

MINISTRY OF TRANSPORTATION OF ONTARIO
1201 WILSON AVENUE
ROOM 315, CENTRAL BUILDING
DOWNSVIEW, ONTARIO
M3M 1J8

MC CLYMONT & RAK ENGINEERS, INC.
GEOTECHNICAL CONSULTANTS

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GEOTECHNICAL CONSULTANTS

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PHILADELPHIA, PENNSYLVANIA - PENNSAUKEN, NEW JERSEY - TAMPA, FLORIDA - TORONTO, CANADA

G1434

July 26, 1993

Ministry of Transportation and Communications
Foundation Design Section
1201 Wilson Avenue
Room 315, Central Building
Downsview, Ontario
M3M 1J8

Attention: Mr. M.S. Devata, P.Eng.

Re: Geotechnical Investigation
Proposed Highway 407
Between Mississauga Road and Hurontario Street
W.O. 93-11008
City of Brampton

Dear Sirs:

McClymont and Rak Engineers Inc. were retained to carry out geotechnical borings for the proposed Highway 407, between Mississauga Road and west of Hurontario Street, in the City of Brampton.

The field investigation was carried out between the period of June 7 and July 6, 1993. The fieldwork comprise twenty boreholes (F601 to F620), accompanied with cone tests. The locations of the boreholes are given in Drawings 1 to 4. The boreholes were staked out, in the field, by Wm. E. Bennett Surveying Limited, retained by the MTO. The co-ordinates and the elevations were provided by the survey firm.

Drilling was subcontracted to Master Soils Investigation Limited. The fieldwork was supervised, on full time basis, by Mr. George Abboud, P.Eng., and Mr. Victor Lukosius. The boreholes were advanced using track mounted auger machines equipped with hollow and solid stem augers.

Samples were recovered by means of a 50 mm O.D. split spoon sampler, driven into the soil according to the specification of the Standard penetration Test (ASTM D 1586-84). In soft to stiff cohesive deposits, relatively undisturbed 75 mm thin walled Shelby tube samples were retrieved. Field vane tests were carried out, using the MTO vane, in the less competent cohesive deposits.

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Observations of groundwater conditions, in the open boreholes, were recorded at the time of drilling; and piezometers were installed in each of the boreholes, to allow measurement of stabilized groundwater levels. In some of the boreholes, two piezometers were nested in the hole, to allow for the measurement of pore water pressure in the upper and lower water bearing strata. Artesian conditions were encountered during drilling of Borehole F609. The hole was plugged, at the source, with bentonite to seal the artesian conditions.

All soil samples were examined, in the laboratory, by our senior geotechnical engineer for textural classification and assignment of laboratory testing. Laboratory testing was carried out on representative samples to identify and determine the physical properties of the overburden including:

- Natural moisture content
- Grain size distribution
- Atterberg Limit
- Unit Weight
- Unconfined Compression test

The soil and the groundwater conditions, along with the field and laboratory test results, are given in the Record of Borehole Sheets (F601 to F620).

Should you have any questions, please do not hesitate to contact our office.

Yours truly,

MCCLYMONT AND RAK ENGINEERS INC.



S. Bandukwala, M.Eng., P.Eng.

SB/mr

RECORD OF BOREHOLE No F601

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,830,663.8, E 283,645.3 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 7, 1993 CHECKED BY SB

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		
186.1	Ground Level													
0.0	Topsoil: 200 mm		1	SS	15	Seal	186							
	Very stiff to hard, heterogeneous, CLAYEY SILT with sand, trace of gravel, mottled to 2.0m, brown, grey below 3.8m, occasional cobbles and boulders, occasional shale and limestone fragments (Glacial Till)		2	SS	39		184						22.3	7 20 45 28
			3	SS	37									
			4	SS	44									
			5	SS	82									
			6	SS	21									
			7	SS	16								22.7	2 15 53 30
			8	SS	24									
			9	SS	30									
			10	SS	49									
			11	SS	100/1	8mm								
			12	SS	100/2	9mm								
173.0			13	SS	100/2	9mm							23.6	9 37 41 13
13.1	Very dense SILTY SAND , some gravel, wet		14	SS	100/1	8mm	Piezometer						15 53 28 4	
172.1														
14.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No F602

METRIC

W.P. W.O. 93-1008 LOCATION Co-ords: N 4,830,700.0, E 283,588.0 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 8, 1993 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
186.2	Ground Level													
0.0	Topsoil: 200 mm		1	SS	11	Seal	186							
	Very stiff to hard, heterogeneous, CLAYEY SILT with sand, trace of gravel, mottled to 2.1m, brown, grey below 3.3m, occasional cobbles and boulders, occasional shale and limestone fragments		2	SS	28		184						21.6	5 22 50 23
			3	SS	39									
			4	SS	47									
			5	SS	51									
			6	SS	34									
			7	SS	24									
			8	SS	34									
			9	SS	64									
	(Glacial Till)		10	SS	56									
			11	SS	46									
			12	SS	107									
	occasional gravelly sand with silt		13	SS	36	Seal	174						23.1	8 30 46 16
173.1			14	SS	35		172							
13.1	Dense to very dense, heterogeneous SANDY SILT, some gravel, trace of clay, reddish-brown, occasional wet sand layers		15	SS	100/127mm	Piezometer	170						23.3	
			16	SS	100/155mm									
	(Glacial Till)		17	SS	100/102mm		168							
167.8														
18.4	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No F603

