

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M4-81

DIST. 4 REGION

W.P. No. 36-84-00

CONT. No.

W. O. No.

STR. SITE No. 36

HWY. No. 6 NEW

LOCATION HWY 403 TO HWY 6,
CALEDONIA, PRELIMINARY

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



LOOKING NORTH ALONG WHITE CHURCH RD.
TOWARDS 6N SITE



LOOKING SOUTH ALONG CHIPPAWA RD.
TOWARDS 6N SITE

HWY. 6 NEW



LOOKING NORTH ALONG CONCESSION 7 RD.
TOWARDS 6N SITE



LOOKING NORTH ALONG TOWNLINE RD.
TOWARDS 6N SITE

HWY. 6 NEW



LOOKING WEST TOWARDS END OF
HWY. 6 (BYPASS)



LOOKING ALONG HWY. 403 EASTBOUND
TOWARDS 403/6N SITE

HWY. 6 NEW



LOOKING WESTBOUND ALONG HWY. 53
TOWARDS 6N/HWY. 53 SITE



LOOKING EAST ALONG BOOK RD.
TOWARDS 6N SITE

HWY. 6 NEW



LOOKING NORTH ALONG UNITY RD.
TOWARDS 6N SITE



LOOKING NORTH ALONG HWY. 6 (BYPASS)
TOWARDS GREENS RD.



LOOKING EAST ALONG BUTTER RD.
TOWARDS 6N SITE



LOOKING SOUTH ALONG GLANCASTER RD.
TOWARDS 6N SITE



Ministry of
Transportation and
Communications

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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

memorandum



Tel: 3731

To: G.C. Burkhardt
Head, Structural Section
Central Region

Date: 1987 02 06

Atten: R.A. Jeffries

From: Foundation Design Section
Room 315, Central Building

RE: W.P. 36-84-00
Highway 6 New
Foundation Recommendations

GEOCRES No 30M4-81

Please find enclosed preliminary foundation recommendations for the above-mentioned project. Also included are copies of the Record of Borehole Sheets.

If there are any questions regarding the contents, do not hesitate to contact our office.

B. Bennett

B. Bennett
Jr. Foundations Engineer

BB/mmj

Encl.

c.c. - P. Shaver

*→ original log sheets on desk.
also field log sheets, notes.*

Two distinct depositional environments were found to exist in the area covered by the proposed roadway. A deltaic deposit known as the Norfolk Sand Plain exists toward the north end and was encountered at Sites 14 and 16. The remaining sites, 1 through 11, fall within the Haldimand Clay Plain characterizing a glacio-lacustrine environment.

The general topography of the area is of relatively low relief. Land use is primarily agricultural and sparsely residential.

Preliminary foundation recommendations are presented for each site and Record of Borehole sheets are attached. It should be noted that the recommendations are of a preliminary nature and that further foundation investigations will be required when design details are finalized.

General Recommendations

The following recommendations are standard and pertain to all sites.

Footings

For frost protection, a minimum cover of 1.2 m is recommended. Structures for which the abutments are to be perched on compacted Granular 'A' fill, should be constructed in accordance with the scheme presented in Figure 2. The following design values are recommended:

Factored Bearing Capacity at U.L.S. = 900 kPa

Bearing Capacity at S.L.S. Type II = 350 kPa

For design purposes, an unfactored friction coefficient of 0.55 may be assumed to apply between the footing and the granular pad.

Approaches

No stability problems are anticipated for the fill heights proposed given that slopes of 2:1 are maintained.

Earth Pressure

Backfill to structures should consist of granular material in accordance with MTC Standard Special Provision #121 (83 10). Computation of earth pressures should be in accordance with Section 6.6.1.2 of the O.H.B.D.C.

Preliminary Foundation Report
For
Highway 6 New: Preliminary Study
Hwy. 403 to Caledonia By-Pass
W.P. 36-84-00 Site 36
District 4, Burlington

GEOLRES No 30M4-81

Introduction

This preliminary report is a summary of the foundation investigation results obtained at the proposed structure locations along Highway 6 New.

The proposed alignment extends approximately 25 km from Highway 403 south to the existing Caledonia By-Pass. There are sixteen structure locations along the stretch of new highway. These consist of twelve road crossings, two creek crossings and two interchanges as shown in Figure 1. For this investigation the sites of the proposed structure locations are numbered, increasing consecutively from south to north. Although sixteen investigations were planned, only thirteen were conducted. Foundation investigations at site numbers 12, 13 and 15 will be carried out at a later date.

The fieldwork was conducted during the period from 86 07 30 to 86 09 19. The work consisted of 25 sampled boreholes with dynamic cone penetration tests. Two boreholes were advanced at each site at the proposed abutment locations with rock coring performed in one of the two boreholes. Only one borehole with rock coring was advanced at Site #3.

General Description

The sites are located in the geographic townships of Ancaster and Haldimand, Wentworth Region. The proposed highway will extend from the existing Caledonia By-Pass and run parallel to and approximately 500 m west of the existing Highway 6. An interchange for the Hamilton Airport is proposed between Whitechurch and Airport Roads, at which point the highway will veer west, crossing Glancaster Road, then bend northward again running parallel to and between Fiddlers Green and Southcote Roads to Highway 403.

For design purposes, the physical properties of the backfill are as follows:

<u>Material</u>	ϕ	γ
Granular 'A'	35°	22.0 kN/m ³
Granular 'B'	30°	21.2 kN/m ³

File Foundations

Where end bearing piles founded on bedrock are recommended the following design loads are to be used:

	<u>HP 310 x 110</u>	<u>HP 310 x 79</u>
Factored Bearing Capacity at U.L.S.	1600 kN/pile	1150 kN/pile
Capacity at S.L.S. Type II	1150 kN/pile	825 kN/pile

Dewatering

Where excavation for footings and pile caps is required below the groundwater level, dewatering problems are not anticipated.

Recommendations

Site #1 - Green Road

Alternative 1: Abutments perched within the approaches on compacted Granular 'A' fill with design loads and sliding resistance coefficient as recommended.

Alternative 2: End bearing piles driven to bedrock.
Either HP 310 x 110 or HP 310 x 79 may be used with design loads as specified.
Pile Tip Elevation: 186.7 m

Alternative 3: Spread footings on original ground.
Recommended design values are as follows:

Factored Bearing Capacity at U.L.S. 280 kPa
Bearing Capacity at S.L.S. Type II 190 kPa

The lateral sliding resistance between the footing and the cohesive foundation material may be assumed to be 60 kPa. The footings should be founded at or below El. 207.0.

Site #2 - Creek Crossing

Alternative 1: Abutments perched within the approaches on compacted Granular 'A' fill with design loads and sliding resistance as recommended.

Alternative 2: Spread footings founded on original ground constructed with the following design parameters:

Factored Bearing Capacity at U.L.S. 420 kPa

Bearing Capacity at S.L.S. Type II 280 kPa

At the South Abutment, the footing should be placed at or below El. 198.0. The North Abutment footing elevation is recommended at or below 201.0.

The sliding resistance between the footing and the ground surface may be assumed to be 95 kPa.

Alternative 3: A rigid frame open culvert may be used at this location. The footings should be placed 1.2 m below the creek invert to protect against frost susceptibility. The recommended footing elevation should be at or below 198.0. The bearing capacities may be considered the same as those specified in Alternative 2.

Alternative 4: End bearing piles driven to bedrock. Either HP 310 x 110 or HP 310 x 79 may be used with the design loads as recommended.

Pile Tip Elevation: 190.2 m

Site #3 - Unity Road

The recommended foundations at this site are spread footings founded on original ground. The design values are given as follows:

Factored Bearing Capacity at U.L.S. 600 kPa

Bearing Capacity at S.L.S. Type II 400 kPa

Recommended depth of the footings is 1.2 m below original ground surface, at or below El. 216.7. The sliding resistance between the footing and the ground surface may be assumed to be 115 kPa.

A 9 m cut is proposed at this location. The cut should be maintained at a 2:1 slope.

Site #4 - Townline Road

Alternative 1: Abutments perched within the approaches on compacted Granular 'A' fill with design loads and sliding resistance as recommended.

