# **APPENDIX A**

# **GEOTECHNICAL REPORT**



**Victor Street** 

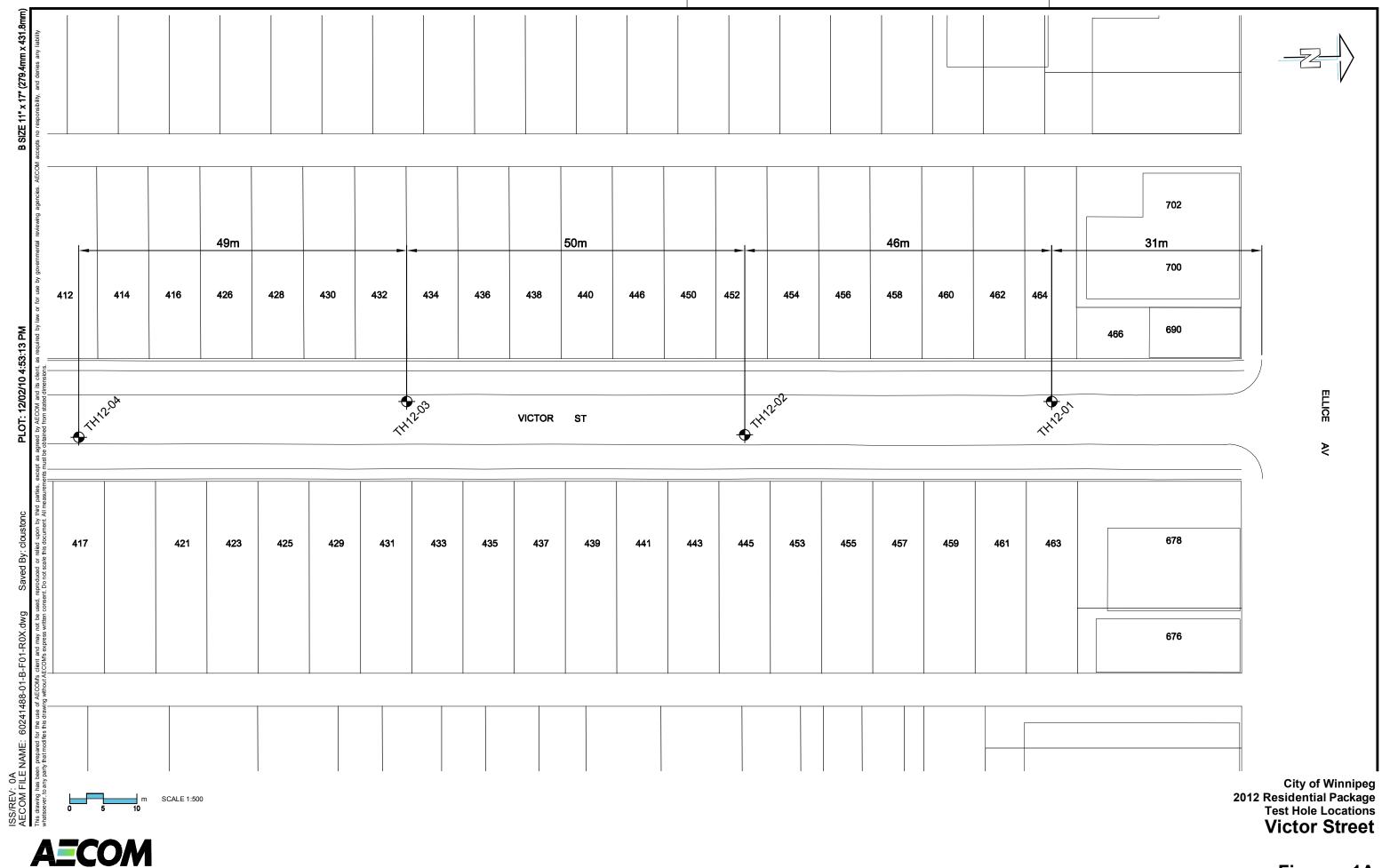
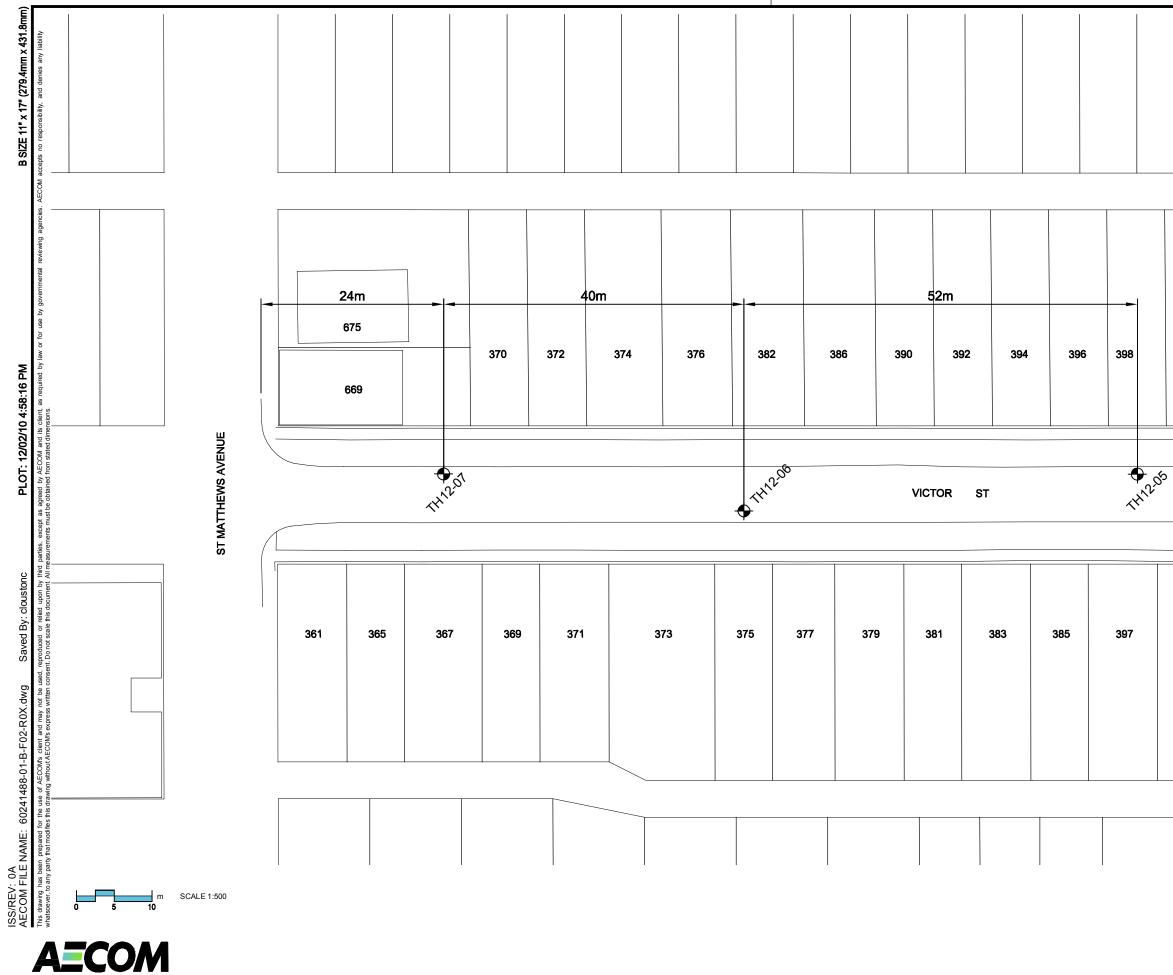