METRIC

W P W.O. 93-11008

LOCATION Co-ords: N 4,830,920.0, E 283,870.0

ORIGINATED BY GA

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger and Cone Test

COMPILED BY VL/SB

DATUM Geodetic

DATE June 9-10, 1993

CHECKED BY SB

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			20 40 60 80 100	W _p W W _L	W _p W W _L	10 20 30			
179.6	Ground Level													
0.0	Topsoil: 250 mm		1	SS	18									
	Very stiff to hard, heterogeneous CLAYEY SILT with sand, trace to some gravel, brown, grey below 3.8m, reddish-brown below 5.5m, occasional cobbles and boulders, wet sand layers (Glacial Till)		2	SS	29									
			3	SS	89									
			4	SS	92									
			5	SS	79									
			6	SS	101/279mm									
			7	SS	74									
			8	SS	110/229mm									
			9	SS	110									
			10	SS	95									
			11	SS	59									
		Shale fragments below 11.0m		12	SS	100/279mm								
	Wet spoon at 12.8m		13	SS	100/78mm									
166.3	Auger refusal													
13.3	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No F604

METRIC

W P W.O. 93-11008 LOCATION Co-ordes: N 4,831,010.0, E 283,949.9 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 11, 1993 CHECKED BY SB

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100					
178.8	Ground Level												
0.0	Topsoil: 75 mm		1	SS	15	Seal	178						
			2	SS	30								
			3	SS	65								
			4	SS	55								
			5	SS	49								
			6	SS	45								
			7	SS	23								
			8	SS	35								
			9	SS	44								
			10	SS	00/102mm								
			11	SS	03/254mm								
			12	SS	85								
			13	SS	00/127mm								
			14	SS	00/127mm	Seal							
			15	SS	100/75mm	Piezometer							
163.5													
15.3	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

Very stiff to hard,
heterogeneous,
CLAYEY SILT with sand,
trace to some gravel,
mottled to 2.0m,
brown, grey below
4.6m, reddish brown
below 7.6m,
wet sand layer at
6.1m, occasional
cobbles and boulders

Shale fragments
and wet sand/silt
layers below 12.2m

SHEAR STRENGTH kPa
 ○ UNCONFINED + FIELD VANE
 ● QUICK TRIAXIAL x LAB VANE

WATER CONTENT (%)
 10 20 30

kN/m³

GR SA SI CL

RECORD OF BOREHOLE No F605

METRIC

W P W.O. 93-11008

LOCATION Co-ords: N 4,831,657.7, E 284,515.4

ORIGINATED BY GA

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger and Cone Test

COMPILED BY VL/SB

DATUM Geodetic

DATE June 15-16, 1993

CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT	NUMBER	TYPE			20 40 60 80 100	100	W _p	W	W _L		
181.4	Ground Level												
0.0	Topsoil: 300 mm		1	SS	7	Seal						20.2	
	Loose to compact, brown, moist to wet SILTY SAND TO SANDY SILT, trace to some clay, trace of gravel		2	SS	11								2 86 (12)
			3	SS	19								2 16 69 13
			4	SS	23								
177.7			5	SS	13								
3.7	Compact, grey, wet SILT, trace of clay		6	SS	15	Piezometer					ON.P.		0 0 93 7
177.0			7	SS	14								
4.4	SILT AND CLAY, varved, compact (very stiff)		8	TW	PM							19.9	
175.9			9	SS	16								
5.5	Very stiff to hard, heterogeneous, grey CLAYEY SILT with sand, trace of gravel, occasional cobbles and boulders		10	SS	26								7 28 46 19
	(Glacial Till)		11	SS	33								
			12	SS	39								
			13	SS	59							22.8	
168.3			14	SS	104								
13.1	Very dense, grey, heterogeneous SANDY SILT TO SILTY SAND, some gravel, trace to some clay, shale fragments below 16.8m, wet sand/silt layers at 13.7m and 15.5m		15	SS	82								
			16	SS	60/75mm								45 31 15 9
	(Glacial Till)		17	SS	100/152mm								
161.5			18	SS	10925mm								
19.9	End of Borehole												

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No F606

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,831,692.0, E 284,463.0 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 14, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							SHEAR STRENGTH kPo	WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE							
181.6	Ground Level															
0.0	Topsoil 175mm		1	SS	6		181									
	Loose to compact, brown, moist to wet SILTY SAND , trace of clay, trace of gravel		2	SS	5									0 66 (34)		
			3	SS	12											
			4	SS	16									7 60 31 2		
177.9			5	SS	16											
3.7	Loose, brown, wet SILT , some clay		6	SS	6											
176.4			7	SS	8									0 0 86 14		
5.2	SILT AND CLAY varved, loose (stiff)		8	SS	9											
175.5			9	SS	17											
6.1	Very stiff to hard, heterogeneous, grey CLAYEY SILT with sand, trace of gravel, occasional cobbles and boulders (Glacial Till)		10	SS	31											
			11	SS	26									10 30 38 22		
			12	SS	38											
			13	SS	100/178mm									24.2		
167.7	Very dense, wet, GRAVELLY SAND , with silt seams		14	SS	64											
13.9			15	SS	97									23.0		
166.0	Hard, grey, heterogeneous CLAYEY SILT with sand, some gravel, silt seams (Glacial Till)		16	SS	100/279mm											
15.6			17	SS	100/26mm									29 36 (35)		
163.2	End of Borehole													17 31 39 13		
18.4																