Alternative 2: Spread footings founded on original ground. The following design values are recommended for footings constructed at or below El. 212.5:

Factored Bearing Capacity at U.L.S. 285 kPa

Bearing Capacity at S.L.S. Type II 190 kPa

The sliding resistance between the footing and the ground surface may be assumed to be 35 kPa.

Alternative 3: End bearing piles founded on bedrock. Either HP 310 x 110 or HP 310 x 79 may be used in accordance with the design values provided.

Pile Tip Elevation: 192.5 m

Site #5 - Leeming Road

Alternative 1: Abutments perched within the approaches on compacted Granular 'A' fill with the design values prescribed.

Alternative 2: Spread footings founded on original ground. The following design values are recommended:

Factored Bearing Capacity at U.L.S. 420 kPa

Bearing Capacity at S.L.S. Type II 280 kPa

Footing Elevation - East Abutment 216.5

Footing Elevation - West Abutment 215.0

The value for sliding resistance between the footing and the ground may be assumed to be 40 kPa.

Alternative 3: End bearing piles founded on bedrock. Either pile size HP 310 x 110 or HP 310 x 79 may be used observing the design values provided.

Pile Tip Elevation: 191.8 m

Site #6 - Chippawa Road

Alternative 1: Abutments perched within the approaches and founded on compacted Granular 'A' fill, the design values for which have been provided.

Alternative 2: Spread footings founded on original ground.
The design values are given as follows:

Factored Bearing Capacity at U.L.S. 420 kPa
Bearing Capacity at S.L.S. Type II 280 kPa
Footing Elevation 212.5

A value of 35 kPa may be assumed as the
sliding resistance.

Alternative 3: End bearing piles founded on bedrock.
Either HP 310 x 110 or HP 310 x 79 may be used,
observing the design values recommended.
Pile tip elevation: 192.8 m

Site #7 - Creek Crossing

A piled foundation is the recommended alternative
at this location given the nature of the
subsurface material. Either HP 310 x 110 or
HP 310 x 79 may be used, the design values
for which have been provided.

Pile Tip Elevation: 185.7 m

Site #8 - Highway 6 Interchange

Alternative 1: Perched abutments founded on compacted Granular
'A' fill, observing the design values recommended.

Alternative 2: Spread footings founded on original ground.
The following parameters are recommended for the
footing design:
Factored Bearing Capacity at U.L.S. 280 kPa
Bearing Capacity at S.L.S. Type II 190 kPa
Footing Elevation - East Abutment at or below 211.0
Footing Elevation - West Abutment at or below 212.0
Sliding resistance between the footing and original
ground may be assumed to be 35 kPa.

Alternative 3: End bearing piles founded on bedrock.
Pile sizes HP 310 x 110 or HP 310 x 79 may be used
given the recommended design loads.
Pile Tip Elevation: 193.1 m

Site #9 - Whitechurch Road

Alternative 1: Perched abutments on compacted Granular 'A' fill using the design values previously prescribed.

Alternative 2: Spread footings founded on original ground. Footings should be constructed with the following design parameters:

Factored Bearing Capacity at U.L.S. 280 kPa

Bearing Capacity at S.L.S. Type II 190 kPa

Footing Elevation - East Abutment at or below 214.8

Footing Elevation - West Abutment at or below 216.0

A sliding resistance of 28 kPa may be assumed.

Alternative 3: End bearing piles driven to bedrock. Either HP 310 x 110 or HP 310 x 79 may be used with design loads as specified.

Pile Tip Elevation: 192.9 m

A cut is proposed at this location. No stability problems are expected given that slopes are maintained at 2:1.

Site#10 - Airport Interchange

Alternative 1: Perched abutments on compacted Granular 'A' fill using the design values recommended.

Alternative 2: Spread footings founded on original ground. Recommended design parameters are as follows:

Factored Bearing Capacity at U.L.S. 280 kPa

Bearing Capacity at S.L.S. Type II 190 kPa

Footing Elevation - North Abutment 219.8

Footing Elevation - South Abutment 219.0

A coefficient of friction against sliding of 0.35 may be assumed.

Alternative 3: End bearing piles founded on bedrock. Either HP 310 x 110 or HP 310 x 79 may be used given the prescribed design loads.

Pile Tip Elevation: 198.1 m

Site #11 - Glancaster Road

A 2.0 m layer of soft organic material was encountered in the boreholes advanced at this location. Removal of this material is recommended for each alternative.

Alternative 1: Abutments perched within the approaches on compacted Granular 'A' fill, design values for which have been provided.

Alternative 2: Spread footings founded on original ground. Footings should be constructed with the following design parameters:

Factored Bearing Capacity at U.L.S.	280 kPa
Bearing Capacity at S.L.S. Type II	190 kPa
Footing Elevation - North Abutment	216.2
Footing Elevation - South Abutment	216.5

Alternative 3: End bearing piles driven to bedrock. Either HP 310 x 110 or HP 310 x 79 may be used with the prescribed design loads.

Pile Tip Elevation: 194.7 m

Site #14 - Highway 53

Alternative 1: Perched abutments on compacted Granular 'A' fill using the recommended design loads.

Alternative 2: Spread footings founded on original ground. The following are recommended design values:

Factored Bearing Capacity at U.L.S.	420 kPa
Bearing Capacity at S.L.S. Type II	280 kPa
Footing Elevation - East Side at or below	242.0
Footing Elevation - West Side at or below	239.6

A coefficient of friction against sliding of 0.35 may be assumed.

Alternative 3: End bearing piles to bedrock. Either HP 310 x 110 or HP 310 x 79 may be used with the recommended design loads.

Pile Tip Elevation: 215.8 m

Site #16 - Highway 403 Interchange

Alternative 1: Perched abutments on compacted Granular 'A' fill, design values for which have been provided.

Alternative 2: Spread footings on original ground. Footings should be constructed with the following parameters:

Factored Bearing Capacity at U.L.S.	420 kPa
Bearing Capacity at S.L.S. Type II	280 kPa
Footing Elevation - East Abutment	242.6
Footing Elevation - West Abutment	245.0

Miscellaneous

A final report, together with soil descriptions, will be forwarded upon completion of the remaining fieldwork.