Figure - 1A



# Figure - 1B

# City of Winnipeg 2012 Residential Package Test Hole Locations **Victor Street**

399	401	407	409	413	

40	00	40	)2	40	04	40	)6	4	08	4	10	4

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#### PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

# **GEOTECHNICAL INVESTIGATION**

## STREET RECONSTRUCTION

#### **Fieldwork**

Revised October 28<sup>th</sup>, 2008

- 1. Clear all underground services at each testhole location.
- 2. Test holes required every 50 m with a minimum of 3 test holes per street.
- 3. Record location of testhole (offset from curb, distance from cross street and house number).
- 4. Drill 150 mm-diameter core in pavement.
- 5. Drill 125 mm-diameter testhole into fill materials and subgrade
- 6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
- 7. Testhole to be drilled to depth of 2 m  $\pm$  150 mm below surface of the pavement.
- 8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
- 9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
- 10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
- 11. Log soil profile for the subgrade.
- 12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
- 13. Make note of any water seepage into the testhole.
- 14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
- 15. Return core sample from the pavement and soil samples to the laboratory.

#### Lab Work

- 1. Test all soil samples for moisture content.
- 2. Photograph core samples recovered from the pavement surface.
- 3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
- 4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

Embrace the Spirit · Vivez l'esprit

#### AECOM Canada Ltd.

#### **GENERAL STATEMENT**

#### NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

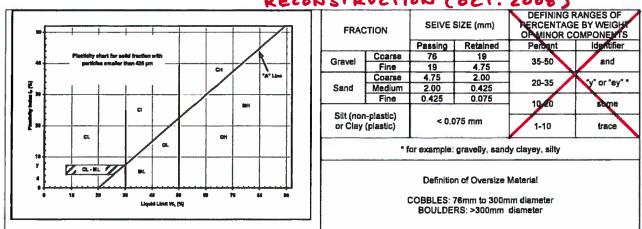
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

