.0													
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	38								
			12	SS	43								
			13	SS	45								
			14	SS	41								
45.3	Cont'd												

30.5

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 26 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 708 12th Rr. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 20-22 & 81 06 19-24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
45.3	Cont'd		15	SS	29								
30.5							44						
			16	SS	43		42						
40.7													
35.1	Sandy Silt to Silt Trace of Clay Dense to Very Dense		17	SS	37		40						
							38						
			18	SC			36						
34.7													
41.1	Silty Clay (CL) Trace of Gravel and Sand Hard		19	SS	60		34						
							32						
			20	SS	42		30						
							28						
							26						
			21	SS	49		24						
							22						
							20						
			22	SS	50		18						
							16						
15.8													
60.0	Bedrock Shale		23	RC	100%								
14.8	Cont'd												

61.0


+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



METRIC

W P 210-79-00 LOCATION Sta. 14 + 708 12 Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodatic DATE 81 05 20-22 & 81 06 19-24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
14.8	Cont'd													
61.0	Bedrock Shale Sound		23	RC	100%									
12.7			24	RC	73%									
63.1	End of Borehole													

+3, x5: Numbers refer to Sensitivity

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RECORD OF BOREHOLE No 27 METRIC

W.P. 210-79-00 LOCATION Sta. 14 + 770 13mRt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 27-28 & 81 06 24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	SPAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100					
76.0	Ground Level												
0.0	Sand to Silty Sand With Gravel, Some Clay Compact (Fill Material)		1	SS	14								
73.6													
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense with Gravel		2	SS	27								
			3	SS	26								
			4	SS	58								
			5	SS	69								
			6	SS	68								
			7	SS	104								
			8	SS	45								
62.9													
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		9	SS	41								
			10	SS	31								
			11	SS	38								
			12	SS	40								
			13	SS	29								
			14	SS	17								
45.5	Cont'd												
30.5													

+3, x⁵: Numbers refer to Sensitivity 15-5 (%) STRAIN AT FAILURE 10

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 27 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 770 13mRt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 27-28 & 81 06 24 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES								
45.5	Cont'd		15	SS	34								
30.5													
44.0													
32.0	Sandy Silt to Silt Trace of Clay Dense to Very Dense		16	SS	54		42						
							40						
			17	SS	48								
							38						
			18	SS	34		36						
34.9													
41.1	Silty Clay (CL) Trace of Gravel and Sand Very Stiff to Hard		19	SS	38		34						
							32						
			20	SS	28		30						
	Occ. Shaly Layers		21	SS	69		28						
							26						
24.8			22	SS	120.3 cm								
51.2	Probable Bedrock End of Borehole						24						

*², x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 28 METRIC

W P 210-79-00 LOCATION Sta. 14 + 833 13_{mt} ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 05 28-29 & 81 06 01 CHECKED BY D.D.

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER								
76.1	Ground Level										
0.0	Sand to Silty Sand Some Gravel Trace of Clay Compact (Fill Material)		1	SS	11						
73.7			2	SS	7						7 85 (8)
2.4	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		3	SS	25						6 88 (6)
			4	SS	31						
	Some Gravel		5	SS	53						11 80 (9)
			6	SS	45						
			7	SS	45						5 81 (14)
			8	SS	31						
63.0			9	SS	21						
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact		10	SS	26						
			11	SS	21						
			12	SS	21						
			13	SS	13						
			14	SS	13						
45.6	Cont'd										

30.5

*3, *5: Numbers refer to Sensitivity
15 - 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 28 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 833 13-Rt. ORIGINATED BY D.D.
 DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
 DATUM Geodetic DATE 81 05 28-29 & 81 06 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
45.6	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	28												
44.1																	
32.0	Sandy Silt to Silt Trace of Gravel Dense		16	SS	41												
			17	SS	48												
			18	SS	48												
35.0																	
41.1	Silty Clay (CL) Trace of Gravel and Sand Occ. Shaly Layers Very Stiff		19	SS	27												
			20	SS	25												
			21	TM	PH												
28.9																	
47.2	Bedrock Shale Sound		22	RC	93%												
			23	RC	100%												
25.8																	
50.3	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

15 \div 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 29 METRIC

W P 210-79-00 LOCATION Sta. 14 + 897 13rd Rt. ORIGINATED BY D.D.
DIST 4 HWY O.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 05 29 - 06 01 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
76.4	Ground Level										
0.0	Gravel Some Sand Trace of Silt and Clay Occ. Slag Fill Dense (Fill Material)		1	SS	33		76				
74.0			2	SS	3		74				
2.4			3	SS	37		72				
	With Gravel		4	SS	34		70				
	Some Gravel		5	SS	51		68				
			6	SS	71		66				
			7	SS	69		64				
	Sand to Silty Sand Trace of Gravel and Clay Very Loose to Very Dense		8	SS	57		62				
61.8			9	SS	44		60				
14.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		10	SS	31		58				
			11	SS	36		56				
			12	SS	14		54				
			13	SS	71		52				
			14	SS	48		50				
43.9	Cont'd						48				

30.5

*3, *5: Numbers refer to
Sensitivity
15 *3 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 30 METRIC

W P 210-79-00 LOCATION Sta. 14 + 965 2nd Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 21.06.01-05 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	VALUES			20 40 60 80 100	SHEAR STRENGTH					
76.1	Ground Level													
0.0	Sand to Silty Sand With Gravel Trace of Silt and Clay		1	SS	9									
73.7	Occ. Waste Concrete Loose, (Fill Material)													
2.4			2	SS	18									0 96 (4)
	Some Gravel		3	SS	44									17 74 (9)
			4	SS	52									
			5	SS	38									4 90 (6)
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		6	SS	46									
			7	SS	80									3 83 (14)
			8	SS	63									
			9	SS	52									
			10	SS	24									
59.3														
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		11	SS	19									
			12	SS	50									
			13	SS	18									
			14	SS	30									
47.1														
29.0	Sandy Silt to Silt Trace of Clay Compact													
45.6	Cont'd													
30.5														

*3, x⁵: Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 30 cont. METRIC

W P 210-79-00 LOCATION Sta. 14 + 965 2-Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 01-05 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
45.6	Cont'd															
30.5	Sandy Silt to Silt		15	SS	21											
	Trace of Clay															
			16	SS	29											
	Sand to Silty Sand Very Dense		17	SS	108	25 cm										
38.0																
38.1	Silty Clay (CL) Trace of Gravel and Sand Very Stiff to Hard		18	SS	20											
	Occ. Shaly Layers		19	SS	60	0.6 cm										
34.6																
41.5	Probable Bedrock End of Borehole															

+3, x5: Numbers refer to 15 ± 5 (%) STRAIN AT FAILURE
Sensitivity 10



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RECORD OF BOREHOLE No 31

METRIC

W P 216-79-00 LOCATION Sta. 15 + 023 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY G.J.
DATUM Geodetic DATE 21 06 01-03 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
76.3	Ground Level											
0.0	Sand to Silty Sand Trace of Gravel and Clay Loose to Compact		1	SS	10							
73.0	(Fill Material)											
2.4	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		2	SS	6							
			3	SS	38							
	With Gravel		4	SS	88							
			5	SS	66							
			6	SS	71							
			7	SS	69							
			8	SS	112							
			9	SS	43							
			10	SS	32							
59.5												
16.8	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		11	SS	27							
			12	SS	33							
			13	SS	12							
			14	SS	23							
45.9	Comp'd											
30.5												

*³, *⁵ Numbers refer to
Sensitivity 15 20 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 31 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 023 12mRt. ORIGINATED BY D.B.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 01-03 CHECKED BY D.B.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.8	Cont'd																
30.5	Silty Sand to Sandy Silt		15	SS	22												
44.3																	
32.0	Sandy Silt to Silt Trace of Gravel Compact to Dense		16	SS	17												
			17	SS	48												
38.2																	
38.1	Silty Clay Trace of Gravel and Sand Occ. Shaly Layers Hard		18	SS	95	27 cm											
34.2																	
42.1	Bedrock Shale Sound		19	SR	65	0 cm											
			20	RC	97												
			21	RC	98												
30.6																	
45.7	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 32 METRIC

W P 210-79-00 LOCATION Sta. 15 + 086 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY D.J.
DATUM Geodetic DATE 81 06 01-03 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
76.3	Ground Level															
0.0	Gravel with Sand Trace of Silt and Clay occ. Cobbles, Dense (Fill Material)		1	SS	31		76									
73.9			2	SS	17		74									18 74 (8)
72.4			3	SS	16		72									9 85 (6)
			4	SS	55		70									
	Some Gravel		5	SS	46		68									10 76 (14)
	Sand to Silty Sand Trace of Gravel and Clay, Compact to Very Dense		6	SS	49		66									3 80 (17)
			7	SS	28		64									
			8	SS	43		62									
			9	SS	28		60									
			10	SS	31		58									
59.5							56									
16.8	Silty Sand to Sandy Silt, Trace of Gravel and Clay, Compact to Dense		11	SS	17		54									
			12	SS	30		52									
			13	SS	14		50									
			14	SS	13		48									
45.8	Cont.						46									
30.3																

+2, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 32 cont. METRIC

W P 210-79-00 LOCATION Sp. 15 + 086 12mRr ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 01-03 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60					
45.8	Cont'd														
30.5	Silty Sand to Sandy Silt		15	SS	22										
44.3															
32.0	Sandy Silt to Silt Trace of Clay Dense		16	SS	38										
			17	SS	39										
38.2															
38.1	Silty Clay (CL) Trace of Gravel and Sand Stiff to Hard		18	SS	11										
33.6			19	SS	39										
43.0	Bedrock		20	SS	40.8 cm										
43.5	Shale, Weathered														
43.8	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 33

METRIC

W P 210-79-00 LOCATION Sta. 15 + 154 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
76.2	Ground Level												
0.0	Gravel with Sand Trace of Silt and Clay Compact (Fill Material)		1	SS	17		76						
73.8	Sand to Silty Sand		2	SS	22		74						
2.4	Trace of Gravel and Clay		3	SS	38		72						4 88 (8)
	Compact to Very Dense		4	SS	26		70						3 89 (8)
	Some Gravel		5	SS	17		68						2 86 (12)
			6	SS	47		66						
			7	SS	25		64						1 84 (15)
			8	SS	56		62						
			9	SS	35		60						
			10	SS	25		58						
59.4	Silty Sand to Sandy Silt		11	SS	24		56						
16.8	Trace of Gravel and Clay		12	SS	26		54						
	Compact to Dense		13	SS	26		52						
			14	SS	30		50						
45.7	Cont'd						48						
30.5							46						

+3, x5: Numbers refer to Sensitivity

15 20 5 (%) STRAIN AT FAILURE
10



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Ontario

RECORD OF BOREHOLE No 33 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 154 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
								SHEAR STRENGTH						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE					
45.7	Cont'd													
30.5			15	SS	43									
44.2														
32.0	Sandy Silt to Silt Trace of Clay Dense to Very Dense													
	Slight Elasticity		16	SS	48									
			17	SS	51									
38.1														
38.1	Silty Clay (CL) Trace of Gravel and Occ. Shaly Layers Stiff to Very Stiff		18	SS	7									
			19	SS	17									
31.4														
44.8			20	RC	572									
	weathered sound													
	Bedrock		21	RC	802									
28.3	Shale													
47.9	End of Borehole													

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



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Ontario

RECORD OF BOREHOLE No 34 METRIC

W P 210-79-00 LOCATION Sta. 15 + 202 12mBt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 03-04 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
76.0	Ground Level													
0.0	Gravel with Sand Trace of Silt and Clay													
73.6	Compact (Fill Material)		1	SS	26									
2.4	Sand to Silty Sand		2	SS	24									7 87 (6)
	Trace of Gravel and Clay		3	SS	42									15 73 (12)
	Compact to Very Dense		4	SS	62									
			5	SS	67									15 78 (7)
			6	SS	53									
			7	SS	65									6 75 (19)
			8	SS	63									
62.9														
13.1	Silty Sand to Sandy Silt		9	SS	48									
	Trace of Gravel and Clay		10	SS	40									
	Compact to Very Dense													
			11	SS	51									
			12	SS	19									
			13	SS	29									
			14	SS	51									
45.5	Cont'd													

30.5

$\times 3, \times 5$: Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 34 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 202 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodatic DATE 81 06 03-04 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
45.5	Cont'd		15	SS	42												
30.5																	
44.0																	
32.0	Sandy Silt to Silt Trace of Clay Dense to Very Dense		16	SS	61												
			17	SS	59												
37.9																	
38.1	Silty Clay (CL) Trace of Gravel & Sand Hard		18	SS	65	0.8 cm											
36.3																	
39.7	Probable Bedrock End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 35 METRIC