B. Bennett
Jr. Foundations Engineer

HIGHWAY 6 NEW - STRUCTURE LOCATIONS

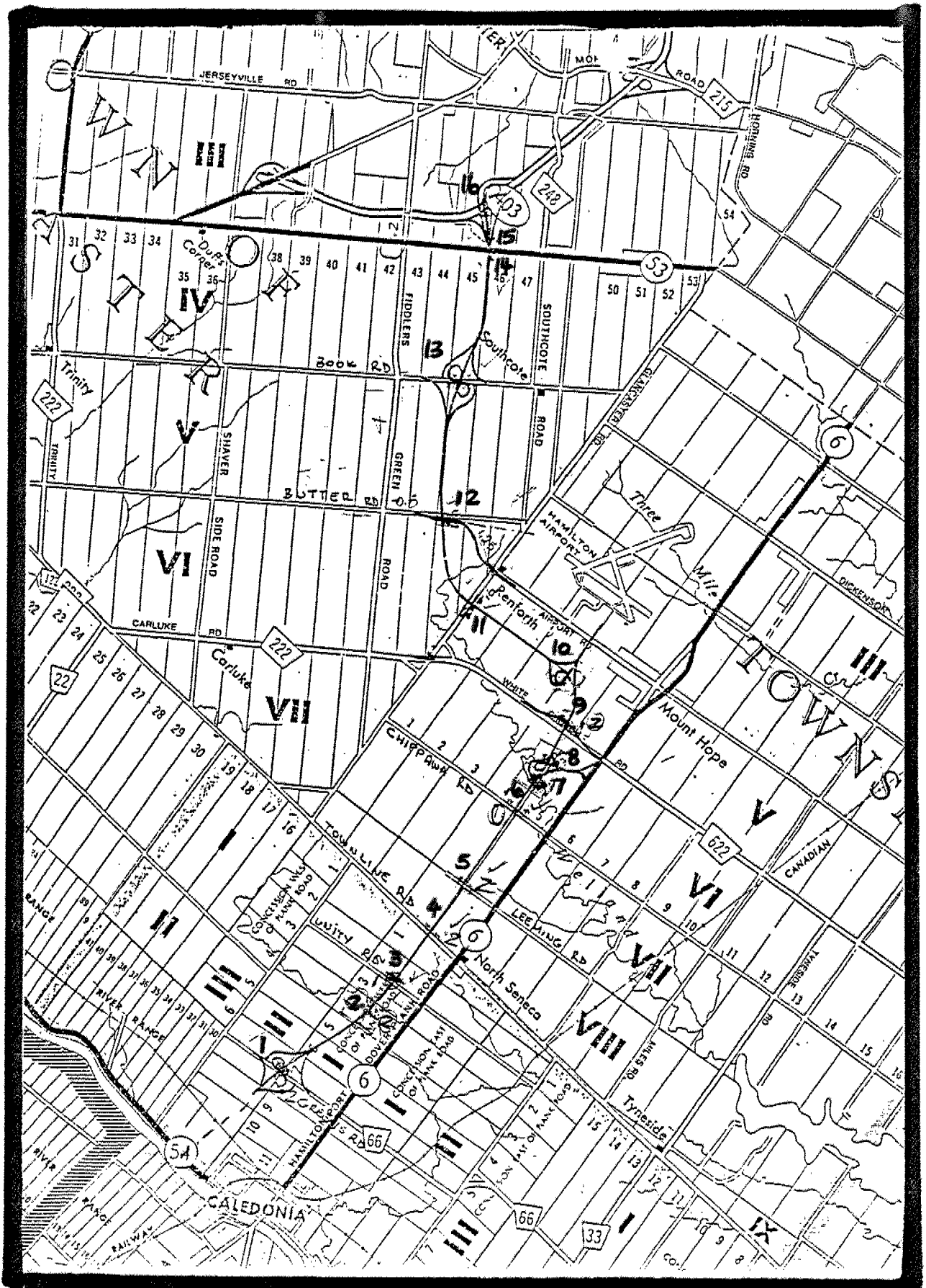
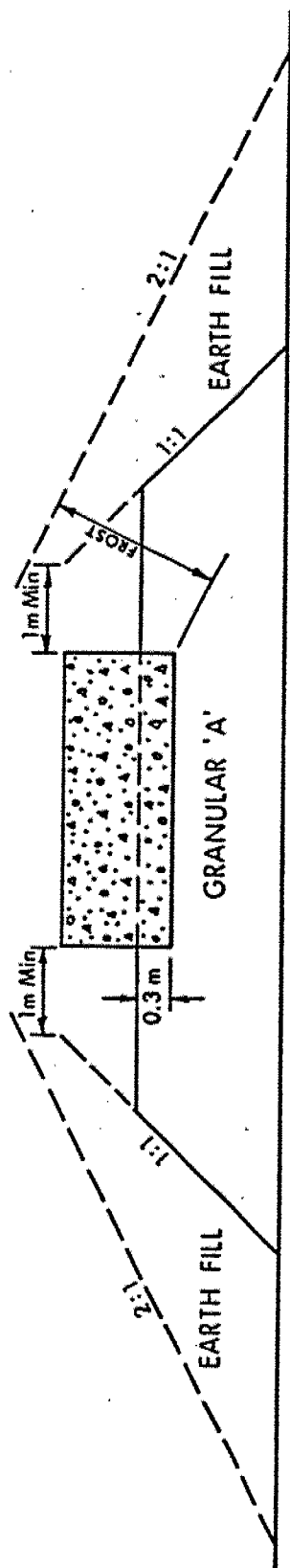
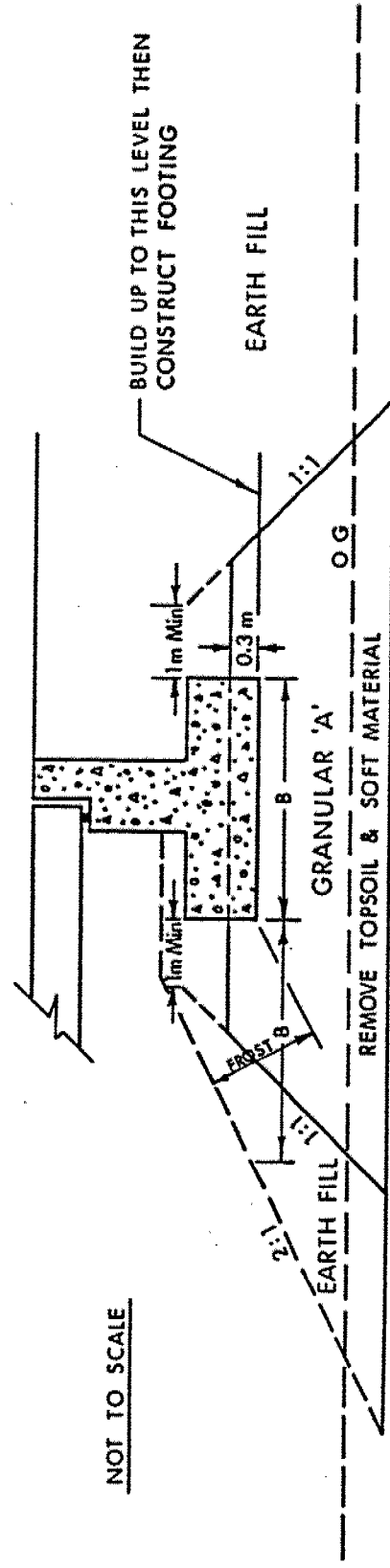


FIGURE 1



X SECTION



NOT TO SCALE

LONGITUDINAL SECTION

- NOTES:
- 1- REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.
 - 2- PLACE GRANULAR 'A' & EARTH FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M T C STANDARDS.
 - 3- CONSTRUCT CONCRETE FOOTING.
 - 4 - PLACE REMAINDER OF GRANULAR 'A' & EARTH FILL AS REQUIRED.

RECORD OF BOREHOLE No 1-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 10+000, o/s 35m Lt (at Greens Rd) ORIGINATED BY WD
DIST CR HWY 6New BOREHOLE TYPE SS Auger, BW Casing, BQ Rock Core COMPILED BY DC
DATUM Geodetic DATE 86-08-18 CHECKED BY BB

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 (%)
								○ UNCONFINED 20 40 60 80 100	+ FIELD VANE × LAB VANE						
208.7	Ground Surface														
0.0	SILTY CLAY Brown with Grey Seams Stiff to Very Stiff		1	SS	21		208						20.8	0 1 (99)	
			2	SS	28		208								
205.8			3	SS	16		208								
2.9	SILT TO SILTY CLAY Trace Sand Very Stiff to Hard		4	SS	33		204						20.8		
204.3			5	SS	24		204								
4.4	SILTY CLAY TO CLAY Occasional silt zones Grey Stiff to Very Stiff		6	SS	10		204						19.0		
			7	SS	10										
			8	SS	9										
			9	SS	11		202								
			10	SS	14		200								
			11	SS	22		198								
			12	TW	PH			196							
			13	SS	13		194								
			14	SS	16		192								
			15	TW	PH		190								
189.2															
18.5	Mixture of Gravel Sand, Silt and Clay Very Dense					/10cm	188								
186.7			16	SS	100										
22.0	BEDROCK Dolomite Slightly weathered		17	RC	REC	75%	186						RQD %		
184.6			18	RC	REC	100%						RQD %			
24.1	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 1-2 1 OF 1 METRIC

WP 36-84-00 LOCATION Sta 10+010, o/s 40m Rt (at Greens Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE Solid Stem Auger COMPILED BY DC
 DATUM Geodetic DATE 86-08-14 CHECKED BY BB

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 ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
208.7	Ground Surface							20 40 60 80 100	20 40 60						
0.0	Trace Organics		1	SS	10		208						21.3	0 1 (99)	
	SILTY CLAY		2	SS	10										
	Brown		3	SS	21		206								
	Stiff to Very Stiff		4	SS	22										
205.2			5	SS	42										
3.5	SILT TO SILTY CLAY		6	SS	26		204								
203.7	Trace Sand		7	SS	10										
5.0	Very Stiff to Hard		8	SS	9										
	SILTY CLAY		9	TW	PH		202								
	Occasional silt zones		10	SS	12		200								
	Grey		11	SS	20		198								
	Stiff to Very Stiff		12	SS	16		196								
	Trace Sand		13	SS	17		194								
			14	SS	18		192								
			15	SS	100		190								
188.0							188								
20.7	Mixture of Gravel														
186.8	Sand, Silt and Clay													10 50 (40)	
	** Very Dense														
21.9	End of Borehole														
	** Auger Refusal														
	Probable Bedrock														