# **EXPLANATION OF FIELD & LABORATORY TEST DATA**

					UMA	$(\%)$ $C_{U} > 4$ $1 < C_{C} < 3$ $GW$ $0.5$ $C_{U} > 4$ $1 < C_{C} < 3$ $GP$ $0.5$ Not satisfying GW requirementsDual symbol $12\%$ fit Dual symbol $0 r W_{p} < 4$ $GM$ > 12Atterberg limits above "A" line or $W_{p} < 4$ $GC$ > 12Atterberg limits above "A" line or $W_{p} < 4$ $GC$ > 12Atterberg limits above "A" line or $W_{p} < 7$ $SW$ $0.5$ $C_{U} > 6$ $1 < C_{C} < 3$ $SP$ $0.5$ $C_{U} > 6$ $1 < C_{c} < 3$ $SM$ > 12Atterberg limits below "A" line or $W_{p} < 7$ $SM$ > 12Atterberg limits above "A" line or $W_{p} < 7$ $SK$ > 12Atterberg limits above "A" line or $W_{p} < 7$ $ML$ $MH$ $CL$ $CH$ $OL$ $OH$	eria			
		Descripti	ion		Log Symbols	Classification	Iton       Fines (%)       Grading       Plasticity       Notes         0-5 $C_U > 4$ $1 < C_C < 3$ Dual symbol       Dual symbol       12% fine         0-5       Not satisfying GW requirements       Atterberg limits above "A" line or Wp<4	Notes		
		CLEAN GRAVELS	Weli grade sandy gravel or no t	s, with little	2001	GW	0-5	C <sub>U</sub> > 4 1 < C <sub>C</sub> < 3		
	GRAVELS (More than 50% of coarse	(Little or no fines)	Poorly grade sandy gravel or no f	s, with little	2121	GP	0-5	GW		Dual symbols if 5
OILS	fraction of gravel size)	DIRTY GRAVELS	Silty gravels, grav		NN	GM	> 12		below "A" line	Dual symbols if above "A" line and
AINED S(		(With some fines)	Clayey grav sandy g			GC	> 12		above "A" line	4 <w<sub>P&lt;7</w<sub>
COARSE GRAINED SOILS		CLEAN SANDS	Well grade gravelly sand or no f	s, with little	0.0	sw	0-5	C <sub>U</sub> > 6 1 < C <sub>C</sub> < 3		$C_{U} = \frac{D_{60}}{D_{10}}$
CO/	SANDS (More than 50% of	(Little or no fines)	Poorly grad gravelly sand or no f	s, with little	000	SP	0-5	SW		$C_{C} = \frac{(D_{30})^{2}}{D_{10} x D_{6}}$
	coarse fraction of sand size)	DIRTY SANDS	Silty sa sand-silt r			SM	> 12		below "A" line	
		(With some fines)	Clayey s sand-clay			SC	> 12		above "A" line	
	SILTS (Below 'A' line	W <sub>L</sub> <50	Inorganic si clayey fine s slight pla	ands, with		ML				
	negligible organic content)	W <sub>L</sub> >50	Inorganic si plasti			МН				
SOILS	CLAYS	WL<30 Inorganic clays, silty clays, sandy clays of low plasticity, lean clays			CL					
FINE GRAINED SOILS	(Above 'A' line negligible organic	30 <w∟<50< td=""><td>Inorganic clay clays of n plasti</td><td>nedium</td><td></td><td>CI</td><td></td><td></td><td>Based upon</td><td></td></w∟<50<>	Inorganic clay clays of n plasti	nedium		CI			Based upon	
	content)	W <sub>L</sub> >50	Inorganic cla plasticity,		$\mathbb{Z}$	сн				
	ORGANIC SILTS & CLAYS	W <sub>L</sub> <50	Organic s organic silty o plasti	clays of low		OL				
	(Below 'A' line)	W <sub>L</sub> >50	Organic cla plasti			он				
н	IGHLY ORGA	NIC SOILS	Peat and ot organic			Pt				
		Asphait			Till					
		Concrete			ledrock fferentiated)		_		AE	COM
XX		Fill			ledrock mestone)					