RECORD OF BOREHOLE No F607

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,831,860.0, E 284,615.0 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 25-26, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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	NUMBER	TYPE	N' VALUES			20 40 60 80 100	W _p	W	W _L	WATER CONTENT (%)		
169.3	Ground Level													
0.8	Topsoil 175mm		1	SS	3									
	Very loose to loose, moist to wet SILTY SAND, clayey silt till layers, trace of roots to 1.3m		2	SS	5									
			3	SS	4									
166.7			4	SS	15									
2.6	Dense to very dense, wet GRAVELLY SAND, trace of silt		5	SS	35									
			6	SS	61									
164.7			7	SS	75									
4.6	Hard, heterogeneous, grey CLAYEY SILT with sand, trace of gravel, occ. cobbles & boulders (Glacial Till)		8	SS	100/									
			9	SS	48									
162.3			10	SS	100/									
7.0	Very dense, heterogeneous, grey SANDY SILT, some gravel, trace of clay, occasional shale fragments, occasional cobbles and boulders		11	SS	100/									
			12	SS	100/									
158.5	(Glacial Till)													
10.8	End of Borehole													

RECORD OF BOREHOLE No F608

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,832,000.0, E 284,715.0 ORIGINATED BY GA
DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
DATUM Geodetic DATE June 24-25, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
168.5	Ground Level													
0.0	Topsoil: 400 mm		1	SS	5	Seal	168							
167.2	Soft CLAYEY SILT, trace of organics, roots		2	SS	6									
1.3	Dense to compact, wet		3	SS	36									
166.0	SAND AND GRAVEL, some silt		4	SS	22		166							45 42 (13)
2.5	Very stiff, grey, heterogeneous, CLAYEY SILT with sand		5	SS	21									
164.1	(Glacial Till)		6	SS	21	Seal	164							4 27 48 21
4.4	Stiff, grey, SILTY CLAY, trace of sand		7	SS	9									0 2 28 70
162.6			8	TW	PM									
162.3	SILTY SAND AND GRAVEL		9	SS	23		162							
6.2			10	SS	00/229mm	Piezometer								
	Hard, heterogeneous, grey CLAYEY SILT with sand, trace of gravel, occasional cobbles and boulders		11	SS	38		160							
	(Glacial Till)		12	SS	33		158							
			13	SS	35		156							23.0 10 20 42 28
	Clay and silt layers at 13.7m		14	SS	64		154							
			15	SS	00/113mm									
	Wet seams at 16.7m		16	SS	00/38mm		152							
149.9			17	SS	00/122mm									
18.6	End of Borehole													

RECORD OF BOREHOLE No F609

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,832,155.1, E 284,815.0 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 22-23, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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			20 40 60 80 100	20 40 60 80 100	W _p	W	W _L		
168.7	Ground Level													
0.0	Topsoil: 450 mm		1	SS	5									
167.8	Soft CLAYEY SILT, trace of organics, roots		2	SS	8	Seal	168							
0.9	Compact to dense, wet SAND AND GRAVEL, trace of silt		3	SS	38									40 53 (7)
166.4			4	SS	21		166							
2.3	Very stiff, heterogeneous CLAYEY SILT with sand, trace of gravel		5	SS	25									
164.3	(Glacial Till)		6	SS	23									
4.4	Stiff to firm, heterogeneous, grey CLAYEY SILT with sand, trace of gravel		7	SS	20		164		100/179mm					17 26 34 23
	(Glacial Till)		8	SS	16									
			9	TW	PM		162		+2.0					
			10	SS	8		160		+2.0					6 22 32 40
	Very stiff below 10.7m		11	SS	6									
157.1			12	TW	PM		158							19.3
11.6	Compact, grey, wet SILT, some clay		13	SS	22	Seal	156							
155.6			14	SS	37		154							
13.1	Compact to very dense, poorly graded, wet medium SAND, some silt		15	SS	23		152							0 85 (15)
			16	SS	61	Piezometer	150							
150.1			17	SS	97		148							
18.6	Hard, heterogeneous, grey, CLAYEY SILT, some sand, trace of gravel, occasional cobbles and boulders		18	SS	51		146							20.5
	(Glacial Till)		19	SS	46		144							22.8
144.9			20	SS	58									
23.8	Dense, wet SILT, some clay		21	SS	47									
144.0			22	SS	79									
24.7	Very dense, wet SAND AND GRAVEL, some silt													
142.3														44 44 11 1
26.4	End of Borehole					Artesian condition encountered								
	* Artesian head was 0.25m above Ground Level.													

RECORD OF BOREHOLE No F610

METRIC

W.P. W.O. 93-1008

LOCATION Co-ords: N 4,832,292.1, E 284,903.0

ORIGINATED BY GA

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger and Cone Test

COMPILED BY VL/SB

DATUM Geodetic

DATE July 5-6, 1993

CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa				W _p	W	W _L		
169.7	Ground Level							20 40 60 80 100								
0.0	Topsoil: 300 mm Loose SANDY SILT, trace of roots, org.		1	SS	7	Sea	169									
168.4			2	SS	9											
1.3	Compact, brown, SILT AND SAND, trace gravel,		3	SS	18											
166.8	trace clay (Glacial Till)		4	SS	18	Piezometer	167									
2.9	Stiff to very stiff CLAYEY SILT		5	SS	19											
165.1	(Glacial Till)		6	SS	18											
4.6	Very stiff to firm, heterogeneous, grey CLAYEY SILT with sand, trace of gravel		7	SS	14		165	100/254mm								
			8	TW	PM											
			9	SS	8		163	+1.5								
	(Glacial Till)		10	SS	8		161	+1.3								
			11	TW	PM											
			12	SS	11		159	+1.5								
			13	SS	12		157	+1.3								
155.1			14	SS	18	Seal	155									
14.6	Loose, grey, wet SILT, trace of clay		15	SS	8											
153.6			16	SS	29		153									
16.1	Compact to very dense, fine to medium wet SAND, some gravel, trace of silt		17	SS	100/76mm		151									
			18	SS	100/02mm	Piezometer	149									
148.1			19	SS	100/52mm											
21.6	End of Borehole															