RECORD OF BOREHOLE No 2-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 11+590 Center Line (Seneca Ck Crossing) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger, BQ Rock Core COMPILED BY BB
 DATUM Geodetic DATE 86-09-16 CHECKED BY BB

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 (%)			
								20	40							60	80	100
203.0	Ground Surface																	
0.0	SILTY CLAY Some Sand Trace Gravel Trace Organics Stiff		1	SS	16									1 27 (72)				
201.8			2	SS	37													
1.2			3	SS	61													
			4	SS	74													
	Mixture of Gravel Sand, Silt and Clay Very Stiff to Hard		5	SS	79													
			6	SS	96													
			7	SS	73													
			8	SS	31													
			9	SS	35										4 35 (61)			
			10	SS	26													
			11	SS	60	/2cm												
	BOULDER, COBBLES, GRAVEL	12	RC	REC	20%									RQD %				
	Weathered and Ground Dolostone	13	SS	39														
190.2																		
12.8	BEDROCK Shaley Dolostone with Gypsum unweathered	14	RC	REC	94%									RQD %				
189.3																		
13.7	End of Borehole																	

RECORD OF BOREHOLE No 2-2

1 OF 1

METRIC

WP 38-84-00 LOCATION Sta 11+840 Center Line (Seneca Ck Crossing) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE H.S. Auger COMPILED BY BB
 DATUM Geodetic DATE 86-09-17 CHECKED BY BB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT			UNIT WEIGHT 7 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				
200.9	Ground Surface													
0.0	SILTY CLAY TO CLAY Trace Organics Trace Sand Brown Stiff		1	SS	13									
			2	SS	13									
			3	SS	11									
197.5			4	SS	15									
3.4	Mixture of Gravel Sand, Silt and Clay Dense to Very Dense Grey Brown Trace Gypsum		5	SS	50									
			6	SS	22									
			7	SS	43									
			8	SS	33									
			9	SS	35									
			10	SS	60									
190.4	** Auger Refusal													
10.5	End of Borehole													

+3, x5; Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 3-1

1 OF 1

METRIC

WP 34-84-00 LOCATION Sta 12+150. o/s 50m Rt (at Unity Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE Solid Stem Auger, BW Casing, BQ Rock Core COMPILED BY DC
 DATUM Geodetic DATE 86-08-25 CHECKED BY BB

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 7 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										

217.9	Ground Surface														
0.0	Mixture of Gravel Sand, Silt, and Clay Trace Cobbles Hard		1	SS	39										
			2	SS	52										
			3	SS	73										
			4	SS	95										
			5	SS	52										
			6	SS	36										
			8	SS	60	/45cm									
			9	SS	98										
			10	SS	59										
			11	SS	109	/28cm									
			12	SS	85	/13cm									
			13	SS	85	/13cm									
			14	SS	85	/8cm									
			15	SS	95										
194.7					17	SS	80	/0cm							
23.2	unweathered		18	RC	REC	35%									
193.2	BEDROCK Shaley Colostone with Gypsum		19	RC	REC	95%									
24.7	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4-1										1 OF 1		METRIC		
WP 36-84-00		LOCATION Sta 13+030, o/s 32m Rt (at Townline Rd)				ORIGINATED BY BB								
DIST CR HWY 6New		BOREHOLE TYPE Solid Stem Auger				COMPILED BY BB								
DATUM Geodetic		DATE 86-08-13				CHECKED BY BB								
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					
214.1	Ground Surface													
0.0	SILTY CLAY Trace Sand Brown Stiff		1	SS	11									
212.1			2	SS	15									
2.0	SILT Trace Sand Trace Gravel Brown Compact to Dense		3	SS	33									
			4	SS	41									
			5	SS	48									
209.2			6	SS	23									
4.9	SILTY CLAY Occasional Silt Zones Grey Stiff to Very Stiff		7	SS	12									
			8	SS	14									
			9	SS	16									
			10	TW	PH									
	Trace Sand Trace Gravel		11	SS	17									
			12	SS	14									
197.8			13	TW	PH									
16.3	Mixture of Gravel Sand, Silt, and Clay Very Dense													
195.7		14	SS	70										
18.4	End of Borehole													

RECORD OF BOREHOLE No 4-2

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 13+036, o/s 21m Lt. (at Townline Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE SS Auger, BW Casing, BQ Rock Core COMPILED BY DC
 DATUM Geodetic DATE 88-08-4 CHECKED BY BB

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 (%)				
214.3	Ground Surface							20 40 60 80 100		W _p W W _L				
0.0	SILTY CLAY Trace Sand, Occ. Oxidized Zones Very Stiff		1	SS	21			20 40 60 80 100				20.8	0 2 (98)	
213.1			2	SS	26									
1.2	SILT Trace Sand Trace Clay		3	SS	15									
211.6	Compact		4	SS	15									
2.7	SILTY CLAY Occasional Silt Zones Stiff to Very Stiff		5	TW	PH									
			6	SS	18									
	Brown		7	SS	19									
	Grey		8	SS	13							19.3		
			9	SS	18									
			10	SS	20									
	Trace Sand		11	SS	10							19.5		
			12	SS	10									
			13	SS	11									
			14	SS	28									
197.5			15	SS	80	/8cm								
18.8	Mixture of Gravel Sand, Silt and Clay		16	SS	85	/5cm								
	Grey		17	SS	80	/8cm								
	Very Dense		18	RC	REC	90%								
192.5	BEDROCK													
21.8	Shaley Dolostone Unweathered													
191.0														
23.3	End of Borehole													

RECORD OF BOREHOLE No 5-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 13+912, o/s 26m Rt (at Leeming Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE SS Auger, BQ Core COMPILED BY BB
 DATUM Geodetic DATE 86-08-06 CHECKED BY BB

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 × LAB VANE 20 40 60 80 100	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE 'N' VALUES						
219.0	Ground Surface								
0.0	SILTY CLAY Trace Sand Very Stiff to Hard Brown ----- Grey	1	SS 44		218				
		2	SS 65						
		3	SS 60						
		4	SS 17		216				
		5	SS 18						
		6	SS 21						
213.5		7	SS 28		214				
5.5	SILT Trace Sand Trace Clay Grey Dense to Very Dense	8	SS 70					18.9	0 1 (99)
		9	SS 51		212				
210.9		10	SS 25						
8.1	SILTY CLAY Trace Gravel Trace Sand Occasional Silt Zones Very Stiff	11	SS 21		210				
		12	SS 22		208				
		13	TW PH		206				
		14	SS -		204				
		15	SS 24		202				
		16	SS 34		200			20.3	
		17	SS 23		198				
		18	TW PH		196				
		19	SS 77	/22cm	194				
191.8	Shale Fragments				192				
27.2	BEDROCK Weathered ----- Sound Shaley Dolostone	20	RC REC 42%						RQD %
188.7		21	RC REC 90%		190				RQD %
29.3	End of Borehole								

