

GEOCRES No. _____

DIST. 52 REGION _____W.P. No. 162-94-00

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. 11LOCATION Temporary New Ramp
Hwy 11 / Meskora Rd. SICNo of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____REMARKS: _____

December 21, 1999

JEGEL 199255

GEOTECHNICAL AND FOUNDATION
INVESTIGATION, TEMPORARY NEW RAMP
HIGHWAY 11 AND MUSKOKA ROAD 3
INTERCHANGE
MTO PROJECT NO. WP 162-94-00

Prepared For

MTO NORTHERN REGION

By

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED
CONSULTING ENGINEERS

#1, 109 Woodbine Downs Boulevard
Toronto, Ontario M9W 6Y1

Telephone: 416-213-1060 Facsimile: 416-213-1070
E-mail: jegel@comnet.ca Website: www.jegel.com

TABLE OF CONTENTS

	Page
INTRODUCTION	1
SITE DESCRIPTION AND GEOLOGY	2
INVESTIGATION PROCEDURE	3
SUBSURFACE CONDITIONS	5
GENERAL	5
PAVEMENT CONDITIONS	5
SUBSOILS AND GROUNDWATER	6
General	6
Silt With Some Clay or Silt and Clay	6
Gravelly Sandy Till	7
Groundwater Conditions	7
CONCLUDING REMARKS	8
RECOMMENDATIONS	9
GENERAL	9
BEARING CAPACITY	9
SETTLEMENT	10
EMBANKMENT FILL	11
PAVEMENT RECOMMENDATIONS ON TEMPORARY FILL	12
DRAINAGE	12
FILL COMPACTION	13
TRANSITION TREATMENTS	13
EXISTING CULVERTS	13
LAKEWOOD PARK ROAD PAVEMENT	14
MATCHING EXISTING PAVEMENTS	14
EROSION	15
CONCLUDING REMARKS	15

GEOTECHNICAL AND FOUNDATION INVESTIGATION REPORT
TEMPORARY NEW RAMP
HIGHWAY 11 AND MUSKOKA ROAD 3 INTERCHANGE
MTO PROJECT NO. WP 162-94-00

1.0 INTRODUCTION

John Emery Geotechnical Engineering Limited, Consulting Engineers (JEGEL) was retained as sub-consultants to Stantec Consulting Ltd. to complete a geotechnical and foundation investigation for the proposed temporary ramp from Highway 11 Southbound to District Road 3 in the District Municipality of Muskoka. This work was completed as part of MTO Project No. WP-162-94-00.

This report describes a geotechnical investigation carried out at the above site to provide recommendations to provide:

- a) design recommendations for a relatively high fill required to support a temporary ramp from Highway 11 to Lakewood Park Road, connecting to District Road 3;
- b) pavement design recommendations for the temporary ramp; and
- c) recommendations for strengthening of the Lakewood Park Road pavement structure to support the additional ramp traffic during the approximately 1 year construction period.

Previous geotechnical investigations had been carried out in the vicinity of this site between 1956 and 1978 in connection with construction of the existing facilities in the area. These investigations are summarized in a report by the MTO Pavement and Foundation Design Section dated November 22, 1979, entitled:

Foundation Investigation Reports for

WP 74-74-01, CNR South Crossing Southbound Lane

WP 74-74-02, CNR South Crossing Service Road, Conn. B

WP 74-74-06, Muskoka Road #3 (Aspdin Road) Underpass

WP 150-73-02, CNR South Crossing Northbound Lane

2.0 SITE DESCRIPTION AND GEOLOGY

The site of the temporary ramp is adjacent to Highway 11 about 500 m north of District Road 3 at the Town of Huntsville in the District Municipality of Muskoka. At this location, Lakewood Park Road runs in a northerly direction from Muskoka Road 3 and roughly parallel to Highway 11. At this location, both Highway 11 and Lakewood Park Road are constructed on embankment fills of 10 m height or more, and the temporary ramp will be constructed between these existing embankments to provide access from southbound Highway 11 to Lakewood Park Road during bridge rehabilitation work.

The existing Highway 11 and Lakewood Park Road embankments are composed of earth fill with side slopes of approximately 2:1. The side slopes appear to be stable with a surface cover of topsoil, well vegetated with grasses and native vegetation. Over most of the area where the temporary ramp is to be constructed, the embankment side slopes of the two fills intersect at the ditch between the fills. At the north end, the temporary ramp will be constructed by widening entirely over the existing Highway 11 fill and at the south end the ramp will be constructed entirely over the existing side slopes of the Highway 11 and Lakewood Park Road fills by filling in the area between the fills, a distance of about 50 m.

The topography of the Huntsville area is fairly typical of the Precambrian Shield area, consisting of areas of highly variable bedrock depth, and the irregular volcanic (igneous) and metamorphic rock surface covered with deep lakes, variable deposits of muskeg and swamps, and generally shallow glaciofluvial and lacustrine soils consisting of peat, clays, silts, and sand and gravel. In the Huntsville area, significant beds of moderate to highly frost susceptible silty soils over the bedrock are common. These soils are usually normally consolidated. A layer of glacial till is sometimes found between the glaciofluvial or lacustrine soils and the bedrock.

The site lies within the physiographic region described by Chapman and Putnam¹ as "The Number 11 Strip". This region consists of Precambrian bedrock with sand, silt and clay deposits in the hollows. The strip was just below the shoreline of glacial Lake Algonquin. The streams entering this lake from the adjacent upland dropped sand as deltas and silts and clays settled out in deeper water offshore.

3.0 INVESTIGATION PROCEDURE

The fieldwork was carried out during the week of October 12, 1999. The boreholes and probeholes were advanced using continuous flight auger equipment supplied by Malone's Soil Samples Co. Ltd., and was continuously supervised by Tom Millis, P.Eng. of JEGEL. Five shallow probeholes, approximately 1.5 m deep, were advanced through Lakewood Park Road pavement to determine the existing pavement structure. Three shallow probeholes, approximately 1.5 m deep, were also advanced through the shoulder of Highway 11 to confirm the depth and type of granular material adjacent to the temporary ramp. Six deeper boreholes ranging in depth between 4 m and 18 m were completed along the detour alignment at 50 m intervals to determine the materials used to build the existing Highway 11 and Lakewood Park Road fills, the soil strata under the fills, and the depth of stripping required for the ramp construction.

The boreholes were completed using a track-mounted Bombardier drill rig. Continuous flight solid stem augers were used for the shallow boreholes, with hollow stem augers utilized for the deeper borings. Subsoil samples were recovered at regular intervals of depth (approximately every 0.5 m down to 3 m depth and approximately every 1.5 m below 3 m depth) by driving a 50 mm O.D. split barrel sampler in accordance with the Standard Penetration Test (SPT) procedures.

1. Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2).

Selected samples of pavement granular materials recovered from the auger flights were submitted for gradation testing. A dynamic cone penetration test was driven to indicate the depth of the silty layer at the bottom of two of the deeper boreholes.

The recovered samples were examined in the field as to their visual and textural characteristics, then preserved and transported to the JEGEL main laboratory for testing. In the laboratory, more detailed examination of the samples was conducted by the project engineer, and with moisture content determinations carried out on all samples. The gradation of the existing base and subbase materials was checked, and hydrometer analysis and Atterberg limit tests were carried out on the silty subsoil to indicate its drainage and frost susceptibility characteristics.

As the investigation progressed, the field engineer observed that the predominant soils beneath the fills were deep beds of silty soils with relatively high SPT 'N' values. These soils appeared to behave like non-cohesive soils. Most samples showed little plasticity, the samples were dilatant, and they appeared to be relatively permeable. Because of the observed nature of these soils, the decision was made to treat the soils as non-cohesive soils in terms of stability and settlement analysis. In previous investigations at this site, these soils had been described as layers of compact silt and stratified firm to stiff clayey silt confirming the predominantly non-cohesive nature of the soils. The investigation concentrated on collecting extensive SPT 'N' values rather than conducting the vane shear strength testing which would have been more appropriate for cohesive soils. The subsequent laboratory testing showed that the soils were classified as silt with some clay to silt and clay.

Groundwater observations were made in the open boreholes during drilling and standpipe piezometers were installed in selected boreholes to permit water monitoring.

All the boreholes were carefully backfilled using the spoil from the holes compacted back in place by crowding with the drill rig and auger. Each separate layer was backfilled with soil from that layer as far as possible, and the asphalt concrete was backfilled with compacted cold mix.

The locations and ground surface elevations for each borehole were established from a staked detour centreline and drawings provided by Stantec Consulting Ltd.

4.0 SUBSURFACE CONDITIONS

4.1 GENERAL

The borehole logs appended to this report provide the details of the pavement structures, soil descriptions, SPT 'N'-values, groundwater observations during drilling and at the completion of drilling, at each borehole and/or probehole location. The subsoil conditions are summarized in the following paragraphs.

4.2 PAVEMENT CONDITIONS

The pavement structure on Lakewood Park Road consists of about 100 mm of hot mix asphalt over sand and gravel basecourse which extends to considerable depth and appears to be quite similar to the sand subgrade material. There is no clearly defined interface between the granular basecourse and the underlying sand and gravel subgrade. The gradation of the granular base material is shown in Figure 1, and confirms that this material meets Granular B gradation requirements. The gradation of the underlying subgrade material is shown in Figure 2. It does not appear that a crushed granular base material (Granular A or equivalent) has been provided in the Lakewood Park Road pavement structure. The existing pavement appears to be in good condition apart from low to medium severity transverse cracks at 2 to 5 m intervals and a single low severity longitudinal crack close to the centre of the pavement. At the junction with the proposed

temporary ramp, the Lakewood Park Road embankment fill consists of relatively free draining sand fill with about 100 mm of topsoil cover.

The pavement structure in the paved shoulder on Highway 11 adjacent to the proposed temporary ramp consists of a single 50 mm layer of hot-mix asphalt (HL 4?) over about 300 mm of gravelly sand base and about 1 m of sand subbase. The gradations of the gravelly sand base and sand subbase are shown in Figures 3 and 4, respectively. Both materials meet Granular B gradation requirements. The upper layers of the existing Highway 11 embankment fill material generally consist of moist compact sand fill, with the lower 2 m or so of this fill consisting of moist to wet clayey silt fill. The average depth of topsoil on the fill side slope is about 100 mm.

4.3 SUBSOILS AND GROUNDWATER

4.3.1 GENERAL

Below the existing embankment fills, the natural subsoil consists of about 9 to 10 metres of moist to wet relatively non-cohesive silt with some clay or silt and clay material underlain by a sandy gravel till.

4.3.2 SILT WITH SOME CLAY OR SILT AND CLAY

The silt with some clay or silt and clay (grey, moist to wet) subsoil is horizontally bedded and varies in depth from 6.7 m to 10.6 m below the original ground surface with an average depth of 9.0 m. Approximately half of this layer is described as silt with some clay with the other half of the deposit described as silt and clay. Typical particle size distributions of the silt with some clay and silt and clay materials are shown in Figures 5 and 6 respectively. As discussed in Section 3.0 of this report, most samples from this layer showed little plasticity, were dilatant and appeared quite permeable. Atterberg limit test results plotted on the Casagrande plasticity chart were in the range of inorganic silts of low compressibility to inorganic clays of low plasticity. The SPT 'N' value of this

layer was 11 with individual SPT 'N' values ranging from 5 to 22 indicating a loose to compact silty material. The more clayey layers had a firm to stiff consistency. This layer appears to be of glacio-lacustrine origin and therefore normally consolidated. The moisture contents of the samples are very variable, indicating that there are frequent thin layers of very silty material interspersed with the more clayey material. Materials of this type tend to behave elastically so that most settlements should occur immediately or shortly after loading.

4.3.3 GRAVELLY SANDY TILL

This subsoil layer described as gravelly, sandy till (wet, brown to grey) was found at the base of the silt with some clay to silt and clay material in Boreholes 5, 7 and 8 and was inferred from dynamic cone penetration measurements in Boreholes 6 and 9. The layer was encountered at between 6.7 m and 10.6 m below the original ground surface elevation. This layer is a compact to very dense till with 'N' values ranging from 18 to refusal. This layer is described in the previous MTO report as possibly of glacio-fluvial origin. In Borehole 7, there is a gravelly sand transition layer about 1.6 m thick between the silt with some clay to silt and clay deposit and this till layer. This transition layer may be of glacio-fluvial origin. The investigation was terminated in the till layer. Till materials of this type generally exhibit very high bearing capacity and low settlement characteristics.

4.3.4 GROUNDWATER CONDITIONS

Standing water was observed in the ditch at the junction of the existing fills on Highway 11 and Lakewood Park Road. Based on the moisture contents, groundwater observations and stand pipe piezometer readings, the stabilized ground water level coincides approximately with the base of the existing fills.

5.0 CONCLUDING REMARKS

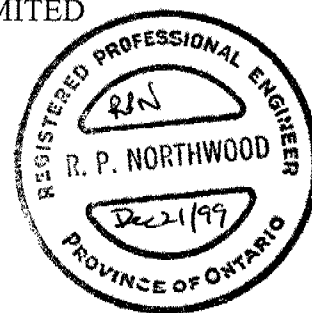
The comments provided in this investigation report have been developed for the use of the design engineers. The subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions between boreholes. Contractors bidding on, or undertaking the works, must conduct their own investigations, and interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED

R. P. Northwood

Roger P. Northwood, M.Sc.(Eng.), P.Eng.
Principal Materials Engineer



Michael H. MacKay

Michael H. MacKay, M.Eng., P.Eng.
Principal Geotechnical Engineer
Consulting Engineer



6.0 RECOMMENDATIONS

6.1 GENERAL

The project involves the construction of a relatively high temporary fill (approximately 10 m in height maximum) between the west side of the existing embankment fill on Highway 11 and the Lakewood Park Road embankment to provide a temporary N-EW ramp for the approximately 1-year period when the existing Highway 11/District Road 3 ramp is closed for bridge rehabilitation. We understand the temporary embankment fill material will be removed or regraded at the end of the project.

The proposed temporary ramp extends for approximately 300 m at an average elevation of 293 m. The elevation of Highway 11 at this location is about 293 m and the elevation of Lakewood Park Road at the junction with the ramp is about 295 m. The original ground level is obscured by the existing embankment fills but appears to be around 285 m with the lowest elevation of the ditch between the fills at about 284 m.

The subsoils at this site have been preloaded by the existing embankments which have been in place over the entire area of the temporary ramp for about 20 years. The temporary rock fill will impose an incremental additional load on the subsoils which will be relatively low in comparison to the loads imposed by the original embankments.

6.2 BEARING CAPACITY

Due to property considerations, we understand that the temporary ramp will probably be constructed using rock fill material. At the north end, the ramp will be constructed by widening the existing side slope of Highway 11, and at the south end the ramp will be constructed over both the existing side slopes of Highway 11 and Lakewood Park Road. At its deepest, there is a maximum potential depth of new fill of about 10 m, however, due to the geometry of the proposed temporary embankment that is to be

constructed traversing the existing overlapping embankments for Highway 11 and Lakewood Park Road, the actual average maximum additional height of fill at the south end of the detour is considerably less than 10 m. A 10 m rock fill will impose an additional load of approximately 20 tonnes/m² on the underlying subsoil. The subsoil was assumed to behave as a silt or slightly cohesive silty soil with an 'N' value of 10. Schmertmann² provides a simplified method of estimating bearing capacity of sandy and silty soils of the above types based on 'N' values. For this type of soil, the method provides an estimated bearing capacity of about approximately 200 tonnes/m². High factors of safety are generally used with this type of estimate, however, it is clear that the underlying subsoils are capable of supporting the additional imposed loads with standard side slopes. Although the soils were assumed to be non-cohesive for the above estimate, a second analysis was carried out assuming the soils were cohesive using shear strength values estimated from the observed consistency of the soil and checked by reviewing field vane shear strength measurements from a previous investigation in this area (average 1400 lb/ft² or 70 kPa for boreholes close to the south end of the ramp). This check also indicated no bearing capacity concerns for the ramp construction. The factor of safety for a highway fill slope over a normally consolidated subsoil should usually be at least 1.5 in the short term. The actual factor of safety will be variable due to the complex geometry of the site but will be higher than 1.5 in all areas. The minimum factor of safety in the short term should be at least 3 in all areas.

6.3 SETTLEMENT

Noting that the site of the proposed temporary embankment has been substantially pre-loaded by the existing Highway 11 and Lakewood Park Road embankments, additional settlements of temporary embankment fills on silty subsoils of this type are expected to be relatively small and mainly elastic, with most settlements occurring during or shortly after construction. Settlements in the silt with some clay to silt and clay layer

2. Schmertmann, J.H. (1970), Static Cone to Compute Static Settlement Over Sand. Journal of Soil Mechanics and Foundation Division, ASCE.

were estimated using the method recommended by Bowles³. The stress-strain modulus for the subsoils was estimated using an 'N' value of 10 blows and estimated soil constants derived for silty soils. The maximum predicted settlement by this method is approximately 50 mm in the subsoils. Therefore, the total settlement during the construction period, including settlement within the rock fill is not expected to exceed 100 mm at the highest point in the temporary fill around Station 21+050. No significant settlements are expected to occur in the pavement or shoulder of existing Highway 11. Longer term settlements should not exceed about 25 mm. This estimate is based on experience of the performance of similar fills on similar soils in this area of Ontario. These settlements are considered to be within the normally tolerable limits for this type of construction.

6.4 EMBANKMENT FILL

The temporary embankment fill may be constructed of earth material with 2:1 side slopes provided in accordance with OPSD 200.020, or of rock material with 1½:1 side slopes in accordance with OPSD 201.020. We understand that it is most likely that rock fill will be used for the temporary embankment construction. Because of the temporary nature of the construction, no berms are required in the higher sections of the fill. The side slopes of the existing fills in the construction zone should be stripped of the topsoil at the junction of the two fills prior to construction to mitigate potential differential settlements. No subexcavation is required beyond removal of this topsoil on the existing slopes. If earth borrow is used for the embankment construction, benching of the existing embankment fills should be carried out in accordance with OPSD 208.010. Alternatively, if a rock fill embankment is constructed, no benching is required but a separation layer should be provided between the silt material in the lower 2 m or so of the Highway 11 fill and the new rock fill to prevent possible migration of silt from the earth fill into the rock fill and causing potentially unacceptable settlements. The separation layer may consist of 600 mm of Granular B material or a Class II (heavy duty) non-

3. Bowles, J.E. (1988), Foundation Analysis and Design, 4th Edition.

woven geotextile meeting the requirements of OPSS 1860 and having an FOS value between 65 and 100 μm .

6.5 PAVEMENT RECOMMENDATIONS ON TEMPORARY FILL

If rock fill is used, the detour pavement structure on the rock fill should consist of:

- 90 mm of HL 4 asphalt concrete (40 mm surface + 50 mm binder)
- 150 mm of Granular A base
- 150 mm of Granular B Type 1 subbase (for estimating purposes, it should be anticipated that 300 mm of Granular B will be required to provide a maximum depth of 150 mm after construction).

Alternatively, a geotextile layer may be provided and the thickness of the granular subbase layer reduced to 150 mm. Regardless, the surface of rock fill should be properly chinked prior to placement of the Granular B subbase.

If granular borrow is used for the embankment construction, the temporary pavement structure should be:

- 90 mm of HL 4 asphalt concrete (40 mm surface + 50 mm binder)
- 150 mm of Granular A base
- 450 mm of Granular B Type 1 subbase.

If earth borrow materials such as silt or silty clay are used for the temporary embankment construction, the Granular B depth should be increased to at least 600 mm. If HL 1 and HDBC are already being currently used on the contract, these may be substituted for the HL 4 surface and binder courses.

6.6 DRAINAGE

All the surface drainage at this site consists of drainage down the side slopes of the existing fills into the ditch at the junction of the two fills. Lateral drainage from the existing granular material on Highway 11 must be maintained during the construction of

the adjacent new ramp. If earth fill is used, the ramp pavement structure should be adjusted adjacent to the Highway 11 shoulder so that the top of the subgrade at the junction of Highway 11 and the new ramp are identical. If rock fill is used, it is anticipated that any subsurface water flowing through the shoulder of Highway 11 should drain laterally into the rock fill.

6.7 FILL COMPACTION

Earth fill must be constructed and compacted in accordance with OPSS 206 and OPSS 501. Rock fills must be constructed in accordance with OPSS 206. Granular base and subbase materials must be placed in accordance with OPSS 314 and compacted in accordance with OPSS 501.