RECORD OF BOREHOLE No F611

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,832,435.0, E 284,996.0 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 29-30, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
171.9	Ground Level													
0.0	Topsoil: 250 mm Loose to dense SAND AND GRAVEL, trace roots & organics to 1.5m, clay seams		1	SS	8	Seal	171							53 38 (9)
169.6			2	SS	45									
			3	SS	21									
2.3			4	SS	25		169							
	Very stiff to firm, heterogeneous, grey CLAYEY SILT with sand, trace of gravel		5	SS	20									2 20 48 30
			6	SS	19									
			7	SS	23		167							
			8	SS	19									
			9	SS	14									
	firm to stiff		10	TW	PM		165		1.6					
	(Glacial Till)		11	SS	15									1 17 47 35
			12	SS	15		163		2.6					
			13	TW	PM				0.9					
160.9			14	SS	46	Seal	161							20.4
11.0														
	Very dense, grey, wet SAND, some silt, trace of gravel, clayey silt till layers below 13.7m		15	SS	100/254mm		159				N.P.			7 79 (14)
			16	SS	100/279mm									
			17	SS	72		157							
			18	SS	100/178mm		155							
154.2						Seal								
17.7			19	SS	100/178mm		153							0 98 (2)
	Very dense, poorly graded, wet, medium SAND					Piezometer								
151.9			20	SS	100/203mm									
20.0	End of Borehole													

RECORD OF BOREHOLE No F612

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,832,656.0, E 285,133.0 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 26 and June 28, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80
179.1	Ground Level															
0.0	Topsoil: 200 mm		1	SS	10								20.8			
	Very stiff to hard, heterogeneous, grey CLAYEY SILT, some sand trace of gravel (Glacial Till)		2	SS	26										3	18
			3	SS	48										47	32
			4	SS	51											
			5	SS	51											
			6	SS	24											
174.1			7	SS	48											
5.0	Dense, heterogenous, grey SANDY SILT, trace of gravel, trace to some clay, occasional wet sand/silt layers (Glacial Till)		8	SS	31								23.2		6	26
			9	SS	28										53	15
			10	SS	31										0	20
169.9			11	SS	47								23.2		78	2
9.2	Very stiff to hard, heterogeneous, grey CLAYEY SILT, trace of sand, trace of gravel, probable cobbles and boulders 200mm thick wet silt layer at 15.5m (Glacial Till)		12	SS	48											
			13	SS	30											
			14	SS	25											
			15	SS	42											
			16	SS	23											
			17	SS	19											
159.9			18	SS	46											
19.2	Dense to very dense, heterogeneous, grey SANDY SILT, trace to some gravel, trace of clay, occasional wet sand/silt layers (Glacial Till)		19	SS	51										0	3
			20	SS	31										17	33
153.9			21	SS	38										48	2
25.2	Very dense, wet, medium SANDY SILT TO SAND		22	SS	100/152mm										0	39
			23	SS	100/27mm										57	4
149.7			24	SS	81											
29.4	End of Borehole															

+³, x⁵: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No F613

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,833,330.3, E 285,789.9 ORIGINATED BY VL
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 30, 1993 CHECKED BY SB

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			20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
204.9	Ground Level													
0.0	Topsoil: 300 mm Very stiff to hard, heterogeneous, CLAYEY SILT , mottled, brown- grey to brown, some sand, trace gravel (Glacial Till)		1	SS	11	Seal	204						22.4	5 19 51 25
			2	SS	31									
			3	SS	48									
			4	SS	56		202							
201.1			5	SS	140/ 279mm	Seal								
3.8	Very dense, brown SANDY SILT , some clay, dry sand seams (Glacial Till)		6	SS	128/79mm		200						22.5	0 34 57 9
199.7			7	SS	114/78mm									
5.2	Very dense, dry, SILT , some sand, trace clay, trace gravel		8	SS	112/54mm									2 16 77 5
198.6			9	SS	122/229mm								21.7	
6.3	End of Borehole					Piezometer								

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No F614

METRIC

W.P. W.O. 93-1008 LOCATION Co-ords: N 4,833,370.0, E 285,719.9 ORIGINATED BY VL
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE July 1, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%) W _p W W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE							
204.9	Ground Level										
0.0	Topsoil: 400 mm		1	SS	9						
	Hard, heterogeneous, CLAYEY SILT with sand, mottled, brown-grey to brown, trace of gravel (Glacial Till)		2	SS	49	Seal					
			3	SS	54						
			4	SS	114						
			5	SS	95/51mm	Seal					
			6	SS	66/178mm						
200.0			7	SS	70						
4.9	Hard, varved, CLAY AND SILT, sand seams		8	SS	113						
198.6			9	SS	129/203mm	Piezometer					
6.3	End of Borehole										

+3, x⁵: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No F615

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,833,775.0, E 286,329.9 ORIGINATED BY VL
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 29, 1993 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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			20 40 60 80 100						
202.4	Ground Level												
0.0	Organic stained clayey silt, topsoil		1	SS	6	202							
0.6			2	SS	24								
			3	SS	44								
			4	SS	67								
			5	SS	48								
			6	SS	43								
			7	SS	23								
			8	SS	31								
			9	SS	57								
			10	SS	100/2								
			11	SS	119/2								
192.5													
9.9	End of Borehole												