+3, x5: Numbers refer to
Sensitivity

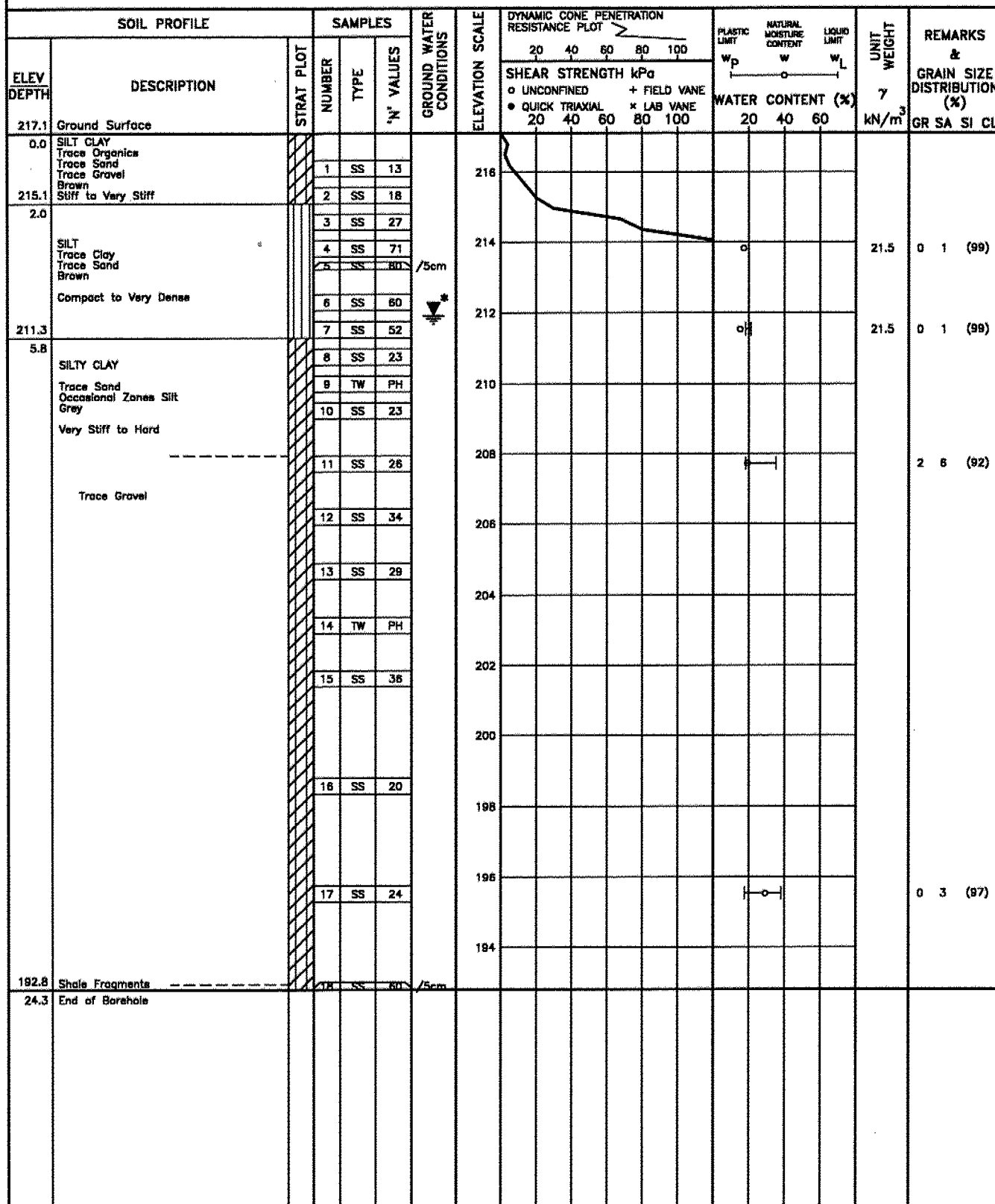
20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 5-2

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 13+912, o/s 20m Lt (at Leeming Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE SS Auger COMPILED BY BB
 DATUM Geodetic DATE 88-08-08 CHECKED BY BB



RECORD OF BOREHOLE No 6-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 15+231, o/s 20m Rt (at Chippewa Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE Hollow Stem Auger, BW Casing, BQ Core COMPILED BY BB
 DATUM Geodetic DATE 88-08-01 CHECKED BY BB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
214.2	Ground Surface												
0.0	SILTY CLAY Trace Sand Trace Organics Brown Very Stiff		1	SS	17		214						
212.2			2	SS	26		212						
2.0			3	SS	34								
	SILT Trace Sand Trace Clay Brown Dense to Very Dense		4	SS	73							20.6	0 3 (97)
			5	SS	87		210						
			6	SS	71								
208.6			7	SS	21		208						
5.6			8	SS	20								
	SILTY CLAY Trace Sand Trace Gravel Occasional Zones Silt Grey Very Stiff to Hard		9	SS	25		206						
			10	SS	16								
			11	SS	17		204					19.6	1 8 (91)
			12	SS	25								
			13	SS	19		202						
			14	SS	29								
			15	SS	40		200					20.9	1 2 (97)
			16	SS	14		198						
192.8			17	SS	60	/3cm	196						
21.4	BEDROCK Dolostone Unweathered		18	RC	REC	98%	192						RQD %
189.8			19	RC	REC	97%	190						RQD %
24.4	End of Borehole												

RECORD OF BOREHOLE No 6-2										1 OF 1	METRIC		
WP 36-84-00		LOCATION Sta 15+239, o/s 24.5m Lt (at Chippewa Rd)				ORIGINATED BY BB							
DIST CR HWY 6New		BOREHOLE TYPE Hollow Stem Auger				COMPILED BY BB							
DATUM Geodetic		DATE 86-09-08				CHECKED BY BB							
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					
214.2	Ground Surface						20 40 60 80 100	20 40 60					
0.0	SILTY CLAY Trace Sand Brown, Hard		1	SS	39								
213.0			2	SS	95								
1.2	SILT Trace Sand Trace Clay Brown Dense to Very Dense		3	SS	48							21.5	0 3 (97)
			4	SS	44								
			5	SS	60								
			6	SS	78								
208.9			7	SS	12							19.5	0 1 (99)
5.3			8	SS	14								
			9	TW	PH								
	SILTY CLAY Trace Sand Occasional Zones Silt Grey Stiff to Hard		10	SS	24								
			11	SS	18								
			12	SS	24								
			13	TW	PH								
			14	SS	33								
			15	SS	15							18.6	0 0 (100)
193.6			16	SS	80	/Dcm							
20.6	End of Borehole * Groundwater level not observed												

RECORD OF BOREHOLE No 7-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 15+590 Center Line (Welland R. Crossing) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE Hollow Stem Auger COMPILED BY BB
 DATUM Geodetic DATE 86-09-10 CHECKED BY BB

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						
209.5	Ground Surface							20 40 60 80 100	20 40 60					
0.0	Trace Organics Mottled Grey/Brown		1	SS	7	*	209							
			2	SS	12		207						20.3	
			3	SS	5		205							
	SILTY CLAY Trace Sand Occasional Zones Silt Grey Firm to Very Stiff		4	SS	8		203							
			5	SS	15		201							
			6	SS	14		199							
			7	SS	10		197							
			8	SS	17		195							
	Trace Gravel		9	SS	15		193							
			10	SS	20									
			11	SS	15									
			12	SS	20									
			13	SS	10								19.0	
191.9	** Auger Refusal													
17.8	End of Borehole * Groundwater level not observed													

+3, x5: Numbers refer to
Sensitivity

20
15-0-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7-2										1 OF 1	METRIC					
WP 36-84-00		LOCATION Sta 15+640 Center Line (Welland R. Crossing)				ORIGINATED BY BB										
DIST CR HWY 6New		BOREHOLE TYPE HS Auger, BQ Rock Core				COMPILED BY BB										
DATUM Geodetic		DATE 86-09-09				CHECKED BY BB										
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
211.0	Ground Surface															
0.0	Trace Organics Occ. Zones Silty Clay		1	SS	11											
	SILT Trace Sand Trace Clay Loose to Compact		2	SS	3											
			3	SS	21											
207.3	Brown Grey		4	SS	30											
3.7	SILTY CLAY Occasional Zones of Silt Trace Sand Grey Firm to Very Stiff		5	SS	5											
			6	TW	PH											
			7	SS	10											
			8	SS	8											
	Trace Gravel		9	SS	14											
			10	SS	11											
			11	TW	PH											
			12	SS	24											
			13	SS	13											
			14	SS	0*											
			15	SS	0*											
185.7	Occ Grinding															
25.3	BEDROCK		16	RC	REC	100%										
184.2	Dolostone Unweathered															RQD %
26.8	End of Borehole * disturbed															

RECORD OF BOREHOLE No 8-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 16+065, o/s 30m Rt (Hwy 6 Connection) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger COMPILED BY BB
 DATUM Geodetic DATE 86-09-11 CHECKED BY BB