6.8 TRANSITION TREATMENTS

No transition treatments are required if rock or granular borrow are used within the frost zone for the temporary embankment. However, if a silt or silty clay borrow is used, transition treatments must be provided to mitigate frost heaving in accordance with OPSD 205.040 for a 't' depth of 1.5 m.

6.9 EXISTING CULVERTS

Two existing corrugated steel pipe storm water culverts meet at the toe of side slope of the existing fills and will be located directly under the proposed temporary embankment fill. Any new short section of culvert required to join the existing culverts, and the exposed sections of the existing culverts will require proper bedding and cover material provided in accordance with the appropriate OPSS and OPSD, to resist the additional load of the proposed new fill. A new manhole will probably be required at the junction of the two existing culverts to provide access to the culverts for cleaning after the fill material has been placed. The new section of culvert and the manhole required may be founded within the compact silt subsoil after stripping of any overlying topsoil.

The structural capacity of the existing culverts should be checked by the structural engineer to ensure that they are adequate for the intended embankment load.

The existing culvert and the manhole will settle under the load of the temporary fill. As previously discussed, the settlement at the level of original ground under the fills will be about 50 mm. This amount of settlement is not expected to significantly affect the culverts subject to their being in good condition and structurally capable (adequate thickness) of supporting the additional fill loads. The new manhole and the existing culverts should settle simultaneously and no special joint will be required to accommodate settlement. Regardless, the embankment construction should be carried out in continuous layers spread uniformly over the existing culverts to distribute the loading evenly over the top of the culvert, not on one side or the other.

6.10 LAKEWOOD PARK ROAD PAVEMENT

The existing pavement structure on Lakewood Park Road appears to be adequate to support the additional temporary increase in traffic from the temporary ramp without any strengthening. However, the absence of a crushed granular base layer under the hot-mix asphalt may contribute to slight deformation/rutting of the pavement under heavy truck traffic. We recommend that provision be made to resurface this section of Lakewood Park Road at the end of the detour period prior to restoring the road to the municipality. Provision should be made for 50 mm of HL 4. Alternatively, HL 1 may be substituted if this mix is currently in use on the contract.

6.11 MATCHING EXISTING PAVEMENTS

The existing shoulder of Highway 11 should be excavated to sufficient depth to provide for 90 mm of HL 4 and 150 mm of new Granular A. At the junction of the new pavement, the edge of pavement on Highway 11 should be saw cut to a vertical face and the ramp hot mix placed to form a butt joint. A similar butt joint should be formed at Lakewood Park Road.

6.12 EROSION

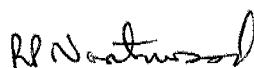
If as expected, the temporary detour ramp is constructed from rock fill, no specific erosion protection measures are necessary other than the provision of the separation layer described in Section 6.4, and the routine granular sealing of the base and subbase materials.

7.0 CONCLUDING REMARKS


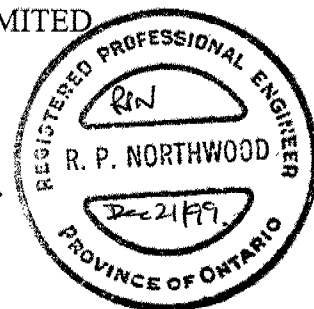
The comments provided in this report have been developed for the use of the design engineers. The subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions between boreholes. Contractors bidding on, or undertaking the works, must conduct their own investigations, and interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED



Roger P. Northwood, M.Sc.(Eng.), P.Eng.
Principal Materials Engineer



Michael H. MacKay, M.Eng., P.Eng.
Principal Geotechnical Engineer
Consulting Engineer

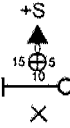


LOG OF BOREHOLE NO. 1DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: **Station 10+080, 2.5m E of CL**
on pavement (Lakewood Park Rd.) (E 324 591, N 5 019 359)

G W L	SOIL DESCRIPTION	ELEVATION M [FT]	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERSERS LIMITS			S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20 40 60 80 BLOWS				% DRY WEIGHT				
				SHEAR STRENGTH 0.1 MPa				10 20 30				
	100 mm ASPHALT CONCRETE	288.2 0.1	0									
	GRAVELY SAND, moist, brown											
		287.4 0.9	1									
	Borehole Refusal, Boulders											
			2									
			3									
			4									
			5									
			6									
			7									
			8									
			9									
			10									

N
O
T
E
S

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 2

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+205, 2.0m E of CL
on pavement (Lakewood Park Rd.) (E 324 873, N 5 019 456)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80 BLOWS		
	100 mm ASPHALT CONCRETE	293.5 0.1	0	SHEAR STRENGTH 0.1 MPa		10	20	30	
	GRAVELY SAND, moist, brown		1						
			2						
		290.7 2.8	3						
	Borehole Refusal, Boulders		4						
			5						
			6						
			7						
			8						
			9						
			10						

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 3

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+345, 2.5m E of CL
on pavement (Lakewood Park Rd.) (E 324 718, N 5 019 588)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS			SAMPLE ID	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80	% DRY WEIGHT				
				BLOWS				10	20	30		
				SHEAR STRENGTH 0.1 MPa								
	100 mm ASPHALT CONCRETE	295.7 0.1	0									
	GRAVELY SAND, moist, brown		1									
			2									
		293.0 2.7	3									
	GRAVELY SAND, Layers of BOULDERS, moist, brown		4									
		291.2 4.5	5									
	Borehole Terminated.		6									
			7									
			8									
			9									
			10									
N O T E S	1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.											
	2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.											

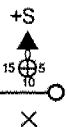
LOG OF BOREHOLE NO. 4

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Stn. 10+417 (21+000), 3m E of
CL on the pav't (Lakewood Pk. Rd.). (E 324 728, N 5 019 656)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		S A M P L E	NATURAL UNIT WEIGHT kn/m ³
				20	40	60	80 BLOWS		
	100 mm ASPHALT CONCRETE	295.4 0.1	0	SHEAR STRENGTH 0.1 MPa		10	20		
	GRAVELY SAND, became finer with depth, moist, brown		1						
	Borehole Terminated.	293.9 1.5	2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						

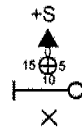
NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 4ADRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+417(21+000), 4m E
of CL on shoulder (Lakewood Park Rd), (E 324 735, N 5 019 655)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		S A M P L E	NATURAL UNIT WEIGHT KN/m ³
				20	40	60	80		
		295.2	0.0	SHEAR STRENGTH 0.1		BLOWS			
	GRAVELY SAND, moist, brown		0						
			1						
			2						
			3						
	Layers of BOULDERS in the last 3 m		4						
			5						
			6						
		288.9	6.3						
	Refusal, Boulders.		7						
			8						
			9						
			10						

NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 5

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+050, 10m N/20m W
of CL, towards bottom of slope (N-EW Ramp). (E 324 757, N 5 019 679)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE	NATURAL UNIT WEIGHT KN/m ³
				20	40	60		
		288.2		SHEAR STRENGTH 0.1		10		
		0.1		MPa		20		
	TOPSOIL		0					
			1					
	SILT with some CLAY, moist to wet, grey, loose to compact		2					
			3					
	some organics		4					
			5					
			6					
			7					
			8					
			9					
		278.4	10					
		9.8						

- N
O
T
E
S
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
 2. WATER LEVEL RECORDS: 6.9 m ON OCTOBER 12, 1999, 6.0 m ON OCTOBER 14, 1999.
 3. 3/4" ID MONITORING WELL INSTALLED TO A DEPTH OF 10.8 m.
 4. TOPSOIL THICKNESS AT STATION 21+025 CL, 90 mm.

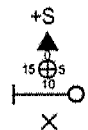
LOG OF BOREHOLE NO. 5

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+050.10m N/20m W
of CL, towards bottom of slope (N-EW Ramp). (E 324 757, N 5 019 679)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		SAMPLE	NATURAL UNIT WEIGHT kN/m ³
				20 SHEAR STRENGTH	40 0.1	60 MPa	80 BLOWS		
	GRAVELLY SANDY TILL, wet, brown-grey, dense	277.4	10						
	Borehole Refusal, TILL	10.8	11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES

- BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
- WATER LEVEL RECORDS: 6.9 m ON OCTOBER 12, 1999, 6.0 m ON OCTOBER 14, 1999.
- 3/4" ID MONITORING WELL INSTALLED TO A DEPTH OF 10.8 m.
- TOPSOIL THICKNESS AT STATION 21+025 CL, 90 mm.

LOG OF BOREHOLE NO. 6

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00
BOREHOLE LOCATION: Station 21+075, 3m W/3m S
of CL on slope (N-EW Ramp). (E 324 787, N 5 019 694)

G W L	SOIL DESCRIPTION	ELEVATION M [FT]	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	S M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60		
				SHEAR STRENGTH 0.1 MPa		10		
	TOPSOIL	291.0 0.075 290.925	0					
	CLAYEY SILT, moist, grey		1					
	some fine sand	288.7 2.3	2					
	GRAVELY SAND, moist to wet, brown to grey	287.9 3.1	3					
	Fine to Medium SAND, moist to wet, brown to grey	287.5 3.5	4					
	SILTY SAND trace CLAY, moist to wet, grey	286.4 4.6	5					
	SILT with some CLAY trace SAND, moist to wet, brown to grey, loose		6					
			7					
		283.4 7.6	8					
	SILT and CLAY, moist to wet, grey, firm to stiff		9					
		281.4 9.6	10					

NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HALLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: 8.5 m ON OCTOBER 12, 1999..

LOG OF BOREHOLE NO. 6

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+075, 3m W/3m S
of CL, on slope (N-EW Ramp). (E 324 787, N 5 019 694)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	S A M P L E	NATURAL UNIT WEIGHT KN/m ³
				20	40	60		
				BLOWS				
				SHEAR STRENGTH				
				0.1	MPa	10	20	30
	SILT with some CLAY, wet, grey, compact		10					
		279.8	11					
		11.2						
			12					
			13					
			14					
		275.8	15					
	Borehole Termination	15.2						
			16					
			17					
			18					
			19					
			20					

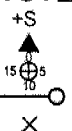
- NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
 2. WATER LEVEL RECORDS: 8.5 m ON OCTOBER 12, 1999.

LOG OF BOREHOLE NO. 7

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+100, 12.5m W of
CL, bottom of slope (N-EW Ramp). (E 324 784, N 5 019 721)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT			NATURAL UNIT WEIGHT kN/m ³	
				20 40 60 80 BLOWS								
				SHEAR STRENGTH 0.1 MPa				10 20 30				
	TOPSOIL	288.8 0.1	0									
	SILT and some CLAY, moist to wet, grey, loose to compact		1									
			2									
			3									
			4									
			5									
			6									
			7									
		281.3 7.6	8									
	GRAVELY SAND trace SILT, wet, brown-grey, compact		9									
		279.7 9.2										
	GRAVELY SANDY TILL, wet, brown	279.35 9.55										
	Borehole Refusal, TILL.		10									
N O T E S	1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999. 2. WATER LEVEL RECORDS: 4.5 m ON OCTOBER 12, 1999. 3. TOPSOIL THICKNESS AT STATION 21+100 CL, 90 mm.											

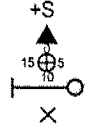
LOG OF BOREHOLE NO. 8

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00
BOREHOLE LOCATION: Station 21+150. 5m E of CL
on edge of shoulder (Hwy 11), (E 324 825, N 5 019 761)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
		293.0		SHEAR STRENGTH 0.1 MPa		10 20 30			
	GRAVELLY SAND and BOULDERS, moist, brown (Fill)	0.0	0						
			1						
			2						
			3						
			4						
		288.4							
	Medium-Coarse SAND some GRAVEL, dry to moist, brown (Fill)	4.6	5						
			6						
	Medium SAND, moist to wet, brown (Fill)	286.9	6.1						
			7						
		285.4							
	SILTY SAND, moist to wet, brown-grey	7.6	8						
			9						
		283.8							
	SILT and CLAY, moist to wet, grey, firm to stiff	9.2	10						

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: 9 m ON OCTOBER 14, 1999.
3. TOPSOIL THICKNESS AT STATION 21+150 CL, 100 mm.

LOG OF BOREHOLE NO. 8

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+150, 5m E of CL
on edge of shoulder (HWY 11), (E 324 825, N 5 019 761)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
				SHEAR STRENGTH 0.1 MPa		10 20 30			
			10						
			11						
			12						
			13						
		279.3 13.7							
	SILT with some CLAY, wet, grey, compact		14						
			15						
		277.1 15.9							
	Layer of GRAVEL	276.8 16.2	16						
	SANDY GRAVELLY TILL, wet, brown-grey, compact		17						
		275.3 17.7							
	Borehole Termination.		18						
			19						
			20						
N O T E S	1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.								
	2. WATER LEVEL RECORDS: 9 m ON OCTOBER 14, 1999. 3. TOPSOIL THICKNESS AT STATION 21+150 CL, 100 mm.								

LOG OF BOREHOLE NO. 9

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00
BOREHOLE LOCATION: Station 21+200, 3m E of CL.
on edge of shoulder (Hwy 11). (E 324 843, N 5 019 805)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
				SHEAR STRENGTH 0.1 MPa		10 20 30			
	GRAVELLY SAND and BOULDERS, moist, brown (Fill)	292.2 0.0	0						
			1						
			2						
			3						
			4						
		287.0 5.2	5						
	CLAYEY SILT some fine SAND, moist to wet, grey (Fill)		6						
		285.8 6.6	7						
	Organics, moist to wet, brown	285.6 6.4	8						
	SILT with some CLAY, moist to wet, grey, compact		9						
		283.0 9.2	10						
	SILT and CLAY, moist to wet, grey, firm to stiff								

- N
O
T
E
S
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
 2. WATER LEVEL RECORDS: 7.6 m ON OCTOBER 14, 1999, 7.0 m ON OCTOBER 15, 1999.
 3. 3/4" ID MONITORING WELL INSTALLED TO A DEPTH OF 16 m.
 4. TOPSOIL THICKNESS AT STATION 21+200 CL, 90 mm.

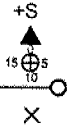
LOG OF BOREHOLE NO. 9

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+150.5m E of CL
on edge of shoulder (HWY 11), (E 324 843, N 5 019 805)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		S A M P L E	NATURAL UNIT WEIGHT KN/m ³
				20	40	60	80		
				BLOWS		MPa			
				SHEAR STRENGTH		0.1			
			10						
			11						
			12						
		279.5 12.7	13						
			14						
			15						
			16						
		275.4 16.8	17						
	Borehole Refusal.		18						
			19						
			20						

- NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
 2. WATER LEVEL RECORDS: 7.6 m ON OCTOBER 14, 1999, 7.0 m ON OCTOBER 15, 1999.
 3. 1/2" ID MONITORING WELL INSTALLED TO A DEPTH OF 16 m.
 4. TOPSOIL THICKNESS AT STATION 21+200 CL, 90 mm.

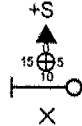
LOG OF BOREHOLE NO. 10

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+250, 2m E of CL
on edge of shoulder (Hwy 11), (E 324 867, N 5 019 852)

G W L	SOIL DESCRIPTION	ELEVATION M [FT]	DEPTH M	N VALUE			NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS			S A M P L E	NATURAL UNIT WEIGHT kN/m ³		
				20	40	60	80	BLOWS	% DRY WEIGHT				
				SHEAR STRENGTH			0.1	MPa	10			20	30
	ASPHALT CONCRETE (50mm at edge of shld.)	292.45 0.05	0						X				
	GRAVELY SAND, moist, brown	292.2 0.3											
	SAND with GRAVEL, moist, brown		1						X				
	Borehole Terminated.	291.0 1.5											
			2										
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

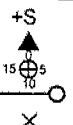
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 11

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+300, 0.5m E of CL
on edge of shoulder (Hwy 11), (E 324 890, N 5 019 895)

G W L	SOIL DESCRIPTION	ELEVATION M [FT]	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
				BLOWS		% DRY WEIGHT			
				SHEAR STRENGTH		MPa			
	ASPHALT CONCRETE (50mm at edge of shld.)	291.5 0.05	0					X	
	GRAVELY SAND, moist, brown	291.2 0.3							
	SAND some GRAVEL, moist, brown		1					X	
	Borehole Terminated.	290.0 1.5	2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						

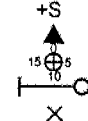
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 12DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: **Station 21+350, 0.5m E of CL**
on edge of shoulder (Hwy 11), (E 324 917, N 5 019 940)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		S A M P L E	NATURAL UNIT WEIGHT KN/m ³
				20	40	60	80 BLOWS		
	ASPHALT CONCRETE (50mm at edge of shld.)	289.45 0.05	0	SHEAR STRENGTH 0.1 MPa		10	20	30	
	GRAVELY SAND, moist, brown	289.2 0.3							
	SAND some GRAVEL, moist, brown		1						
	Borehole Terminated.	288.0 1.5	2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 13

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELLY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+176, 3.5m E of CL
on edge of shld (Lakewood Park Rd), (E 324 657, N 5 019 431)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		SAMPLE	NATURAL UNIT WEIGHT KN/m ³
				20	40	60	80		
		292.6 0.1	0	SHEAR STRENGTH 0.1 MPa		10	20		
	ASPHALT CONCRETE (100mm at edge of shld.)								
	GRAVELY SAND, moist, brown								
		291.1 1.5	1						
	Borehole Terminated.		2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						


1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

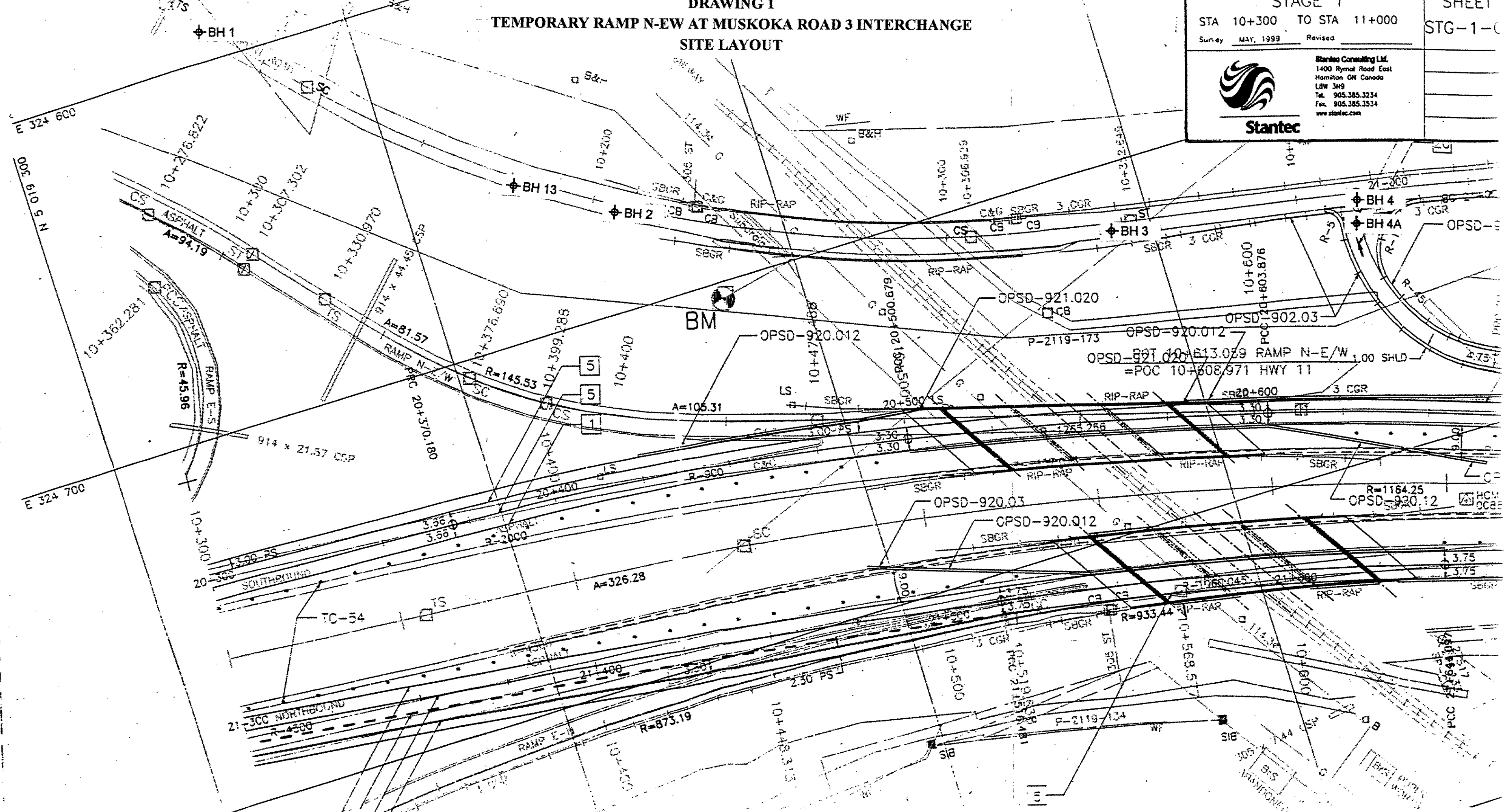
CON 1
LOT 7

METRIC

PLATE No 825-0011/00-2
CONT No
WP No 162-94-00

DRAWING 1
TEMPORARY RAMP N-EW AT MUSKOKA ROAD 3 INTERCHANGE
SITE LAYOUT

STAGE 1		SHEET STG-1-C
STA 10+300	TO STA 11+000	
Survey MAY, 1999 Revised		
 Stantec		
Stantec Consulting Ltd. 1400 Rymal Road East Hamilton ON Canada L8W 3M9 Tel. 905.385.3234 Fax. 905.385.3534 www.stantec.com		