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No F616

METRIC

W.P. W.O. 93-1008

LOCATION Co-ords: N 4,833,791.9, E 286,258.0

ORIGINATED BY GA

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger and Cone Test

COMPILED BY VL/SB

DATUM Geodetic

DATE June 17, 1993

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
202.1	Ground Level												
0.0	Topsoil: 100mm		1	SS	9								
	Very stiff to hard, heterogeneous, CLAYEY SILT with sand, trace of gravel, mottled to brown, grey below 3.8m, occasional wet sand layers, occasional cobbles and boulders (Glacial Till)		2	SS	29							22.0	6 29 44 21
			3	SS	52							23.2	
			4	SS	45								
			5	SS	66								
			6	SS	27								
			7	SS	23								
			8	SS	45								
			9	SS	33								
			10	SS	28								
192.0				11	SS	31							
10.1	Very dense, wet GRAVELLY SAND, some silt		12	SS	52							22.59 (19)	
190.5													
11.6	Very dense, wet SILT, some sand, trace of clay		13	SS	00/203mm								
189.0													
13.1	Very dense, heterogeneous SANDY SILT, wet sand layers, some gravel (Glacial Till)		14	SS	00/102mm							16.42 37 5	
186.7													
15.4	End of Borehole		15	SS	00/127mm								

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (% STRAIN AT FAILURE

RECORD OF BOREHOLE No F617

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,833,968.1, E 286,566.3 ORIGINATED BY VL
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 30, 1993 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L	WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES							
201.3	Ground Level											
0.0	Clayey silt (Fill) 300mm		1	SS	6		201					
0.3	Very stiff to hard, heterogeneous, CLAYEY SILT with sand, trace of gravel (Glacial Till)		2	SS	26							
			3	SS	81							
198.4			4	SS	62							
2.9			5	SS	97							
	Very dense, heterogeneous SAND AND SILT , some gravel, trace clay, wet below 4.4m, occasional cobbles and boulders (Glacial Till)		6	SS	14/229mm		199					
			7	SS	14/229mm							
			8	SS	67/254mm							
194.8			9	SS	78/229mm							
6.5	End of Borehole											

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No F618

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,834,050.1, E 286,683.2 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 18, 1993 CHECKED BY SB

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT Wp NATURAL MOISTURE CONTENT W LIQUID LIMIT Wl WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
200.5	Ground Level									
0.0	Topsoil: 600mm		1	SS	10					
	Very stiff to hard, heterogeneous, CLAYEY SILT with sand, trace of gravel, brown, grey below 3.3m, sand seam at 3.8m (Glacial Till)		2	SS	16					
			3	SS	35					
			4	SS	31					
			5	SS	35					
			6	SS	33					
			7	SS	33					
195.0	Very dense, heterogeneous SAND AND SILT, some clay, some gravel, wet at 7.6m (Glacial Till)		8	SS	00/52mm					
5.5			9	SS	00/25mm					
			10	SS	00/102mm					
192.8										
7.7	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No F619

METRIC

W P W.O. 93-1008 LOCATION Co-ords: N 4,834,151.8, E 286,811.8 ORIGINATED BY GA
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY VL/SB
 DATUM Geodetic DATE June 18, 1993 CHECKED BY SB