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

#### NOT USED TO CLASSIFY SUBGRADE, REFER TO CITY OF WINN IPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



#### LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- qu undrained shear strength (kPa) derived from unconfined compression testing.
- T<sub>v</sub> undrained shear strength (kPa) measured using a torvane
- pp undrained shear strength (kPa) measured using a pocket penetrometer.
- L<sub>v</sub> undrained shear strength (kPa) measured using a lab vane.
- Fv undrained shear strength (kPa) measured using a field vane.
- $\gamma$  bulk unit weight (kN/m<sup>3</sup>).
- SPT Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w moisture content (WL, WP)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	CONSISTENCY
<12	very soft
12 - 25	soft
25 - 50	medium or firm
50 - 100	stiff
100 - 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0-4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PRO	JEC	CT:	Local Streets Package 12-R-03	CLI	ENT	: Ci	ty of	Winr	nipeg					TE	STHOLE NO: TH12-0	)1
LOC	ATI	ON:	Victor Street; In Front of House #464, Southbound Lan											PR	OJECT NO.: 6024148	38
CON	ITR	ACT	OR: Maple Leaf Drilling Ltd					nm S	SSA	with 1	50 r	nm Cori	ng	EL	EVATION (m):	
SAM	IPLE	ΞT	PE   GRAB   SHELBY TUBE	S	PLIT	SPO	ON		В	ULK			ŽNO F	RECOVE	RY CORE	
DEPTH (m)		SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE #	◆ SF 0 2 16 1; F	★	Becker amic C ndard F ws/300 0 6 al Unit (kN/m)	one Pen Test mm) 0 80 Wt ■ 20 Liquid	) ♦ 100 21		D SHEAR S Torvane - X QU X Lab Vane I ocket Pen Field Vane (kPa) 100	+ □ . △	COMMENTS	DEPTH
0			ASPHALT (thickness = 145 mm)						0 0		100					
-		. 4	CONCRETE (thickness = 80 mm)										· · · · · · · · · · · · · · · · · · ·			-
-			CLAY - some silt, trace sand													-
-			<ul> <li>brown</li> <li>frozen to 1.2 m, moist when thawed</li> </ul>			G1		•				•••••				-
-			- high plasticity													-
-												••••••	····›			-
						62									Gradation:	
						G2									Sand = 1.9%, Silt = 17.7%, Clay = 80.4%	
-																-
-																-
-						G3		•				· · · · · · · · · · · · · · · · · · ·				-
1								_								1-
												· · · · · · · · · · · ·	····;····			
-																-
-			- below 1.2 m, silty, firm			G4		• • •				· · · · · · · · · · · · · · · · · · ·				-
-																-
_			SILT - trace clay									·····;··	····; :			-
			- light brown - moist, soft											•		
			- low plasticity			G5		<b>D</b>				••••••	•••••			
-														•		-
/12	Ī		SILTY CLAY - brown - moist, firm										•••••	•••••••••		-
- 2/14	R		- intermediate plasticity			G6										-
1.GDT	ł					Go										-
AIN o														; 		2
^ -2	H															2-
L95	ß	11	END OF TEST HOLE AT 2.1 m in silty clay.			G7		•								-
DGS.			NOTES:													-
AM LC			<ol> <li>No sloughing observed.</li> <li>No seepage observed.</li> </ol>										· · · · · · · · ·			-
RKH			<ol><li>Test hole backfilled with auger cuttings, bentonite and asphalt col patch to surface.</li></ol>	d												_
RA A			4. Drilled with 150 mm diamond core to 0.225 m, solid stem augers to	to												
			2.1 m.													-
ANCE												••••••	•••••	••••••••		-
CH														•		-
CTO																-
> ⊔																
LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12																-
, TES.												etsche		COMPL	ETION DEPTH: 2.10 m	I
G OF			AECOM							1: Faris				COMPL	ETION DATE: 1/26/12	
9							PRC	NEC	I ENO	INEE	<b>≺</b> : E	Blair Cock	rell		Page	1 of 1

		Local Streets Package 12-R-03	ENT: C				peg							STHOLE NO: TH12-0	
		: Victor Street; In Front of House #445, Northbound Lar TOR: Maple Leaf Drilling Ltd					~ ^		450		<u> </u>			OJECT NO.: 602414	88
	IPLE T	· · · · · · · · · · · · · · · · · · ·	THOD: PLIT SPO				SA I BI		150	mm (				EVATION (m):	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE SAMPLE #	0	PE ◆ SPT 20 17	NETRA WETRA Dynar (Stanc (Blows 40 Total (k 18 stic	ATION ecker mic C dard F s/300 6( 000 000 1000 19 19 MC	TEST * one ≎ Pen Te mm) 0 8 Wt ■ Liqui	est) ♦ 8 <u>0 100</u> 0 21		AINED S + To ∠ □ Lat △ Pocł ● Fiel (I	HEAR S rvane + QU × Vane [ ket Pen. d Vane k (Pa)	TRENGTH ⊢ . △ �	COMMENTS	DEPTH
0		ASPHALT (thickness = 150 mm)			20	40	60	0 8	<u>80 100</u>		50	100	150 200		
-		CONCRETE (thickness = 100 mm) GRANULAR BASE - well graded (<19 mm diameter) CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity	 G8												-
- 1 - - -		CLAYEY SILT - trace sand - light brown - frozen to 1.2 m, moist when thawed - intermediate plasticity - below 1.2 m, soft SILTY CLAY - trace sand - brown - moist, firm - intermediate to high plasticity	 G9 G10 G11	)											1
GPJ_UMA_WINN.GDT_2/14/12 7 7		END OF TEST HOLE AT 2.1 m in silty clay.	G12			•									2-
LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12		NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt co patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers 2.1 m.													
		AECOM	 <u>ı  </u>	F	REVII	EWEI	D BY	∕: Fa	ris Kl		ne Cockrel			ETION DEPTH: 2.10 m ETION DATE: 1/26/12 Page	1 of 1