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 (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
212.5	Ground Surface							20 40 60 80 100	20 40 60						
0.0	SILTY CLAY														
211.7	Trace Snd, Trace Orgncs, Brwn, Frm														
0.8	SILT		1	SS	8										
	Trace Sand		2	SS	28										
	Trace Clay		3	SS	29										
	Compact to Dense		4	SS	39										
	Brown		5	SS	32										
	Gray		6	SS	29										
	Occasional Zones of Silty Clay		7	SS	11										
208.8			8	SS	11										
5.7	SILTY CLAY		9	TW	PH										
	Trace Sand		10	SS	16										
	Occasional Zones Silt		11	SS	34										
	Gray		12	SS	26										
	Stiff to Hard		13	SS	18										
	Trace Gravel		14	TW	PH										
193.1			15	RC	REC	100%									
19.4	BEDROCK														
191.6	Dolostone Unweathered														
20.9	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10


RECORD OF BOREHOLE No 8-2										1 OF 1		METRIC		
WP 36-84-00		LOCATION Sta 16+065, e/s 30m Lt (HWY 6 Connection)				ORIGINATED BY BB								
DIST CR HWY 5New		BOREHOLE TYPE HS Auger				COMPILED BY BB								
DATUM Geodetic		DATE 86-09-15				CHECKED BY BB								
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					
213.3	Ground Surface													
0.0	SILT to SILTY CLAY													
212.1	Trace Sand Compact		1	SS	21									
1.2	SILT		2	SS	36									
	Trace Sand		3	SS	43									
	Trace/Some Gravel		4	SS	71									
	Compact to Very Dense		5	SS	45									
	----- Brown		6	SS	16									
	----- Grey		7	SS	14									
208.3	Occasional Zones Silty Clay		8	SS	16									
5.0			9	SS	18									
	SILTY CLAY		10	SS	22									
	Trace Sand		11	SS	24									
	Trace Gravel		12	SS	19									
	Grey													
	Occasional Zones Silt		13	TW	PH									
	Stiff to Very Stiff		14	SS	13									
	** Auger Refusal													
192.9	** Probable Bedrock													
20.4	End of Borehole													
	* Groundwater Level Not Observed													

RECORD OF BOREHOLE No 9-1

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 16+600, 60m Rt (at Whitechurch Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE Solid Stem Auger COMPILED BY DC
 DATUM Geodetic DATE 86-08-28 CHECKED BY BB

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 7 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 (%)
216.0	Ground Surface							20 40 60 80 100	20 40 60						
0.0	SILTY CLAY Trace Sand Trace Organics Very Stiff		1	SS	18		214						21.1	0 1 (99)	
212.3			2	SS	17										
		3	SS	17											
		4	SS	22											
3.7	SILT Trace Clay Trace Sand Brown to Grey Dense to Very Dense		5	SS	100		/28cm	212						22.0	0 2 (98)
			6	SS	78			210							
		7	SS	32											
		8	SS	43											
		9	SS	58											
		207.9		10	SS		55	208							
		8.1	SILTY CLAY Trace Sand Occasional Silt Zones Grey Firm to Hard		11	SS	7	206	+3					19.8	0 1 (99)
			12	SS	27		204								
		13	SS	25		202									
		14	SS	22		200									
		15	SS	32		198									
			16	SS	22		196								
		17	SS	80	/0cm	194							19.5	0 1 (99)	
192.7	Trace Gravel ** Probable Bedrock														
23.3	End of Borehole														

+3, x5: Numbers refer to
Sensitivity

20
15-0-5
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 9-2

1 OF 1

METRIC

WP 36-84-00 LOCATION Sta 16+814, o/s 30m Lt (at Whitechurch Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE SS Auger, BW Casing, BQ Core COMPILED BY DC
 DATUM Geodetic DATE 86-08-26 CHECKED BY BB

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					
217.3	Ground Surface													
0.0	SILTY CLAY Trace Sand Brown Very Stiff to Hard		1	SS	31		217							
			2	SS	21		215						20.1	0 1 (99)
			3	SS	17									
			4	SS	15									
213.0			5	SS	25		213							0 1 (99)
4.3			6	SS	65									
	Brown		7	SS	76									
	Grey		8	SS	43		211							
	SILT Trace Sand Trace Clay Compact to Very Dense		9	SS	36		209						21.8	0 4 (98)
			10	SS	28		207							
206.2			11	SS	15		205							
11.1			12	TW	PH		203							
	SILTY CLAY Occasional Silt Zones Grey Stiff to Hard		13	SS	18		201						18.9	
			14	SS	35		199							
	Trace Sand Trace Gravel		15	TW	PH		197							
192.9	Rock Fragments		16	SS	80	/25cm	195							
24.4	BEDROCK		17	RC	REC	97%	193							
191.4	Dolostone Unweathered													RQD %
25.9	End of Borehole													

RECORD OF BOREHOLE No 10-1 1 OF 1 METRIC

W.P. 36-84-00 LOCATION Sta 17+570, o/s 30m Rt (Airport Rd Connection) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger, BQ Rock Core COMPILED BY BB
 DATUM Geodetic DATE 86-09-18 CHECKED BY BB

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	20 40 60 80 100					
221.3	Ground Surface												
0.0	SILTY CLAY												
219.6	Trace Organics Stiff		1	SS	11								
1.5			2	SS	32								
	SILT		3	SS	97								
	Trace Sand		4	SS	42								
	Trace Clay		5	SS	43								
	Dense to Very Dense		6	SS	57								
215.5			7	SS	44								
5.8			8	SS	22								
			9	SS	30								
			10	SS	26								
			11	SS	16								
	SILTY CLAY		12	SS	17								
	Trace Sand												
	Trace Gravel												
	Occasional Silt Zones												
	Very Stiff												
			13	SS	22								
			14	SS	22								
			15	SS	15								
198.1													
23.2	BEDROCK		16	RC	REC	100%							
196.4	Dolostone Unweathered												
24.9	End of Borehole * Groundwater Level Not Observed												

RECORD OF BOREHOLE No 10-2 1 OF 1 METRIC

W.P. 38-84-00 LOCATION Sta 17+570, o/s 30m Lt (Airport Rd Connection) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger COMPILED BY BB
 DATUM Geodetic DATE 86-09-19 CHECKED BY BB

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 (%)
220.5	Ground Surface						20 40 60 80 100	20 40 60 80 100						
0.0	SILT Trace Sand Trace Clay Trace Organics Brown Grey Occ. Zones Silty Clay Dense to Very Dense		1	SS	32	220						20.6	0 10 (90)	
			2	SS	73	218								
			3	SS	38									
			4	SS	16									
			5	SS	35									
			6	SS	44									
			7	SS	45									
214.7			8	SS	22	214								
5.8	SILTY CLAY Trace Sand Trace Gravel Occasional Silt Zones Grey Stiff to Very Stiff		9	SS	19	212							0 3 (97)	
			10	SS	21	210								
			11	SS	21									
			12	SS	27	208								
			13	SS	27	206								
			14	SS	30	204								
			15	SS	14	202								
197.4	** Probable Bedrock					198								
23.1	End of Borehole													