LEGEND
◆ BOREHOLE

SCALE
5m 10m
1:2500

CON
LOT 8

METRIC

PLATE No 625-0011, 00-2

CONT No
WP No 162-94-00

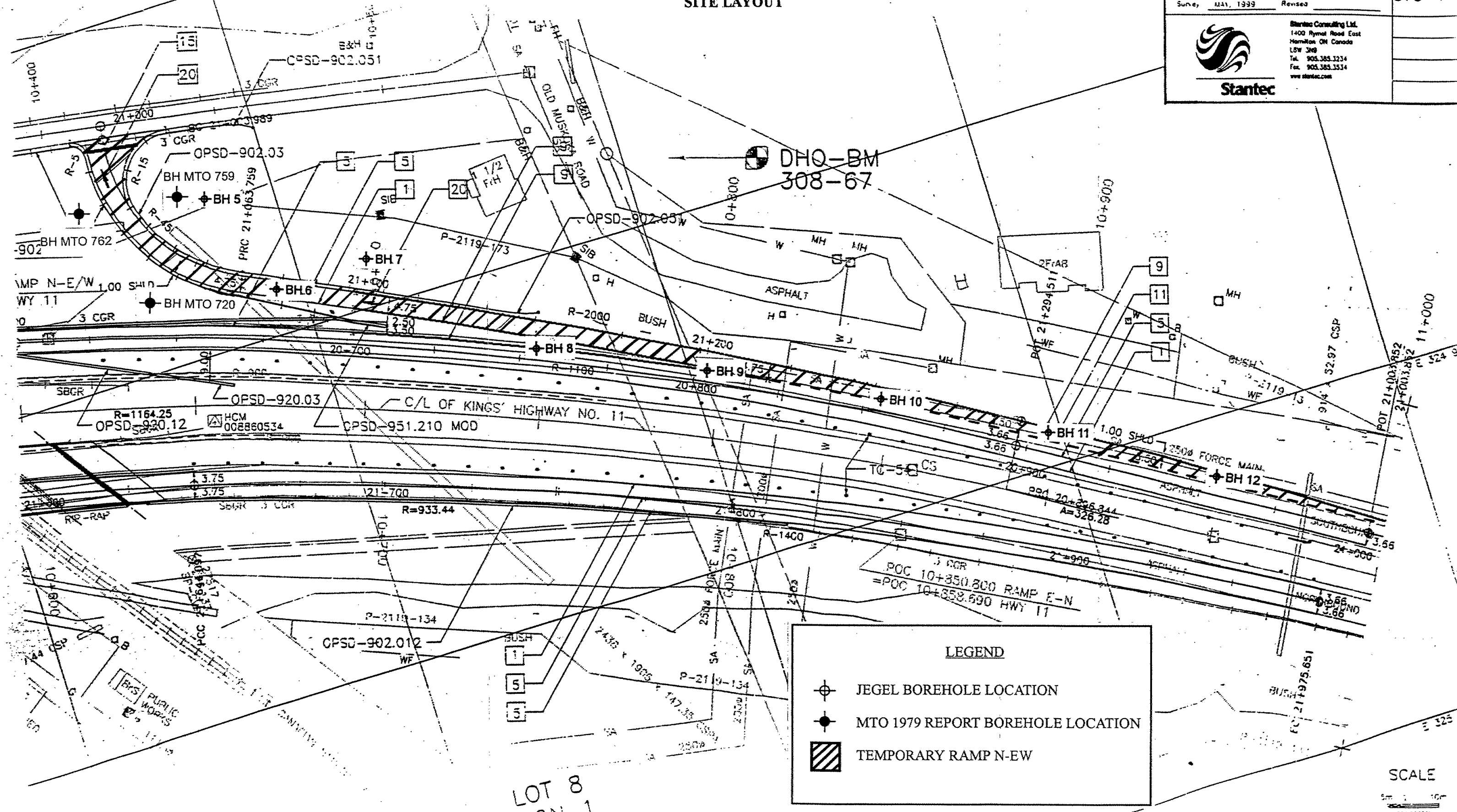
DRAWING 2
TEMPORARY RAMP N-EW AT MUSKOKA ROAD 3 INTERCHANGE
SITE LAYOUT

STAGE 1
STA 10+300 TO STA 11+000
Survey, MAY, 1999 Revised

SHEET
STG-1-



Stantec Consulting Ltd.
1400 Rymal Road East
Hamilton, ON Canada
L8W 3K9
Tel. 905.383.3234
Fax. 905.383.3534
www.stantec.com



LEGEND

- JEGEL BOREHOLE LOCATION
- MTO 1979 REPORT BOREHOLE LOCATION
- TEMPORARY RAMP N-EW

SCALE
0m 10m

LOT 8
CON 1

GEOCRES No. 31E-183DIST. 52 REGION W.P. No. 162-94-00CONT. No. W. O. No. STR. SITE No. HWY. No. 11

LOCATION Hwy 11 - TEMPORARY
NEW RAMP AT MUSKOKA RD 3
INTERCHANGE

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

December 21, 1999

JEGEL 199255

GEOTECHNICAL AND FOUNDATION
INVESTIGATION, TEMPORARY NEW RAMP
HIGHWAY 11 AND MUSKOKA ROAD 3
INTERCHANGE
MTO PROJECT NO. WP 162-94-00

Prepared For

MTO NORTHERN REGION

By

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED
CONSULTING ENGINEERS

#1, 109 Woodbine Downs Boulevard

Toronto, Ontario M9W 6Y1

Telephone: 416-213-1060 Facsimile: 416-213-1070

E-mail: jegel@comnet.ca Website: www.jegel.com

TABLE OF CONTENTS

	Page
INTRODUCTION	1
SITE DESCRIPTION AND GEOLOGY	2
INVESTIGATION PROCEDURE	3
SUBSURFACE CONDITIONS	5
GENERAL	5
PAVEMENT CONDITIONS	5
SUBSOILS AND GROUNDWATER	6
General	6
Silt With Some Clay or Silt and Clay	6
Gravelly Sandy Till	7
Groundwater Conditions	7
CONCLUDING REMARKS	8
RECOMMENDATIONS	9
GENERAL	9
BEARING CAPACITY	9
SETTLEMENT	10
EMBANKMENT FILL	11
PAVEMENT RECOMMENDATIONS ON TEMPORARY FILL	12
DRAINAGE	12
FILL COMPACTION	13
TRANSITION TREATMENTS	13
EXISTING CULVERTS	13
LAKEWOOD PARK ROAD PAVEMENT	14
MATCHING EXISTING PAVEMENTS	14
EROSION	15
CONCLUDING REMARKS	15

GEOTECHNICAL AND FOUNDATION INVESTIGATION REPORT
TEMPORARY NEW RAMP
HIGHWAY 11 AND MUSKOKA ROAD 3 INTERCHANGE
MTO PROJECT NO. WP 162-94-00

1.0 INTRODUCTION

John Emery Geotechnical Engineering Limited, Consulting Engineers (JEGEL) was retained as sub-consultants to Stantec Consulting Ltd. to complete a geotechnical and foundation investigation for the proposed temporary ramp from Highway 11 Southbound to District Road 3 in the District Municipality of Muskoka. This work was completed as part of MTO Project No. WP-162-94-00.

This report describes a geotechnical investigation carried out at the above site to provide recommendations to provide:

- a) design recommendations for a relatively high fill required to support a temporary ramp from Highway 11 to Lakewood Park Road, connecting to District Road 3;
- b) pavement design recommendations for the temporary ramp; and
- c) recommendations for strengthening of the Lakewood Park Road pavement structure to support the additional ramp traffic during the approximately 1 year construction period.

Previous geotechnical investigations had been carried out in the vicinity of this site between 1956 and 1978 in connection with construction of the existing facilities in the area. These investigations are summarized in a report by the MTO Pavement and Foundation Design Section dated November 22, 1979, entitled:

Foundation Investigation Reports for

WP 74-74-01, CNR South Crossing Southbound Lane
WP 74-74-02, CNR South Crossing Service Road, Conn. B
WP 74-74-06, Muskoka Road #3 (Aspdin Road) Underpass
WP 150-73-02, CNR South Crossing Northbound Lane

2.0 SITE DESCRIPTION AND GEOLOGY

The site of the temporary ramp is adjacent to Highway 11 about 500 m north of District Road 3 at the Town of Huntsville in the District Municipality of Muskoka. At this location, Lakewood Park Road runs in a northerly direction from Muskoka Road 3 and roughly parallel to Highway 11. At this location, both Highway 11 and Lakewood Park Road are constructed on embankment fills of 10 m height or more, and the temporary ramp will be constructed between these existing embankments to provide access from southbound Highway 11 to Lakewood Park Road during bridge rehabilitation work.

The existing Highway 11 and Lakewood Park Road embankments are composed of earth fill with side slopes of approximately 2:1. The side slopes appear to be stable with a surface cover of topsoil, well vegetated with grasses and native vegetation. Over most of the area where the temporary ramp is to be constructed, the embankment side slopes of the two fills intersect at the ditch between the fills. At the north end, the temporary ramp will be constructed by widening entirely over the existing Highway 11 fill and at the south end the ramp will be constructed entirely over the existing side slopes of the Highway 11 and Lakewood Park Road fills by filling in the area between the fills, a distance of about 50 m.

The topography of the Huntsville area is fairly typical of the Precambrian Shield area, consisting of areas of highly variable bedrock depth, and the irregular volcanic (igneous) and metamorphic rock surface covered with deep lakes, variable deposits of muskeg and swamps, and generally shallow glaciofluvial and lacustrine soils consisting of peat, clays, silts, and sand and gravel. In the Huntsville area, significant beds of moderate to highly frost susceptible silty soils over the bedrock are common. These soils are usually normally consolidated. A layer of glacial till is sometimes found between the glaciofluvial or lacustrine soils and the bedrock.

The site lies within the physiographic region described by Chapman and Putnam¹ as "The Number 11 Strip". This region consists of Precambrian bedrock with sand, silt and clay deposits in the hollows. The strip was just below the shoreline of glacial Lake Algonquin. The streams entering this lake from the adjacent upland dropped sand as deltas and silts and clays settled out in deeper water offshore.

3.0 INVESTIGATION PROCEDURE

The fieldwork was carried out during the week of October 12, 1999. The boreholes and probeholes were advanced using continuous flight auger equipment supplied by Malone's Soil Samples Co. Ltd., and was continuously supervised by Tom Millis, P.Eng. of JEGEL. Five shallow probeholes, approximately 1.5 m deep, were advanced through Lakewood Park Road pavement to determine the existing pavement structure. Three shallow probeholes, approximately 1.5 m deep, were also advanced through the shoulder of Highway 11 to confirm the depth and type of granular material adjacent to the temporary ramp. Six deeper boreholes ranging in depth between 4 m and 18 m were completed along the detour alignment at 50 m intervals to determine the materials used to build the existing Highway 11 and Lakewood Park Road fills, the soil strata under the fills, and the depth of stripping required for the ramp construction.

The boreholes were completed using a track-mounted Bombardier drill rig. Continuous flight solid stem augers were used for the shallow boreholes, with hollow stem augers utilized for the deeper borings. Subsoil samples were recovered at regular intervals of depth (approximately every 0.5 m down to 3 m depth and approximately every 1.5 m below 3 m depth) by driving a 50 mm O.D. split barrel sampler in accordance with the Standard Penetration Test (SPT) procedures.

1. Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2).

Selected samples of pavement granular materials recovered from the auger flights were submitted for gradation testing. A dynamic cone penetration test was driven to indicate the depth of the silty layer at the bottom of two of the deeper boreholes.

The recovered samples were examined in the field as to their visual and textural characteristics, then preserved and transported to the JEGEL main laboratory for testing. In the laboratory, more detailed examination of the samples was conducted by the project engineer, and with moisture content determinations carried out on all samples. The gradation of the existing base and subbase materials was checked, and hydrometer analysis and Atterberg limit tests were carried out on the silty subsoil to indicate its drainage and frost susceptibility characteristics.

As the investigation progressed, the field engineer observed that the predominant soils beneath the fills were deep beds of silty soils with relatively high SPT 'N' values. These soils appeared to behave like non-cohesive soils. Most samples showed little plasticity, the samples were dilatant, and they appeared to be relatively permeable. Because of the observed nature of these soils, the decision was made to treat the soils as non-cohesive soils in terms of stability and settlement analysis. In previous investigations at this site, these soils had been described as layers of compact silt and stratified firm to stiff clayey silt confirming the predominantly non-cohesive nature of the soils. The investigation concentrated on collecting extensive SPT 'N' values rather than conducting the vane shear strength testing which would have been more appropriate for cohesive soils. The subsequent laboratory testing showed that the soils were classified as silt with some clay to silt and clay.

Groundwater observations were made in the open boreholes during drilling and standpipe piezometers were installed in selected boreholes to permit water monitoring.

All the boreholes were carefully backfilled using the spoil from the holes compacted back in place by crowding with the drill rig and auger. Each separate layer was backfilled with soil from that layer as far as possible, and the asphalt concrete was backfilled with compacted cold mix.

The locations and ground surface elevations for each borehole were established from a staked detour centreline and drawings provided by Stantec Consulting Ltd.

4.0 SUBSURFACE CONDITIONS

4.1 GENERAL

The borehole logs appended to this report provide the details of the pavement structures, soil descriptions, SPT 'N'-values, groundwater observations during drilling and at the completion of drilling, at each borehole and/or probehole location. The subsoil conditions are summarized in the following paragraphs.

4.2 PAVEMENT CONDITIONS

The pavement structure on Lakewood Park Road consists of about 100 mm of hot mix asphalt over sand and gravel basecourse which extends to considerable depth and appears to be quite similar to the sand subgrade material. There is no clearly defined interface between the granular basecourse and the underlying sand and gravel subgrade. The gradation of the granular base material is shown in Figure 1, and confirms that this material meets Granular B gradation requirements. The gradation of the underlying subgrade material is shown in Figure 2. It does not appear that a crushed granular base material (Granular A or equivalent) has been provided in the Lakewood Park Road pavement structure. The existing pavement appears to be in good condition apart from low to medium severity transverse cracks at 2 to 5 m intervals and a single low severity longitudinal crack close to the centre of the pavement. At the junction with the proposed

temporary ramp, the Lakewood Park Road embankment fill consists of relatively free draining sand fill with about 100 mm of topsoil cover.

The pavement structure in the paved shoulder on Highway 11 adjacent to the proposed temporary ramp consists of a single 50 mm layer of hot-mix asphalt (HL 4?) over about 300 mm of gravelly sand base and about 1 m of sand subbase. The gradations of the gravelly sand base and sand subbase are shown in Figures 3 and 4, respectively. Both materials meet Granular B gradation requirements. The upper layers of the existing Highway 11 embankment fill material generally consist of moist compact sand fill, with the lower 2 m or so of this fill consisting of moist to wet clayey silt fill. The average depth of topsoil on the fill side slope is about 100 mm.

4.3 SUBSOILS AND GROUNDWATER

4.3.1 GENERAL

Below the existing embankment fills, the natural subsoil consists of about 9 to 10 metres of moist to wet relatively non-cohesive silt with some clay or silt and clay material underlain by a sandy gravel till.

4.3.2 SILT WITH SOME CLAY OR SILT AND CLAY

The silt with some clay or silt and clay (grey, moist to wet) subsoil is horizontally bedded and varies in depth from 6.7 m to 10.6 m below the original ground surface with an average depth of 9.0 m. Approximately half of this layer is described as silt with some clay with the other half of the deposit described as silt and clay. Typical particle size distributions of the silt with some clay and silt and clay materials are shown in Figures 5 and 6 respectively. As discussed in Section 3.0 of this report, most samples from this layer showed little plasticity, were dilatant and appeared quite permeable. Atterberg limit test results plotted on the Casagrande plasticity chart were in the range of inorganic silts of low compressibility to inorganic clays of low plasticity. The SPT 'N' value of this

layer was 11 with individual SPT 'N' values ranging from 5 to 22 indicating a loose to compact silty material. The more clayey layers had a firm to stiff consistency. This layer appears to be of glacio-lacustrine origin and therefore normally consolidated. The moisture contents of the samples are very variable, indicating that there are frequent thin layers of very silty material interspersed with the more clayey material. Materials of this type tend to behave elastically so that most settlements should occur immediately or shortly after loading.

4.3.3 GRAVELLY SANDY TILL

This subsoil layer described as gravelly, sandy till (wet, brown to grey) was found at the base of the silt with some clay to silt and clay material in Boreholes 5, 7 and 8 and was inferred from dynamic cone penetration measurements in Boreholes 6 and 9. The layer was encountered at between 6.7 m and 10.6 m below the original ground surface elevation. This layer is a compact to very dense till with 'N' values ranging from 18 to refusal. This layer is described in the previous MTO report as possibly of glacio-fluvial origin. In Borehole 7, there is a gravelly sand transition layer about 1.6 m thick between the silt with some clay to silt and clay deposit and this till layer. This transition layer may be of glacio-fluvial origin. The investigation was terminated in the till layer. Till materials of this type generally exhibit very high bearing capacity and low settlement characteristics.

4.3.4 GROUNDWATER CONDITIONS

Standing water was observed in the ditch at the junction of the existing fills on Highway 11 and Lakewood Park Road. Based on the moisture contents, groundwater observations and stand pipe piezometer readings, the stabilized ground water level coincides approximately with the base of the existing fills.

5.0 CONCLUDING REMARKS

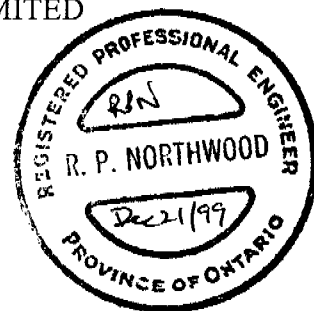
The comments provided in this investigation report have been developed for the use of the design engineers. The subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions between boreholes. Contractors bidding on, or undertaking the works, must conduct their own investigations, and interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED

R. P. Northwood

Roger P. Northwood, M.Sc.(Eng.), P.Eng.
Principal Materials Engineer



Michael H. MacKay

Michael H. MacKay, M.Eng., P.Eng.
Principal Geotechnical Engineer
Consulting Engineer



6.0 RECOMMENDATIONS

6.1 GENERAL

The project involves the construction of a relatively high temporary fill (approximately 10 m in height maximum) between the west side of the existing embankment fill on Highway 11 and the Lakewood Park Road embankment to provide a temporary N-EW ramp for the approximately 1-year period when the existing Highway 11/District Road 3 ramp is closed for bridge rehabilitation. We understand the temporary embankment fill material will be removed or regraded at the end of the project.

The proposed temporary ramp extends for approximately 300 m at an average elevation of 293 m. The elevation of Highway 11 at this location is about 293 m and the elevation of Lakewood Park Road at the junction with the ramp is about 295 m. The original ground level is obscured by the existing embankment fills but appears to be around 285 m with the lowest elevation of the ditch between the fills at about 284 m.