				NT: C										STHOLE NO: TH12-0	
		: Victor Street; Along Property Line of House #432 and 434												OJECT NO.: 6024148	38
	PLE T			HOD: LIT SPO		mm S	<u>SSA</u> B	with III K	150 i	nm Co		O REC		EVATION (m):	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE SAMPLE #	◆ SI 0 : 16 1	PENET	RATION Becke amic C Indard ws/300 0 6 tal Unit (kN/m <sup>3</sup> 8 1	N TEST r ¥ Cone ≎ Pen Te )mm) 60 8 ; Wt ∎ ) 9 20 Liqui	est) ♦ 0 100	2	NED SHEA + Torva ×QU □ Lab Va Nocket I Pocket I Field Va (kPa	AR STREM ne + × ine □ Pen. △ ane <del>•</del> )	NGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 120 mm)				20- 2	ю - е	<u>80 8</u>	0 100	50	100	150	200		
-	4	CONCRETE (thickness = 105 mm)	_			: 	: 	: 		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · ·				
-		CLAY (FILL) - trace silt, trace sand, trace rootlets - dark brown - frozen, moist when thawed - intermediate plasticity		G14 G15				<pre></pre>							-
- - -1		CLAY - silty, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G16			<pre></pre>	· · · · · · · · · · · · · · · · · · ·						Gradation: Sand = 7.2%, Silt = 27.3%, Clay = 65.5%	- - 1
-		- below 1.2 m, firm SILT - trace clay - light brown - moist, soft - low plasticity		G17 G18											-
LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12		CLAYEY SILT - brown - moist, soft - intermediate plasticity END OF TEST HOLE AT 2.1 m in clayey silt. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.225 m, solid stem augers to 2.1 m.		G19											2-
		AECOM			RE	/IEW	ED B'	Y: Fa	ris Kł	Petsche alil 3lair Co				ETION DEPTH: 2.10 m ETION DATE: 1/26/12 Page	1 of 1

		Local Streets Package 12-R-03 : Victor Street; In Front of House #417, Northbound Land		: City of Winnipeg     TESTHOLE NO: TH12       Vest of Curb     PROJECT NO.: 60241													
		TOR: Maple Leaf Drilling Ltd		HOD:			SSA	with	150 ı	mm C	orina		ELEVATION (m):				
SAMF			SPL				В						ECOVER'				
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE SAMPLE #	0	<ul> <li>◇ Dyn</li> <li>PT (Sta</li> <li>(Blo</li> <li>20 4</li> <li>20 4</li> <li>20 10</li> <li>17 12</li> <li>Plastic</li> </ul>	Becker amic C ndard I ws/300 0 6 tal Unit (kN/m <sup>3</sup> 8 19	r ¥ Cone Pen Te Imm) 0 8 Wt∎ ) 9 20 Liqui	est) ♦ 0 100		+ To × 0 □ Lab △ Pock ❤ Field (k	rvane + QU × v Vane ⊑ ket Pen d Vane <b>€</b> kPa)		COMMENTS	ITULU		
0		ASPHALT (thickness = 150 mm)								·`							
		CONCRETE (thickness = 125 mm)				· · · ·	•		•			· · · · · · · · · · · · · · · · · · ·					
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G21		•						· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
		CLAY - some silt, trace sand		G22		•					· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
1		- dark brown - frozen, moist when thawed		G23	     	•					· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
		- below 1.2 m, firm SILT - trace clay		G24		•					· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
		<ul> <li>light brown</li> <li>moist, soft</li> <li>low plasticity</li> </ul> CLAY - silty		G25			· · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · ·					
0		- brown - moist, firm - high plasticity		G26		•					· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
-2		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed.		G27		•	- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -				· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
		<ol> <li>No socgamp observed.</li> <li>No seepage observed.</li> <li>Test hole backfilled with auger cuttings, bentonite and asphalt col patch to surface.</li> <li>Drilled with 150 mm diamond core to 0.275 m, solid stem augers 2.1 m.</li> </ol>															
												· · · · · · · · · · · · · · · · · · ·					
3		AECOM				gged Viewi				Petsch nalil	e			TION DEPTH: 2.10 m TION DATE: 1/26/12			

		Local Streets Package 12-R-03 : Victor Street; In Front of House #398, Southbound Lan				<u>f Winnipeg</u> Curb	<u> </u>				THOLE NO: TH12-( )JECT NO.: 602414	
		TOR: Maple Leaf Drilling Ltd				mm SSA \		mm Co	ring		VATION (m):	
SAMF	PLET	YPE GRAB IIISHELBY TUBE		LIT SPC	ON	BI	ULK			ECOVER	Y CORE	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE IYPE SAMPLE #	0	■ Total Unit (kN/m <sup>3</sup> )	₩       one        Pen Test) ◆       mm)       0     80       100       Wt ■       2     20       Liquid		ED SHEAR S + Torvane + ×QU× Lab Vane [ Pocket Pen. Field Vane ( (kPa) 100	] 	COMMENTS	- Hala
0		ASPHALT (thickness = 100 mm)										
		CONCRETE (thickness = 225 mm)				· · · · · · · · · · · · · · · · · · ·						
		CLAY (FILL) - trace silt, trace sand - dark brown										
		<ul> <li>frozen, moist when thawed</li> <li>intermediate to high plasticity</li> </ul>				· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · ·	·····			
				G28		•	· · · · · · · · · · · · · · · · · · ·					
		CLAY - some silt, trace sand - dark brown							•••••			
		- frozen, moist when thawed		G29								
1		- intermediate to high plasticity		629								
1						· · · · · · · · · · · · · · · · · · ·						
				G30		•						
		SILT - trace clay, trace sand										
		- moist, soft				· · · · · · · · · · · · · · · · · · ·			·····			
		- low plasticity										
				G31				<u>.</u> .				
		SILTY CLAY - trace sand										
		- brown - moist, firm							·····;···· :			
		- high plasticity		G32								
				632								
-2												
2												
	1111	END OF TEST HOLE AT 2.1 m in silty clay.		G33		•						
		NOTES:										
		1. No sloughing observed. 2. No seepage observed.										
		<ol> <li>Test hole backfilled with auger cuttings, bentonite and asphalt col patch to surface.</li> </ol>										
		4. Drilled with 150 mm diamond core to 0.325 m, solid stem augers 2.1 m.	to									
3												
						GGED BY:					TION DEPTH: 2.10 m	
		AECOM				VIEWED BY				COMPLE	TION DATE: 1/26/12 Page	