RECORD OF BOREHOLE No 11-1

1 OF 1

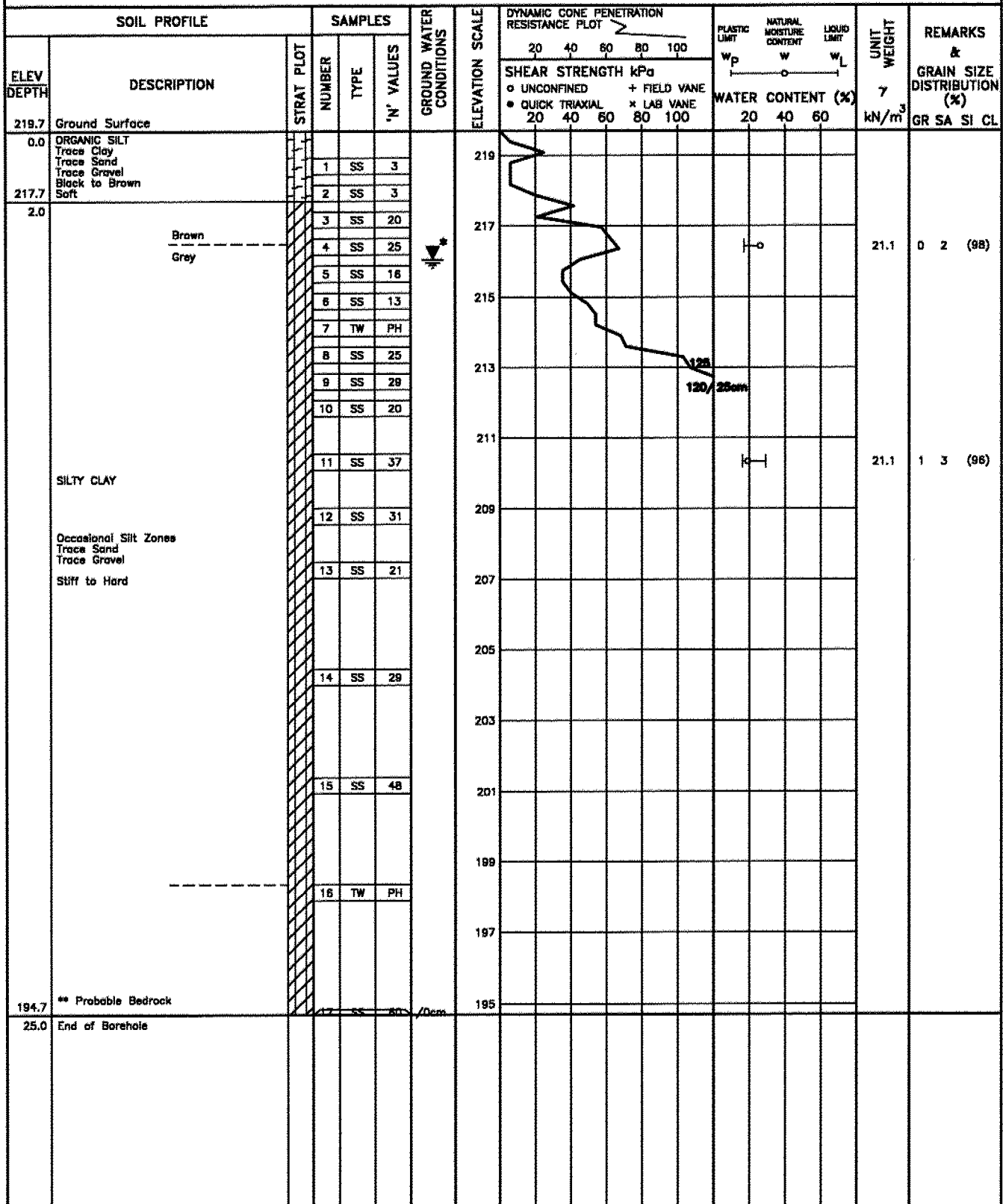
METRIC

W.P. 36-84-00 LOCATION Sta 19+148, o/s 30m Lt (at Gloucester Rd.) ORIGINATED BY WD
 DIST CR HWY 6New BOREHOLE TYPE SS Auger, BW Casing, BQ Core COMPILED BY DC
 DATUM Geodetic DATE 86-08-19 CHECKED BY BB

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						
219.4	Ground Surface							20 40 60 80 100	20 40 60					
0.0	ORGANIC SILT Trace/Some Sand Trace Gravel Trace Clay Black to Brown Soft to Firm		1	SS	3			○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
217.4			2	SS	6								21.1	1 15 (84)
2.0			3	SS	13									
	Brown		4	SS	12									
	Grey		5	SS	10									
			6	SS	13									
			7	SS	11									
			8	SS	12									
			9	SS	15									
			10	SS	17									
			11	TW	PH									
			12	SS	18									
	SILTY CLAY Trace Sand Trace Gravel Occasional Silt Zones Stiff to Hard		13	SS	14									
			14	SS	28									
			15	SS	38									
			16	SS	17									
194.7	Some Sand, Some Gravel		17	SS	80	/3cm							20.2	0 0 (100)
24.7	BEDROCK		18	RC	REC	100%								RQD %
193.2	Dolostone Unweathered													
26.2	End of Borehole													

RECORD OF BOREHOLE No 11-2 1 OF 1 METRIC

W.P. 38-84-00 LOCATION Sta 19+148, o/s 30m Rt. (at Gloucester Rd) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger COMPILED BY DC
 DATUM Geodetic DATE 86-08-21 CHECKED BY BB



RECORD OF BOREHOLE No 14-1 1 OF 1 METRIC


W.P. 36-84-00 LOCATION Sta 24+636, o/s 27m Rt (at Hwy 53) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger, BW Casing, BQ Rock Core COMPILED BY BB
 DATUM Geodetic DATE 88-07-30 CHECKED BY BB

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					
243.4	Ground Surface													
0.0	SILT Trace Sand Trace Clay		1	SS	6		243							
	Trace Organics		2	SS	7		241							0 1 (98)
	Trace Gravel		3	SS	21									
	Loose to Compact		4	SS	24									0 43 (57)
239.9	SANDY SILT													
3.5			5	SS	23		239							
	SAND		6	SS	16									
			7	SS	36		237							6 82 (12)
	Trace/Some Silt		8	SS	17									
	Trace Clay		9	SS	17		235							
	Trace Gravel		10	SS	13									
	- Brown Compact to Dense		11	SS	18		233							
			12	SS	22		231							0 65 (35)
229.7														
13.7			13	SS	7		229							
	SANDY SILT to SILT						227							
	Trace Clay		14	SS	27		225							
	Brown to Grey Loose to Very Dense		15	SS	60	/5cm	223							
219.0			16	SS	33		221							
24.4	SILTY CLAY Trace Sand Grey Hard						219							
217.2			17	SS	51		217							
26.2	SANDY SILT Trace Gravel Trace Clay Very Dense		18	SS	60	/3cm								
215.8			19	RC	REC	95%	215							RQD %
27.8	BEDROCK													
214.3	Dolostone Unweathered													
29.1	End of Borehole													

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

RECORD OF BOREHOLE No 14-2 1 OF 1 METRIC

W.P. 36-84-00 LOCATION Sta 24+636, o/s 22m Lt (at Hwy 53) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger COMPILED BY BB
 DATUM Geodetic DATE 88-09-02 CHECKED BY BB

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 (%)
								○ UNCONFINED 20 40 60 80 100	+ FIELD VANE x LAB VANE						
240.8	Ground Surface														
0.0	Trace/Some Gravel SAND Some Silt Trace Clay Dark Brown Very Loose to Compact	.	1	SS	17		240							0 75 (25)	
			2	SS	21		238							15 74 (11)	
			3	SS	10										
			4	SS	13										
			5	SS	17										
			6	SS	18										
			7	SS	10										
			8	SS	1*										
232.4			9	SS	8		232								
8.4	SILTY SAND Trace Clay Grey Compact to Dense	.	10	SS	17		230								
			11	SS	18										
			12	SS	43										
227.1							228						0 52 (48)		
13.7	SANDY SILT to SILT Grey Compact to Very Dense	.	13	SS	18		226								
								224							
			14	SS	48			222						0 35 (85)	
								220							
	Occasional Zones of Silty Clay	.	15	SS	46		218								
			16	SS	96			216						0 1 (99)	
215.3	** Probable Bedrock		17	SS	80	/Dcm									
25.5	End of Borehole														
	* Disturbed Sample														

RECORD OF BOREHOLE No 16-1 1 OF 2 METRIC

W.P. 36-84-00 LOCATION Sta 25+242, o/s 48m Rt (at Hwy 403) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger, BW Casing, BQ Rock Core COMPILED BY BB
 DATUM Geodetic DATE 86-09-03 CHECKED BY BB

