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GEOCRES # 31D-384

REPORT ON

**FOUNDATION INVESTIGATION AND DESIGN
OVERPASS STRUCTURES AT HERALD ROAD
HIGHWAY 404 EXTENSION
DAVIS DRIVE TO HERALD ROAD
REGIONAL MUNICIPALITY OF YORK
GWP: 421-98-00**

Submitted to:

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PART A – FIELD INVESTIGATION

HIGHWAY 404 EXTENSION
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DAVIS DRIVE TO HERALD ROAD
REGIONAL MUNICIPALITY OF YORK
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1.0 INTRODUCTION

Golder Associates Ltd. has been retained by the McCormick Rankin Corporation (McCormick Rankin) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out a foundation investigation at the site of the proposed twin overpass at Herald Road in the Region of York, Ontario. The project consists of the extension of Highway 404 from Davis Drive northerly to Herald Road and includes a partial interchange with twin overpass structures at Highway 404 and Herald Road. This report addresses the proposed twin overpass structures and their approaches within 20 m of the structures.

The purpose of the foundation investigation is to determine the subsurface conditions at the site of the proposed overpass structures by drilling boreholes, and carrying out in-situ tests and laboratory tests on selected samples. Based on our interpretation of the data obtained, recommendations on the foundation aspects of design of the proposed works are provided. Comments are also provided on anticipated construction problems where they may affect the design of the proposed bridges and approach embankments.

The terms of reference for the scope of work are outlined in our proposal letter P91-8040, dated June 2, 1999. The work was carried out in accordance with our Quality Control Plan for Foundation Design Services, dated July 26, 1999.

2.0 SITE DESCRIPTION

The site is located approximately 1.5 km west of the intersection of Herald Road and Woodbine Avenue and 2.4 km north of Davis Drive, near the Town of Newmarket, in the Regional Municipality of York.

The topography of the site area is generally level with a regional trench sloping down to the south towards Lake Ontario. The ground surface at the site varies locally from about Elevations 292 m to 295 m. The existing Herald Road is a two-lane, undivided unpaved roadway which runs east-west within the project limits. Based on available information, the approximate existing grade of Herald Road is about Elevation 294 m. The lands in the vicinity of site are mainly agricultural. Residential properties are located along the south side of Herald Road and one residential property is located on the north side of Herald Road to the immediate east of the proposed bridge structures.

Within the project limits, the vegetation cover generally consists of grass, bushes, and mature trees. The south portion of the site is mainly comprised of grassed lawns as part of the residential properties; an open field exists to the north of Harold Road.

The original MTO foundation report for the Davis Drive underpass located to the south of the site was reviewed for this report, and is referenced as:

- GEOCRE 31D-262, titled "Highway 404 Underpass at Regional Road 31 (Davis Drive)", W.P. 160-74-40, Highway 404, District 6, Toronto, dated September 1978.

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out between November 8 and 11, 1999. At this time fourteen (14) boreholes were put down at the site. Boreholes 1 to 4 and 8 to 11 were put down within the limits of the proposed foundation units. Boreholes 5 and 6 were put down in the area of the south and north approaches, respectively, for the southbound structure within 20 m of the proposed abutments. Boreholes 12 and 13 were put down in the area of the south and north approaches, respectively, for the northbound structure within 20 m of the proposed abutments. Boreholes 7 and 14 were advanced along the existing Herald Road to the west and east of the structures, respectively.

The investigation was carried out using a track-mounted B-57 drill rig supplied and operated by Master Soil Investigation of North York. In the boreholes, samples of the overburden were obtained at regular intervals of depth of 0.75 m to 1.5 m using 50 mm outside diameter split-spoon samplers in accordance with the Standard Penetration Test (SPT) procedures. The boreholes were extended to depths of between 3.7 m and 18.4 m below the existing ground surface. Groundwater conditions in the open boreholes were observed throughout the drilling operations. Piezometers were installed in four boreholes to permit monitoring of the groundwater levels at the site. The piezometers consisted of a 200 mm long slotted tip threaded into 12 mm diameter PVC rigid tubing.

The field work was supervised on a full-time basis by a member of our engineering staff who located the boreholes in the field, directed the drilling, sampling and in-situ testing operations, and logged the boreholes. The soil samples were identified in the field, placed in labeled containers and transported back to our laboratory in Mississauga for further examination. Index and classification tests consisting of grain size analyses, Atterberg Limits tests and water content determinations were carried out on selected samples.

The borehole locations were surveyed and staked in the field by J.D. Barnes Limited, professional land surveyors. Based on the information provided, the northing and easting co-ordinates of the borehole locations are given in UTM, and the borehole elevations are referenced to the Geodetic Datum. The co-ordinates of the boreholes are indicated on the Record of Borehole sheets and the locations of the boreholes are shown on Drawings 1 and 2.

4.0 GENERAL SITE GEOLOGY AND STRATIGRAPHY

4.1 Site Geology

The site is located in the physiographic region known as the Oak Ridges Moraine, which was formed between two opposing movements of ice during the late Wisconsinan period of glaciation (Chapman and Putnam, "The Physiography of Southern Ontario", 3rd Edition, 1984). The topography of the Oak Ridges Moraine is hilly, with knob and basin relief that is typical for an end moraine. The subsoils for this region are generally comprised of sandy materials, which are underlain by glacial till. Interbeds of fine sand, silt, and clay are also common. Bedrock is generally deep below the ground surface in this region; previous investigations carried out by others in the general area found the bedrock surface is at depths between 180 m to 240 m below the ground surface.

4.2 Site Stratigraphy

The detailed subsurface soil and groundwater conditions encountered in the boreholes, together with the results of the laboratory tests carried out on selected soil samples, are given on the attached Record of Borehole sheets following the text of this report. The stratigraphic boundaries shown on the borehole sheets are inferred from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. Subsoil conditions will vary between and beyond the borehole locations.