		Local Streets Package 12-R-03				<sup>E</sup> Winnip	eg					TESTHOLE NO: TH12-	
		: Victor Street; In Front of House #375, Northbound Lane TOR: Maple Leaf Drilling Ltd	1				A !!!	450	~			PROJECT NO.: 602414	188
	PLE T		<u>  METH</u>   Spl			mm SS	A with BULK		mm Co		D RECO	ELEVATION (m):	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION			♦ S 0	PENETRAT	Cone < cker ₩ ic Cone < ird Pen T 300mm) 60 Jnit Wt ■ /m) 19 2 IC Liqu	TS iest) ♦ 80 100 20 21 uid		NED SHEAU + Torvan ×QU 2 □ Lab Var △ Pocket P ④ Field Va (kPa)	R STREN( ne + × ne □ Pen. △ ine <del>®</del>	COMMENTS	
0		ASPHALT (thickness = 90 mm)		_		20 40	60	80 100	50	<u>0 100</u>	150	_200	+
		CONCRETE (thickness = 130 mm) CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed		G34		•	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					
	$\mathbb{Z}$	- high plasticity CLAY - silty, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G35		•		· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	Gradation: Sand = 6.3%, Silt =	
		- myn prasiury		G36		•		- - - - - - - - - - - - - - - - - - -				28.2%, Clay = 65.5%	
1		- below 1.2 m, firm		G37		•					· · · · · · · · · · · · · · · · · · ·		
				G38		•							
		- below 1.7 m, silt pockets		G39		•	- - - - - - - - - - - - - - - - - - -	· · · · · ·			· · · · · · · · · · · · · · · · · · ·		
2		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed.		G40		•							
		<ol> <li>No sloughing observed.</li> <li>No seepage observed.</li> <li>Test hole backfilled with auger cuttings, bentonite and asphalt color patch to surface.</li> <li>Drilled with 150 mm diamond core to 0.22 m, solid stem augers to 2.1 m.</li> </ol>											
3					LO	GGED B	: Y: Ster	: ohen l	Petsche	:	CON	IPLETION DEPTH: 2.10 m	
		AECOM				VIEWED						PLETION DATE: 1/26/12	

		Local Streets Package 12-R-03 : Victor Street; Opposite House #367, Southbound Lane,				Winnipeg b		TESTHOLE NO: TH12 PROJECT NO.: 60241	
		TOR: Maple Leaf Drilling Ltd				nm SSA with 150	mm Corina	ELEVATION (m):	100
	PLE T								
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPI F TVDF	SAMPLE #	◆ SP 0 20 16 17 Pl	■ Total Unit Wt ■ (kN/m <sup>3</sup> )	□ Lab Vane □ △ Pocket Pen. 2 ♥ Field Vane ♥ (kPa)	COMMENTS	
0		ASPHALT (thickness =125 mm)							
		CONCRETE (thickness = 125 mm) CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G41		•			
-1	$\gg$	CLAY - silty, trace sand - brown - frozen to 1.3 m, moist when thawed - high plasticity		G42 G43		• •		Gradation: Sand = 2.5%, Silt = 23.3%, Clay = 74.2%	
		- below 1.3 m, firm CLAYEY SILT - trace sand - brown - moist, soft to firm - intermediate plasticity		G44		•			
-2		SILTY CLAY - trace sand - brown - moist, firm - high plasticity		G45 G46		•		· · · · · · · · · · · · · · · · · · ·	
		<ul> <li>END OF TEST HOLE AT 2.1 m in silty clay. NOTES:</li> <li>1. No sloughing observed.</li> <li>2. No seepage observed.</li> <li>3. Test hole backfilled with auger cuttings, bentonite and asphalt colpatch to surface.</li> <li>4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.</li> </ul>				-			
3						CED BV: Stanhan	Potscho C		
		AECOM				GED BY: Stephen IEWED BY: Faris K		COMPLETION DEPTH: 2.10 m COMPLETION DATE: 1/26/12	