W P 210-79-00 LOCATION Sta. 15 + 252 20=RT: ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 09-10 CHECKED BY D.D.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
75.7	Ground Level									
0.0	Gravel with Sand Trace of Silt & Clay Very Dense (Fill Material)		1	SS	50					
73.3			2	SS	20					
2.4			3	SS	38					
	Some Gravel		4	SS	35					
	Sand to Silty Sand Trace of Gravel & Clay Compact to Very Dense		5	SS	52					
			6	SS	44					
			7	SS	50					
64.1			8	SS	33					
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		9	SS	36					
			10	SS	28					
			11	SS	33					
			12	SS	29					
			13	SS	32					
			14	SS	21					
45.2	Cont'd									
30.5										

+3, x5: Numbers refer to 15 20 5 (%) STRAIN AT FAILURE
Sensitivity 10



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RECORD OF BOREHOLE No 35 cont. METRIC

W P 210-79-00 LOCATION Sta. 15 + 252 20mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY O.J.
DATUM Geodetic DATE 81 06 09, 10 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
45.2	Cont'd		15	SS	22											
30.5							44									
43.7																
32.0	Sandy Silt to Silt Trace of Clay Compact to Dense		16	SS	25		42									
							40									
			17	SS	47		38									
37.6																
38.1	Silty Clay (CL) Trace of Gravel, Sand and Organics Occ. Shaly layers Very Stiff		18	SS	17		36									
							34									
32.9			19	SS	70, 10 cm											
42.8	Probable Bedrock End of Borehole						32									

+3, x5: Numbers refer to 20
Sensitivity 15 5 (%) STRAIN AT FAILURE
10

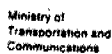
RECORD OF BOREHOLE No 36 METRIC

W P 210-79-00 LOCATION Sta. 15 + 298 12th Rt. ORIGINATED BY D.D.
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
 DATUM Geodetic DATE 81 06 05-08 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	WATER CONTENT (%)					
76.3	Ground Level													
0.0	Sand to Silty Sand Trace of Gravel and Clay Occ. Organics Very Loose (Fill Material)		1	SS	2									
73.9														
2.4	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		2	SS	14									2 92 (6)
			3	SS	35									5 84 (11)
	Some Gravel		4	SS	30									
			5	SS	66									8 65 (17)
														2 84 (14)
			7	SS	61									1 79 (20)
			8	SS	91									
63.2														
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Very Dense		9	SS	48									
			10	SS	29									
			11	SS	42									
			12	SS	36									
			13	SS	39									
			14	SS	58									
45.8	Cont'd													
30.5														

*3, x5: Numbers refer to
Sensitivity

20
15 ± 5 (%) STRAIN AT FAILURE
10



W P 210-79-00 LOCATION Sta. 15 + 298 12th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger & NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 05-08 CHECKED BY D.D.

[illegible]

+3, x3: Numbers refer to Sensitivity

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Ontario

RECORD OF BOREHOLE No 37 METRIC

W P 210-79-00 LOCATION Sta. 15 + 347 11.8t. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY D.J.
DATUM Geodetic DATE 81 06 09 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.5	Ground Level											
0.0	Gravel with Sand Trace of Silt & Clay Occ. Organics & Slag Compact (Fill Material)		1	SS	19		76					
74.1			2	SS	20		74					
2.4	Some Gravel		3	SS	22		72					
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		4	SS	34		70					
			5	SS	76		68					
	and Organic Silt (OL) Hard		6	SS	94		66					
			7	SS	50		64					
			8	SS	55		62					
			9	SS	19		60					
61.9			10	SS	19		58					
14.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Loose to Very Dense		11	SS	9		56					
			12	SS	19		54					
			13	SS	50		52					
50.6			14	SS	37		50					
25.9	Sandy Silt to Silt Trace of Clay Dense to Very Dense		15	SS	130		48					
45.6	Occ. Sandy Layers						46					
30.9	End of Borehole											

+3, x5: Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 38

METRIC

W P 210-79-00 LOCATION Sta. 13 + 398 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
76.1	Ground Level															
0.0	Sand to Silty Sand Some Gravel, Trace of Clay Occ. Organics & Slag Very Loose (Fill Material)		1	SS	3											
73.7			2	SS	5											
2.4	Some Gravel		3	SS	36											1 97 (2)
			4	SS	34											17 74 (9)
	Sand to Silty Sand Trace of Gravel and Clay Very Loose to Very Dense		5	SS	54											8 84 (8)
			6	SS	49											
			7	SS	35											1 93 (6)
			8	SS	44											
63.0			9	SS	40											
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		10	SS	29											
			11	SS	32											
			12	SS	28											
53.2			13	SS	24											
22.9	Sandy Silt to Silt Trace of Clay Compact		14	SS	18											
			15	SS	29											
45.2																
30.9	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

15 ÷ 5 (%) STRAIN AT FAILURE
10



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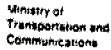
RECORD OF BOREHOLE No 39

METRIC

W P 210-79-00 LOCATION Sta. 15 + 433 12mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger, NX Casing COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.0	Ground Level											
0.0	Gravel with Sand Trace of Silt and Clay Occ. Slag Fill Compact (Fill Material)		1	SS	21							
73.6												
2.4	Sand to Silty Sand Trace of Gravel and Clay Loose to Very Dense		2	SS	8							
			3	SS	35							
	Some Gravel		4	SS	68							
			5	SS	70							
			6	SS	58							
	Some Gravel		7	SS	38							
64.4												
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		8	SS	46							
			9	SS	42							
			10	SS	25							
			11	SS	35							
			12	SS	34							
53.1												
22.9	Sandy Silt to Silt Trace of Clay Dense to Very Dense		13	SS	33							
			14	SS	65							
45.5												
30.5	Cont'd											

*3, x5: Numbers refer to Sensitivity
15 ± 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 39 cont. METRIC

W P	210-79-00	LOCATION	Sta. 15 + 433	12 Rt.	ORIGINATED BY	D.D.	
DIST	4	HWY	Q.E.W.	BOREHOLE TYPE	Hollow Stem Auger & Cone Test	COMPILED BY	O.J.
DATUM	Geodetic	DATE	81 06 10-11			CHECKED BY	D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										WATER CONTENT (%)		
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
45.3	Cont'd		15	SS	57															
30.5	Sandy Silt to Silt Trace of Clay Dense to Very Dense						44													
			16	SS	43		42													
							40													
39.1																				
36.9	Silty Clay Trace of Gravel and Sand Hard		17	SS	55		38													
36.4																				
39.6	Weathered		18	RC	20%		36													
	Sound																			
	Bedrock		19	RC	100%		34													
33.3	Shale																			
42.7	End of Borehole						32													

+3, x5: Numbers refer to Sensitivity

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RECORD OF BOREHOLE No 40 METRIC

W P 210-79-00 LOCATION Sta. 15 + 478 15th Rt. ORIGINATED BY D.D.
DIST 4 HWY G.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
75.9	Ground Level												
0.0	Gravel Some Sand, Silt and Clay Compact (Fill Material)		1	SS	20		74						
73.5			2	SS	7		72						4 79 (17)
2.4	Some Gravel		3	SS	25		70						14 79 (7)
			4	SS	67		68						1 98 (1)
	Sand to Silty Sand Trace of Gravel and Clay Compact to Very Dense		5	SS	56		66						7 92 (1)
			6	SS	35		64						
			7	SS	32		62						
			8	SS	27								
62.8			9	SS	22								
13.1	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact		10	SS	18								
60.2													
15.7	End of Borehole						60						

+3, x5: Numbers refer to
Sensitivity 15 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 41 METRIC

W P 210-79-00 LOCATION Sta. 15 + 544 13mRt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 10-11 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.2	Ground Level											
0.0	Gravel with Sand Trace of Silt and Clay Occ. Slag Fill Compact to Dense (Fill Material)		1	SS	46		76					
			2	SS	15		74					
72.2			3	SS	24		72					
4.0	With Gravel Some Gravel		4	SS	45		70					
			5	SS	38		68					
	Sand to Silty Sand Trace of Gravel and Clay Compact to Dense		6	SS	28		66					
			7	SS	38		64					
64.6			8	SS	36		62					
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Compact to Dense		9	SS	38		60					
			10	SS	22		58					
			11	SS	26		56					
			12	SS	34		54					
53.3			13	SS	29		52					
22.9	Sandy Silt to Silt Trace of Clay Compact to Very Dense		14	SS	43		50					
			15	SS	52		48					
45.3							46					

30.9 End of Borehole

+3, x5: Numbers refer to
Sensitivity

15 20
5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 42 METRIC

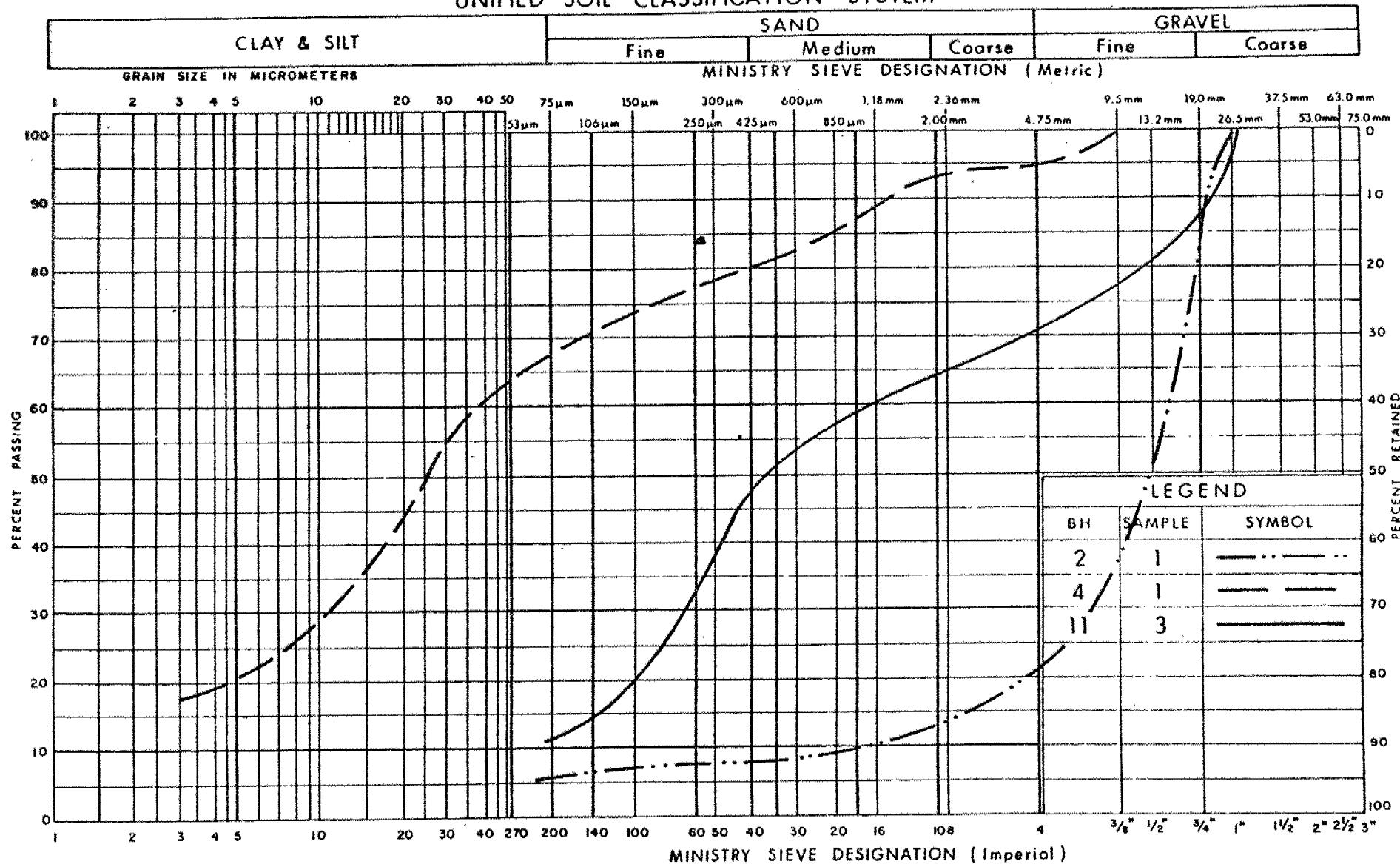
W P 210-79-00 LOCATION Sta. 15 + 617 18th Rt. ORIGINATED BY D.D.
DIST 4 HWY Q.E.W. BOREHOLE TYPE Hollow Stem Auger COMPILED BY O.J.
DATUM Geodetic DATE 81 06 11-12 CHECKED BY D.D.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
76.7	Ground Level											
0.0	Gravel and Sand Trace of Silt and Clay Compact (Fill Material) with Sand		1	SS	12		76					
72.7			2	SS	19		74					51 40 (9)
4.0	Sand to Silty Sand Trace of Gravel and Clay Compact to Vary Dense with Gravel		3	SS	21		72					9 82 (9)
			4	SS	62		70					
			5	SS	32		68					24 68 (8)
	some Gravel		6	SS	79		66					13 74 (13)
65.1			7	SS	27		64					
11.6	Silty Sand to Sandy Silt Trace of Gravel and Clay Dense to Vary Dense		8	SS	54		62					
			9	SS	32							
61.0			10	SS	33							
15.7	End of Borehole						60					