In summary, the subsoils at the site generally consist of a surficial layer of topsoil or loose silty sand fill underlain by a 0.8 m to 2.2 m thick deposit of loose to dense silty sand to sandy silt. The silty sand / sandy silt is underlain by a 0.9 m to 4.2 m thick deposit of very stiff to hard clayey silt glacial till which grades into hard sandy clayey silt glacial till at about Elevation 289 m. At depth, a lower deposit of hard clayey silt till was encountered between Elevations 278 m and 279 m, which was not fully penetrated in the boreholes, but proved to a thickness of 2.2 m to 5.4 m. Cobbles were inferred from auger resistance / grinding within the till deposits. A boulder of undetermined size was encountered in one borehole where auger refusal on the boulder required re-augering a second borehole adjacent to the initial location in order to advance the borehole further.

Locations and elevations of the borings, together with the interpreted stratigraphical profile and sections, are shown on the attached Drawings 1 and 2. A detailed description of the subsurface conditions encountered in the boreholes for this investigation is provided in the following sections.

4.2.1 Topsoil

A surficial layer of topsoil between 300 mm and 600 mm thick was encountered in all the boreholes, except in Boreholes 7, 12 and 14.

4.2.2 Silty Sand Fill

Surficial fill material consisting of silty sand, some gravel was encountered at the location of Boreholes 7 and 14 which were put down along the south side of Herald Road. Occasional organics were noted within the silty sand fill. Standard Penetration testing (SPT) carried out within the fill gave 'N' values of 7 blows per 0.3 m of penetration, indicating a loose state of packing. The natural water content for a selected sample of the silt sand fill was measured at about 11 percent.

4.2.3 Silty Sand to Sandy Silt

A 0.8 m to 2.2 m thick deposit of silty sand to sandy silt was encountered below the topsoil and silty sand fill at the location of all the boreholes, except in Borehole 14. At the location of Borehole 12 the silt / sand deposit was encountered surficially. The deposit generally consists of sandy silt, trace clay and gravel in the north area of the proposed structures and silty sand to silt and sand, trace gravel in the south area of the proposed structures. A grain size distribution curve for a selected sample of the silt / sand is shown on Figure 1. Standard Penetration Testing (SPT) carried out within the silt / sand gave 'N' values of between 8 blows and 47 blows per 0.3 m of penetration, which indicates a loose to dense state of packing. The natural water content of selected samples of the silt / sand were measured at between 5 percent and 19 percent, with an average of about 12 percent.

4.2.4 Upper Clayey Silt Till

An upper deposit of clayey silt glacial till was encountered below the silt / sand in all of the boreholes. Some sand, trace gravel and occasional cobbles were noted within the clayey silt till.

Grain size distribution curves for selected samples of the upper clayey silt till are shown on Figure 2. The clayey silt till was fully penetrated in all the boreholes, except Boreholes 5 and 12 which were terminated within the deposit, where the deposit was found to be 0.9 m to 4.2 m thick. The deposit was proved to a thickness of at least 3.4 m and 2.7 m in Boreholes 5 and 12, respectively.

Standard Penetration Testing (SPT) carried out within the clayey silt till gave 'N' values of 17 blows to greater than 100 blows per 0.3 m of penetration, indicating a very stiff to hard consistency. In general, the clayey silt till is hard with 'N' values of greater than 100 blows for 0.3 m of penetration.

Atterberg limits testing was carried out on selected samples of the upper clayey silt till. The limit test results are shown on Figure 3 and summarized in the following table.

	<i>Liquid Limit (%)</i>	<i>Plastic Limit (%)</i>	<i>Plasticity Index (%)</i>
Range	18 to 21	11 to 14	5 to 8
Average	19	13	6

The results indicate the clayey silt is inorganic and of low plasticity. The natural water content measured on selected samples of the clayey silt till ranged from about 5 percent to 14 percent, with an average of about 8 percent, and were generally below the plastic limit.

4.2.5 Sandy Clayey Silt Till

The clayey silt till grades into sandy clayey silt till at about Elevation 289 m in all the boreholes, except in Boreholes 5 and 12 which were terminated within the upper clayey silt till. The deposit contains trace to some gravel and occasional cobbles, which were inferred from auger resistance / grinding. At the location of Borehole 14, a boulder of unknown size was encountered at about Elevation 286 m.; auger refusal on the boulder required re-augering a second borehole adjacent to the initial location in order to advance further. Grain size distribution curves for selected samples of the sandy clayey silt are shown on Figure 4. Standard Penetration Testing

(SPT) carried out within the sandy clayey silt till deposit measured 'N' values of greater than 100 blows per 0.3 m of penetration, which indicates a hard consistency.

Atterberg limits testing was carried out on selected samples of the sandy clayey silt till. The limit test results are shown on Figure 5 and summarized in the following table.

	<i>Liquid Limit (%)</i>	<i>Plastic Limit (%)</i>	<i>Plasticity Index (%)</i>
Range	14 to 17	10 to 11	4 to 6
Average	16	11	5

The results indicate the clayey silt is inorganic and of low plasticity. The natural water content measured on selected samples of the clayey silt till ranged from about 4 percent to 9 percent, with an average of about 7 percent, and were generally below the plastic limit.

4.2.6 Lower Clayey Silt Till

At depth, the sandy clayey silt till grades into a lower deposit of clayey silt till containing some sand, trace gravel with the surface at between about Elevations 278 m and 279 m. A grain size distribution curve for a selected sample of the lower till (Borehole 8, Sample 14) is shown on Figure 2. The lower till is generally hard in consistency. Standard Penetration Testing (SPT) carried out within the lower till gave 'N' values of greater than 100 blows per 0.3 m of penetration. The natural water content measured on selected samples of the lower clayey silt till ranged from about 6 percent to 12 percent, with an average of 8 percent.

The lower clayey silt till was not fully penetrated in the boreholes, but proved to a thickness of 2.2 m to 5.4 m.