The subsoils at this site have been preloaded by the existing embankments which have been in place over the entire area of the temporary ramp for about 20 years. The temporary rock fill will impose an incremental additional load on the subsoils which will be relatively low in comparison to the loads imposed by the original embankments.

6.2 BEARING CAPACITY

Due to property considerations, we understand that the temporary ramp will probably be constructed using rock fill material. At the north end, the ramp will be constructed by widening the existing side slope of Highway 11, and at the south end the ramp will be constructed over both the existing side slopes of Highway 11 and Lakewood Park Road. At its deepest, there is a maximum potential depth of new fill of about 10 m, however, due to the geometry of the proposed temporary embankment that is to be

constructed traversing the existing overlapping embankments for Highway 11 and Lakewood Park Road, the actual average maximum additional height of fill at the south end of the detour is considerably less than 10 m. A 10 m rock fill will impose an additional load of approximately 20 tonnes/m² on the underlying subsoil. The subsoil was assumed to behave as a silt or slightly cohesive silty soil with an 'N' value of 10. Schmertmann² provides a simplified method of estimating bearing capacity of sandy and silty soils of the above types based on 'N' values. For this type of soil, the method provides an estimated bearing capacity of about approximately 200 tonnes/m². High factors of safety are generally used with this type of estimate, however, it is clear that the underlying subsoils are capable of supporting the additional imposed loads with standard side slopes. Although the soils were assumed to be non-cohesive for the above estimate, a second analysis was carried out assuming the soils were cohesive using shear strength values estimated from the observed consistency of the soil and checked by reviewing field vane shear strength measurements from a previous investigation in this area (average 1400 lb/ft² or 70 kPa for boreholes close to the south end of the ramp). This check also indicated no bearing capacity concerns for the ramp construction. The factor of safety for a highway fill slope over a normally consolidated subsoil should usually be at least 1.5 in the short term. The actual factor of safety will be variable due to the complex geometry of the site but will be higher than 1.5 in all areas. The minimum factor of safety in the short term should be at least 3 in all areas.

6.3 SETTLEMENT

Noting that the site of the proposed temporary embankment has been substantially pre-loaded by the existing Highway 11 and Lakewood Park Road embankments, additional settlements of temporary embankment fills on silty subsoils of this type are expected to be relatively small and mainly elastic, with most settlements occurring during or shortly after construction. Settlements in the silt with some clay to silt and clay layer

2. Schmertmann, J.H. (1970), Static Cone to Compute Static Settlement Over Sand. Journal of Soil Mechanics and Foundation Division, ASCE.

were estimated using the method recommended by Bowles³. The stress-strain modulus for the subsoils was estimated using an 'N' value of 10 blows and estimated soil constants derived for silty soils. The maximum predicted settlement by this method is approximately 50 mm in the subsoils. Therefore, the total settlement during the construction period, including settlement within the rock fill is not expected to exceed 100 mm at the highest point in the temporary fill around Station 21+050. No significant settlements are expected to occur in the pavement or shoulder of existing Highway 11. Longer term settlements should not exceed about 25 mm. This estimate is based on experience of the performance of similar fills on similar soils in this area of Ontario. These settlements are considered to be within the normally tolerable limits for this type of construction.

6.4 EMBANKMENT FILL

The temporary embankment fill may be constructed of earth material with 2:1 side slopes provided in accordance with OPSD 200.020, or of rock material with 1¼:1 side slopes in accordance with OPSD 201.020. We understand that it is most likely that rock fill will be used for the temporary embankment construction. Because of the temporary nature of the construction, no berms are required in the higher sections of the fill. The side slopes of the existing fills in the construction zone should be stripped of the topsoil at the junction of the two fills prior to construction to mitigate potential differential settlements. No subexcavation is required beyond removal of this topsoil on the existing slopes. If earth borrow is used for the embankment construction, benching of the existing embankment fills should be carried out in accordance with OPSD 208.010. Alternatively, if a rock fill embankment is constructed, no benching is required but a separation layer should be provided between the silt material in the lower 2 m or so of the Highway 11 fill and the new rock fill to prevent possible migration of silt from the earth fill into the rock fill and causing potentially unacceptable settlements. The separation layer may consist of 600 mm of Granular B material or a Class II (heavy duty) non-

3. Bowles, J.E. (1988), Foundation Analysis and Design, 4th Edition.

woven geotextile meeting the requirements of OPSS 1860 and having an FOS value between 65 and 100 μm .

6.5 PAVEMENT RECOMMENDATIONS ON TEMPORARY FILL

If rock fill is used, the detour pavement structure on the rock fill should consist of:

- 90 mm of HL 4 asphalt concrete (40 mm surface + 50 mm binder)
- 150 mm of Granular A base
- 150 mm of Granular B Type 1 subbase (for estimating purposes, it should be anticipated that 300 mm of Granular B will be required to provide a maximum depth of 150 mm after construction).

Alternatively, a geotextile layer may be provided and the thickness of the granular subbase layer reduced to 150 mm. Regardless, the surface of rock fill should be properly chinked prior to placement of the Granular B subbase.

If granular borrow is used for the embankment construction, the temporary pavement structure should be:

- 90 mm of HL 4 asphalt concrete (40 mm surface + 50 mm binder)
- 150 mm of Granular A base
- 450 mm of Granular B Type 1 subbase.

If earth borrow materials such as silt or silty clay are used for the temporary embankment construction, the Granular B depth should be increased to at least 600 mm. If HL 1 and HDBC are already being currently used on the contract, these may be substituted for the HL 4 surface and binder courses.

6.6 DRAINAGE

All the surface drainage at this site consists of drainage down the side slopes of the existing fills into the ditch at the junction of the two fills. Lateral drainage from the existing granular material on Highway 11 must be maintained during the construction of

the adjacent new ramp. If earth fill is used, the ramp pavement structure should be adjusted adjacent to the Highway 11 shoulder so that the top of the subgrade at the junction of Highway 11 and the new ramp are identical. If rock fill is used, it is anticipated that any subsurface water flowing through the shoulder of Highway 11 should drain laterally into the rock fill.

6.7 FILL COMPACTION

Earth fill must be constructed and compacted in accordance with OPSS 206 and OPSS 501. Rock fills must be constructed in accordance with OPSS 206. Granular base and subbase materials must be placed in accordance with OPSS 314 and compacted in accordance with OPSS 501.

6.8 TRANSITION TREATMENTS

No transition treatments are required if rock or granular borrow are used within the frost zone for the temporary embankment. However, if a silt or silty clay borrow is used, transition treatments must be provided to mitigate frost heaving in accordance with OPSD 205.040 for a 't' depth of 1.5 m.

6.9 EXISTING CULVERTS

Two existing corrugated steel pipe storm water culverts meet at the toe of side slope of the existing fills and will be located directly under the proposed temporary embankment fill. Any new short section of culvert required to join the existing culverts, and the exposed sections of the existing culverts will require proper bedding and cover material provided in accordance with the appropriate OPSS and OPSD, to resist the additional load of the proposed new fill. A new manhole will probably be required at the junction of the two existing culverts to provide access to the culverts for cleaning after the fill material has been placed. The new section of culvert and the manhole required may be founded within the compact silt subsoil after stripping of any overlying topsoil.

The structural capacity of the existing culverts should be checked by the structural engineer to ensure that they are adequate for the intended embankment load.

The existing culvert and the manhole will settle under the load of the temporary fill. As previously discussed, the settlement at the level of original ground under the fills will be about 50 mm. This amount of settlement is not expected to significantly affect the culverts subject to their being in good condition and structurally capable (adequate thickness) of supporting the additional fill loads. The new manhole and the existing culverts should settle simultaneously and no special joint will be required to accommodate settlement. Regardless, the embankment construction should be carried out in continuous layers spread uniformly over the existing culverts to distribute the loading evenly over the top of the culvert, not on one side or the other.

6.10 LAKEWOOD PARK ROAD PAVEMENT

The existing pavement structure on Lakewood Park Road appears to be adequate to support the additional temporary increase in traffic from the temporary ramp without any strengthening. However, the absence of a crushed granular base layer under the hot-mix asphalt may contribute to slight deformation/rutting of the pavement under heavy truck traffic. We recommend that provision be made to resurface this section of Lakewood Park Road at the end of the detour period prior to restoring the road to the municipality. Provision should be made for 50 mm of HL 4. Alternatively, HL 1 may be substituted if this mix is currently in use on the contract.

6.11 MATCHING EXISTING PAVEMENTS

The existing shoulder of Highway 11 should be excavated to sufficient depth to provide for 90 mm of HL 4 and 150 mm of new Granular A. At the junction of the new pavement, the edge of pavement on Highway 11 should be saw cut to a vertical face and the ramp hot mix placed to form a butt joint. A similar butt joint should be formed at Lakewood Park Road.

6.12 EROSION

If as expected, the temporary detour ramp is constructed from rock fill, no specific erosion protection measures are necessary other than the provision of the separation layer described in Section 6.4, and the routine granular sealing of the base and subbase materials.

7.0 CONCLUDING REMARKS

The comments provided in this report have been developed for the use of the design engineers. The subsoil and groundwater conditions have been determined at the borehole locations only. Additional boreholes and/or test pits would be necessary to determine the localized conditions between boreholes. Contractors bidding on, or undertaking the works, must conduct their own investigations, and interpretations of the factual borehole data, and draw their own conclusions as to how the subsoil and groundwater conditions may affect their construction techniques, scheduling and costs.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED

R. P. Northwood

Roger P. Northwood, M.Sc.(Eng.), P.Eng.
Principal Materials Engineer

Michael H. MacKay

Michael H. MacKay, M.Eng., P.Eng.
Principal Geotechnical Engineer
Consulting Engineer



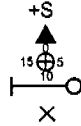
LOG OF BOREHOLE NO. 1

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+080, 2.5m E of CL
on pavement (Lakewood Park Rd). (E 324 591, N 5 019 359)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
	100 mm ASPHALT CONCRETE	288.3 0.1	0	SHEAR STRENGTH 0.1 MPa		10 20 30			
	GRAVELY SAND, moist, brown								
	Borehole Refusal, Boulders	287.4 0.9	1						
			2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						

N
O
T
E
S

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

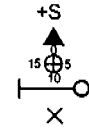
LOG OF BOREHOLE NO. 2

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00
BOREHOLE LOCATION: Station 10+206, 2.0m E of CL
on pavement (Lakewood Park Rd.) (E 324 873, N 5 019 458)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
	100 mm ASPHALT CONCRETE	293.4 0.1	0	SHEAR STRENGTH 0.1 MPa		10 20 30			
	GRAVELY SAND, moist, brown		1						
			2						
	Borehole Refusal, Boulders	290.7 2.8	3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

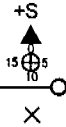
LOG OF BOREHOLE NO. 3

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+345, 2.5m E of CL
on pavement (Lakewood Park Rd), (E 324 718, N 5 019 588)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT KN/m ³
				20	40	60	80 BLOWS		
	100 mm ASPHALT CONCRETE	295.7 0.1	0	SHEAR STRENGTH 0.1 MPa		10	20	30	
	GRAVELY SAND, moist, brown		1						
			2						
		293.0 2.7	3						
	GRAVELY SAND, Layers of BOULDERS, moist, brown		4						
		291.2 4.5	5						
	Borehole Terminated.		6						
			7						
			8						
			9						
			10						

N
O
T
E
S

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

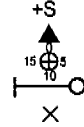
LOG OF BOREHOLE NO. 4

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Stn. 10+417 (21+000), 3m E of
CL on the pav't (Lakewood Pk. Rd.), (E 324 728, N 5 019 656)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT			S A M P L E	NATURAL UNIT WEIGHT kN/m ³		
				20	40	60	80							
				BLOWS										
				SHEAR STRENGTH 0.1 MPa				10	20	30				
	100 mm ASPHALT CONCRETE	295.3 0.1	0											
	GRAVELY SAND, became finer with depth, moist, brown		1											
		293.9 1.5												
	Borehole Terminated.		2											
			3											
			4											
			5											
			6											
			7											
			8											
			9											
			10											
N O T E S	1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999. 2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.													

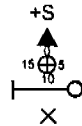
LOG OF BOREHOLE NO. 4A

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+417(21+000), 4m E
of C.L. on shoulder (Lakewood Park Rd), (E 324 735, N 5 019 655)

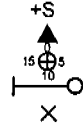
G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	S A M P L E	NATURAL UNIT WEIGHT KN/m ³
				20	40	60		
		295.2		SHEAR STRENGTH 0.1 MPa		10		
	GRAVELY SAND, moist, brown	0.0	0					
			1					
			2					
			3					
	Layers of BOULDERS in the last 3 m		4					
			5					
			6					
		288.9						
	Refusal, Boulders.	6.3	7					
			8					
			9					
			10					
N O T E S	1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.							
	2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.							

LOG OF BOREHOLE NO. 5

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+050, 10m N/20m W
of CL, towards bottom of slope (N-EW Ramp), (E 324 757, N 5 019 679)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60		
		288.2		SHEAR STRENGTH 0.1 MPa		10		
	TOPSOIL	288.1 0.1	0					
	SILT with some CLAY, moist to wet, grey, loose to compact		1					
			2					
	some organics		3					
			4					
			5					
			6					
			7					
			8					
			9					
		278.4 9.8	10					

- N
O
T
E
S
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
 2. WATER LEVEL RECORDS: 6.9 m ON OCTOBER 12, 1999, 6.0 m ON OCTOBER 14, 1999.
 3. 1/2" ID MONITORING WELL INSTALLED TO A DEPTH OF 10.8 m.
 4. TOPSOIL THICKNESS AT STATION 21+025 CL, 90 mm.

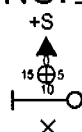
LOG OF BOREHOLE NO. 5

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+050, 10m N/20m W
of CL towards bottom of slope (N-EW Ramp). (E 324 757, N 5 019 679)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	10	30		
	GRAVELLY SANDY TILL, wet, brown-grey, dense		10						
		277.4							
	Borehole Refusal, TILL	10.8	11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

N
O
T
E
S

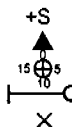
1. BOREHOLE ADVANCED UNCASD USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: 6.9 m ON OCTOBER 12, 1999, 6.0 m ON OCTOBER 14, 1999.
3. 1/2" ID MONITORING WELL INSTALLED TO A DEPTH OF 10.8 m.
4. TOPSOIL THICKNESS AT STATION 21+025 CL, 90 mm.

LOG OF BOREHOLE NO. 6

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+075, 3m W/3m S
of CL on slope (N-EW Ramp). (E 324 787, N 5 019 694)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	NATURAL UNIT WEIGHT kN/m ³
				20	40		
				SHEAR STRENGTH 0.1 MPa			
	TOPSOIL	291.0 0.075 290.925	0				
	CLAYEY SILT, moist, grey		1				
	some fine sand	288.7 2.3	2				
	GRAVELY SAND, moist to wet, brown to grey	287.9 3.1	3				
	Fine to Medium SAND, moist to wet, brown to grey	287.5 3.5	4				
	SILTY SAND trace CLAY, moist to wet, grey	286.4 4.6	5				
	SILT with some CLAY trace SAND, moist to wet, brown to grey, loose		6				
			7				
		283.4 7.6	8				
	SILT and CLAY, moist to wet, grey, firm to stiff		9				
		281.4 9.6	10				

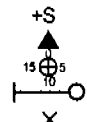
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HALLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
2. WATER LEVEL RECORDS: 8.5 m ON OCTOBER 12, 1999.

LOG OF BOREHOLE NO. 6

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+075.3m W/3m S
of CL, on slope (N-EW Ramp). (E 324 787, N 5 019 694)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20 SHEAR STRENGTH 0.1	40 BLOWS MPa	10	20 30		
	SILT with some CLAY, wet, grey, compact		10						
		279.8	11						
		11.2							
			12						
			13						
			14						
			15						
	Borehole Termination	275.8	15.2						
			16						
			17						
			18						
			19						
			20						

- NOTES
- BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
 - WATER LEVEL RECORDS: 8.5 m ON OCTOBER 12, 1999.

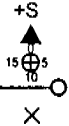
LOG OF BOREHOLE NO. 7

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+100, 12.5m W of
CL, bottom of slope (N-EW Ramp). (E 324 784, N 5 019 721)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60		
				SHEAR STRENGTH 0.1 MPa		10		
	TOPSOIL	288.8 288.9 0.1	0					
	SILT and some CLAY, moist to wet, grey, loose to compact		1					
			2					
			3					
			4					
			5					
			6					
			7					
		281.3 7.6	8					
	GRAVELY SAND trace SILT, wet, brown-grey, compact		9					
		279.7 9.2						
	GRAVELY SANDY TILL, wet, brown	279.35 9.55						
	Borehole Refusal, TILL.		10					

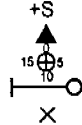
- NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 12, 1999.
 2. WATER LEVEL RECORDS: 4.5 m ON OCTOBER 12, 1999.
 3. TOPSOIL THICKNESS AT STATION 21+100 CL, 90 mm.

LOG OF BOREHOLE NO. 8

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00
BOREHOLE LOCATION: Station 21+150, 5m E of CL,
on edge of shoulder (Hwy 11), (E 324 825, N 5 019 761)

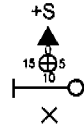
G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
		293.0	0.0	SHEAR STRENGTH 0.1		MPa			
	GRAVELY SAND and BOULDERS, moist, brown (Fill)		0						
			1						
			2						
			3						
			4						
		288.4	4.6						
	Medium-Coarse SAND some GRAVEL, dry to moist, brown (Fill)		5						
		286.9	6.1						
	Medium SAND, moist to wet, brown (Fill)		6						
			7						
		285.4	7.6						
	SILTY SAND, moist to wet, brown-grey		8						
			9						
		283.8	9.2						
	SILT and CLAY, moist to wet, grey, firm to stiff		10						
N O T E S	1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999. 2. WATER LEVEL RECORDS: 9 m ON OCTOBER 14, 1999. 3. TOPSOIL THICKNESS AT STATION 21+150 CL, 100 mm.								

LOG OF BOREHOLE NO. 8

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+150, 5m E of CL
on edge of shoulder (HWY 11), (E 324 825, N 5 019 761)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
				SHEAR STRENGTH 0.1 MPa		10 20 30			
			10						
			11						
			12						
			13						
		279.3 13.7							
	SILT with some CLAY, wet, grey, compact		14						
			15						
		277.1 15.9							
	Layer of GRAVEL	276.8 16.2	16						
	SANDY GRAVELY TILL, wet, brown-grey, compact		17						
		275.3 17.7							
	Borehole Termination.		18						
			19						
			20						

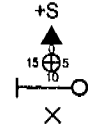
- NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
 2. WATER LEVEL RECORDS: 9 m ON OCTOBER 14, 1999.
 3. TOPSOIL THICKNESS AT STATION 21+150 CL, 100 mm.

LOG OF BOREHOLE NO. 9

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00
BOREHOLE LOCATION: Station 21+200, 3m E of CL.
on edge of shoulder (Hwy 11), (E 324 843, N 5 019 805)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT			S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80 BLOWS	10	20	30		
		292.2	0.0	SHEAR STRENGTH 0.1 MPa								
	GRAVELLY SAND and BOULDERS, moist, brown (Fill)		0									
			1									
			2									
			3									
			4									
		287.0	5									
	CLAYEY SILT some fine SAND, moist to wet, grey (Fill)	5.2										
			6									
	Organics, moist to wet, brown	285.8										
		285.6	6.4									
	SILT with some CLAY, moist to wet, grey, compact	6.6										
			7									
			8									
		283.0	9									
	SILT and CLAY, moist to wet, grey, firm to stiff	9.2										
			10									

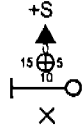
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: 7.6 m ON OCTOBER 14, 1999, 7.0 m ON OCTOBER 15, 1999.
3. 1/2" ID MONITORING WELL INSTALLED TO A DEPTH OF 16 m.
4. TOPSOIL THICKNESS AT STATION 21+200 CL, 90 mm.