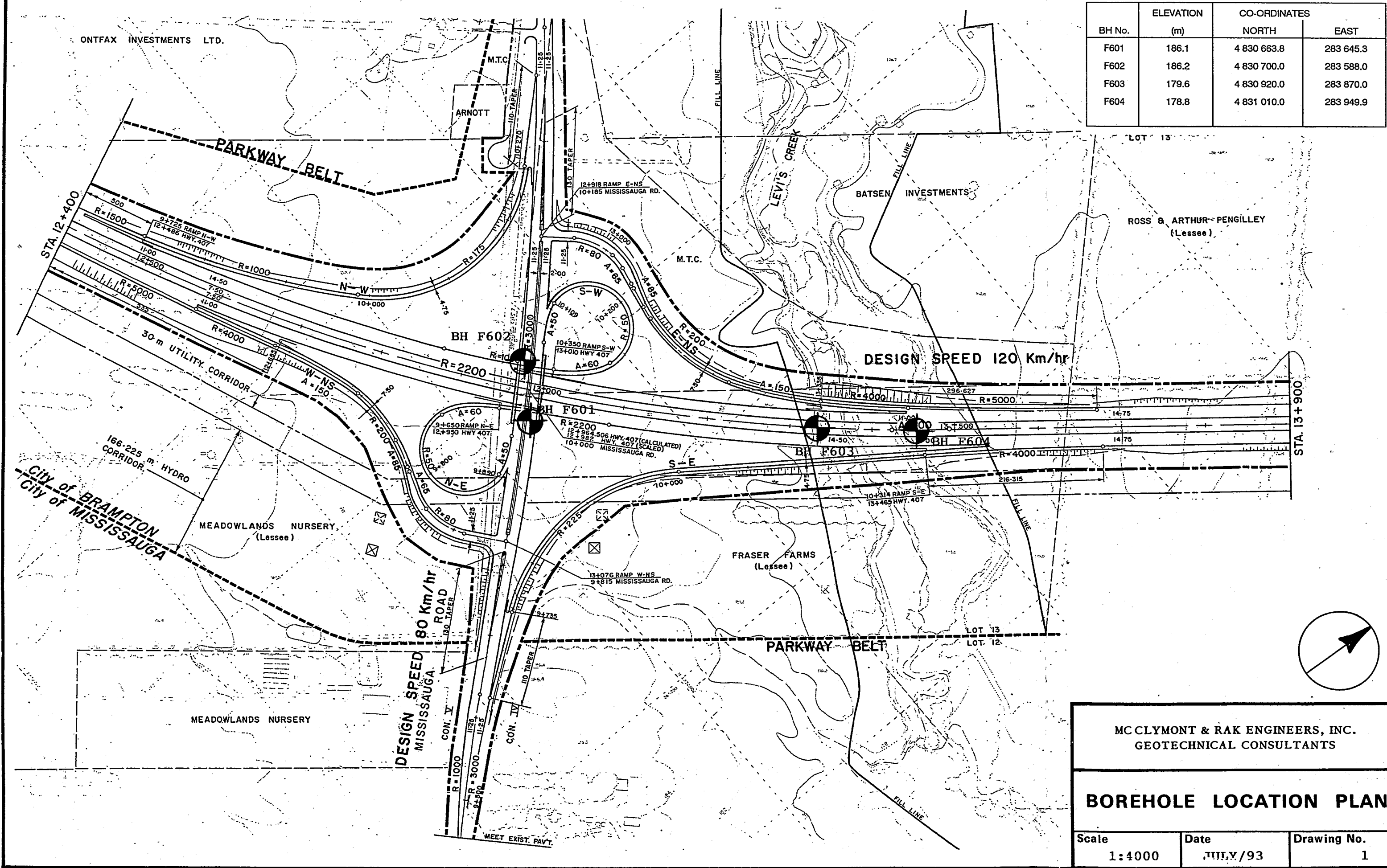
OFFICE REPORT ON SOIL EXPLORATION

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100		W _p	W	W _L		
196.8	Ground Level												
0.0	Topsoil: 200mm Firm to stiff CLAYEY SILT, brown		1	SS	5							20.8	
195.3			2	SS	10								
1.5	Hard, heterogeneous, grey, CLAYEY SILT with sand, silt seams		3	SS	107/254mm								
			4	SS	74								
			5	SS	100/279mm							23.8	6 37 46 11
192.5	(Glacial Till)		6	SS	107/229mm								
4.3	Very dense, heterogeneous SAND AND SILT, some gravel, trace clay, wet to moist, occasional cobbles and boulders		7	SS	128/203mm								
			8	SS	100/127mm								
			9	SS	100/152mm							22.6	12 43 41 4
188.9	(Glacial Till)												
7.9	End of Borehole		10	SS	100/52mm								

<div style="display: flex; justify-content: space-between;"> RECORD OF BOREHOLE No F620 METRIC </div>													
W P <u>W.O. 93-1008</u>		LOCATION <u>Co-ords: N 4,834,217.3, E 286,887.7</u>				ORIGINATED BY <u>VL</u>							
DIST <u>6</u> HWY <u>407</u>		BOREHOLE TYPE <u>Solid Stem Auger with Cone Test</u>				COMPILED BY <u>VL/SB</u>							
DATUM <u>Geodetic</u>		DATE <u>June 30, 1993</u>				CHECKED BY <u>SB</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	20 40 60 80 100	W _p W W _L	10 20 30			
196.8	Ground Level												
196.9	Very loose, SILTY SAND roots, brown		1	SS	3								
0.5	Very stiff to hard, CLAYEY SILT with sand, (Glacial Till)		2	SS	28								
194.7			3	SS	39	Seal							
2.1	Very dense, heterogeneous SAND AND SILT, trace to some gravel, trace of clay, moist, wet at 6.0m, occasional cobbles and boulders		4	SS	75								
			5	SS	75								
			6	SS	57								
			7	SS	100/13mm								
			8	SS	15/152mm								
190.5	(Glacial Till)		9	SS	0.5/0.4mm								
6.3	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

BH No.	ELEVATION (m)	CO-ORDINATES	
		NORTH	EAST
F601	186.1	4 830 663.8	283 645.3
F602	186.2	4 830 700.0	283 588.0
F603	179.6	4 830 920.0	283 870.0
F604	178.8	4 831 010.0	283 949.9