4.3 Groundwater Conditions

Water levels were noted in the open boreholes during and upon completion of the drilling operation; these levels are shown on the attached Record of Borehole sheets. Piezometers were sealed in Boreholes 1, 7, 10 and 14 to permit the monitoring of the groundwater levels at the site.

Details of the piezometer installations and water level measurements are shown on the attached Record of Borehole sheets.

Water was noted in open Boreholes 6 and 9 on completion of drilling at Elevation 285 m and 286.6 m, respectively. All of the remaining boreholes were dry upon completion of drilling operations. A summary of the water level monitoring results are provided in the following table.

Borehole	On Completion of Drilling		Water Levels in Piezometers					
			November 23, 1999		December 17, 1999		January 04, 2000	
	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
1	Dry	-	10.7	281.5	9.9	282.3	9.5	282.7
6	6.5	285.0		-	-	-	-	-
7	Dry	-	6.5	286.5	3.8	289.2	3.8	289.2
9	6.9	286.6	-	-	-	-	-	-
10	Dry	-	3.7	290.7	3.2	291.2	3.1	291.3
14	Dry	-	5.2	289.4	3.2	291.4	3.0	291.3


These measurements indicate the possible presence of two groundwater tables at this site; alternatively the piezometer installed in Borehole 1 is blocked or the level had not stabilized as of the time of writing this report. The levels measured in Boreholes 7, 10 and 14 indicate that the piezometric level within the sandy clayey silt till deposit slopes slightly downward toward the west from about Elevations 291.6 m to 289.2 m at the east and west of the site respectively.

The latest water level in the piezometer installed in Borehole 1, with tip placed within the lower clayey silt till, was at Elevation 282.7 m and may indicate downward seepage is occurring. There has been a slight rise in water level over the last month, which is not reflected in the other three piezometers; this may indicate that the level has not yet stabilized.

It should be noted that groundwater levels are expected to fluctuate seasonally and are expected to be higher during wet periods of the year.

GOLDER ASSOCIATES LTD.


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Designated MTO Contact



DKB/AMP/ASP/FJH/clg
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LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.).

Dynamic Penetration Resistance; N_d :

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60° conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	c_u, s_u kPa	psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane test (LV-laboratory vane test)
γ	unit weight

Note:

1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I GENERAL

π	= 3.1416
$\ln x$,	natural logarithm of x
$\log_{10} x$ or $\log x$,	logarithm of x to base 10
g	acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ϵ	linear strain
ϵ_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress = $(\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation
*	Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

(a) Index Properties (con't.)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity Index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(c) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(d) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_α	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	Overconsolidation ratio = σ'_p / σ'_{vo}

(e) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1. $\tau = c' + \sigma' \tan \phi'$

2. Shear strength = (Compressive strength)/2

PROJECT 991-1162		RECORD OF BOREHOLE No 1		1 OF 2	METRIC
W.P. 421-98-00	LOCATION N 4883009.892, E 310885.324	ORIGINATED BY SB			
DIST 6 HWY 404	BOREHOLE TYPE 114mm SOLID STEM AUGERS	COMPILED BY DKB			
DATUM GEODETTIC	DATE 11.11.99	CHECKED BY ASP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED									
							20	40	60	80	100	WATER CONTENT (%)				GR SA SI CL	
292.24	0.00	Topsoil															
291.79	0.45	Sandy Silt, trace clay and gravel Compact Brown Moist		1	50 DO	6											
				2	50 DO	16											
290.72	1.52	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		3	50 DO	133											
				4	50 DO	75/15											
				5	50 DO	100/15											
288.75	3.49	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Brown becoming grey at 5.8m depth Moist (Glacial Till)		6	50 DO	85/15											
				7	50 DO	100/15											
				8	50 DO	100/15											
				9	50 DO	100/15											
				10	50 DO	92/15											
				11	50 DO	100/15											
				12	50 DO	100/15											
279.24	13.00	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Grey Moist (Glacial Till)		13	50 DO	95/15											

Continued Next Page

+³ ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT 991-1162				RECORD OF BOREHOLE No 1				2 OF 2		METRIC			
W.P. 421-98-00				LOCATION N 4883009.892; E 310885.324				ORIGINATED BY SB					
DIST 6 HWY 404				BOREHOLE TYPE 114mm SOLID STEM AUGERS				COMPILED BY DKB					
DATUM GEODETIC				DATE 11.11.99				CHECKED BY ASP					
SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
							20 40 60 80 100						
	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Grey Moist (Glacial Till)(continued)		14	50 DO	100/0								
			15	50 DO	100/0								
273.84 18.40	END OF BOREHOLE		16	50 DO	85/15								
Note: 1. Open Borehole dry upon completion of drilling. 2. Water level measured in piezometer at 10.7m depth (Elev.281.5m) on Nov.23, 1999. 3. Water level measured in piezometer at 9.9m depth (Elev.282.3m) on Dec.17, 1999. 4. Water level measured in piezometer at 9.5m depth (Elev.282.7m) on Jan.4, 2000.													

ON-MOT 991-1162 GPJ ON-MOT-GDT 5/1/00

PROJECT 991-1162		RECORD OF BOREHOLE No 2		1 OF 1	METRIC
W.P. 421-98-00	LOCATION N 4883018.769; E 310913.233	ORIGINATED BY SB			
DIST 6 HWY 404	BOREHOLE TYPE 114mm SOLID STEM AUGERS	COMPILED BY DKB			
DATUM GEODETIC	DATE 11.10 & 11.99	CHECKED BY ASP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20	40	60	80	100	W _p	W	W _L		
292.84	Topsoil		1	50 DO	5												
292.39	Sandy Silt, trace clay and gravel Loose Brown Moist		2	50 DO	8												
291.39	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		3	50 DO	41												
1.45			4	50 DO	75/15												
			5	50 DO	85/15												
289.26	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Brown becoming grey at 5.5m depth Moist (Glacial Till)		6	50 DO	80/15												
3.58			7	50 DO	100/0												
			8	50 DO	100/1												
			9	50 DO	100/15												
			10	50 DO	100/15												
			11	50 DO	100/1												
			12	50 DO	100/15												
280.50	END OF BOREHOLE																
12.34	Note: 1. Open Borehole dry upon completion of drilling.																