+3, x5 : Numbers refer to
Sensitivity
15 20
5 (%) STRAIN AT FAILURE
10

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
FILL MATERIAL

FIG No 1

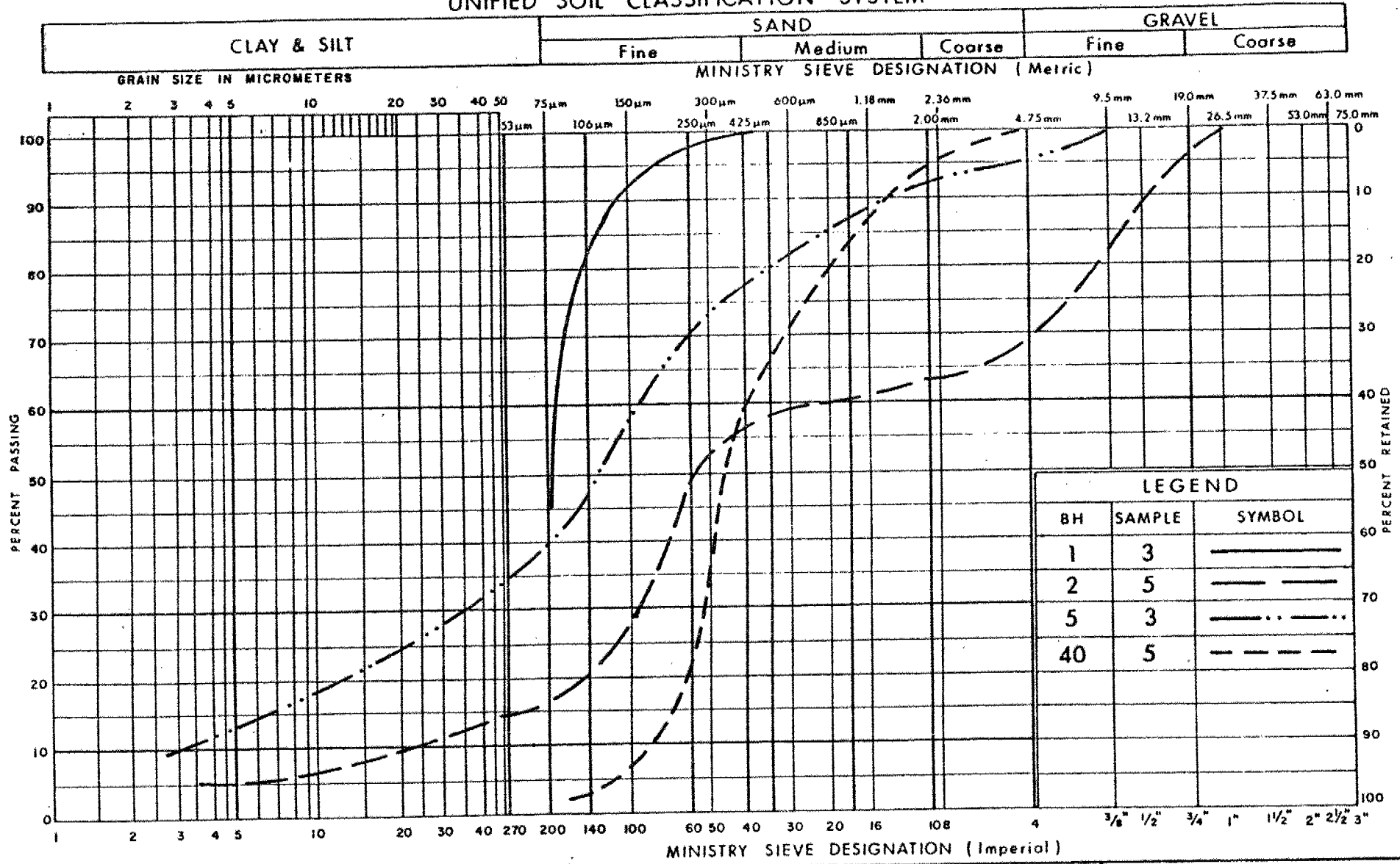
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UNIFIED SOIL CLASSIFICATION SYSTEM

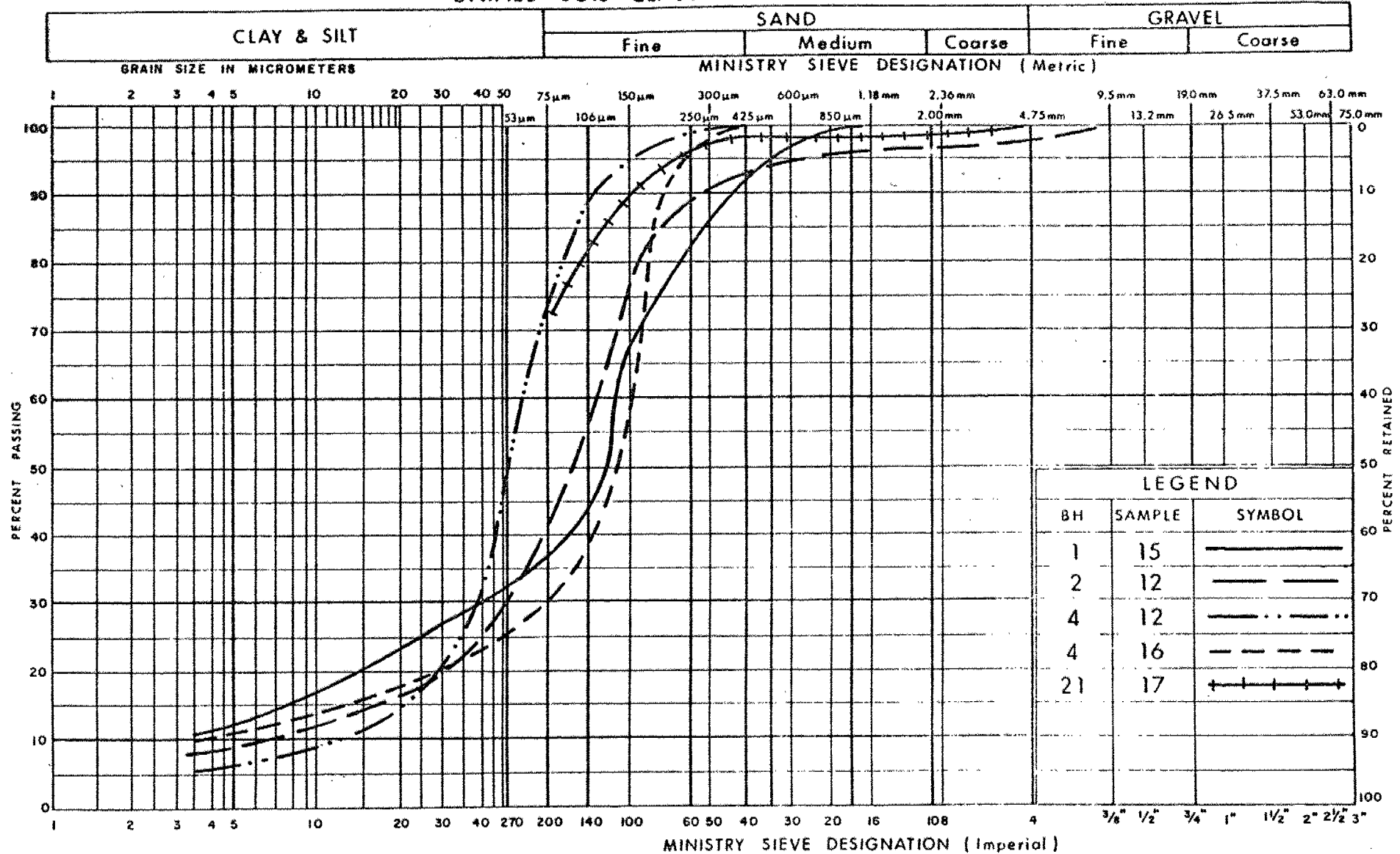


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GRAIN SIZE DISTRIBUTION
SAND TO SILTY SAND
TRACE, SOME, WITH GRAVEL TR. OF CLAY

FIG No 2
W P 210-79-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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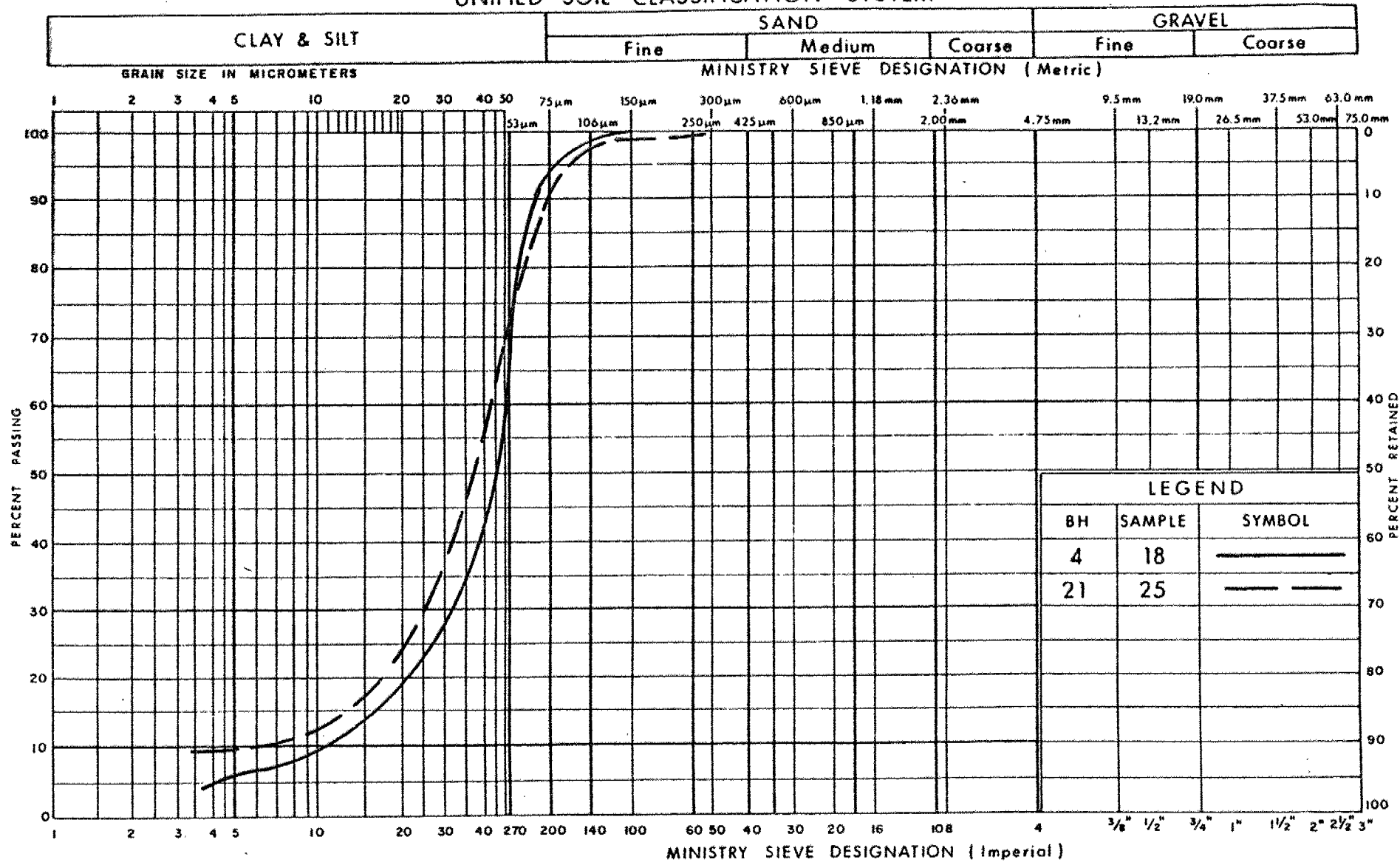
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GRAIN SIZE DISTRIBUTION
SILTY SAND TO SANDY SILT
TRACE OF GRAVEL & CLAY