Photograph 1. Victor Street – TH12-01



Photograph 2. Victor Street – TH12-02



Photograph 3. Victor Street – TH12-03



Photograph 4. Victor Street – TH12-04



Photograph 5. Victor Street – TH12-05



Photograph 6. Victor Street – TH12-06



Photograph 7. Victor Street – TH12-07

# City of Winnipeg Local Streets Package 12-R-03 Geotechnical Investigation

Test		Pavement S	urface	Pavement Structu	re Material	Subgrade	Sample	Moisture		Hydromet	er Analysi
Hole No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Description	Depth (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)
						Clay	0.3	26.8			
		Apphalt	145			Clay	0.6	29.0	0.0	1.9	17.7
	Victor Street; In Front of	Asphalt	145			Clay	0.9	28.0			
TH12-01	House #464, Southbound			None	n/a	Clay	1.2	24.3			
	Lane, 1.0 m East of Curb					Silt	1.5	21.3			
		Concrete	80			Silty Clay	1.8	35.3			
						Silty Clay	2.1	27.0			
						Clay FIII	0.6	25.8			
	Vieter Street, In Front of	Asphalt	150			Clay Fill	0.9	24.7			
TH12-02	Victor Street; In Front of House #445, Northbound			Granular Base	50	Clayey Silt	1.2	16.5			
1012-02	Lane, 1.5 m West of Curb			Granular Dase	50	Silty Clay	1.5	23.8			
	Lane, 1.5 m West of Curb	Concrete	100			Silty Clay	1.8	27.7			
						Silty Clay	2.1	33.1			
						Clay Fill	0.3	21.6			
	Matan Streat, Alana Dranartu	Acabalt	120			Clay Fill	0.6	21.4			
	Victor Street; Along Property	Asphalt	120			Clay	0.9	21.5	0.0	7.2	27.3
TH12-03	Line of House #432 and 434, Southbound Lane, 1.0 m East			None	n/a	Clay	1.2	22.4			
	of Curb					Silt	1.5	17.1			
	or curb	Concrete	105			Silt	1.8	16.4			
						Clayey Silt	2.1	19.0			
						Clay Fill	0.3	27.8			
		Acabalt	150			Clay Fill	0.6	28.9			
	Victor Street; In Front of	Asphalt	150			Clay	0.9	27.1			
TH12-04	House #417, Northbound			None	n/a	Clay	1.2	25.5			
	Lane, 1.0 m West of Curb					Silt	1.5	14.9			
		Concrete	125			Clay	1.8	27.0			
						Clay	2.1	33.7			
		Acrehalt	100			Clay Fill	0.6	24.5			
		Asphalt	100			Clay	0.9	24.3			
	Victor Street; In Front of			Neree		Clay	1.2	23.6			
TH12-05	House #398, Southbound	Consta	225	None	n/a	Silt	1.5	17.3			
	Lane, 1.0 m East of Curb	Concrete	225			Silty Clay	1.8	23.6			
						Silty Clay	2.1	35.4			



sis			terberg Lim	
)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
	80.4	75.7	26.7	49.0
			22.4	44.0
	65.5	66.6	22.4	44.2

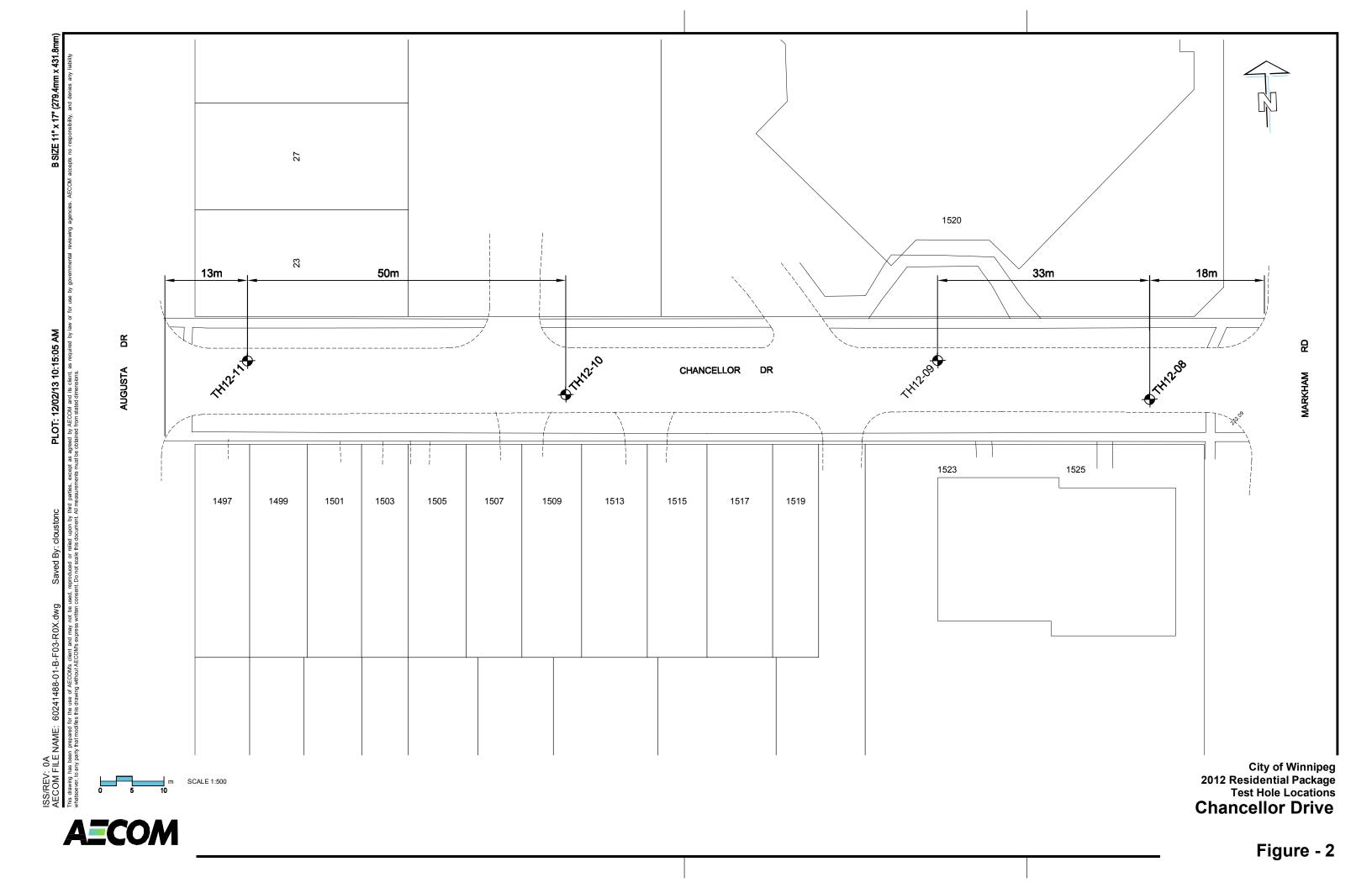
# City of Winnipeg Local Streets Package 12-R-03 Geotechnical Investigation