ON_MOT_991-1162.GPJ ON MOT CDT 5/1/00

PROJECT 991-1162

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. 421-98-00

LOCATION N 4882979.883; E 310893.004

ORIGINATED BY SB

DIST 6 HWY 404

BOREHOLE TYPE 114mm SOLID STEM AUGERS

COMPILED BY DKB

DATUM GEODETIC

DATE 9.11.99

CHECKED BY ASP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
294.74	Topsoil		1	50 DO	6		294										
294.14	Silty Sand, trace gravel Dense Brown Moist		2	50 DO	35		293										
293.29	Clayey Silt, some sand, trace gravel, occasional cobbles Very stiff to hard Brown Moist (Glacial Till)		3	50 DO	27		292										4 14 (82)
1.45			4	50 DO	58		291										
			5	50 DO	84/15		290										
			6	50 DO	56/15		289										
			7	50 DO	100/15		288										
289.35	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Grey Moist (Glacial Till)		8	50 DO	85/15		287										8 37 (55)
5.39			9	50 DO	100/15		286										
			10	50 DO	94/15		285										
			11	50 DO	100/15		284										
282.40	END OF BOREHOLE		12	50 DO	109/15		283										
12.34	Note: 1. Open Borehole dry upon completion of drilling.																


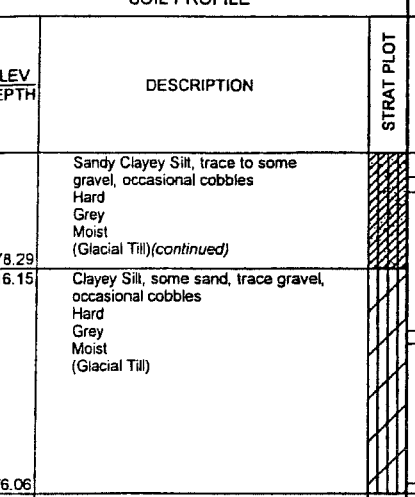

ON MOT 991-1162.GPJ ON MOT.GDT 5/1/00

+ 3, X 3 Numbers refer to
Sensitivity

○ 3% STRAIN AT FAILURE

ON_MOT 991-1162.GPJ ON_MOT.GDT 5/1/00

PROJECT <u>991-1162</u>		RECORD OF BOREHOLE No 4		2 OF 2		METRIC	
W.P. <u>421-98-00</u>		LOCATION <u>N 4882988.091; E 310918.905</u>		ORIGINATED BY <u>SB</u>			
DIST <u>6</u> HWY <u>404</u>		BOREHOLE TYPE <u>114mm SOLID STEM AUGERS</u>		COMPILED BY <u>DKB</u>			
DATUM <u>GEODETIC</u>		DATE <u>9.11.99</u>		CHECKED BY <u>ASP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20 40 60 80 100		W _p	W	W _L					
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × REMOULDED									
								20 40 60 80 100		10 20 30							
278.29	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Grey Moist (Glacial Till)(continued)		14	50 DO	85/15		279										
16.15	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Grey Moist (Glacial Till)		15	50 DO	150/13		278			○							
276.06							277										
18.38	END OF BOREHOLE Note: 1. Open Borehole dry upon completion of drilling.		16	50 DO	100/1					○							

ON_MOT_991-1162.GPJ ON_MOT_GDT_5/1/00

PROJECT <u>991-1162</u>		RECORD OF BOREHOLE No 5		1 OF 1 METRIC	
W.P. <u>421-98-00</u>		LOCATION <u>N 4882964.270; E 310908.940</u>		ORIGINATED BY <u>SB</u>	
DIST <u>6</u> HWY <u>404</u>		BOREHOLE TYPE <u>114mm SOLID STEM AUGERS</u>		COMPILED BY <u>DKB</u>	
DATUM <u>GEODETIC</u>		DATE <u>9.11.99</u>		CHECKED BY <u>ASP</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W _p	W	W _L		
							20	40	60	80	100	10	20	30			
295.44	0.00	Topsoil		1	50 DO	3											
294.96	0.48	Silty Sand, trace gravel Compact Brown Moist		2	50 DO	15											
293.99	1.45	Clayey Silt, some sand, trace gravel, occasional cobbles Very stiff to hard Brown Moist (Glacial Till)		3	50 DO	23											
				4	50 DO	56											
				5	50 DO	98/15											
				6	50 DO	79/15											
290.57	4.87			END OF BOREHOLE	7	50 DO											75/15
Note: 1. Open Borehole dry upon completion of drilling.																	

PROJECT 991-1162				RECORD OF BOREHOLE No 6				1 OF 1				METRIC			
W.P. 421-98-00				LOCATION N 4883034.073; E 310895.891				ORIGINATED BY SB							
DIST 6 HWY 404				BOREHOLE TYPE 114mm SOLID STEM AUGERS				COMPILED BY DKB							
DATUM GEODETIC				DATE 11.11.99				CHECKED BY ASP							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
291.49	0.00	Topsoil	1	50 DO	11										
291.04	0.45	Sandy Silt, trace clay and gravel Compact Brown Moist	2	50 DO	14										
290.04	1.45	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)	3	50 DO	45										
288.75	2.74	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Brown becoming grey at 7.0m depth Moist (Glacial Till)	4	50 DO	70/15										
			5	50 DO	85/15										
			6	50 DO	83/15										
			7	50 DO	87/15										
			8	50 DO	77/15										
			9	50 DO	86/15										
283.59	7.90	END OF BOREHOLE													
Note: 1. Water level measured in open borehole at 6.5m depth (Elev 285.0m) upon completion of drilling.															