FIG No 3

W P 210-79-00

UNIFIED SOIL CLASSIFICATION SYSTEM



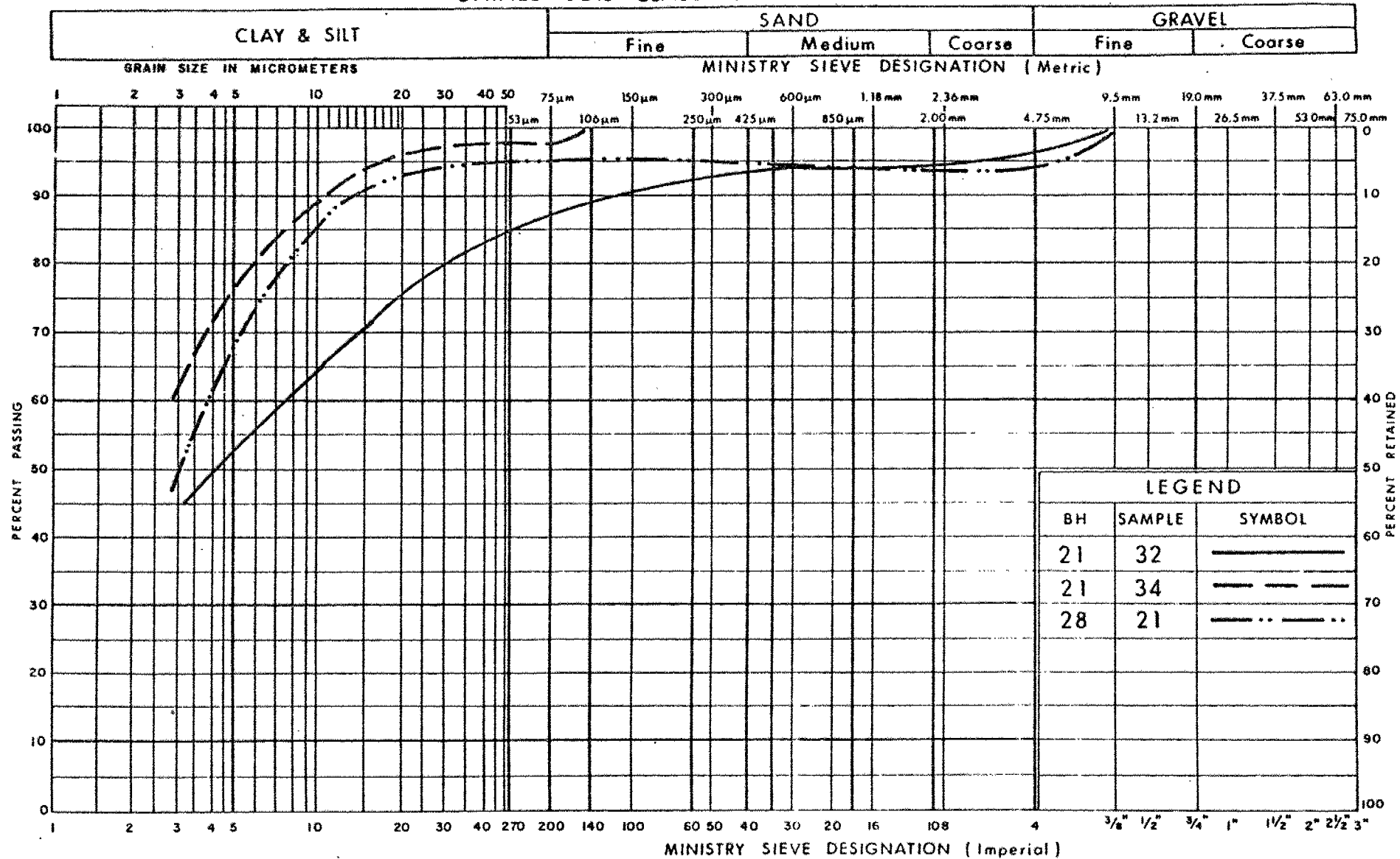
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GRAIN SIZE DISTRIBUTION
SANDY SILT TO SILT
TRACE OF CLAY

FIG No 4

W P 210-79-00

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION
SILTY CLAY
TRACE OF GRAVEL & SAND

FIG No 5

W P 210-79-00

METRIC

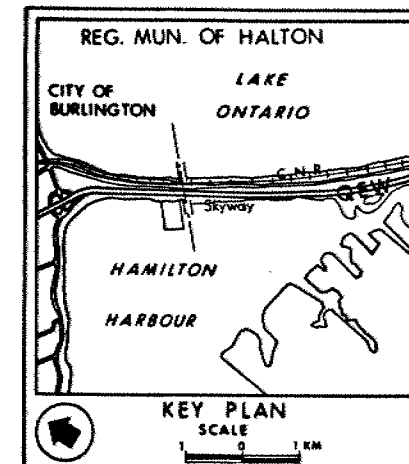
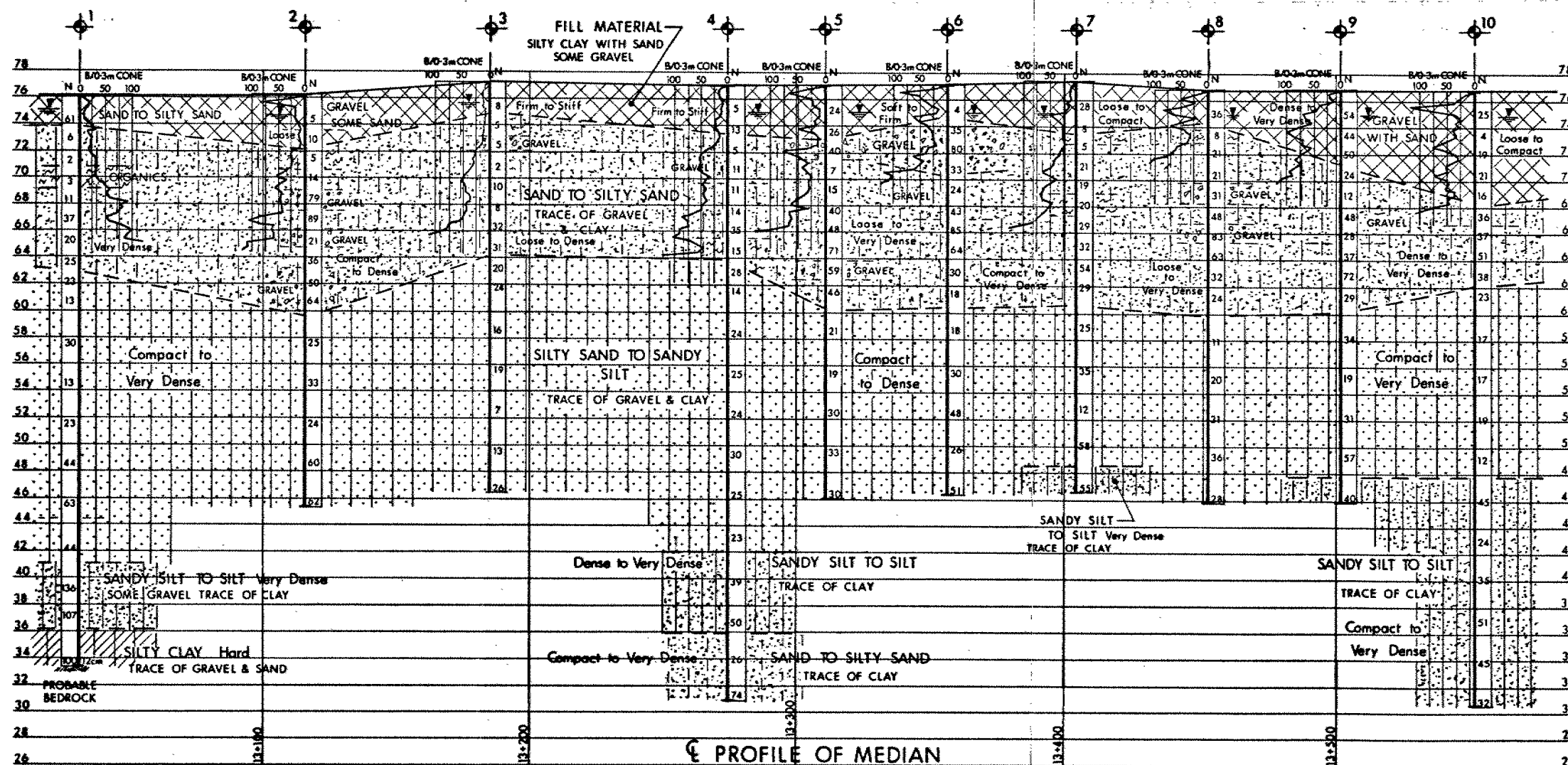
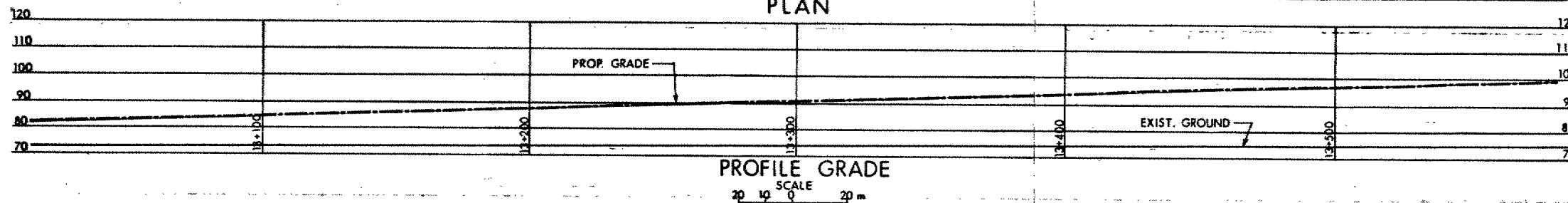
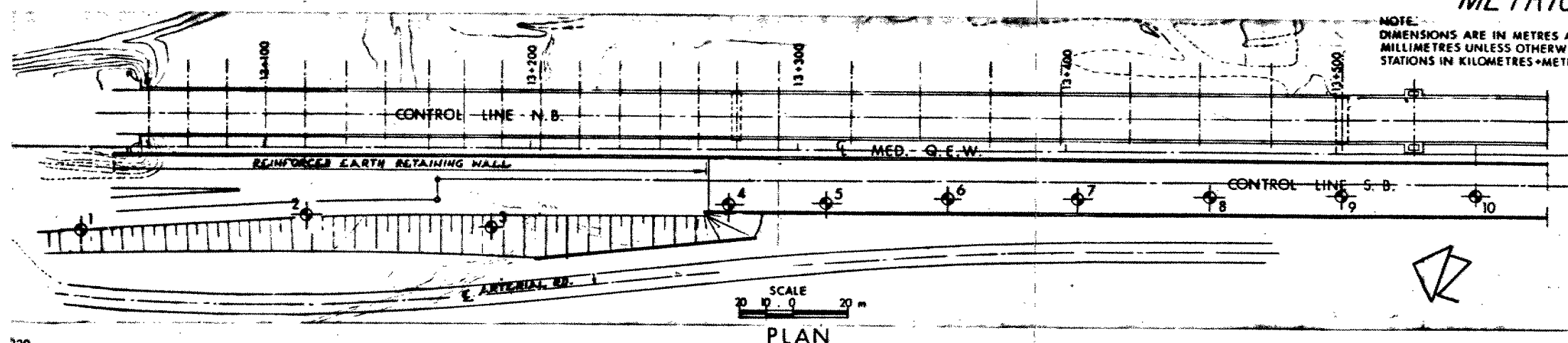
CONT No 83-13
WP No 210-79-01

BURLINGTON BAY SKYWAY
Q.E.W. S.B.

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 81 06 12 to 18

No	ELEVATION	STATION	Q MED OFFSET (m)
1	76.2	13+027	32 RT
2	76.3	13+115	25 RT
3	77.3	13+184	30 RT
4	77.0	13+275	20 RT
5	77.0	13+311	20 RT
6	77.2	13+356	18 RT
7	77.4	13+403	18 RT
8	76.7	13+454	17 RT
9	76.8	13+503	16 RT
10	76.8	13+552	16 RT

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

DATE	BY	DESCRIPTION

Geocres No 30M5-135			
DRY No	Q.E.W.	DIST	4
REMARKS D.D. CHECKED	DATE 82 05 18	SITE	36-60
DRAWN/NO. J. CHECKED	APPROVED	DWG	2107901-A

NOTE:
The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102.2 of Form 100.