LOG OF BOREHOLE NO. 9

DRAWING NO. 2

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

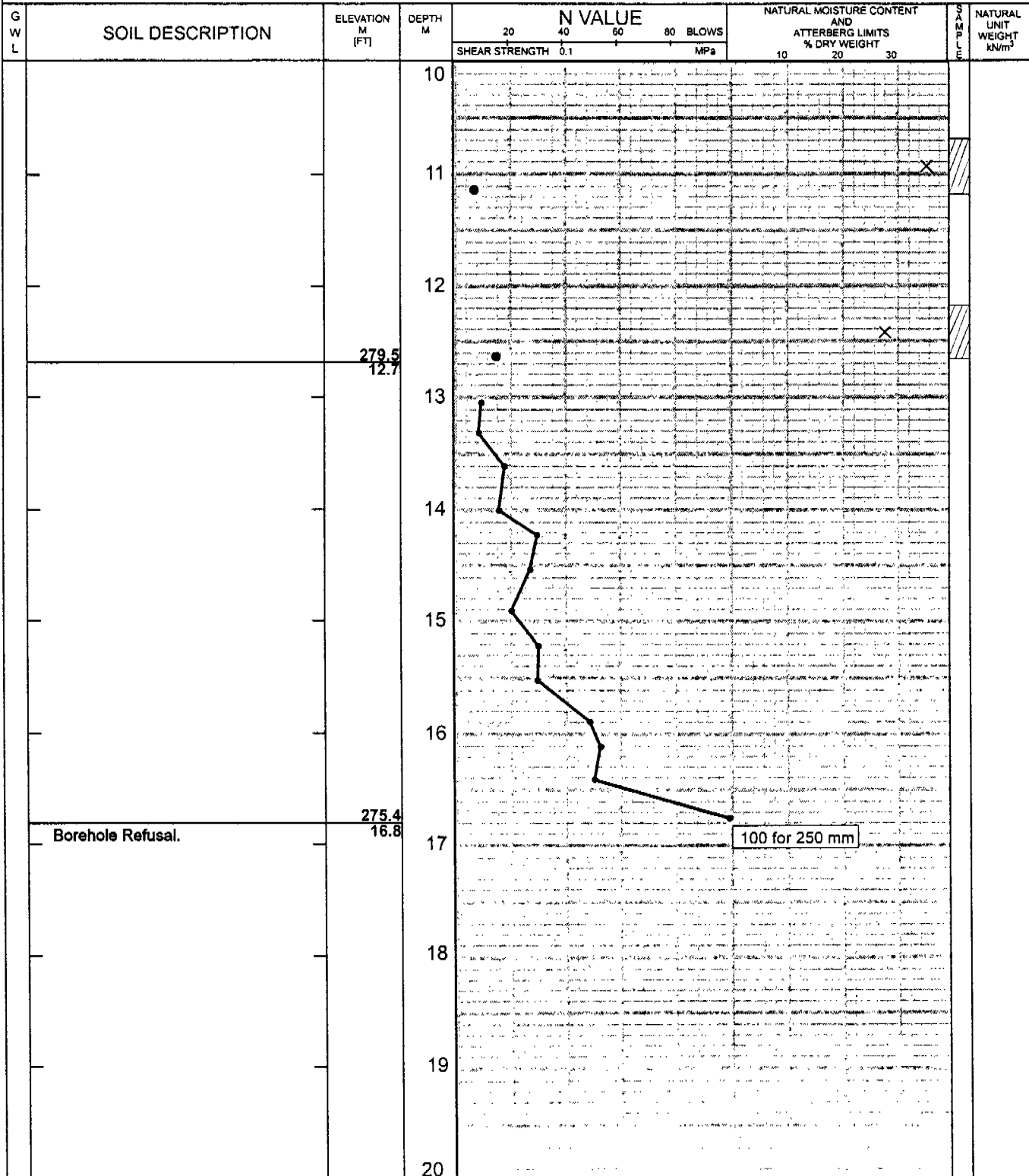
FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:

N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+150.5m E of CL
on edge of shoulder (HWY 11), (E 324 843, N 5 019 805)



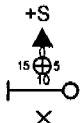
- NOTES
1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT HOLLOW STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
 2. WATER LEVEL RECORDS: 7.6 m ON OCTOBER 14, 1999, 7.0 m ON OCTOBER 15, 1999.
 3. 3/4" ID MONITORING WELL INSTALLED TO A DEPTH OF 16 m.
 4. TOPSOIL THICKNESS AT STATION 21+200 CL, 90 mm.

LOG OF BOREHOLE NO. 10

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAxIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+250, 2m E of CL,
on edge of shoulder (Hwy 11), (E 324 867, N 5 019 852)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60	80		
	ASPHALT CONCRETE (50mm at edge of shld.)	292.45 0.05	0						
	GRAVELY SAND, moist, brown	292.2 0.3							
	SAND with GRAVEL, moist, brown		1						
	Borehole Terminated.	291.0 1.5	2						
			3						
			4						
			5						
			6						
			7						
			8						
			9						
			10						

N
O
T
E
S

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

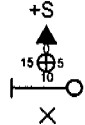
LOG OF BOREHOLE NO. 11

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE



FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+300, 0.5m E of CL
on edge of shoulder (Hwy 11). (E 324 890, N 5 019 895)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	S A M P L E	NATURAL UNIT WEIGHT kN/m ³
				20	40	60		
	ASPHALT CONCRETE (50mm at edge of shld.)	291.45 0.05	0	SHEAR STRENGTH 0.1 MPa		10		
	GRAVELY SAND, moist, brown	291.2 0.3						
	SAND some GRAVEL, moist, brown		1					
	Borehole Terminated.	290.0 1.5	2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			10					

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

DRAWING NO. 1

The diagram shows a circuit breaker (CB) with a 15 kV rating and a 1000 A rating. It is connected to a 10 kV busbar (represented by a circle with a cross) and a 15 kV busbar (represented by a circle with a cross). The CB is shown in the open position, with a 15 kV busbar on the left and a 10 kV busbar on the right.

PROJECT DESCRIPTION: N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 21+350, 0.5m E of CL
on edge of shoulder (Hwy 11). (E 324 917, N 5 019 940)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT			S A M P L E	NATURAL UNIT WEIGHT KN/m ³	
				20	40	60	80	BLOWS	10	20			30
				SHEAR STRENGTH				0.1	MPa				
	ASPHALT CONCRETE (50mm at edge of shld.)	289.45 0.05	0										
	GRAVELY SAND, moist, brown	289.2 0.3											
	SAND some GRAVEL, moist, brown		1										
	Borehole Terminated.	288.0 1.5	2										
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

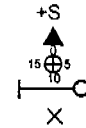
N 1. BOREHOLE ADVANCED UNCASD USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
O 2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

LOG OF BOREHOLE NO. 13

DRAWING NO. 1

AUGER SAMPLE
SPLIT-SPOON SAMPLE
SHELBY TUBE SAMPLE
SPT (N VALUE)
DYNAMIC CONE

FIELD VANE
POCKET PENETROMETER
TRIAXIAL TEST (% Strain)
PLASTIC AND LIQUID LIMIT
NATURAL MOISTURE CONTENT



PROJECT DESCRIPTION:
N-EW Ramp at Highway 11 and Muskoka Road 3
WP 162-94-00

BOREHOLE LOCATION: Station 10+176, 3.5m E of CL
on edge of shld (Lakewood Park Rd). (E 324 657, N 5 019 431)

G W L	SOIL DESCRIPTION	ELEVATION M (FT)	DEPTH M	N VALUE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS			S A M P L E	NATURAL UNIT WEIGHT kN/m ³	
				20	40	60	80	% DRY WEIGHT					
				BLOWS				10	20	30			
				SHEAR STRENGTH 0.1 MPa									
	ASPHALT CONCRETE (100mm at edge of shld.)	292.5 0.1	0										
	GRAVELY SAND, moist, brown		1										

1. BOREHOLE ADVANCED UNCASSED USING CONTINUOUS FLIGHT SOLID STEM AUGERS SUPPLIED BY MALONE'S SOIL SAMPLES CO. LTD. ON OCTOBER 14, 1999.
2. WATER LEVEL RECORDS: HOLE DRY ON COMPLETION.

CON 1
LOT 7

METRIC

PLATE No 625-0011/00-2

CONT No
WP No 162-94-00



DRAWING 1
TEMPORARY RAMP N-EW AT MUSKOKA ROAD 3 INTERCHANGE
SITE LAYOUT

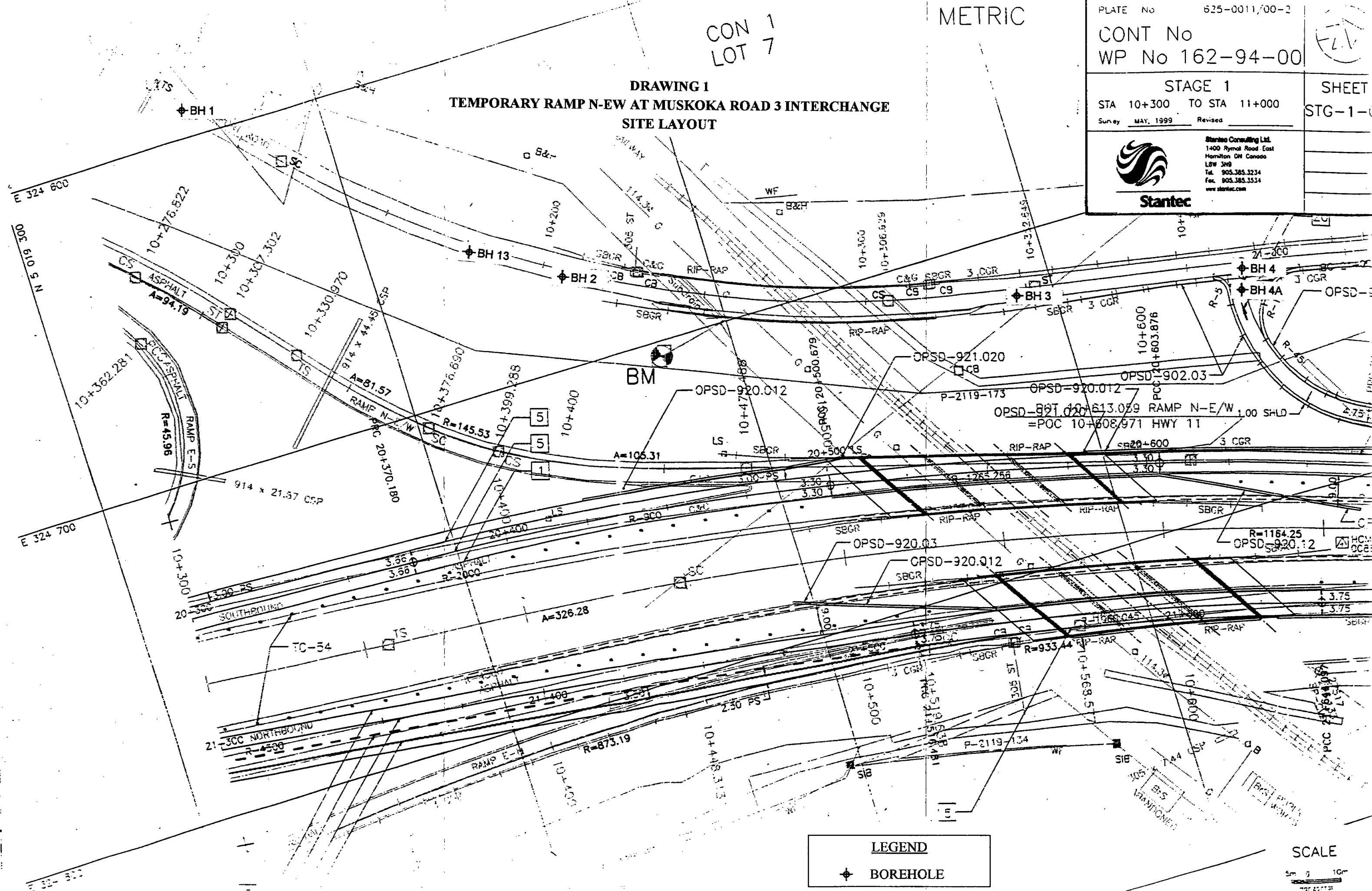
STAGE 1
STA 10+300 TO STA 11+000
SHEET
STG-1-C

Survey MAY, 1999

Revised



Stantec Consulting Ltd.
1400 Rymal Road East
Hamilton ON Canada
L8W 3N9
Tel. 905.385.3234
Fax. 905.385.1534
www.stantec.com



LEGEND

◆ BOREHOLE

SCALE

5m 10m
1:2000

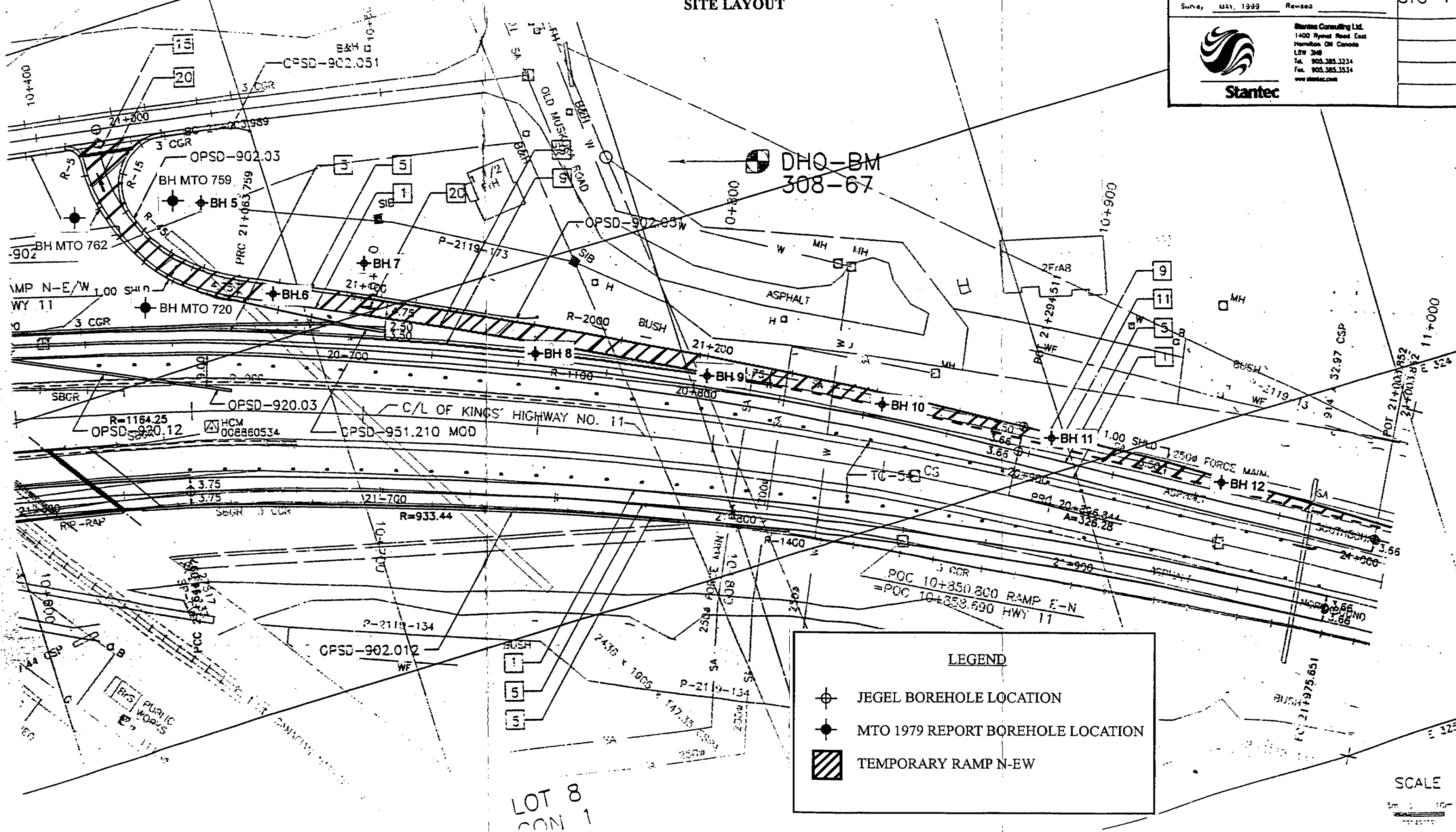
DRAWING 2
TEMPORARY RAMP N-EW AT MUSKOKA ROAD 3 INTERCHANGE
SITE LAYOUT

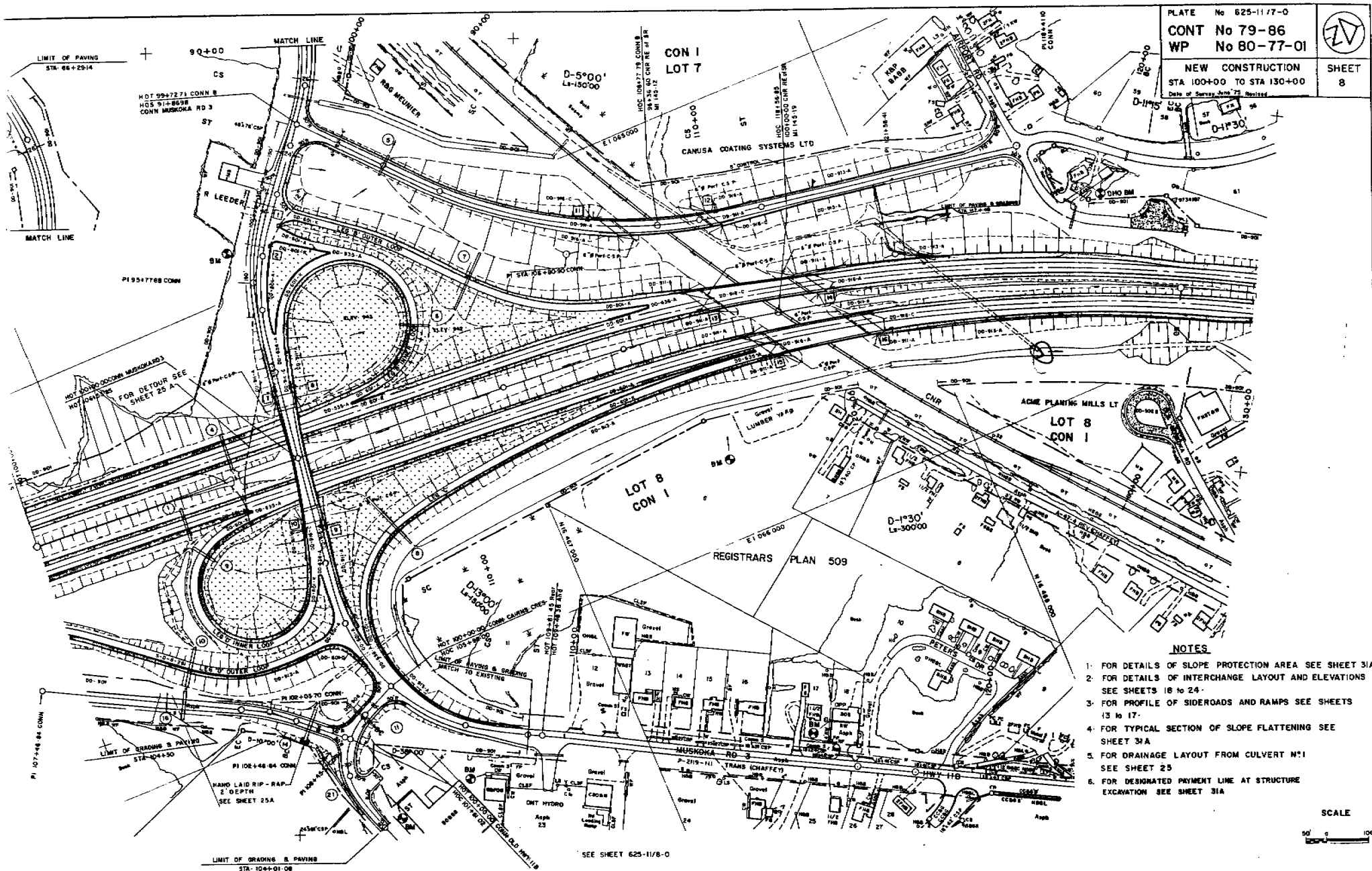
STAGE 1
STA 10+300 TO STA 11+000
Sun., May. 1999 Reuses