ON MOT 991-1162 GPJ ON MOT GDT 5/1/00

PROJECT 991-1162		RECORD OF BOREHOLE No 7		1 OF 1	METRIC
W.P. 421-98-00		LOCATION N 4882988 375; E 310870 250		ORIGINATED BY SB	
DIST 6 HWY 404		BOREHOLE TYPE 114mm SOLID STEM AUGERS		COMPILED BY DKB	
DATUM GEODETIC		DATE 9.11.99		CHECKED BY ASP	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
								20 40 60 80 100	20 40 60 80 100	W _p W W _L	10 20 30			

293.04 0.00	Silty Sand, some gravel, trace clay, occasional organics Loose Brown/grey Moist (Fill)		1	50 DO	7														
292.35 0.69	Sandy Silt, trace clay and gravel Compact Brown Moist		2	50 DO	28														
291.59 1.45	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		3	50 DO	30														
			4	50 DO	92/15														
			5	50 DO	150/25														
			6	50 DO	100/15														
288.77 4.27	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Brown becoming grey at 7.0m depth Moist (Glacial Till)		7	50 DO	100/15														
			8	50 DO	90/15														
			9	50 DO	110/15														
			10	50 DO	91/15														
282.24 10.80	END OF BOREHOLE		11	50 DO	92/15														

Note:

1. Open Borehole dry upon completion of drilling.
2. Water level measured in piezometer at 6.5m depth (Elev 286.5m) on Nov.23, 1999.
3. Water level measured in piezometer at 3.8m depth (Elev 289.2m) on Dec.17, 1999 and on Jan.4, 2000.

Note:
1. Open Borehole dry upon
completion of drilling.
2. Water level measured in
piezometer at 6.5m depth
(Elev 286.5m) on Nov.23, 1999.
3. Water level measured in
piezometer at 3.8m depth
(Elev 289.2m) on Dec.17, 1999 and
on Jan.4, 2000.

ON MOT 991-1162 GPJ ON MOT GDT 5/1/00

ON_MOT 991-1162.GPJ ON_MOT.GDT 5/1/00

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

[illegible]

PROJECT 991-1162		RECORD OF BOREHOLE No 9		1 OF 1	METRIC
W.P. 421-98-00		LOCATION N 4883028.579; E 310947.987		ORIGINATED BY SB	
DIST 6 HWY 404		BOREHOLE TYPE 114mm SOLID STEM AUGERS		COMPILED BY DKB	
DATUM GEODETIC		DATE 10.11.99		CHECKED BY ASP	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								20 40 60 80 100		20 40 60 80 100							10 20 30		
293.50	Topsoil		1	50 DO	8		293												
0.00 293.20 0.30	Sandy Silt, trace clay and gravel Loose to dense Brown Moist		2	50 DO	16		292												
			3	50 DO	47														
291.29	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		4	50 DO	82/15		291												
2.21			5	50 DO	74		290												
			6	50 DO	83														
289.08	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Grey Moist (Glacial Till)		7	50 DO	103/15		289												
4.42			8	50 DO	100/13		288												
							287												
			9	50 DO	83		286												
							285												
			10	50 DO	105		284												
							283												
			11	50 DO	127		282												

ON MOT 991-1162.GPJ ON MOT.GDT 5/1/00

PROJECT 991-1162		RECORD OF BOREHOLE No 10		1 OF 1	METRIC
W.P. 421-98-00		LOCATION N 4882989.633; E 310927.841		ORIGINATED BY SB	
DIST 6 HWY 404		BOREHOLE TYPE 114mm SOLID STEM AUGERS		COMPILED BY DKB	
DATUM GEODETIC		DATE 8.11.99		CHECKED BY ASP	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)			
294.43 0.00	Topsoil		1	50 DO	6		294							
293.98 0.45	Silt and Sand, trace clay and gravel Loose to compact Brown Moist		2	50 DO	22		293							1 53 44 2
			3	50 DO	22									
292.22 2.21	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		4	50 DO	92/15		292							
			5	50 DO	119		291							
			6	50 DO	71		290							
			7	50 DO	108									
288.87 5.56	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Grey Moist (Glacial Till)		8	50 DO	112		289							
							288							
			9	50 DO	92/15		287							9 39 (52)
							286							
							285							
							284							
							283							
282.09 12.34	END OF BOREHOLE		12	50 DO	100/15									
<div>Note: 1. Open Borehole dry upon completion of drilling. 2. Water level measured in piezometer at 3.7m depth (Elev.290.7m) on Nov.23, 1999. 3. Water level measured in piezometer at 3.2m depth (Elev.291.2m) on Dec.17, 1999. 4. Water level measured in piezometer at 3.1m depth (Elev.291.3m) on Jan.4, 2000.</div>														

Note:
1. Open Borehole dry upon completion of drilling.
2. Water level measured in piezometer at 3.7m depth (Elev.290.7m) on Nov.23, 1999.
3. Water level measured in piezometer at 3.2m depth (Elev.291.2m) on Dec.17, 1999.
4. Water level measured in piezometer at 3.1m depth (Elev.291.3m) on Jan.4, 2000.