METRIC

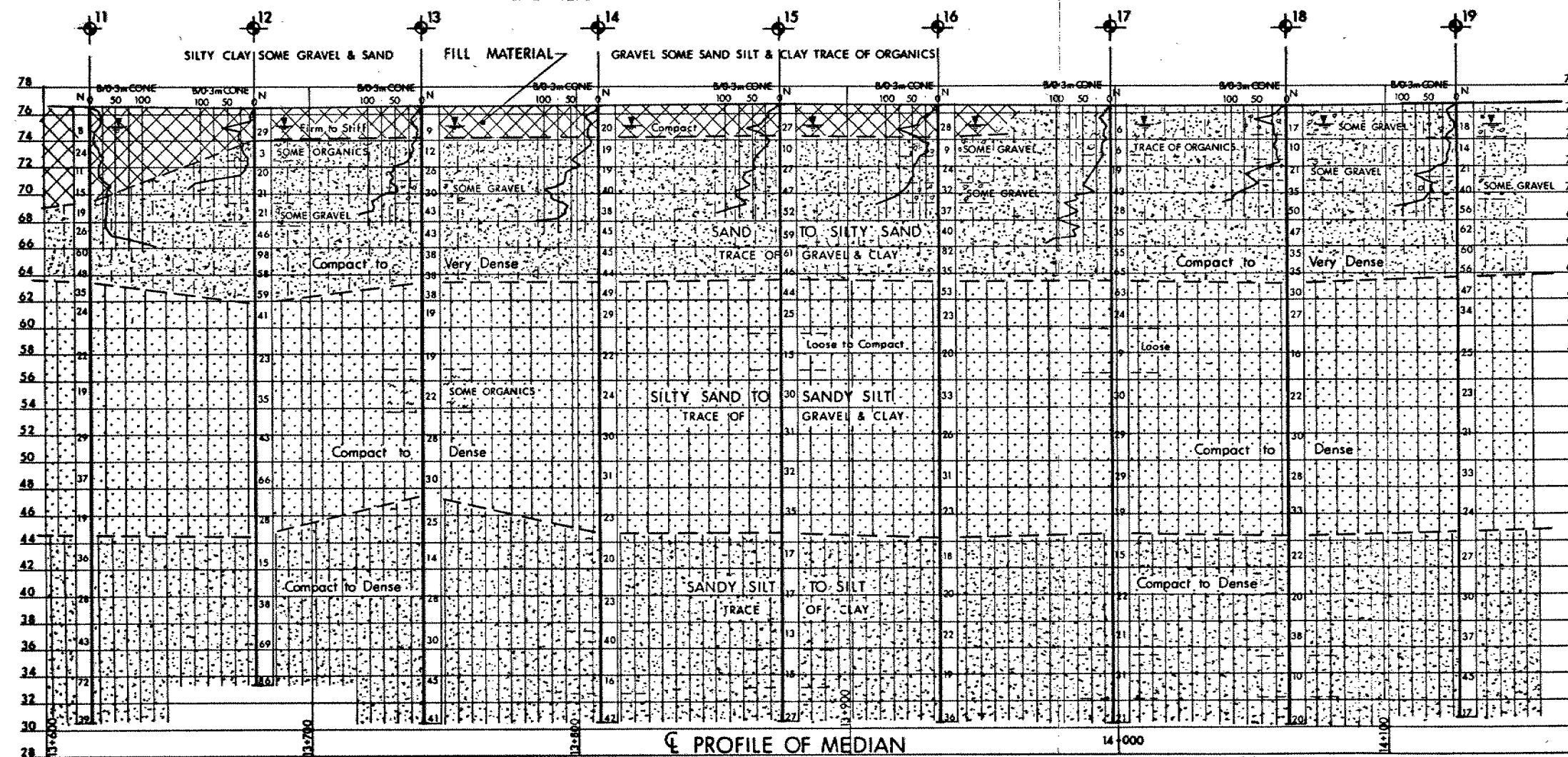
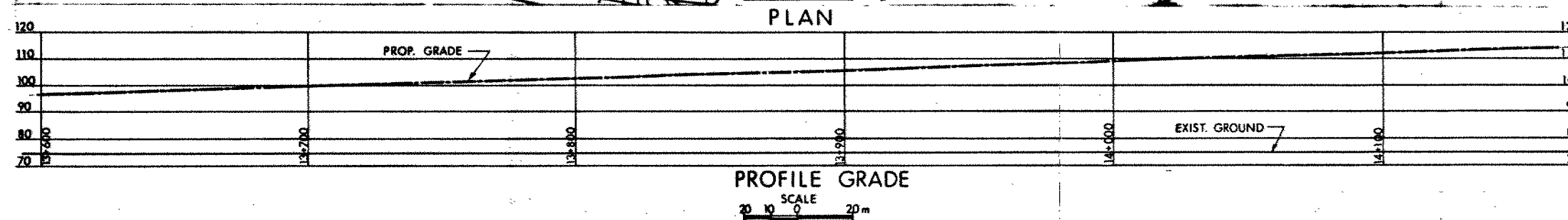
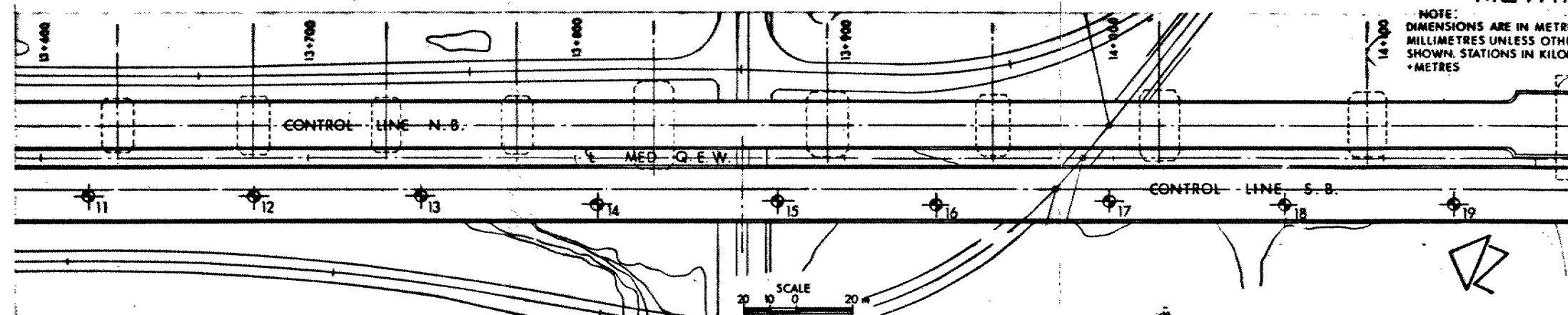
CONT No 83-13
WP No 210-79-01

BURLINGTON BAY SKYWAY
Q.E.W. S.B.

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- ⬇ WL at time of investigation 81 06 19 to 81 07 08

No	ELEVATION	STATION	Q. MED OFFSET (m)
11	76.6	13+617	14 RT
12	76.4	13+680	14 RT
13	76.6	13+742	14 RT
14	76.6	13+809	17 RT
15	76.7	13+875	16 RT
16	76.6	13+935	17 RT
17	76.5	13+999	16 RT
18	76.4	14+064	18 RT
19	76.7	14+126	18 RT

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 30M5-135			
DESIGNED BY	Q.E.W.	DIST	4
DRAWN BY	J. CHECKED	DATE	82 05 12
APPROVED		SITE	36-60
		DWG	21079C1-B

NOTE:

The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 10.2 of Form 100.

METRIC

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

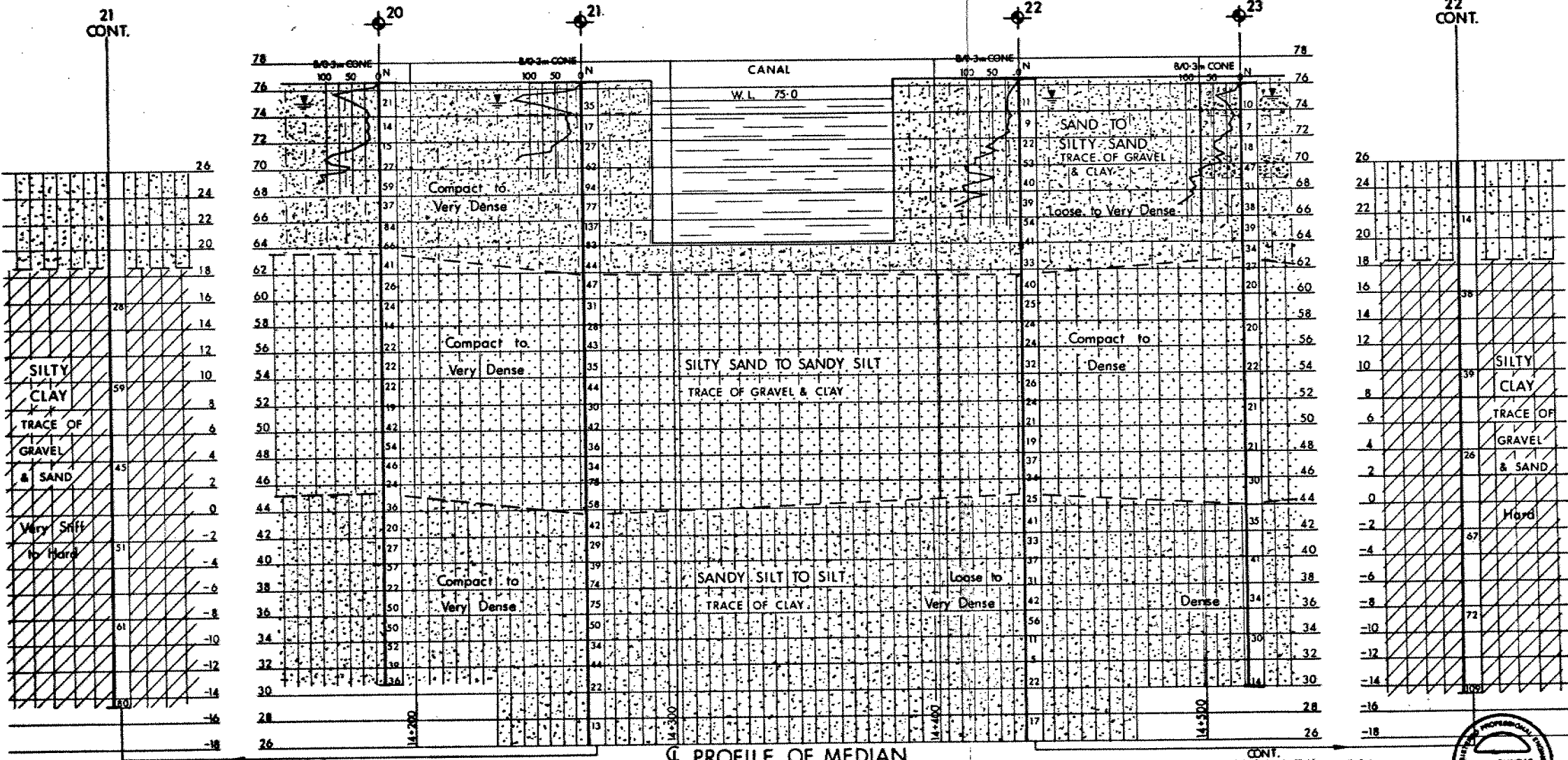
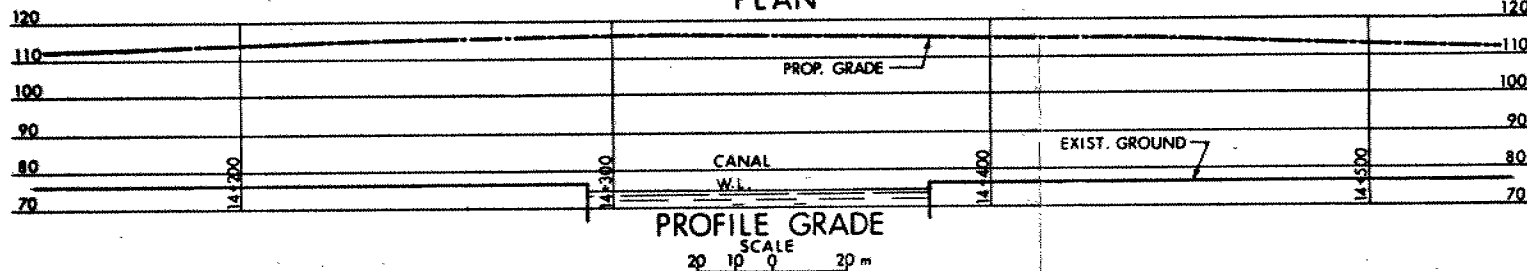
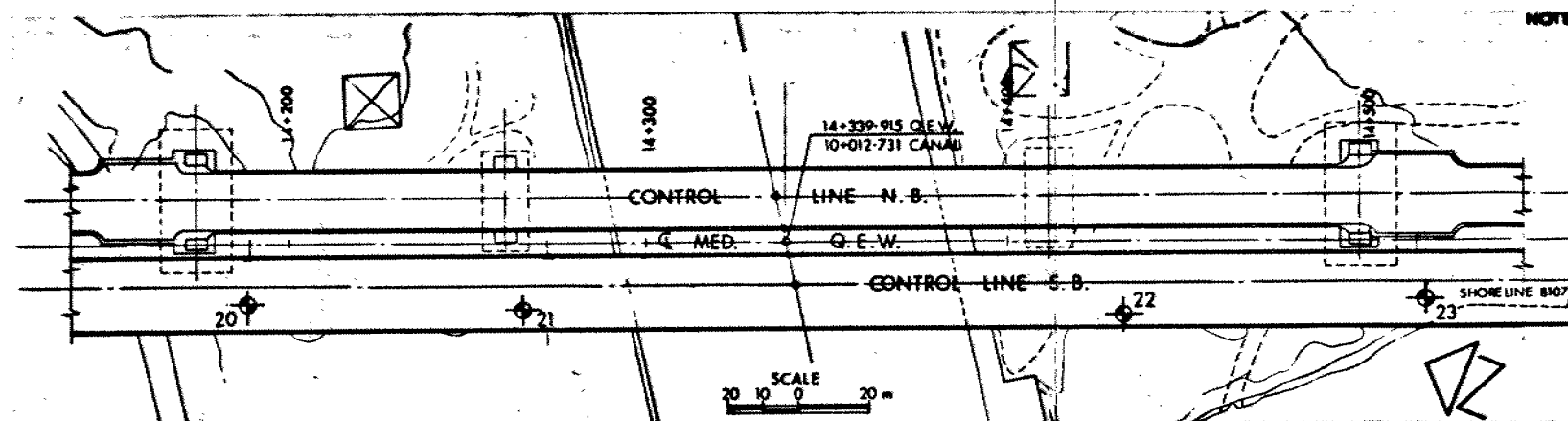
CONT No 83-13
WP No 210-79-01

BURLINGTON BAY SKYWAY
Q.E.W. S.B.