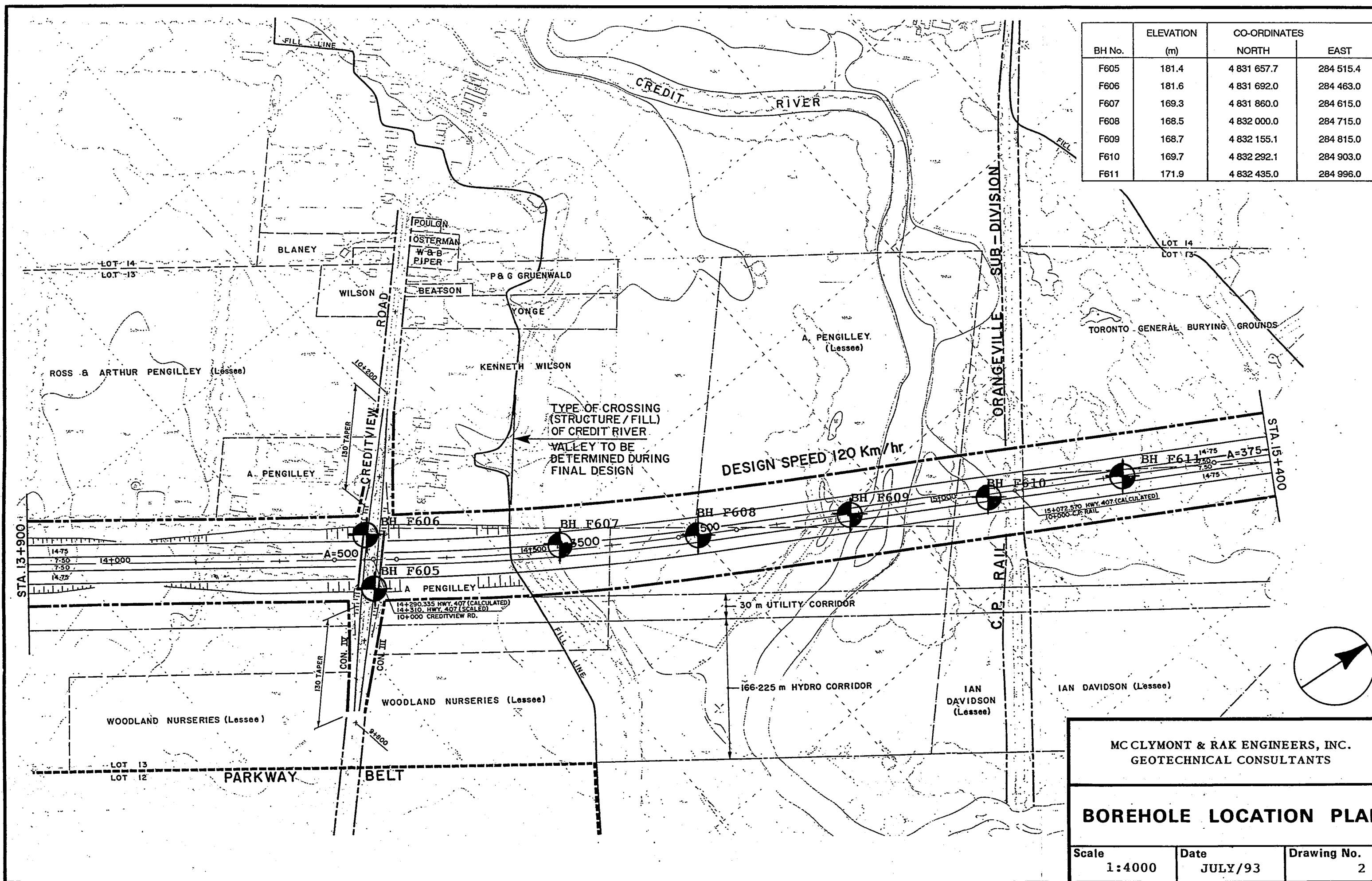


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GEOTECHNICAL CONSULTANTS

BOREHOLE LOCATION PLAN

Scale 1:4000	Date JULY/93	Drawing No. 1
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BH No.	ELEVATION (m)	CO-ORDINATES	
		NORTH	EAST
F605	181.4	4 831 657.7	284 515.4
F606	181.6	4 831 692.0	284 463.0
F607	169.3	4 831 860.0	284 615.0
F608	168.5	4 832 000.0	284 715.0
F609	168.7	4 832 155.1	284 815.0
F610	169.7	4 832 292.1	284 903.0
F611	171.9	4 832 435.0	284 996.0