ON MOT 991-1162.GPJ ON MOT.GDT 5/1/00

PROJECT 991-1162		RECORD OF BOREHOLE No 11		1 OF 2		METRIC						
W.P. 421-98-00		LOCATION N 4882998.594; E 310955.788		ORIGINATED BY SB								
DIST 6 HWY 404		BOREHOLE TYPE 114mm SOLID STEM AUGERS		COMPILED BY DKB								
DATUM GEODETIC		DATE 12.11.99		CHECKED BY ASP								
SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER			TYPE	"N" VALUES					
294.56 0.00	Topsoil		1	50 DO	4							
294.11 0.45	Silty Sand, trace gravel Loose to compact Brown Moist		2	50 DO	23							
293.04 1.52	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		3	50 DO	33							
			4	50 DO	66							
			5	50 DO	60							
290.90 3.66	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Grey Moist (Glacial Till)		6	50 DO	85							
			7	50 DO	95/15							
			8	50 DO	100/0							
			9	50 DO	95/15							
			10	50 DO	100/0							
			11	50 DO	80/15							
			12	50 DO	85/15							
			13	50 DO	100/15							

PROJECT <u>991-1162</u>		RECORD OF BOREHOLE No 11		2 OF 2		METRIC	
W.P. <u>421-98-00</u>		LOCATION <u>N 4882998.594; E 310955.788</u>		ORIGINATED BY <u>SB</u>			
DIST <u>6</u> HWY <u>404</u>		BOREHOLE TYPE <u>114mm SOLID STEM AUGERS</u>		COMPILED BY <u>DKB</u>			
DATUM <u>GEODETIC</u>		DATE <u>12.11.99</u>		CHECKED BY <u>ASP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					
								<div><div></div><div>20406080100</div></div> <div>○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x REMOULDED</div> <div>20406080100</div>					<div><div></div><div>102030</div></div> <div>W_p W W_L</div>					
278.50	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Grey Moist (Glacial Till)		14	SO	DO	100/7.1												
16.06																		
			15	SO	DO	107/15												
276.16			16	SO	DO	100/13												
18.40	END OF BOREHOLE																	
	Note: 1. Open Borehole dry upon completion of drilling.																	

ON MOT 991-1162.GPJ ON MOT GDT 5/1/00

PROJECT 991-1162			RECORD OF BOREHOLE No 12			1 OF 1			METRIC											
W.P. 421-98-00			LOCATION N 4882974.191; E 310945.278			ORIGINATED BY SB														
DIST 6 HWY 404			BOREHOLE TYPE 114mm SOLID STEM AUGERS			COMPILED BY DKB														
DATUM GEODETIC			DATE 8.11.99			CHECKED BY ASP														
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ	GR	SA	SI	CL
295.33 0.00	Silty Sand, trace gravel Compact Brown Moist		1	50 DO	11		295													
2			50 DO	12		294														
3			50 DO	24		293														
293.12 2.21	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		4	50 DO	56		293													
5			50 DO	96		292														
6			50 DO	80		291														
7			50 DO	78/15																
290.46 4.87	END OF BOREHOLE																			
Note: 1. Open Borehole dry upon completion of drilling.																				

PROJECT <u>991-1162</u>		RECORD OF BOREHOLE No 13		1 OF 1	METRIC
W.P. <u>421-98-00</u>	LOCATION <u>N 4883044.816; E 310932.002</u>	ORIGINATED BY <u>SB</u>			
DIST <u>6</u> HWY <u>404</u>	BOREHOLE TYPE <u>114mm SOLID STEM AUGERS</u>	COMPILED BY <u>DKB</u>			
DATUM <u>GEODETIC</u>	DATE <u>11.11.99</u>	CHECKED BY <u>ASP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20 40 60 80 100					W _p	W	W _L		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x REMOULDED											
292.07																	
0.00	Topsoil		1	50 DO	8												
291.77																	
0.30	Sandy Silt, trace clay and gravel Loose to very dense Brown Moist		2	50 DO	38												
290.18			3	50 DO	88												
1.89	Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		4	50 DO	100/0												
289.27																	
2.80	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Brown Moist (Glacial Till)		5	50 DO	123												
			6	50 DO	105												
			7	50 DO	74/15												
			8	50 DO	100/13												
284.45			9	50 DO	100/0												
7.62	END OF BOREHOLE																
	Note: 1. Open Borehole dry upon completion of drilling.																

ON MOT 991-1162 GPJ ON MOT.GDT 5/1/00

PROJECT 991-1162

RECORD OF BOREHOLE No 14

1 OF 1

METRIC

W.P. 421-98-00

LOCATION N 4883020 241; E 310970 723

ORIGINATED BY SB

DIST 6 HWY 404

BOREHOLE TYPE 114mm SOLID STEM AUGERS

COMPILED BY DK8

DATUM GEODETIC

DATE 9.11.99

CHECKED BY ASP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED											
							20	40	60	80	100	10	20	30	GR	SA	SI	CL	
294.58	Silty Sand, trace gravel, occasional organics Loose Brown/grey Moist (Fill) Clayey Silt, some sand, trace gravel, occasional cobbles Hard Brown Moist (Glacial Till)		1	50 DO	7		294									3	31	(66)	
293.89			2	50 DO	20		293												
0.69			3	50 DO	12		292												
			4	50 DO	86		291												
			5	50 DO	105		290												
			6	50 DO	86		289												
			7	50 DO	145		288												
289.00	Sandy Clayey Silt, trace to some gravel, occasional cobbles Hard Brown becoming grey at 7.0m depth Moist (Glacial Till)		8	50 DO	100/15		287												
5.58			9	50 DO	90/15		286												
			10	50 DO	95/15		285												
			11	50 DO	100/15		284												
283.80	END OF BOREHOLE																		
10.78	<p>Note:</p> <ol style="list-style-type: none">1. Open Borehole dry upon completion of drilling.2. Water level measured in piezometer at 5.2m depth (Elev. 289.4m) on Nov. 23, 1999.3. Water level measured in piezometer at 3.2m depth (Elev. 291.4m) on Dec. 17, 1999.4. Water level measured in piezometer at 3.0m depth (Elev. 291.6m) on Jan. 4, 2000.																		