SHEET
STG-1-

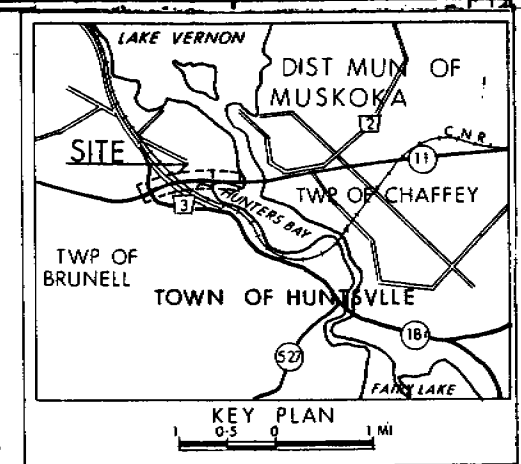
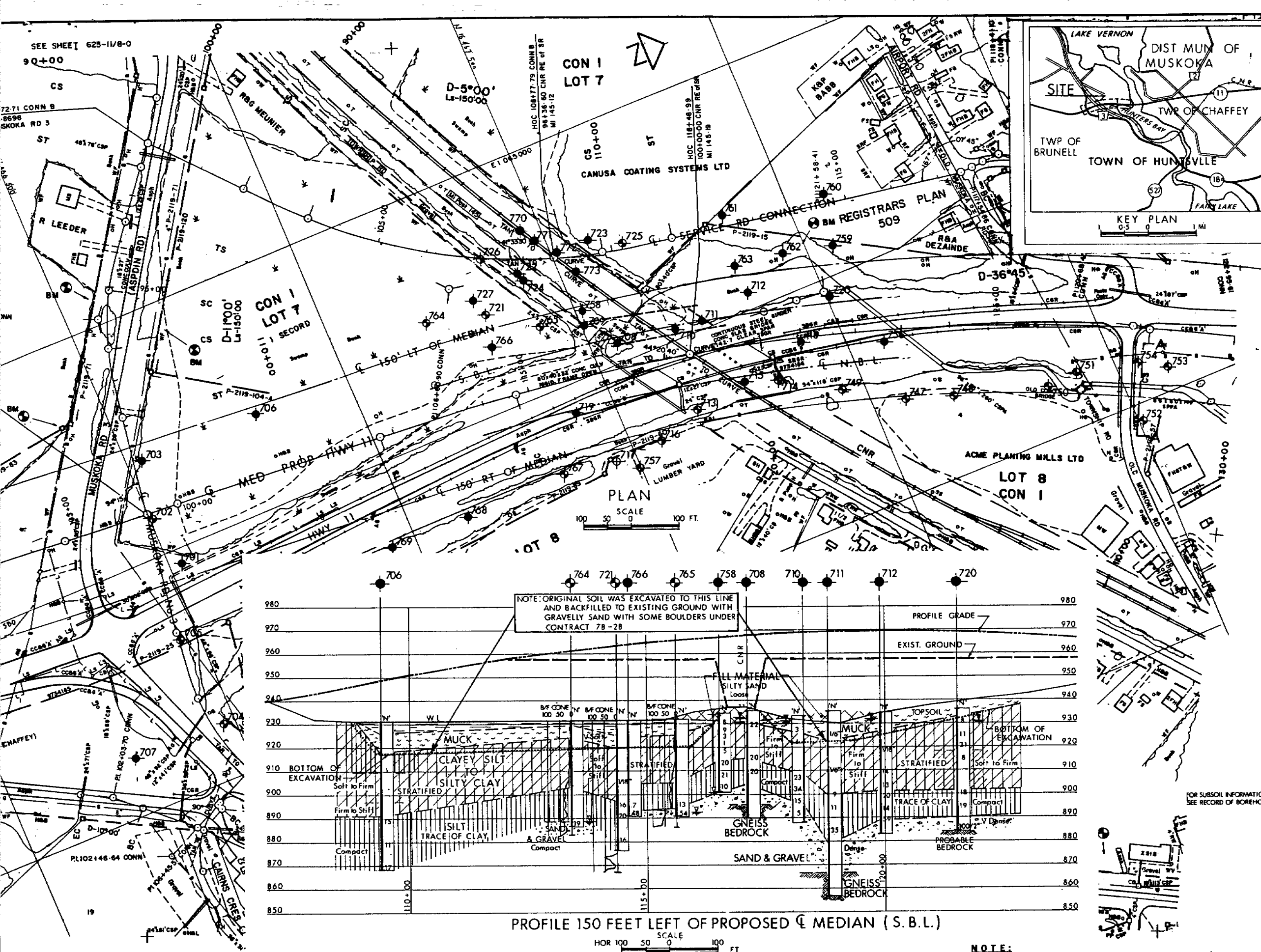
**Stantec**

Stantec Consulting Ltd.
1400 Rymal Road East
Hamilton ON Canada
L8W 3A9
Tel. 905.385.3234
Fax. 905.385.3534
www.stantec.com





SEE SHEET 625-11/8-0
90+00



CONT No 79-86
WP No 74-74-01



C.N.R. SOUTH CROSSING S.B.L.

SHEET
43

BORE HOLE LOCATIONS & SOIL STRATA

- LEGEND
- Bore Hole
 - ⊕ Dynamic Cone Penetration Test (Cone)
 - ⊙ Bore Hole & Cone
 - 'N' Blows/ft (Std Pen Test 350ft lbs energy)
 - CONE Blows/ft (60° Cone 350ft lbs energy)
 - W.L. at time of investigation

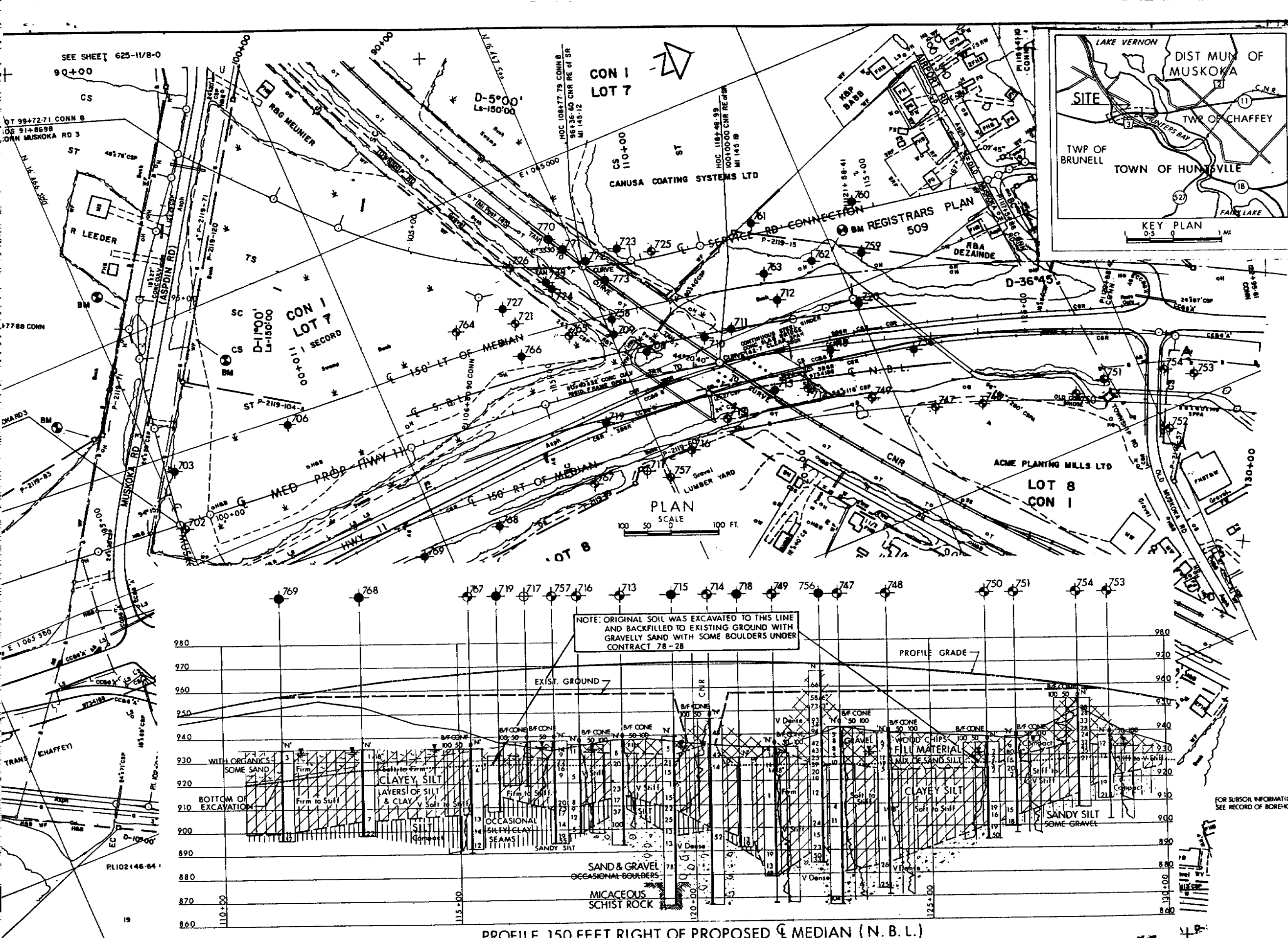
No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
701	936.7	16 466 528	1 065 533
702	936.5	16 466 504	1 065 423
703	941.0	16 466 533	1 065 885
704	935.5	16 466 462	1 065 885
705	937.9	16 466 462	1 065 682
706	930.0	16 466 790	1 065 300
707	934.0	16 466 275	1 065 875
708	935.6	16 467 557	1 065 457
709	935.2	16 467 502	1 063 391
710	933.7	16 467 680	1 065 477
711	935.2	16 467 739	1 065 481
712	934.6	16 467 852	1 065 461
713	938.9	16 467 657	1 065 652
714	947.5	16 467 846	1 065 659
715	939.2	16 467 772	1 065 634
716	936.5	16 467 560	1 065 683
717	938.0	16 467 455	1 065 687
718	931.0	16 467 913	1 065 607
719	932.0	16 467 418	1 065 560
720	936.0	16 468 010	1 065 535
721	930.0	16 467 325	1 065 295
722	935.0	16 467 418	1 065 242
723	936.1	16 467 585	1 065 230
724	935.0	16 467 425	1 065 255
725	937.0	16 467 650	1 065 265
726	935.0	16 467 360	1 065 180
727	931.0	16 467 310	1 065 255
747	941.9	16 468 070	1 065 800
748	940.0	16 468 165	1 065 835
749	934.4	16 467 455	1 065 730
750	935.5	16 468 355	1 065 895
751	938.5	16 468 420	1 065 885
752	946.2	16 468 510	1 066 035
753	938.4	16 468 600	1 065 950
754	954.4	16 468 545	1 065 915
755	934.4	16 468 760	1 066 115
756	967.3	16 468 075	1 065 675
757	938.0	16 467 500	1 065 725
758	934.5	16 467 515	1 065 365
759	943.0	16 468 055	1 065 435
760	948.0	16 468 080	1 065 330
761	943.0	16 467 865	1 065 290
762	935.0	16 467 950	1 065 415
763	933.0	16 467 845	1 065 400
764	931.5	16 467 200	1 065 260
765	932.0	16 467 415	1 065 360
766	931.8	16 467 310	1 065 365
767	935.0	16 467 345	1 065 670
768	935.7	16 467 120	1 065 175
769	935.0	16 466 950	1 065 170
770	940.0	16 467 460	1 065 158
771	940.0	16 467 479	1 065 190
772	938.5	16 467 514	1 065 232
773	940.0	16 467 535	1 065 285

-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

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.

Drawn by: J. J. [Signature]
Checked by: J. J. [Signature]
Date: 29 JULY 1979
Site: 42-17A
Draw: 42-17A-2



CONT No 79-86
WP No 150-73-02

C.N.R. SOUTH CROSSING
N.B.L.

BORE HOLE LOCATIONS & SOIL STRATA

SHEET 100

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone 350ft lbs energy)
- W.L. at time of investigation

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
701	936.7	16 466 528	1 065 533
702	936.5	16 466 504	1 065 423
703	941.0	16 466 533	1 065 885
704	935.5	16 466 462	1 065 885
705	937.9	16 466 462	1 065 682
706	930.0	16 466 790	1 065 300
707	934.0	16 466 275	1 065 875
708	935.6	16 467 557	1 065 457
709	935.2	16 467 502	1 063 391
710	933.7	16 467 680	1 065 477
711	935.2	16 467 739	1 065 481
712	934.6	16 467 852	1 065 461
713	938.9	16 467 657	1 065 652
714	947.5	16 467 846	1 065 659
715	939.2	16 467 772	1 065 634
716	936.5	16 467 560	1 065 683
717	938.0	16 467 455	1 065 687
718	931.0	16 467 913	1 065 607
719	932.0	16 467 418	1 065 560
720	936.0	16 468 010	1 065 535
721	930.0	16 467 325	1 065 295
722	935.0	16 467 418	1 065 242
723	936.1	16 467 585	1 065 230
724	935.0	16 467 425	1 065 255
725	937.0	16 467 650	1 065 265
726	935.0	16 467 360	1 065 180
727	931.0	16 467 310	1 065 255
747	941.9	16 468 070	1 065 800
748	940.0	16 468 165	1 065 835
749	934.4	16 467 455	1 065 730
750	935.5	16 468 355	1 065 895
751	938.5	16 468 420	1 065 885
752	946.2	16 468 510	1 066 035
753	938.4	16 468 600	1 065 950
754	954.4	16 468 545	1 065 915
755	934.4	16 468 760	1 066 115
756	967.3	16 468 075	1 065 675
757	938.0	16 467 500	1 065 725
758	934.5	16 467 515	1 065 365
759	943.0	16 468 055	1 065 435
760	948.0	16 468 080	1 065 330
761	943.0	16 467 865	1 065 290
762	935.0	16 467 950	1 065 415
763	933.0	16 467 845	1 065 400
764	931.5	16 467 200	1 065 260
765	932.0	16 467 415	1 065 360
766	931.8	16 467 310	1 065 365
767	935.0	16 467 345	1 065 670
768	935.7	16 467 120	1 065 175
769	935.0	16 466 950	1 065 170
770	940.0	16 467 460	1 065 158
771	940.0	16 467 479	1 065 190
772	938.5	16 467 514	1 065 232
773	940.0	16 467 535	1 065 285