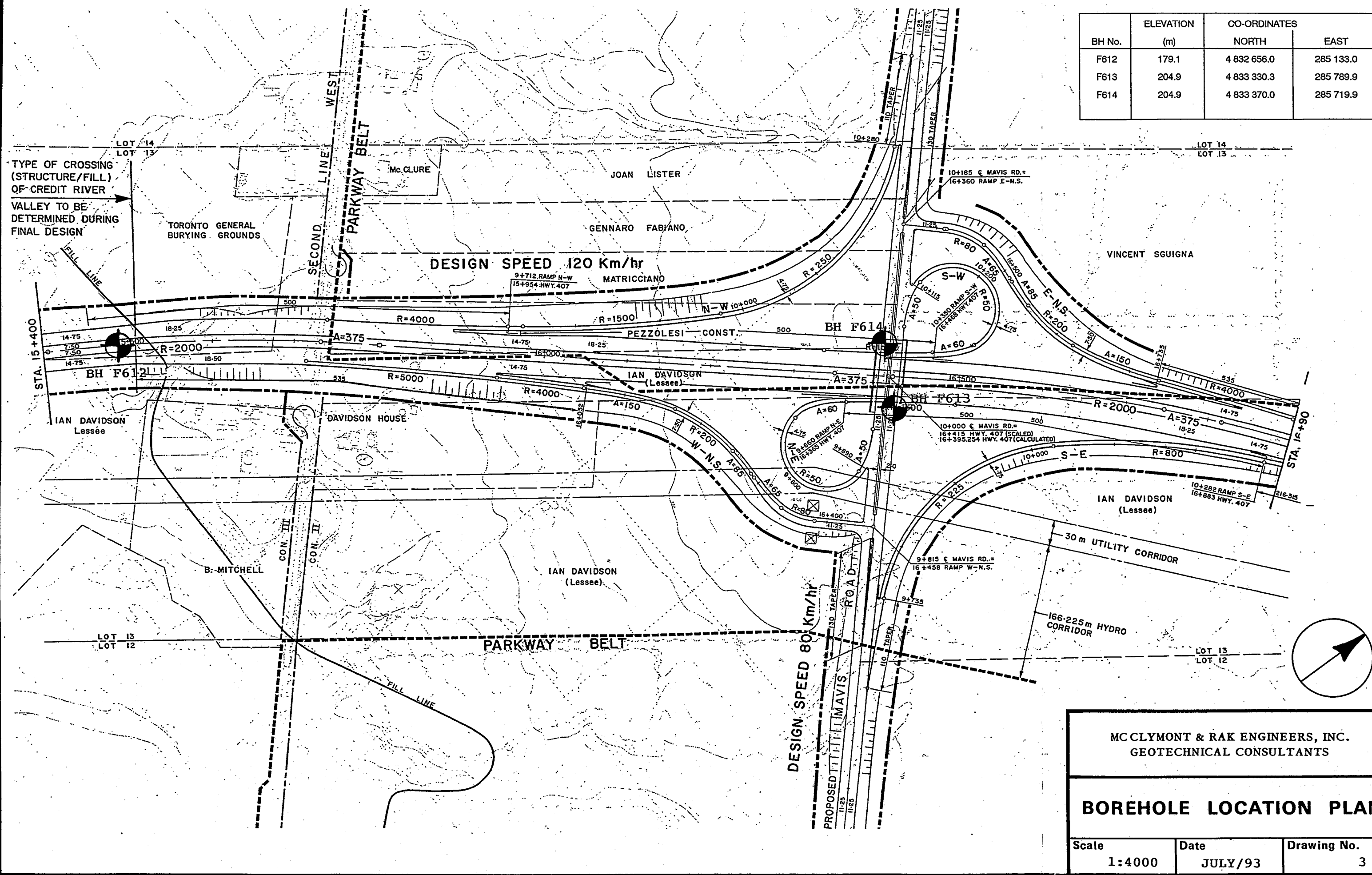


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GEOTECHNICAL CONSULTANTS

BOREHOLE LOCATION PLAN

Scale 1:4000	Date JULY/93	Drawing No. 2
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BH No.	ELEVATION (m)	CO-ORDINATES	
		NORTH	EAST
F612	179.1	4 832 656.0	285 133.0
F613	204.9	4 833 330.3	285 789.9
F614	204.9	4 833 370.0	285 719.9

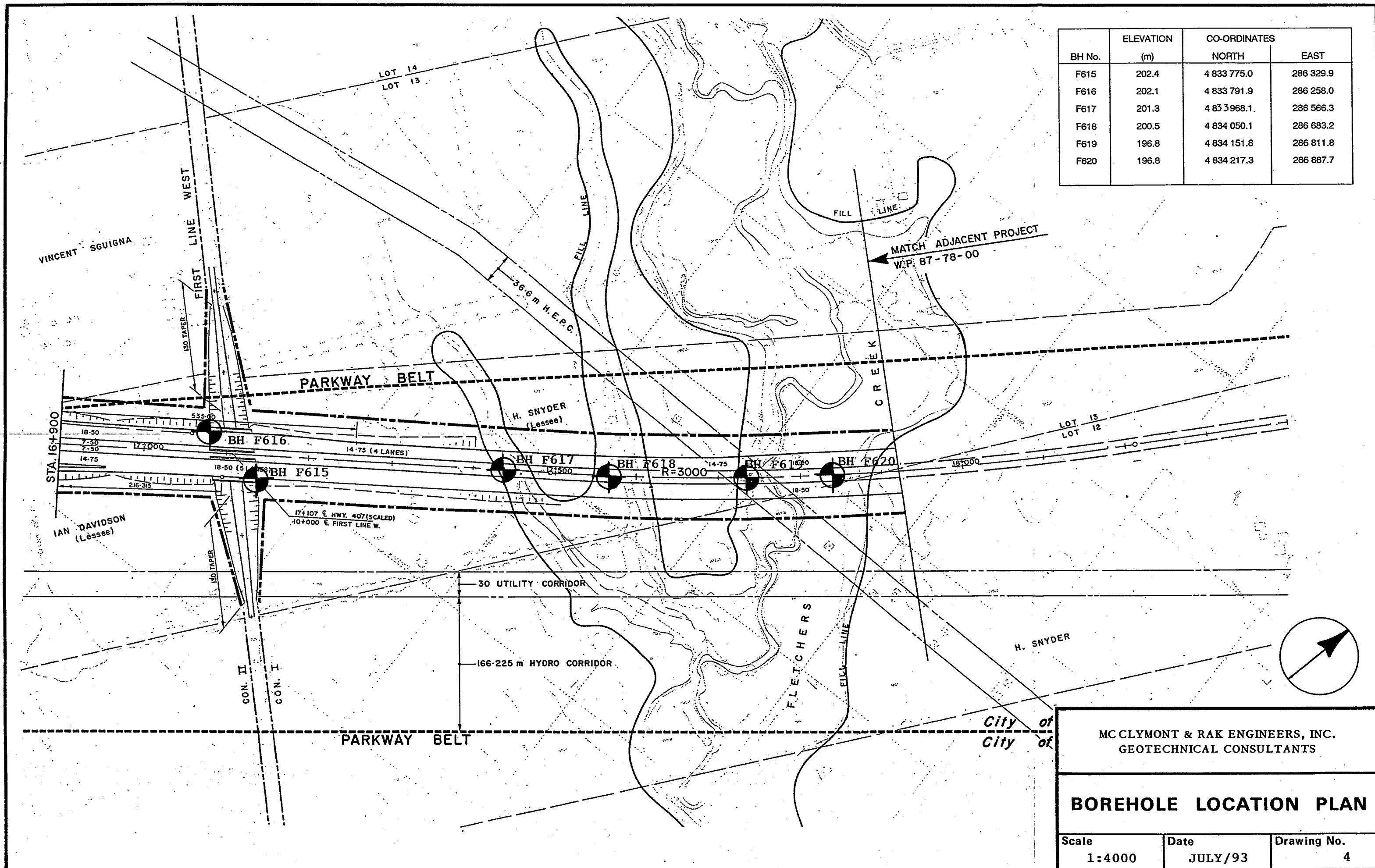


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GEOTECHNICAL CONSULTANTS

BOREHOLE LOCATION PLAN

Scale	Date	Drawing No.
1:4000	JULY/93	3

BH No.	ELEVATION (m)	CO-ORDINATES	
		NORTH	EAST
F615	202.4	4 833 775.0	286 329.9
F616	202.1	4 833 791.9	286 258.0
F617	201.3	4 833 968.1	286 566.3
F618	200.5	4 834 050.1	286 683.2
F619	196.8	4 834 151.8	286 811.8
F620	196.8	4 834 217.3	286 887.7



MC CLYMONT & RAK ENGINEERS, INC. GEOTECHNICAL CONSULTANTS		
BOREHOLE LOCATION PLAN		
Scale 1:4000	Date JULY/93	Drawing No. 4