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

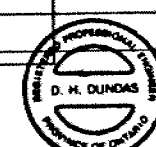
- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
81 05 22 to 81 07 06

No	ELEVATION	STATION	Q.E.W. MED. OFFSET (m)
20	76.7	14+187	18 RT
21	76.5	14+266	19 RT
22	76.3	14+434	20 RT
23	76.0	14+516	16 RT

NOTE

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

NOTE: The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is so excluded in accordance with the conditions of Section 102.1 of Form 100.



REVISIONS	DATE	BY	DESCRIPTION

Geocres No 30M5-135

HWY No	Q.E.W.	DIST	4
SUBMITTAL	CHECKED	DATE	82 05 12
DRAWN	NOL	CHECKED	APPROVED

METRIC

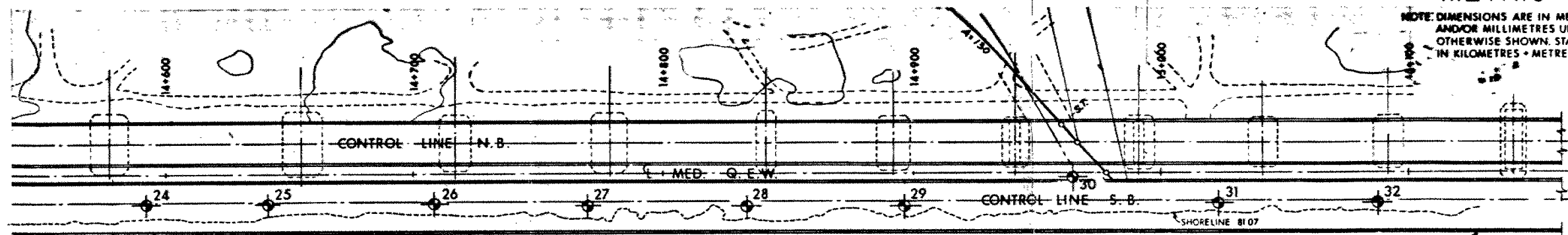
CONT No 83-13
WP No 210-79-01

BURLINGTON BAY SKYWAY
Q.E.W. S.B.

BORE HOLE LOCATIONS & SOIL STRATA

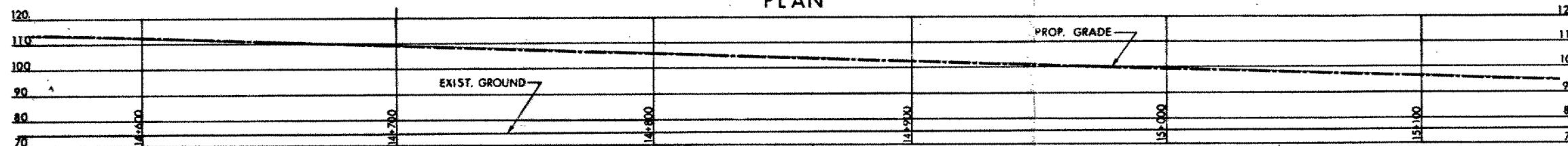


SHEET



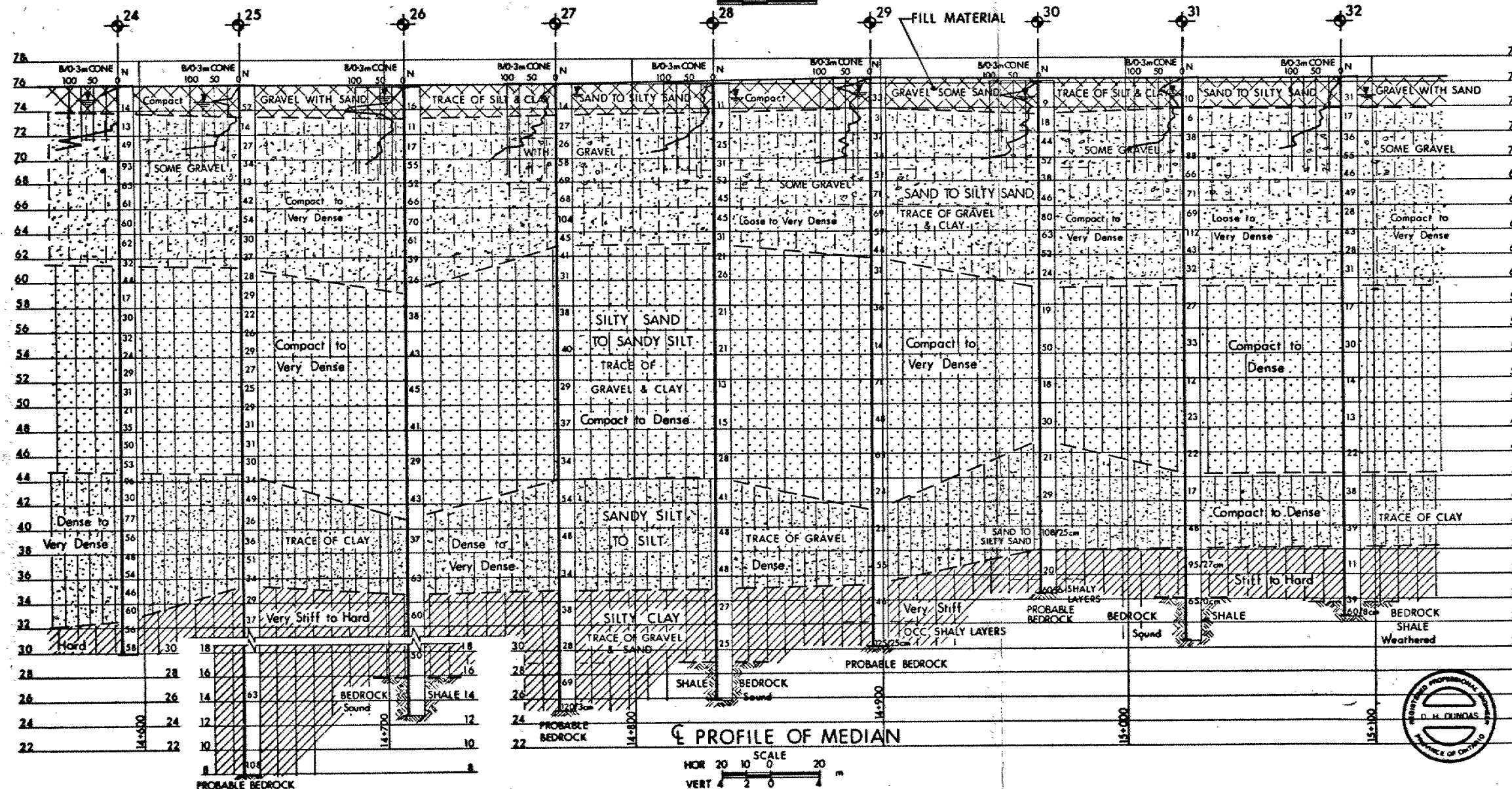
SCALE
20 10 0 10 20 m

PLAN



PROFILE GRADE

SCALE
20 10 0 10 20 m



PROFILE OF MEDIAN

SCALE
HORIZ 20 10 0 10 20 m
VERT 4 2 0 2 4 m

LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
81 05 15 to 81 06 03

No	ELEVATION	STATION	Q.E.W. OFFSET (m)
24	76.1	14+592	12 RT
25	75.9	14+642	12 RT
26	75.8	14+708	12 RT
27	76.0	14+770	13 RT
28	76.1	14+833	13 RT
29	76.4	14+897	13 RT
30	76.1	14+965	2 RT
31	76.3	15+023	12 RT
32	76.3	15+086	12 RT

NOTES
The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No	30M5-135
SHW No	Q.E.W.
Subm'd D.D.	CHECKED
DATE	82 05 24
SITE	36-60
DRW'NOL	CHECKED
APPROVED	
DWG	2107901-D

METRIC

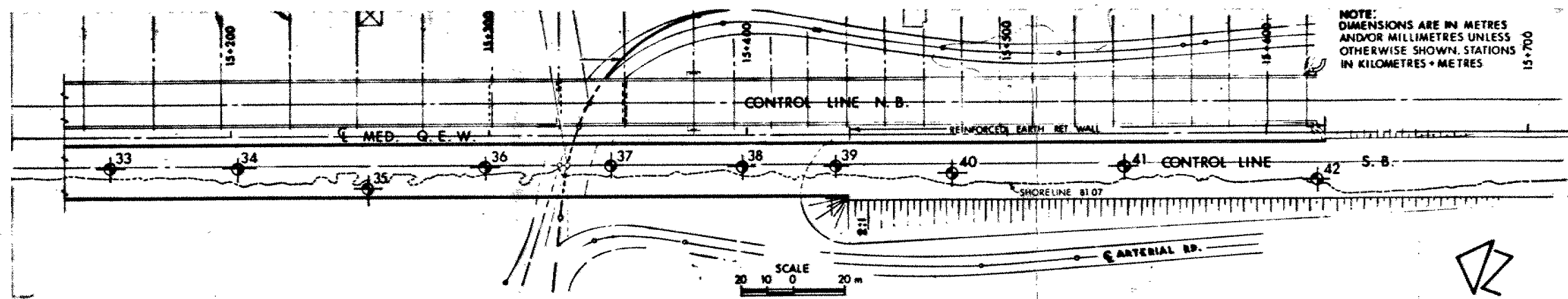
CONT No 83-13
WP No 210-79-01

BURLINGTON BAY SKYWAY
Q.E.W. S.B.