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

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

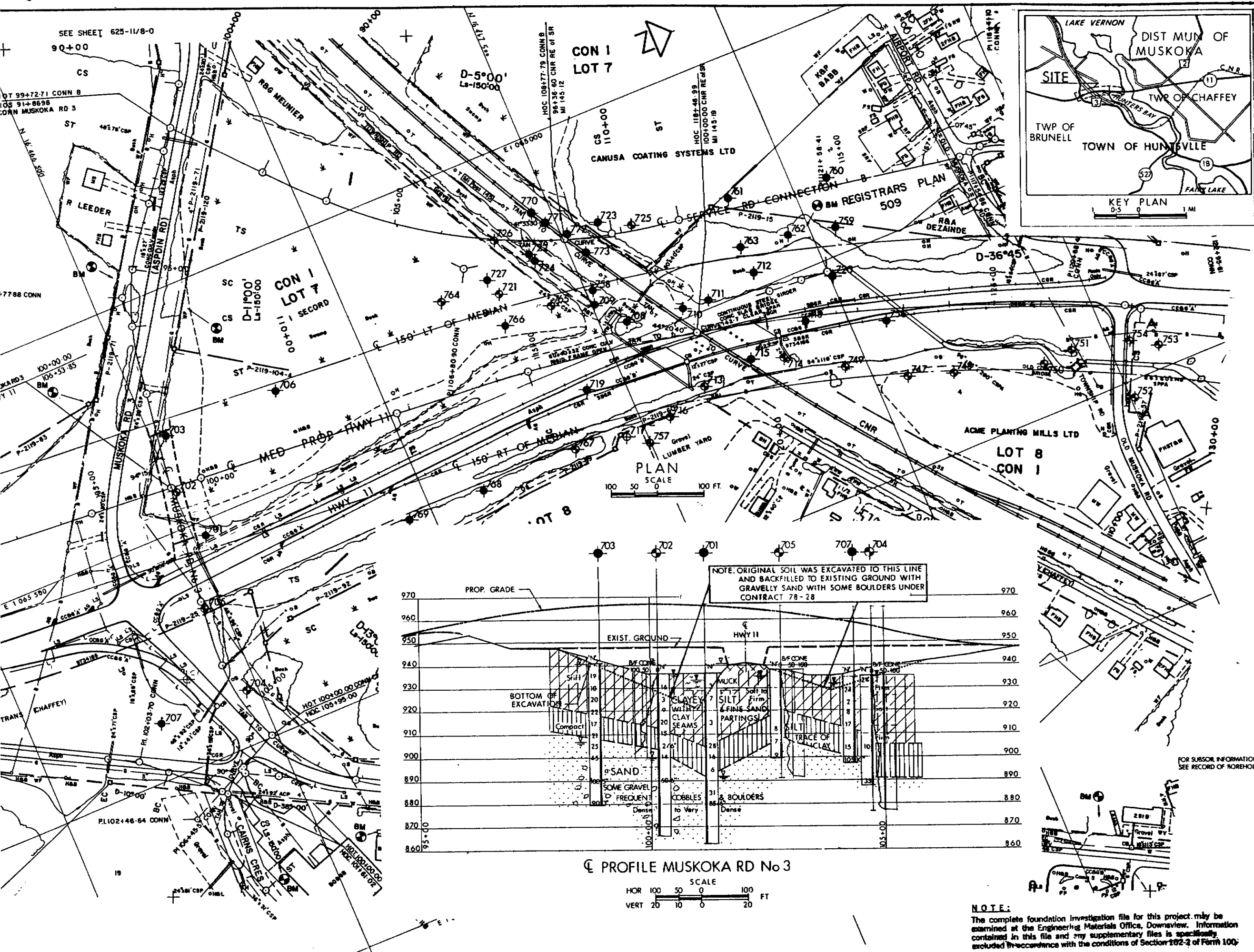
HWY No 11






DATE 22 JULY 1979

DIST 11

FILE 42-178

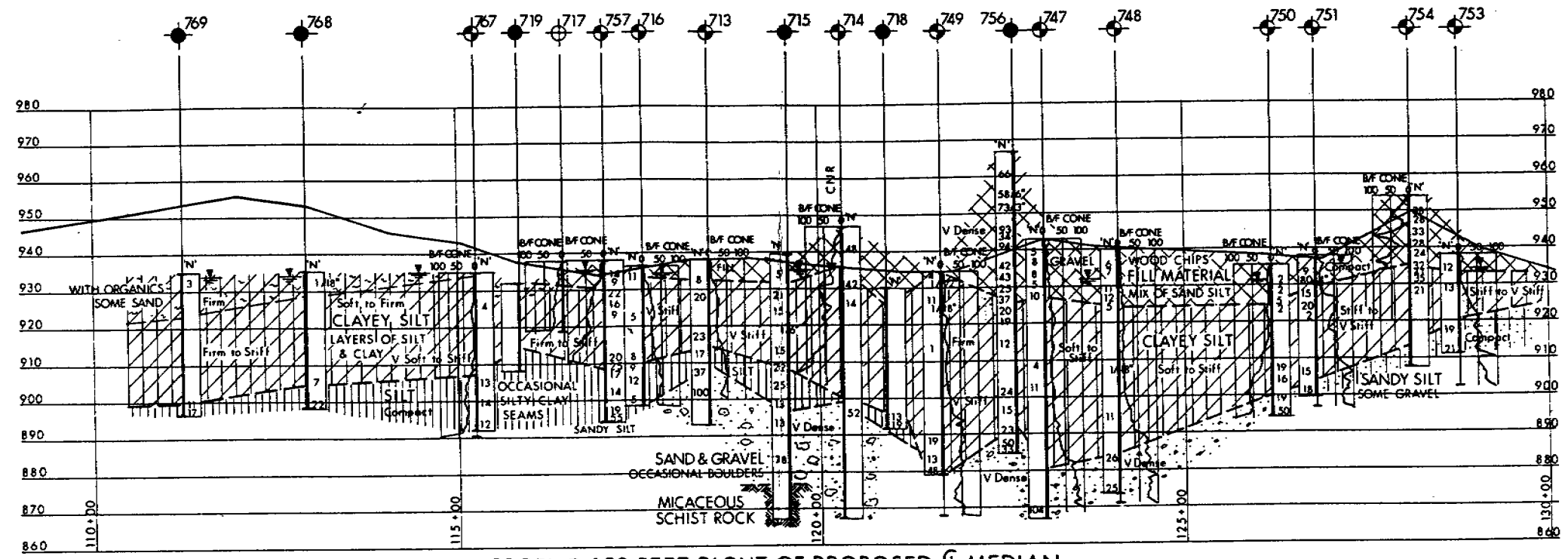
FILE 42-178 2



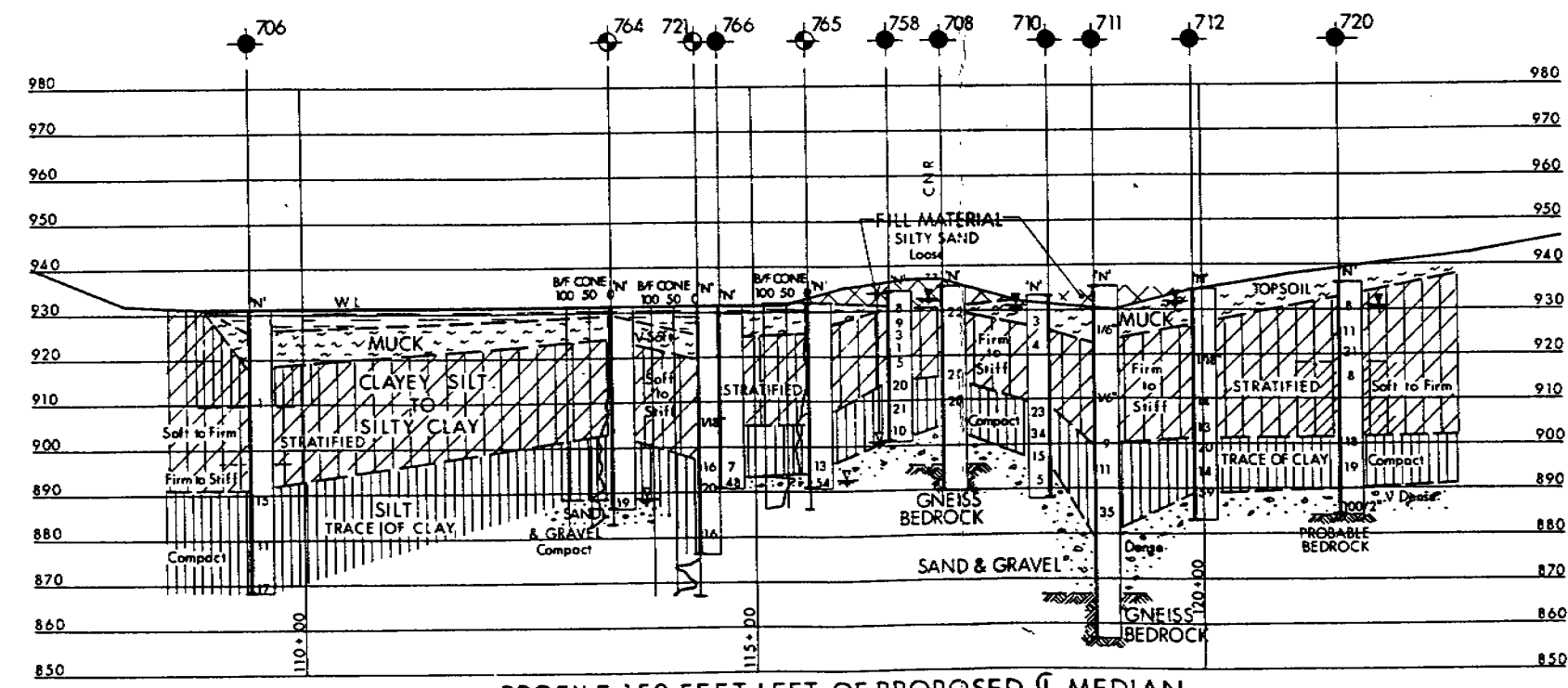
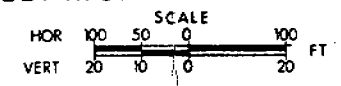
CONT No 79-86 WP No 74-74-06																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
MUSKOKA RD. No 3 (ASPDIN RD.) UNDERPASS		SHEET 79																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
BORE HOLE LOCATIONS & SOIL STRATA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
<div>LEGEND</div> <div><div> Bore Hole</div><div> Dynamic Cone Penetration Test (Cone)</div><div> Bore Hole & Cone</div><div><div>'N' Blows/ft (Std Pen Test 350ft lbs energy)</div><div>CONE Blows/ft (60° Cone 350ft lbs energy)</div></div><div> W/L at time of investigation</div></div>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
<table><tr><th rowspan="2">No</th><th rowspan="2">ELEVATION</th><th colspan="2">CO-ORDINATES</th></tr><tr><th>NORTH</th><th>EAST</th></tr><tr><td>701</td><td>936.7</td><td>16 466 528</td><td>1 065 533</td></tr><tr><td>702</td><td>936.5</td><td>16 466 504</td><td>1 065 423</td></tr><tr><td>703</td><td>941.0</td><td>16 466 533</td><td>1 065 885</td></tr><tr><td>704</td><td>935.5</td><td>16 466 462</td><td>1 065 885</td></tr><tr><td>705</td><td>937.9</td><td>16 466 462</td><td>1 065 682</td></tr><tr><td>706</td><td>930.0</td><td>16 466 790</td><td>1 065 300</td></tr><tr><td>707</td><td>934.0</td><td>16 466 275</td><td>1 065 875</td></tr><tr><td>708</td><td>935.6</td><td>16 467 557</td><td>1 065 457</td></tr><tr><td>709</td><td>935.2</td><td>16 467 502</td><td>1 063 391</td></tr><tr><td>710</td><td>933.7</td><td>16 467 680</td><td>1 065 477</td></tr><tr><td>711</td><td>935.2</td><td>16 467 739</td><td>1 065 481</td></tr><tr><td>712</td><td>934.6</td><td>16 467 852</td><td>1 065 461</td></tr><tr><td>713</td><td>938.9</td><td>16 467 657</td><td>1 065 652</td></tr><tr><td>714</td><td>947.5</td><td>16 467 846</td><td>1 065 659</td></tr><tr><td>715</td><td>939.2</td><td>16 467 772</td><td>1 065 634</td></tr><tr><td>716</td><td>936.5</td><td>16 467 560</td><td>1 065 683</td></tr><tr><td>717</td><td>938.0</td><td>16 467 455</td><td>1 065 687</td></tr><tr><td>718</td><td>931.0</td><td>16 467 913</td><td>1 065 607</td></tr><tr><td>719</td><td>932.0</td><td>16 467 418</td><td>1 065 560</td></tr><tr><td>720</td><td>936.0</td><td>16 468 010</td><td>1 065 535</td></tr><tr><td>721</td><td>930.0</td><td>16 467 325</td><td>1 065 295</td></tr><tr><td>722</td><td>935.0</td><td>16 467 418</td><td>1 065 242</td></tr><tr><td>723</td><td>936.1</td><td>16 467 585</td><td>1 065 230</td></tr><tr><td>724</td><td>935.0</td><td>16 467 425</td><td>1 065 255</td></tr><tr><td>725</td><td>937.0</td><td>16 467 650</td><td>1 065 265</td></tr><tr><td>726</td><td>935.0</td><td>16 467 360</td><td>1 065 180</td></tr><tr><td>727</td><td>931.0</td><td>16 467 310</td><td>1 065 255</td></tr><tr><td>728</td><td>941.9</td><td>16 468 070</td><td>1 065 800</td></tr><tr><td>729</td><td>940.0</td><td>16 468 165</td><td>1 065 835</td></tr><tr><td>730</td><td>934.4</td><td>16 467 455</td><td>1 065 730</td></tr><tr><td>731</td><td>935.5</td><td>16 468 355</td><td>1 065 895</td></tr><tr><td>732</td><td>938.5</td><td>16 468 420</td><td>1 065 885</td></tr><tr><td>733</td><td>946.2</td><td>16 468 510</td><td>1 066 035</td></tr><tr><td>734</td><td>938.4</td><td>16 468 600</td><td>1 065 950</td></tr><tr><td>735</td><td>954.4</td><td>16 468 545</td><td>1 065 915</td></tr><tr><td>736</td><td>934.4</td><td>16 468 760</td><td>1 066 115</td></tr><tr><td>737</td><td>967.3</td><td>16 468 075</td><td>1 065 675</td></tr><tr><td>738</td><td>938.0</td><td>16 467 500</td><td>1 065 725</td></tr><tr><td>739</td><td>934.5</td><td>16 467 515</td><td>1 065 365</td></tr><tr><td>739</td><td>943.0</td><td>16 468 055</td><td>1 065 435</td></tr><tr><td>740</td><td>948.0</td><td>16 468 080</td><td>1 065 330</td></tr><tr><td>741</td><td>943.0</td><td>16 467 865</td><td>1 065 290</td></tr><tr><td>742</td><td>935.0</td><td>16 467 950</td><td>1 065 415</td></tr><tr><td>743</td><td>933.0</td><td>16 467 845</td><td>1 065 400</td></tr><tr><td>744</td><td>931.5</td><td>16 467 200</td><td>1 065 260</td></tr><tr><td>745</td><td>932.0</td><td>16 467 415</td><td>1 065 360</td></tr><tr><td>746</td><td>931.8</td><td>16 467 310</td><td>1 065 365</td></tr><tr><td>747</td><td>935.0</td><td>16 467 345</td><td>1 065 670</td></tr><tr><td>748</td><td>935.7</td><td>16 467 120</td><td>1 065 175</td></tr><tr><td>749</td><td>935.0</td><td>16 466 950</td><td>1 065 170</td></tr><tr><td>750</td><td>940.0</td><td>16 467 460</td><td>1 065 158</td></tr><tr><td>751</td><td>940.0</td><td>16 467 479</td><td>1 065 190</td></tr><tr><td>752</td><td>938.5</td><td>16 467 514</td><td>1 065 232</td></tr><tr><td>753</td><td>940.0</td><td>16 467 535</td><td>1 065 285</td></tr></table>				No	ELEVATION	CO-ORDINATES		NORTH	EAST	701	936.7	16 466 528	1 065 533	702	936.5	16 466 504	1 065 423	703	941.0	16 466 533	1 065 885	704	935.5	16 466 462	1 065 885	705	937.9	16 466 462	1 065 682	706	930.0	16 466 790	1 065 300	707	934.0	16 466 275	1 065 875	708	935.6	16 467 557	1 065 457	709	935.2	16 467 502	1 063 391	710	933.7	16 467 680	1 065 477	711	935.2	16 467 739	1 065 481	712	934.6	16 467 852	1 065 461	713	938.9	16 467 657	1 065 652	714	947.5	16 467 846	1 065 659	715	939.2	16 467 772	1 065 634	716	936.5	16 467 560	1 065 683	717	938.0	16 467 455	1 065 687	718	931.0	16 467 913	1 065 607	719	932.0	16 467 418	1 065 560	720	936.0	16 468 010	1 065 535	721	930.0	16 467 325	1 065 295	722	935.0	16 467 418	1 065 242	723	936.1	16 467 585	1 065 230	724	935.0	16 467 425	1 065 255	725	937.0	16 467 650	1 065 265	726	935.0	16 467 360	1 065 180	727	931.0	16 467 310	1 065 255	728	941.9	16 468 070	1 065 800	729	940.0	16 468 165	1 065 835	730	934.4	16 467 455	1 065 730	731	935.5	16 468 355	1 065 895	732	938.5	16 468 420	1 065 885	733	946.2	16 468 510	1 066 035	734	938.4	16 468 600	1 065 950	735	954.4	16 468 545	1 065 915	736	934.4	16 468 760	1 066 115	737	967.3	16 468 075	1 065 675	738	938.0	16 467 500	1 065 725	739	934.5	16 467 515	1 065 365	739	943.0	16 468 055	1 065 435	740	948.0	16 468 080	1 065 330	741	943.0	16 467 865	1 065 290	742	935.0	16 467 950	1 065 415	743	933.0	16 467 845	1 065 400	744	931.5	16 467 200	1 065 260	745	932.0	16 467 415	1 065 360	746	931.8	16 467 310	1 065 365	747	935.0	16 467 345	1 065 670	748	935.7	16 467 120	1 065 175	749	935.0	16 466 950	1 065 170	750	940.0	16 467 460	1 065 158	751	940.0	16 467 479	1 065 190	752	938.5	16 467 514	1 065 232	753	940.0	16 467 535	1 065 285																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
No	ELEVATION	CO-ORDINATES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		NORTH	EAST																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
701	936.7	16 466 528	1 065 533																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
702	936.5	16 466 504	1 065 423																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
703	941.0	16 466 533	1 065 885																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
704	935.5	16 466 462	1 065 885																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
705	937.9	16 466 462	1 065 682																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
706	930.0	16 466 790	1 065 300																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
707	934.0	16 466 275	1 065 875																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
708	935.6	16 467 557	1 065 457																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
709	935.2	16 467 502	1 063 391																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
710	933.7	16 467 680	1 065 477																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
711	935.2	16 467 739	1 065 481																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
712	934.6	16 467 852	1 065 461																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
713	938.9	16 467 657	1 065 652																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
714	947.5	16 467 846	1 065 659																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
715	939.2	16 467 772	1 065 634																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
716	936.5	16 467 560	1 065 683																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
717	938.0	16 467 455	1 065 687																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
718	931.0	16 467 913	1 065 607																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
719	932.0	16 467 418	1 065 560																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
720	936.0	16 468 010	1 065 535																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
721	930.0	16 467 325	1 065 295																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
722	935.0	16 467 418	1 065 242																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
723	936.1	16 467 585	1 065 230																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
724	935.0	16 467 425	1 065 255																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
725	937.0	16 467 650	1 065 265																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
726	935.0	16 467 360	1 065 180																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
727	931.0	16 467 310	1 065 255																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
728	941.9	16 468 070	1 065 800																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
729	940.0	16 468 165	1 065 835																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
730	934.4	16 467 455	1 065 730																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
731	935.5	16 468 355	1 065 895																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
732	938.5	16 468 420	1 065 885																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
733	946.2	16 468 510	1 066 035																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
734	938.4	16 468 600	1 065 950																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
735	954.4	16 468 545	1 065 915																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
736	934.4	16 468 760	1 066 115																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
737	967.3	16 468 075	1 065 675																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
738	938.0	16 467 500	1 065 725																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
739	934.5	16 467 515	1 065 365																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
739	943.0	16 468 055	1 065 435																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
740	948.0	16 468 080	1 065 330																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
741	943.0	16 467 865	1 065 290																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
742	935.0	16 467 950	1 065 415																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
743	933.0	16 467 845	1 065 400																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
744	931.5	16 467 200	1 065 260																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
745	932.0	16 467 415	1 065 360																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
746	931.8	16 467 310	1 065 365																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
747	935.0	16 467 345	1 065 670																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
748	935.7	16 467 120	1 065 175																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
749	935.0	16 466 950	1 065 170																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
750	940.0	16 467 460	1 065 158																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
751	940.0	16 467 479	1 065 190																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
752	938.5	16 467 514	1 065 232																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
753	940.0	16 467 535	1 065 285																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
<div>-NOTE-</div> <div>The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.</div>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
<div>REVISIONS</div> <table><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><</tr></table>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

HUNTSVILLE BYPASS

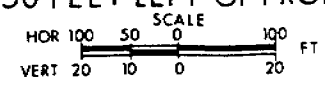
BORE HOLE LOCATIONS & SOIL STRATA



PROFILE 150 FEET RIGHT OF PROPOSED \bar{C} MEDIAN



PROFILE 150 FEET LEFT OF PROPOSED \bar{C} MEDIAN



KEY PLAN

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- W.L. at time of investigation
- ARTESIAN WATER CONDITIONS
- BH No 758 764 765
- OCT & NOV 1974 AUG & SEPT 1975
- FEB & AUG 1976

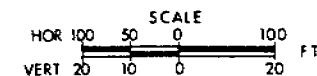
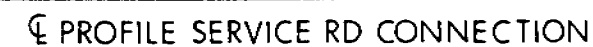
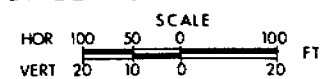
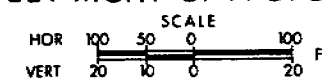
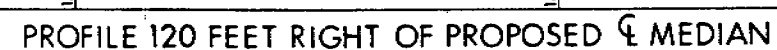
No	ELEVATION		





NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

HUNTSVILLE BYPASS

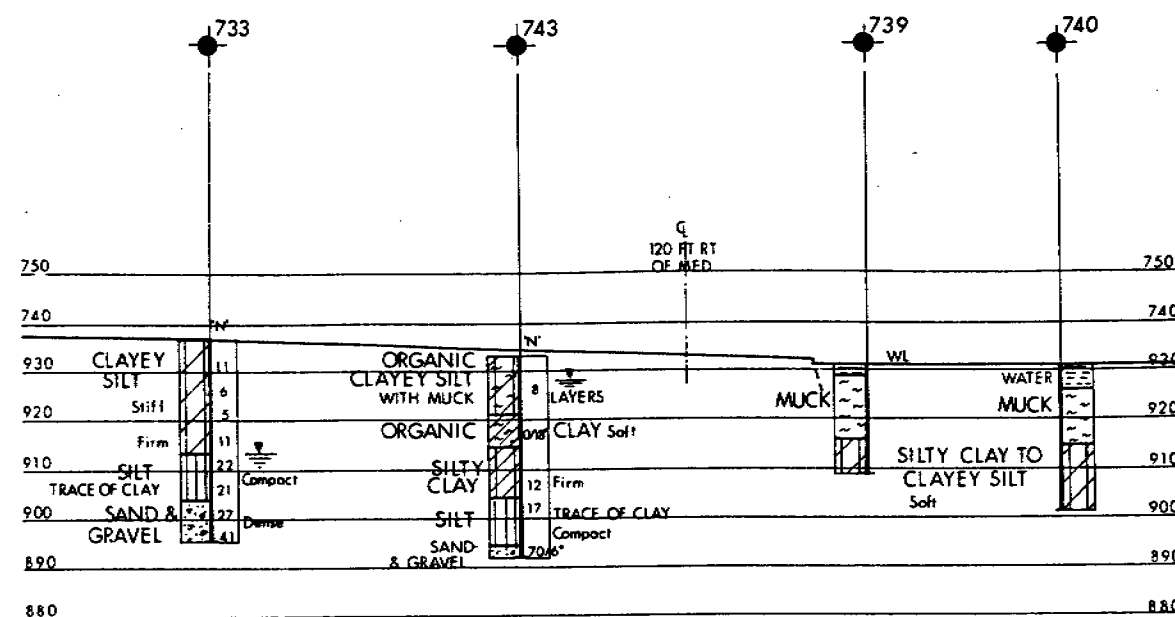


 Bore Hole
 Dynamic Cone Penetration Test {Cone}
 Bore Hole & Cone
 'N' Blows/ft {Std Pen Test 350ft lbs energy}
 CONE Blows/ft {60° Cone, 350ft lbs energy}
 Wl at time of investigation
 ARTHESIAN WATER CONDITION
 BH No 701 702 703 763
 SEPT 1961 & 1975 OCT 1961, 1974 & 75 FEB 1975 & 76
 AUG 1975 & 76 JULY 1975 MAY 1978

[illegible]

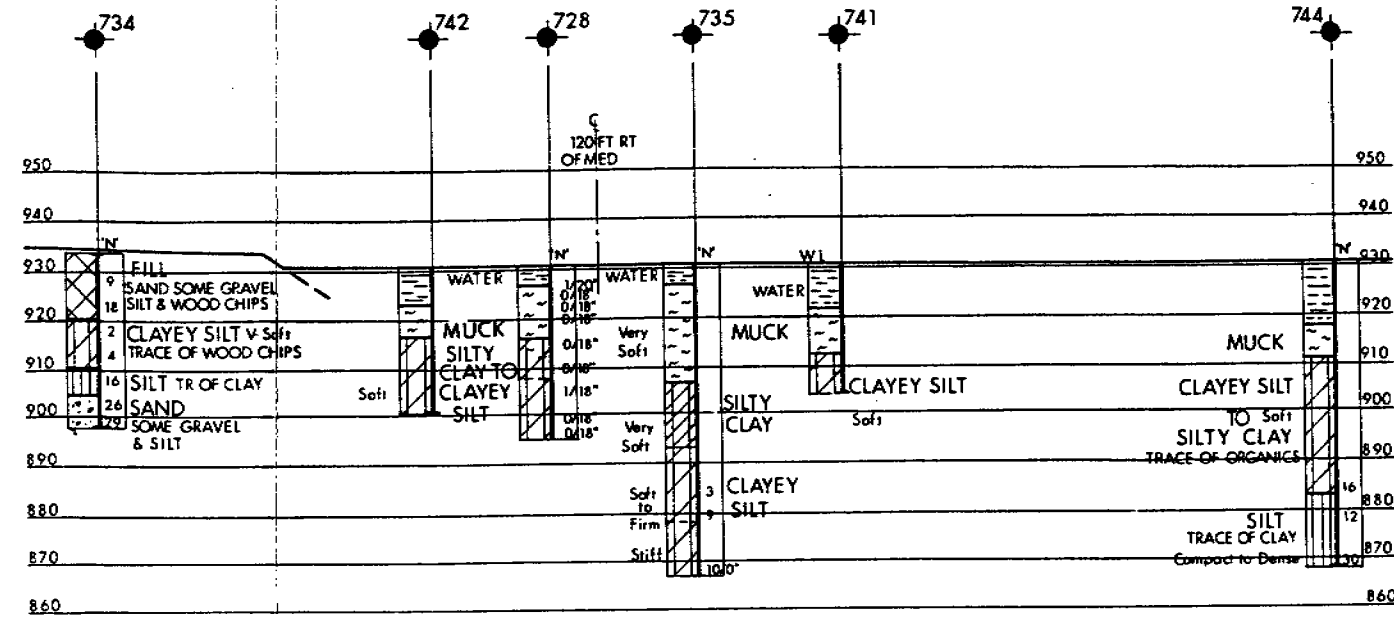
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Hole boundaries are assumed from geological evidence.