ON MOT 991-1162 GPJ ON MOT GDT 5/1/00

FIGURE 1

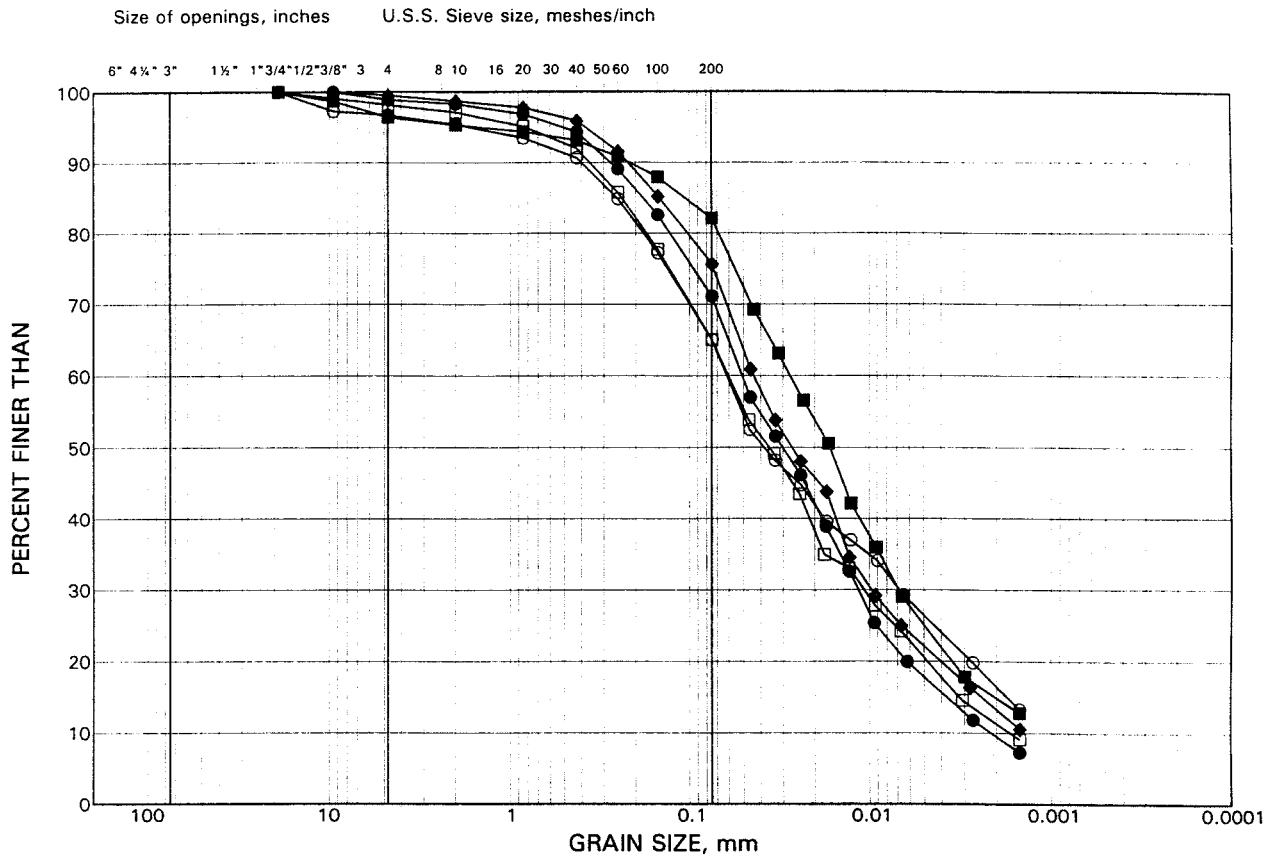


● 10 2 293.0

GRAIN SIZE DISTRIBUTION

Clayey Silt, some sand (Glacial Till)