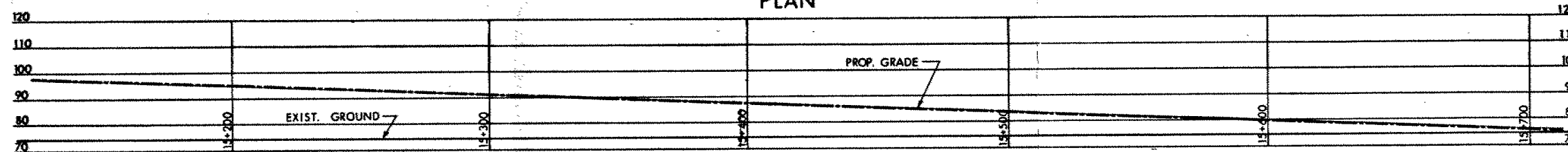
BORE HOLE LOCATIONS & SOIL STRATA



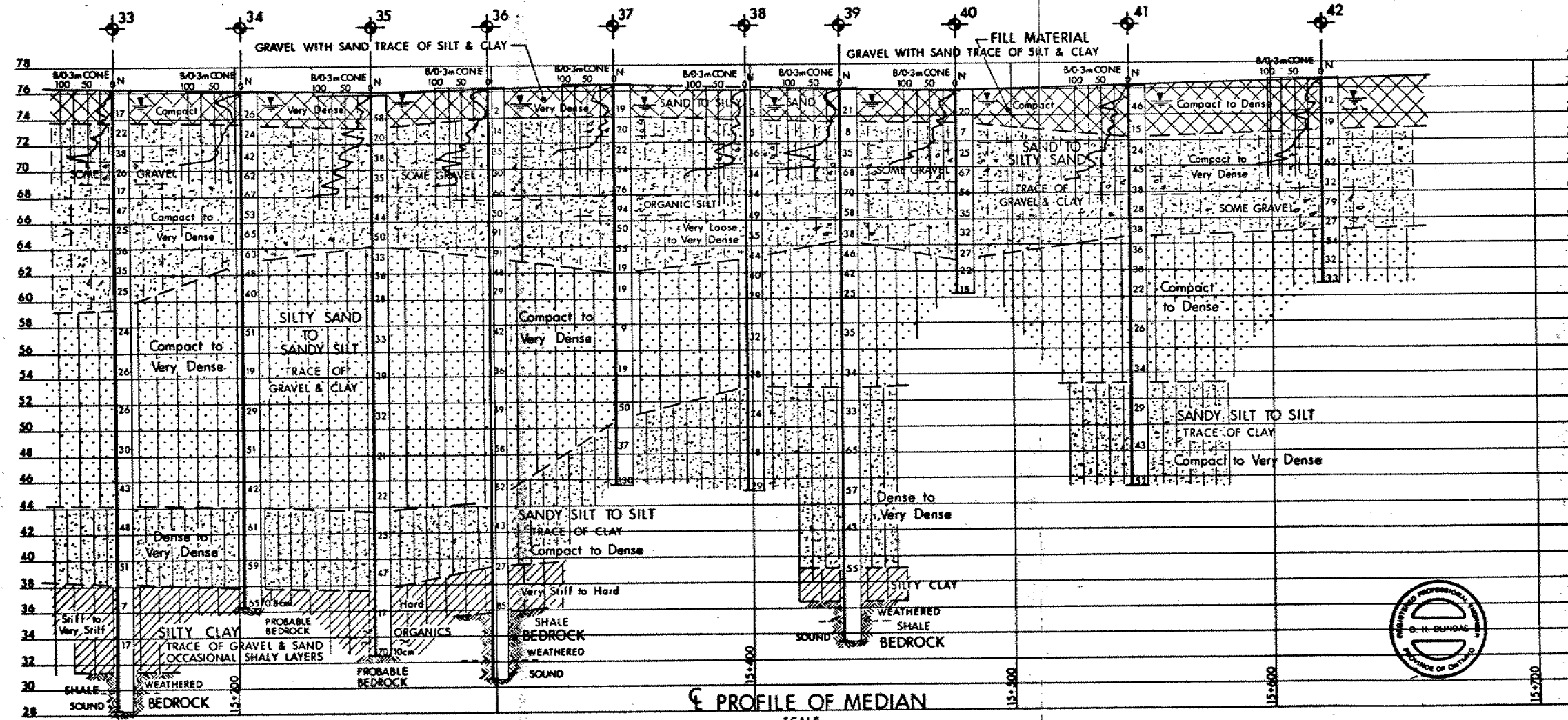
SHEET



PLAN



PROFILE GRADE



PROFILE OF MEDIAN

LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
81 06 03 to 12

No	ELEVATION	STATION	Q. MED. OFFSET (m)
33	76.2	15+154	12 RT.
34	76.0	15+202	12 RT.
35	75.7	15+252	20 RT.
36	76.3	15+298	12 RT.
37	76.5	15+347	11 RT.
38	76.1	15+398	12 RT.
39	76.0	15+433	12 RT.
40	75.9	15+478	15 RT.
41	76.2	15+544	13 RT.
42	76.7	15+617	18 RT.

NOTE:
The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

NOTE

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

REVISION	DATE	BY	DESCRIPTION

Geotechnical No 30M5-135	Q.E.W.	DIST 4
DESIGNED BY D. D. CHECKED	DATE 82 05 24	SITE 36-60
DRAWN BY J. J. CHECKED	DATE 82 05 24	DWG 2107901-E

CONT No 83-13
WP No 210-79-01

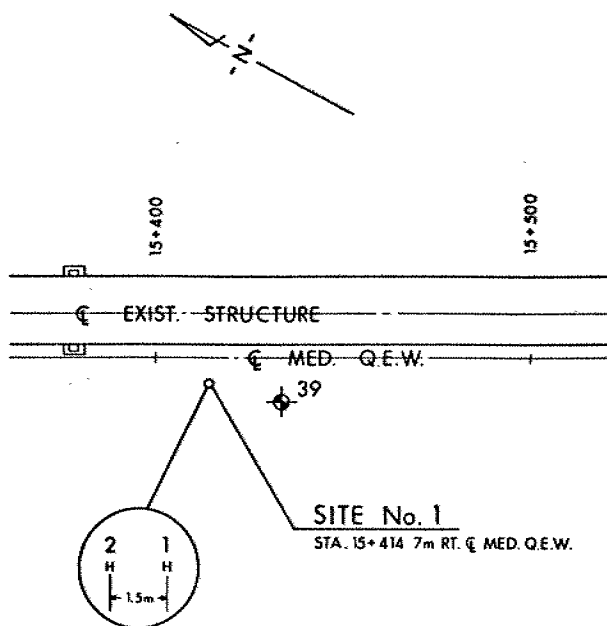
BURLINGTON BAY SKYWAY
Q.E.W. S.B.

DRIVING RECORD OF TEST PILES

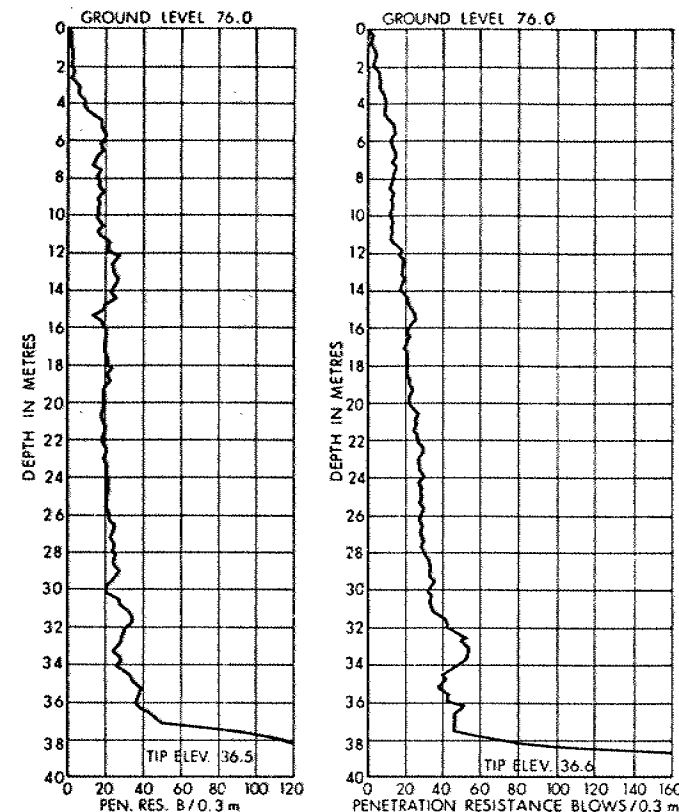
SHEET

METRIC

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



PILE TEST LOCATION

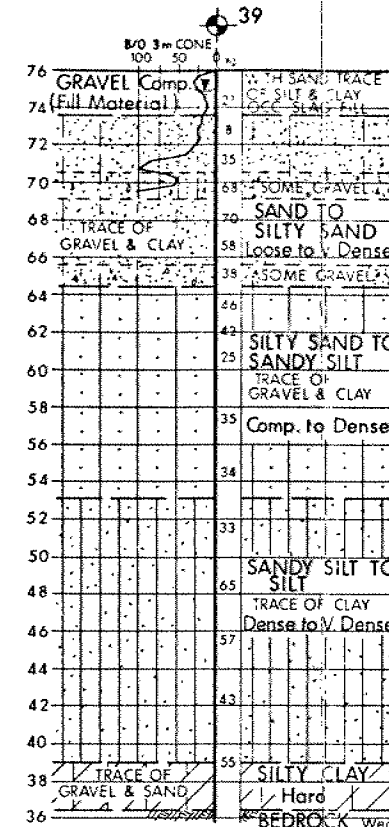


PILE 1

PILE TYPE - HP 310x79

PILE 2

PILE TYPE - HP 310x79



B.H. 39

	HAMMER		HAMMER CUSHION		DATE DRIVEN	NET DRIVING TIME
	MODEL	RATED ENERGY (J)	MATERIAL	MASS (kg)		
PILE 1	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 08	73 min
PILE 2	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 08	87 min
PILE 3	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 22	28 min
PILE 4	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 19-22	54 min
PILE 5	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 22-23	55 min
PILE 6	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 19-22	16 min
PILE 7	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 19-22	64 min
PILE 8	LINK BELT 640	54 200	3 - 25.4 mm FORCE 10 PADS	726	82 11 22-23	72 min

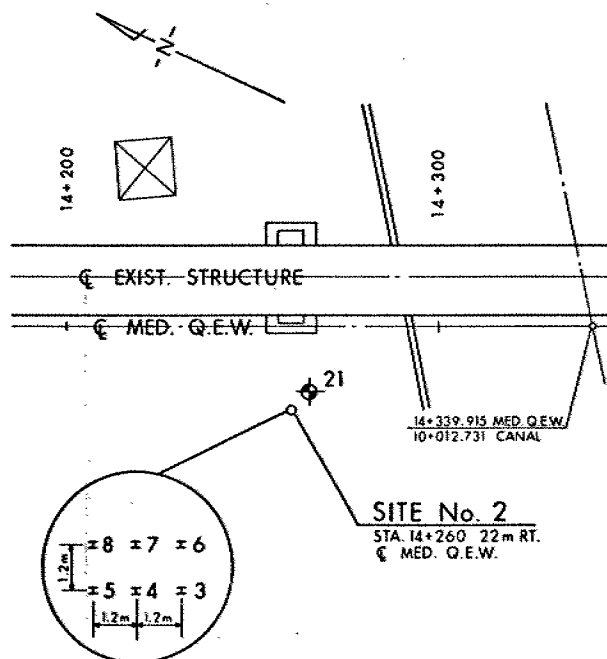
NOTE: MASS OF HAMMER 2720 kg

KEY PLAN
SCALE

LEGEND

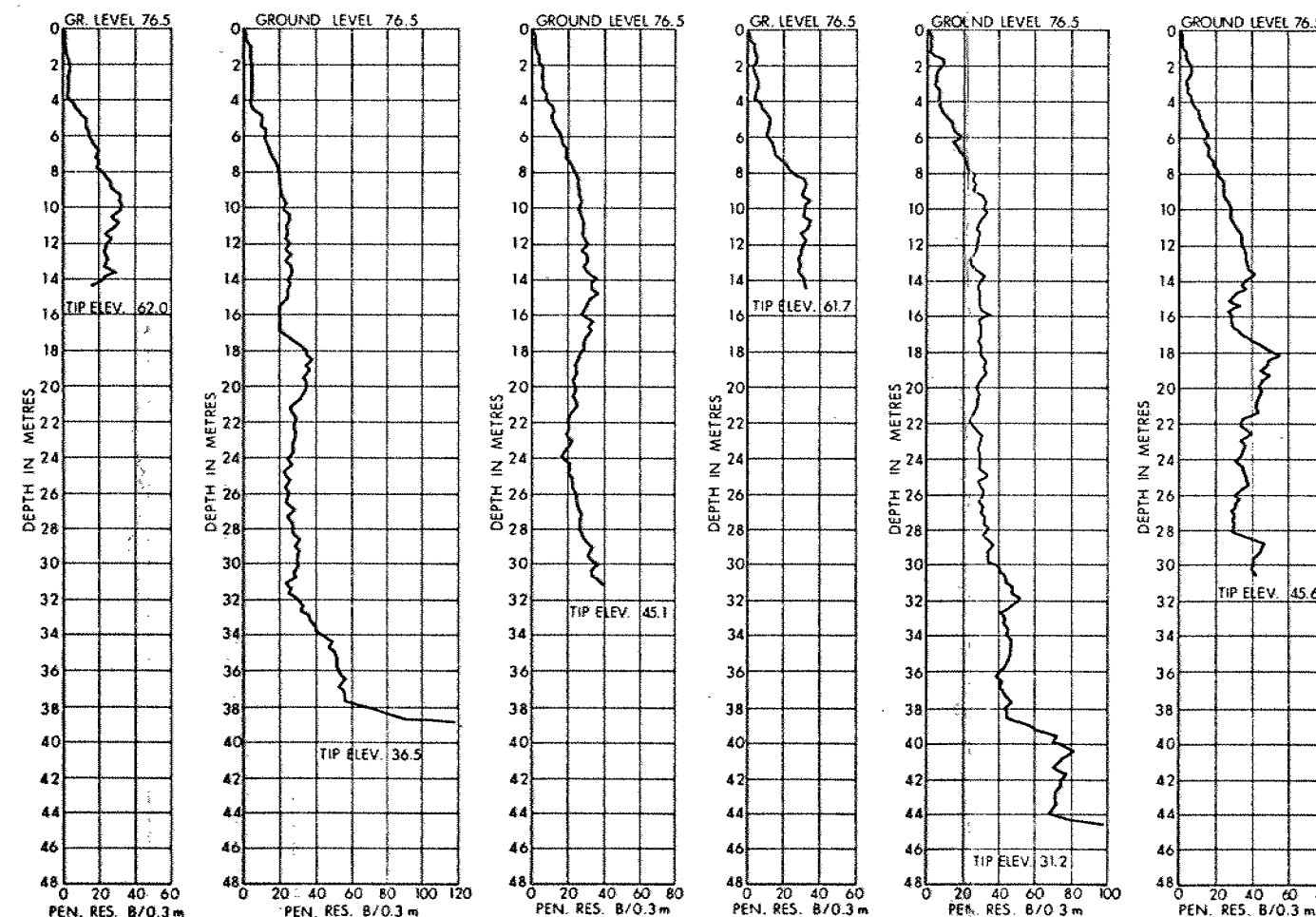
- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 81 05 to 07

No	ELEVATION	STATION	OFFSET (m) Q.E.W.
21	76.5	14+266	19 RT.
39	76.0	15+433	12 RT.