REVISIONS			
	DATE	BY	DESCRIPTION



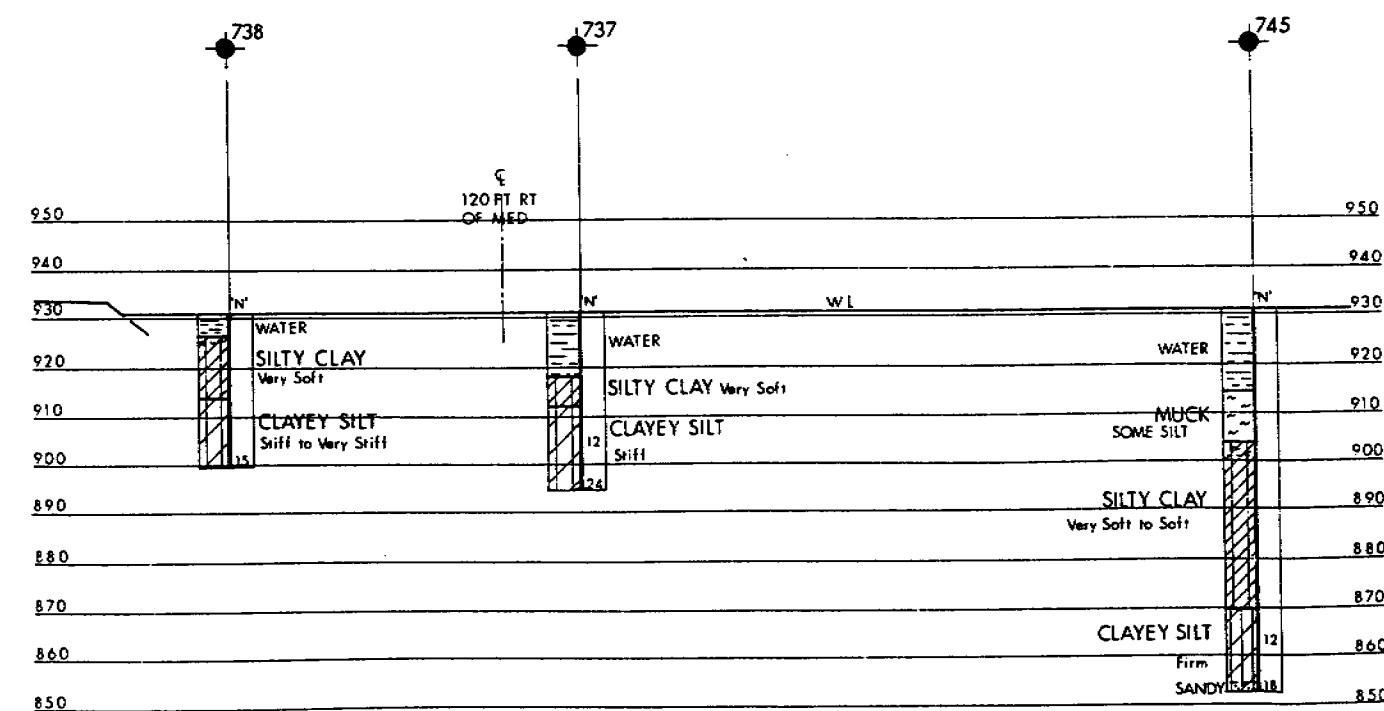
SECTION B-B

SCALE
20 10 0 20 FT



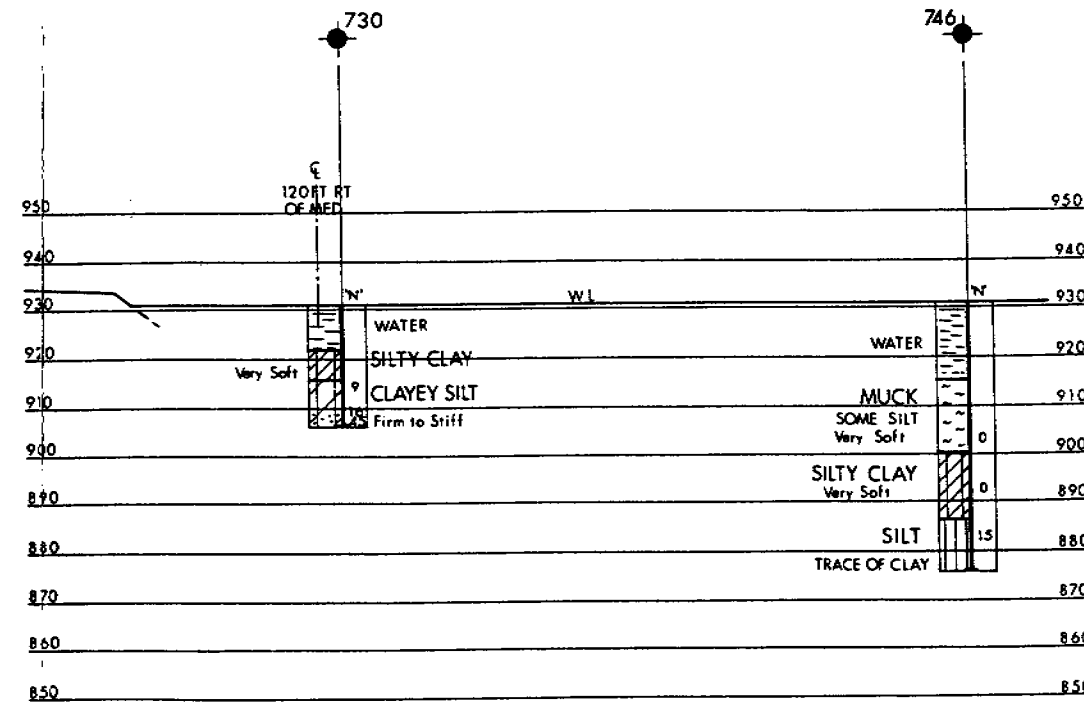
SECTION C-C

SCALE
20 10 0 20 FT



SECTION D-D

SCALE
20 10 0 20 FT



SECTION E-E

SCALE
20 10 0 20 FT

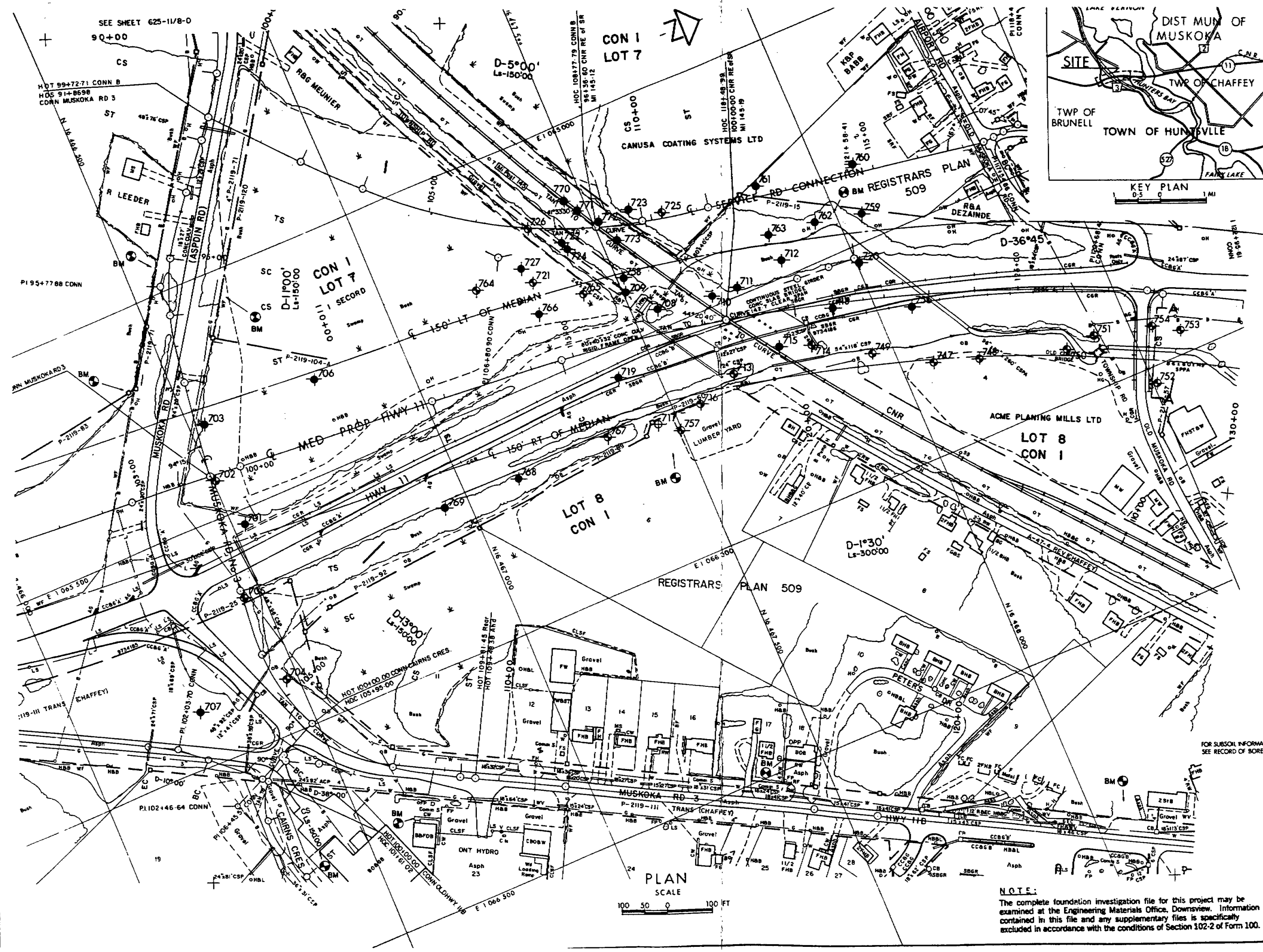
- LEGEND
- Bore Hole
 - ⊕ Dynamic Cone Penetration Test (Cone)
 - ⊗ Bore Hole & Cone
 - 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
 - CONE Blows/ft (60° Cone, 350 ft lbs energy)
 - W.L. at time of investigation

No	ELEVATION		

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

-NOTE-

REVISIONS	DATE	BY	DESCRIPTION



CONT No 78-28
WP No 74-74-07

HUNTSVILLE BYPASS

BORE HOLE LOCATIONS & SOIL STRATA

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone 350ft lbs energy)
- W/L at time of investigation

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
701	936.7	16 466 528	1 065 533
702	936.5	16 466 504	1 065 423
703	941.0	16 466 533	1 065 885
704	935.5	16 466 462	1 065 885
705	937.9	16 466 462	1 065 682
706	930.0	16 466 790	1 065 300
707	934.0	16 466 275	1 065 875
708	935.6	16 467 557	1 065 457
709	935.2	16 467 502	1 063 391
710	933.7	16 467 680	1 065 477
711	935.2	16 467 739	1 065 481
712	934.6	16 467 852	1 065 461
713	938.9	16 467 657	1 065 652
714	947.5	16 467 846	1 065 659
715	939.2	16 467 772	1 065 634
716	936.5	16 467 560	1 065 683
717	938.0	16 467 455	1 065 687
718	931.0	16 467 913	1 065 607
719	932.0	16 467 418	1 065 560
720	936.0	16 468 010	1 065 535
721	930.0	16 467 325	1 065 295
722	935.0	16 467 418	1 065 242
723	936.1	16 467 585	1 065 230
724	935.0	16 467 425	1 065 255
725	937.0	16 467 650	1 065 265
726	935.0	16 467 360	1 065 180
727	931.0	16 467 310	1 065 255
747	941.9	16 468 070	1 065 800
748	940.0	16 468 165	1 065 835
749	934.4	16 467 455	1 065 730
750	935.5	16 468 355	1 065 895
751	938.5	16 468 420	1 065 885
752	946.2	16 468 510	1 066 035
753	938.4	16 468 600	1 065 950
754	954.4	16 468 545	1 065 915
755	934.4	16 468 760	1 066 115
756	967.3	16 468 075	1 065 675
757	938.0	16 467 500	1 065 725
758	934.5	16 467 515	1 065 365
759	943.0	16 468 055	1 065 435
760	948.0	16 468 080	1 065 330
761	943.0	16 467 865	1 065 290
762	935.0	16 467 950	1 065 415
763	933.0	16 467 845	1 065 400
764	931.5	16 467 200	1 065 260
765	932.0	16 467 415	1 065 360
766	931.8	16 467 310	1 065 365
767	935.0	16 467 345	1 065 670
768	935.7	16 467 120	1 065 175
769	935.0	16 466 950	1 065 170
770	940.0	16 467 460	1 065 158
771	940.0	16 467 479	1 065 190
772	938.5	16 467 514	1 065 232
773	940.0	16 467 535	1 065 285

-NOTE-

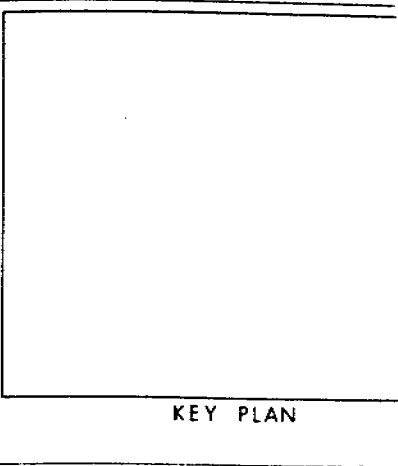
The boundaries between soil strata have been only at Bore Hole locations. Between Bore Hole boundaries are assumed from geological ev

REVISIONS	DATE	BY	DESCRIPTION

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.

HWY No. 11
SUBMIT P.P. CHECKED
DRAWN CL J CHECKED
DATE 6 JULY 1977



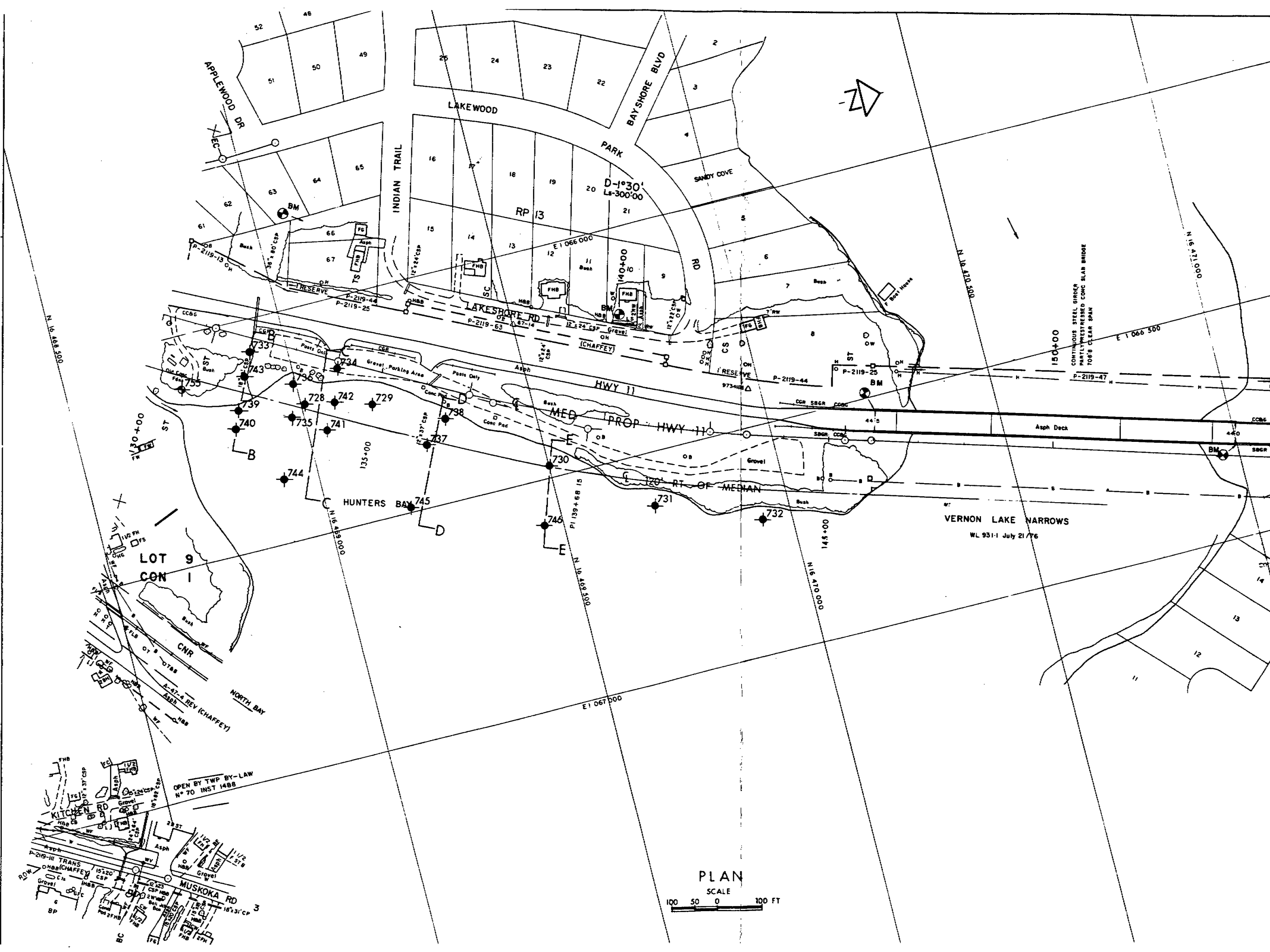
LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- ↓ WL at time of investigation

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
728	WL 931-1	16 469 010	1066 210
729	---	16 469 155	1066 250
730	---	16 469 500	1066 475
731	---	16 469 710	1066 615
732	---	16 469 935	1066 705
733	936-6	16 468 920	1066 070
734	933-7	16 469 100	1066 155
735	931-1	16 468 975	1066 235
736	---	16 468 995	1066 165
737	---	16 469 250	1066 365
738	---	16 469 305	1066 320
739	---	16 468 865	1066 190
740	---	16 468 850	1066 230
741	---	16 469 045	1066 280
742	---	16 469 075	1066 225
743	933-0	16 468 895	1066 120
744	929-0	16 468 922	1066 362
745	---	16 469 180	1066 490
746	---	16 469 460	1066 600
755	934-4	16 468 760	1066 115

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

REVISIONS		
DATE	BY	DESCRIPTION



PLAN
SCALE
100 50 0 50 100 FT