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					
244.9	Ground Surface													
0.0	SAND Trace Gravel, Trace Silt		1	SS	7		244							
243.7	Trace Clay, Trace Organics, Loose													
1.2	SILTY CLAY Trace Sand, Trace Gravel		2	SS	10									
242.6	Trace Organics, Stiff													
2.3	SILT Trace/Some Sand Trace Gravel Occasional Zones Silty Clay Compact to Very Dense		3	SS	54		242							
			4	SS	34									
			5	SS	44									
			6	SS	37		240							5 6 (89)
			7	SS	38									
			8	SS	58									
	Brown		9	SS	21		238							
237.3	Grey													
7.6			10	SS	21		236							
			11	SS	61									
	SAND Trace Gravel Trace/Some Silt Trace Clay Brown Compact to Very Dense		12	SS	16		234							0 87 (13)
			13	SS	31									
			14	SS	19		232							
							230							
							228							
226.1			15	SS	16		226							
18.8														
			16	SS	52		224							0 18 (82)
							222							
	SILT Trace/Some Sand Occasional Silty Clay Zones Brown to Grey Compact to Very Dense		17	SS	53		220							
			18	SS	22		218							
							216							
214.4														

30.5

Continued

+³, x⁵: Numbers refer to
Sensitivity

20
15-25 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No 16-1 2 OF 2 METRIC

W.P. 36-84-00 LOCATION Sta 25+242. o/s 48m Rt (at Hwy 403) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger, BW Casing, BQ Rock Core COMPILED BY BB
 DATUM Geodetic DATE 86-09-03 CHECKED BY BB

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 (%)				
								20 40 60 80 100					20 40 60				
214.4	Continued																
30.5	Mixture of Gravel, Sand, Silt and Clay		19	SS	39										35 42 (23)		
	Boulder		20	RC	REC	-x									RQD %		
	Dense																
211.4																	
33.5	BEDROCK																
210.2	Dolostons Unweathered		21	RC	REC	100%									RQD %		
34.7	End of Borehole																

RECORD OF BOREHOLE No 16-2 1 OF 2 METRIC

W.P. 36-84-00 LOCATION Sta 25+308, o/s 33m Lt (at Hwy 403) ORIGINATED BY BB
 DIST CR HWY 8New BOREHOLE TYPE HS Auger COMPILED BY BB
 DATUM Geodetic DATE 86-08-04 CHECKED BY BB

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
								20 40 60 80 100	20 40 60						
247.1	Ground Surface														
0.0	SILTY SAND to SANDY SILT		1	SS	8		248							4 53 (43)	
	Trace Gravel		2	SS	3										
	Trace Clay		3	SS	17										
	Brown		4	SS	30										
	Trace Organics		5	SS	33										
	Very Loose to Compact		6	SS	21										
241.2			7	SS	47										
5.9			8	SS	106										
			9	SS	60										
	SAND to SILTY SAND		10	SS	24										
	Trace Gravel		11	SS	31										
	Trace Clay		12	SS	16										
	Brown to Grey Brown														
	Very Loose to Very Dense														
231.4			13	SS	3*										
15.7															
	SILT		14	SS	19										
	Trace/Some Sand														
	Occasional Silty Clay Zones														
	Brown to Grey														
	Compact to Very Dense														
			15	SS	22										
			16	SS	72										
			17	SS	112										

Continued

+3, x5: Numbers refer to
Sensitivity

20
15-5 (X) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No 16-2 2 OF 2 METRIC

W.P. 36-84-00 LOCATION Sta 25+308, o/s 33m Lt (at Hwy 403) ORIGINATED BY BB
 DIST CR HWY 6New BOREHOLE TYPE HS Auger COMPILED BY BB
 DATUM Geodetic DATE 86-09-04 CHECKED BY BB

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					
216.6	Continued		18	SS	120	720cm							
30.5													
215.7							216						
31.4	End of Borehole * disturbed sample												

memorandum

248-3286



To: **M. Devata**
Chief Foundation Engineer
Foundation Design Section
Room 315, Central Building

Attn: **B. Bennett**

From: **Soils and Aggregates Section**
Engineering Materials Office
Room 309, Central Building

Date: **86 11 21**

File No.: **3162-2-4-113**

Re: **Borehole Core Descriptions,**
Hwy. 6 New,
Caledonia to Ancaster
W.P. 36-84-00

As requested by your section, core from thirteen (13) boreholes was logged, and descriptions are appended. Depth to top of bedrock and depth to top of unweathered rock in each borehole are tabulated below:

Borehole Number	Depth to Bedrock in metres below ground surface	Depth to Unweathered Rock (including slightly weathered) in metres below ground surface
1-1	22.06	22.06
2-1	12.81	12.81
3-1	23.18	23.33
4-2	21.76	21.76
5-1	27.22	27.88
6-1	21.55	21.55
7-2	25.31	25.31
8-1	19.83	19.83
9-2	24.40	24.40
10-1	23.18	23.18
11-1	24.65	24.65
14-1	27.63	27.63
16-1	31.72	31.72

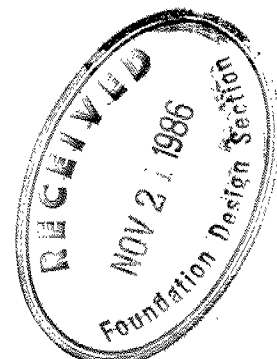
Bedrock in boreholes 1 to 3 is dolostone, shale, and gypsum of the Salina Formation. In the remaining boreholes, bedrock is dolostone of the Guelph Formation.

If you have any questions, please contact me.

A handwritten signature in black ink, appearing to read "E.R. Magni".

E.R. Magni,
Geologist.

ERM/jlo
Attachment



DESCRIPTION OF ROCK CORE - W.P. 36-84-00

BOREHOLE NUMBER				CORE DESCRIPTION	
	DEPTH (m)	% CR *	% RQD *	DEPTH (m)	DESCRIPTION
1-1	22.06-23.58 23.58-24.14	75 100	25 0	22.06-24.14	DOLOSTONE (95%), grey, slightly weathered, closely to very closely spaced joints, with SHALE (5%), dark grey, slightly weathered; core loss mainly due to drilling procedure
2-1	12.81-13.72	94	72	12.81-13.06 13.06-13.72	SHALEY DOLOSTONE (30%), containing GYPSUM (70%), white, slightly weathered, very closely spaced joints DOLOSTONE, grey, unweathered, widely spaced joints
3-1	23.18-23.68 23.68-24.76	85 95	0 50	23.18-23.33 23.33-24.76	SHALEY DOLOSTONE, grey, slightly to moderately weathered, very closely spaced joints DOLOSTONE (30%), grey, slightly weathered, with GYPSUM (70%), white, medium spaced joints
4-2	21.76-23.28	90	90	21.76-23.28	SHALEY DOLOSTONE, grey, unweathered, widely spaced joints
5-1	27.22-28.37 28.37-29.38	42 100	0 97	27.22-27.88 27.88-29.28	Assumed zone of core loss SHALEY DOLOSTONE, grey, unweathered, closely spaced joints becoming medium spaced joints at 28.37
6-1	21.55-23.12 23.12-24.43	98 97	58 88	21.55-24.43	DOLOSTONE, light grey, unweathered, medium spaced joints
7-2	25.31-26.84	100	57	25.31-26.84	DOLOSTONE, light grey, unweathered, medium to closely spaced joints
8-1	19.83-21.35	100	67	19.83-21.35	DOLOSTONE, light grey, unweathered, medium spaced joints with single, vertical joint from 19.83-20.19
9-2	24.40-25.98	97	69	24.40-25.98	DOLOSTONE, light grey, unweathered, medium spaced joints

* CR = CORE RECOVERY ; RQD = ROCK QUALITY DESIGNATION

DESCRIPTION OF ROCK CORE - W.P. 36-84-00

36-84-00

BOREHOLE NUMBER				CORE DESCRIPTION	
	DEPTH (m)	% CR *	% RQD *	DEPTH (m)	DESCRIPTION
10-1	23.18-24.91	100	35	23.18-24.91	DOLOSTONE, light grey, slightly weathered, closely to very closely spaced joints
11-1	24.65-26.17	100	93	24.65-26.17	DOLOSTONE, light grey, unweathered, widely spaced joints
14-1	27.63-29.16	95	68	27.63-29.16	DOLOSTONE, light grey, unweathered, widely spaced joints
16-1	31.72-31.92 33.17-34.69	100 100	N/A 62	31.72-31.92 33.17-34.69	Boulder DOLOSTONE, light grey, unweathered, widely spaced joints

* CR= CORE RECOVERY ; RQD = ROCK QUALITY DESIGNATION