PILE TEST LOCATION

SCALE
10m 5 0 10 20 30m



PILE 3

PILE TYPE - HP 310x79

PILE 4

PILE TYPE - HP 310x79

PILE 5

PILE TYPE - HP 310x79

PILE 6

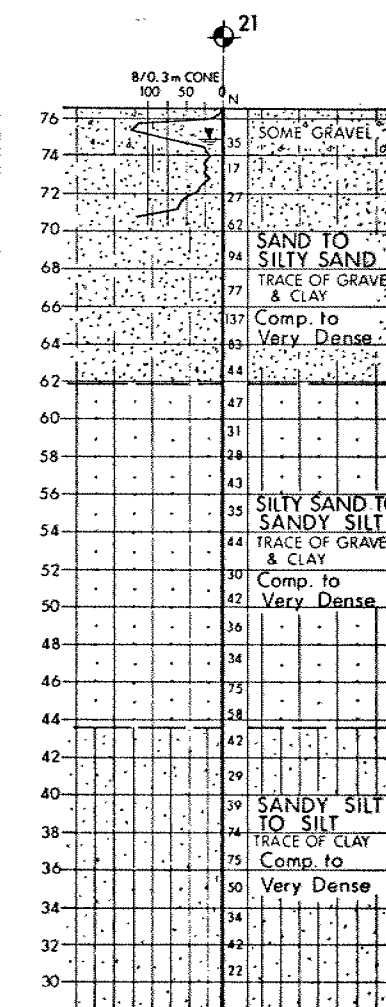
PILE TYPE - HP 310x110

PILE 7

PILE TYPE - HP 310x110

PILE 8

PILE TYPE - HP 310x110



B.H. 21

NOTE

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION
1	83 03 04		

Geocres No 30M5-135

HWY No Q.E.W.	DATE 83 03 04	DIST 4
SUBMD K.S. CHECKED	APPROVED	SITE 36-60
DRAWN S.O. CHECKED		DWG 2107901-F

ADDENDUM TO FOUNDATION INVESTIGATION REPORT

For

W.P. 210-79-01, Site 36-60
Burlington Bay Skyway
Q.E.W. S.B. District 4

INTRODUCTION

The foundation investigation report for this project describes conditions which existed at the time of the fieldwork in 1981. Since that time however, hydraulic fill has been placed in the harbour along the west side of the New Skyway site south of the harbour entrance channel under M.T.C. Contract 82-80 and a further Contract 82-85 has been let in which slag fill will be placed along the west side of the New Skyway site north of the harbour entrance channel. Also 8 steel H piles of various lengths have been driven and tested at two different sites. These new developments are discussed in more detail below under appropriate headings.

CONTRACT 82-80 - HYDRAULIC FILL

Under this contract, hydraulic fill has been placed on the west side of the previous harbour shoreline from about Sta. 15 + 000 to beyond the south limits of this present project. From approximate Sta. 15 + 000 to Sta. 15 + 325 the hydraulic fill is composed of a very soft or very loose mixture of sand, silt and organics contaminated with chemical waste products. The surface of this material is approximate el. 76.0 m. Attention is drawn to the toxic nature of the chemicals which is illustrated in a report by IEC Beak Consultants Ltd. prepared for the Ministry in connection with Contract 82-80. A copy of this report is included in the Appendix to this Addendum. Photos of sampling sites referred to in the report are not included.

South of approximate Sta. 15 + 325 the hydraulic fill is composed of loose to compact silty sand with occasional gravel. The surface of the fill is approximate el. 76.5 m. Figs. A1 and A2 of the Appendix show typical cross-sections through the two types of hydraulic fill.

CONTRACT 82-85 - SLAG FILL

Between Stas. 13 + 050 and 13 + 850 approximately, slag fill of maximum particle size 50 mm will be placed from the existing shoreline west of the Skyway to beyond the west limits of this project under Contract 82-85.

PILE TESTS

A pile test program was carried out at the site between November 1982 and January 1983 in which steel H piles were driven and tested. Details of these test piles including continuous driving times and penetration resistances are shown on Sheet No. 96-5 and 197-5 of the Contract Drawings.



D. H. Dundas

D.H. Dundas, P. Eng.
Project Foundations Engineer

K. G. Selby

K.G. Selby, P. Eng.
Senior Foundations Engineer

83 03 07

APPENDIX



6870 Goreway Drive
Mississauga, Ontario
Canada L4V 1P1
(416) 671-2600

30 November 1982

Ontario Ministry of Transportation and Communications
Planning and Design Section
Engineering and Right of Way Office
5000 Yonge Street
Willowdale, Ontario
M2N 6E9

Attention: Mr. Harvey McNeely
Senior Environmental Planner

Reference: 2154.1 Bulk Chemical Composition of Dredge Spoil - Burlington
Skyway Twinning

Dear Harvey:

This letter report presents the results of a dredge spoil characterization study undertaken by IEC BEAK for the Ontario Ministry of Transportation and Communications (MTC).

The MTC is landfilling along the western edge of the Burlington/Hamilton Beach headland to provide land for the construction of the Burlington Skyway twinning. The source of fill is a deposit of sand, gravel and cobble in the southeast corner of Hamilton Harbour. During the course of fill deposition behind the landfill berm, a muddy sediment mass was being partitioned from the clean coarse fill, pushed in bulk ahead of the clean fill, and accumulated in the south and north ends of the berm area. This accumulation of mud fill likely represents mud spoil associated with the clean spoil at the extraction site as well as in situ bottom sediments being displaced by the denser and heavier clean fill at the berm site. The MTC requested that bulk chemical composition of this muddy fill material be determined to permit assessment of options for disposal.

Five surficial sediment samples were collected by IEC BEAK on 19 November 1982. Three samples were obtained at the south end of the berm area (reference mark 16 + 375): a "dewatered" (exposed to air), glutinous mud sample; a "watery" (covered by water), muddy ooze sample, and a "dewatered" glutinous sandy mud sample. The samples were characterized by a thin, light brown, oxidized surface layer overlying black, anoxic sediments. The two samples collected at the north end of the berm area (reference marks 16 + 580 and 15 + 490) were light brown in colour. All samples had a moderate to strong odour of oil. Significant numbers of the amphipod, Gammarus fasciatus, were observed actively swimming above the sediment surface at the north end of the berm area. Photographs of the sampling sites are enclosed.

Mr. Harvey McNeely

30 November 1982

Bulk chemical composition of the sediment samples is presented in Table 1, along with the Ontario Ministry of the Environment (MOE) guidelines for open water dredge spoil disposal. The muddy fill material consistently exceeded the MOE guidelines for volatile solids, chemical oxygen demand (COD) and oil and grease. The MOE guidelines for nutrients (total kjeldahl nitrogen, ammonia nitrogen and total phosphorous) and mercury were exceeded by some of the samples. The muddy fill material could be classified as contaminated for arsenic, cadmium, chromium, copper, iron and lead, and highly contaminated for cyanide, total PCB's and zinc. Nickel concentrations generally were below the MOE guideline.

On the basis of the MOE guidelines indicating significant contamination by cyanide, PCB's and zinc as well as contamination to a lesser degree by other pollutants, the muddy fill material is unsuitable for open water disposal. Therefore, to prevent entry to surface waters, this fill material should be retained within the berm area, relocated to adjacent, suitably-engineered dyked areas, or disposed of at an upland secure landfill site. Potential disposal options of landspreading and incineration are not feasible due to low organic content and high contaminant concentrations.

The most cost-effective and environmentally sound disposal option would be to maintain the muddy fill material within the confines of the landfill area.

It has been a pleasure to work with you and your colleagues and IEC BEAK looks forward to future provision of services to the MTC. If you have any questions concerning our study findings, please do not hesitate to contact me.

Yours very truly,



J. Fitchko
Director, Aquatic Ecology Services

TABLE 1: COMPARISON OF BULK CHEMICAL COMPOSITION OF BURLINGTON BAY DREDGE SPOIL WITH OPEN WATER DREDGE SPOIL DISPOSAL GUIDELINES

Parameter	Concentration (ug/g unless otherwise indicated)					MOE Open Water Dredge Spoil Disposal Guideline ¹
	16+375 South end, East side Dewatered Glutinous Mud	16+375 South end Watery Muddy Ooze	16+325 South end, West side Dewatered Glutinous Sandy Mud	16+580 North end, East side Watery Silt	15+490 North end, East side Watery Silt	
Volatile Solids (%)	10	7.6	7.1/6.8	11.5	11.3	6
COD(%)	14.2	8.2	11.9	15.3/15.2	15.6	5
Oil and Grease (%)	1.15/1.15	0.90	0.39	0.29	0.33	0.15
Total Kjeldahl Nitrogen (%)	0.29	0.29/0.29	0.11	0.37/0.37	0.40	0.2
Ammonia Nitrogen	155	80/80	100	145/140	130/135	100
Total Phosphorus	2430	1100	1430	638	778/849	1000
Cyanide	12.3/13.6	8.9	8.4	3.3	3.4	0.1
Total PCB	2.35	2.44	0.89/0.97	0.51	0.45	0.05
Arsenic	20	13	11/12	8	10	8
Cadmium	6.0	3.8	3.4/3.4	1.4	1.2	1
Chromium	174	116	104/104	47	49	25
Copper	146	106	95/92	65	86	25
Iron (%)	7.25	5.50	5.10/5.15	2.60	2.75	1
Lead	364	254	212/206	68	68	50
Mercury	0.80	0.63	0.52	0.19	0.19/0.18	0.3
Nickel	30.5	23.0	21.5/20.5	17.0	13.0	25
Zinc	2600	1860	1640/1640	600	550	100

¹ Persaud, D. and W.D. Wilkins. 1976. Evaluating Construction Activities Impacting on Water Resources. MOE Report.

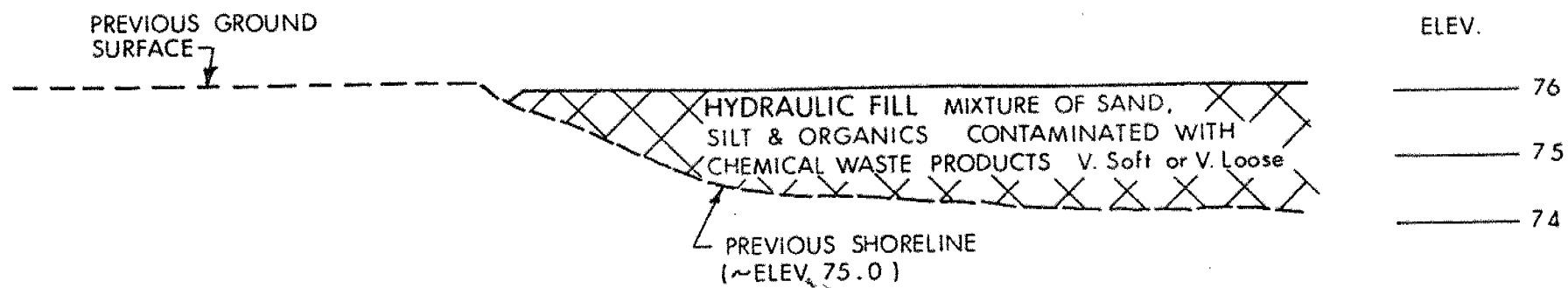


FIG. A-1 - TYPICAL SECTION STA. 15+000 to STA. 15+325

W.P. 210-79-01

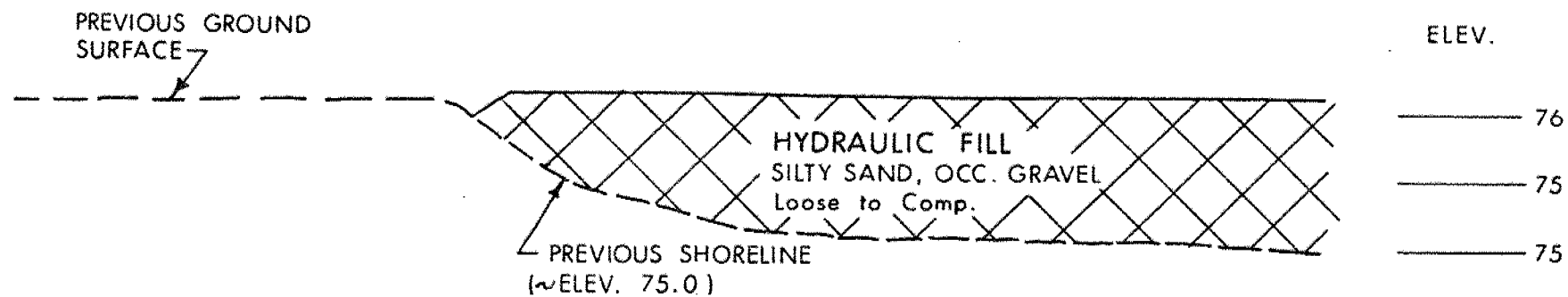


FIG. A-2 - TYPICAL SECTION FROM STA. 15+325 SOUTH

W.P. 210-79-01