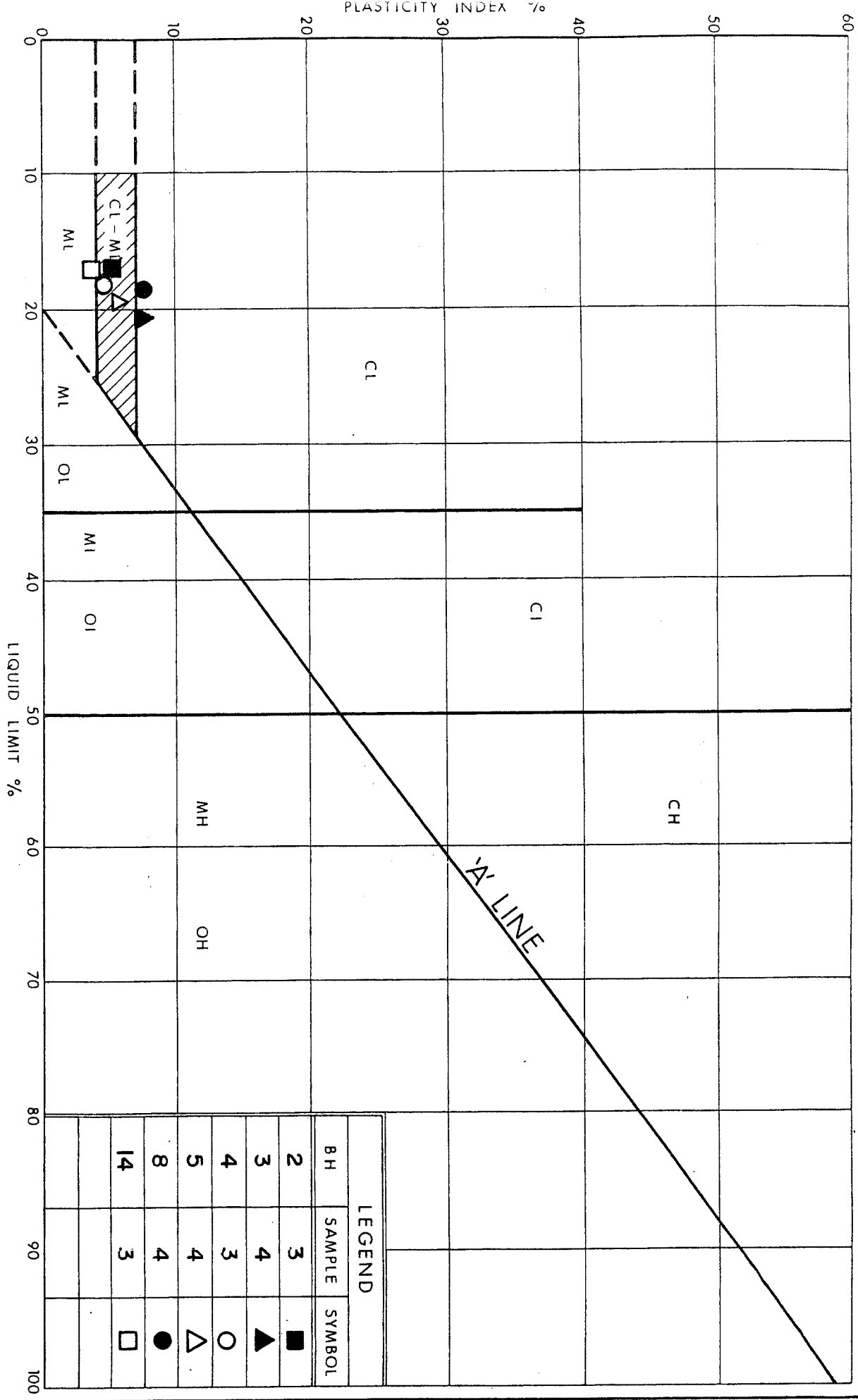
FIGURE 2



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	2	3	290.7
■	3	4	291.8
◆	4	3	292.3
○	8	14	277.5
□	14	3	292.5



LEGEND		
BH	SAMPLE	SYMBOL
2	3	■
3	4	▲
4	3	○
5	4	△
8	4	●
14	3	□

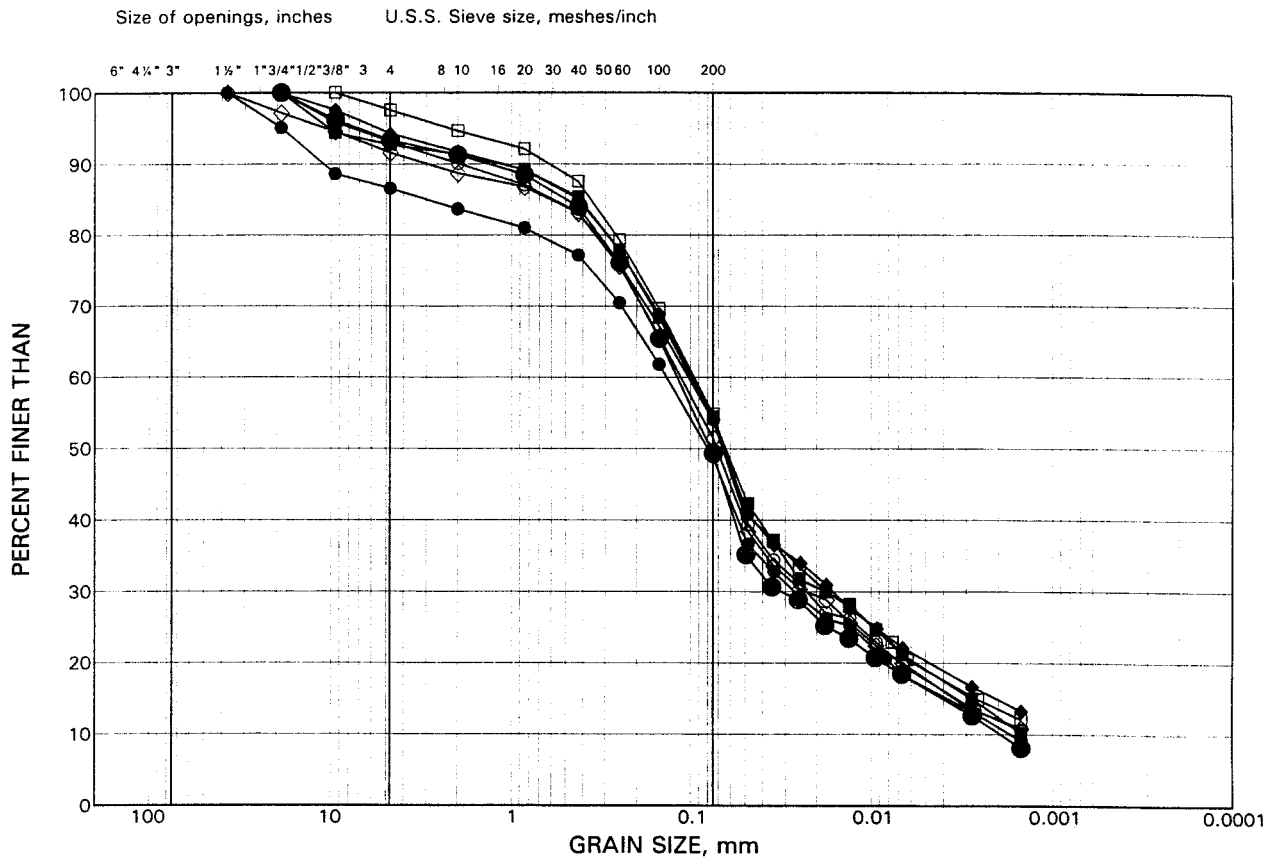
PLASTICITY CHART
CLAYEY SILT (GLACIAL TILL)

FIG No 3
W P 421-98-00

GRAIN SIZE DISTRIBUTION

Sandy Clayey Silt (Glacial Till)

FIGURE 4



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL BOREHOLE SAMPLE ELEVATION(m)

●	1	10	282.8
■	3	9	286.8
◆	4	9	286.5
○	6	5	288.3
□	8	6	289.2
◇	10	9	286.5
●	11	6	290.3

FIG No	5
W P	421-98-00