Test		Pavement Su	urface	Pavement Structu	ure Material	Subgrade	Sample	Moisture		Hydromet	er Analysis		At	terberg Lir	nits
Hole No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Description	Depth (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
						Clay Fill	0.3	29.5							
		Asphalt	90			Clay	0.6	25.9	0.0	6.3	28.2	65.5	64.5	25.6	39.0
	Victor Street; In Front of					Clay	0.9	25.3							
TH12-06	House #375, Northbound			None	n/a	Clay	1.2	25.6							
	TH12-07 House #373, Northbound Lane, 1.5 m West of Curb Victor Street; Opposite House #367, Southbound Lane, 1.0 m East of Curb	Concrete	130			Clay	1.5	26.6							
			130			Clay	1.8	29.3							
						Clay	2.1	24.8							
						Clay Fill	0.6	28.4							
		Asphalt	125			Clay	0.9	25.5	0.0	2.5	23.3	74.2	69.7	29.9	39.8
TH12 07				None	n/a	Clay	1.2	26.2							
11112-07				NOTE	11/ d	Clayey Silt	1.5	22.1							
		Asphalt	125			Silty Clay	1.8	30.3							
						Silty Clay	2.1	37.3							





Chancellor Drive South Leg





#### PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

# **GEOTECHNICAL INVESTIGATION**

## STREET RECONSTRUCTION

#### **Fieldwork**

Revised October 28<sup>th</sup>, 2008

- 1. Clear all underground services at each testhole location.
- 2. Test holes required every 50 m with a minimum of 3 test holes per street.
- 3. Record location of testhole (offset from curb, distance from cross street and house number).
- 4. Drill 150 mm-diameter core in pavement.
- 5. Drill 125 mm-diameter testhole into fill materials and subgrade
- 6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
- 7. Testhole to be drilled to depth of 2 m  $\pm$  150 mm below surface of the pavement.
- 8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
- 9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
- 10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
- 11. Log soil profile for the subgrade.
- 12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
- 13. Make note of any water seepage into the testhole.
- 14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
- 15. Return core sample from the pavement and soil samples to the laboratory.

#### Lab Work

- 1. Test all soil samples for moisture content.
- 2. Photograph core samples recovered from the pavement surface.
- 3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
- 4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

Embrace the Spirit · Vivez l'esprit

#### AECOM Canada Ltd.

#### **GENERAL STATEMENT**

#### NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

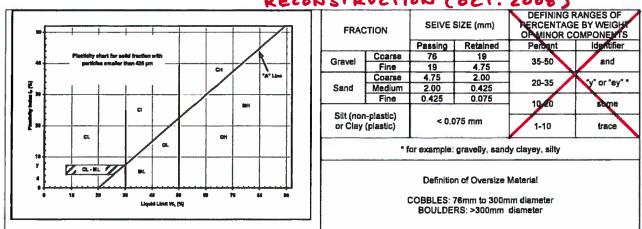
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

# **EXPLANATION OF FIELD & LABORATORY TEST DATA**

					UMA	USCS	Laboratory Classification Criteria							
		Descripti	ion		Log Symbols	Classification	Fines (%)	Grading	Plasticity	Notes				
		CLEAN GRAVELS	Weli grade sandy gravel or no t	s, with little	200	GW	0-5	C <sub>U</sub> > 4 1 < C <sub>C</sub> < 3						
	GRAVELS (More than 50% of coarse	(Little or no fines)	Poorly grade sandy gravel or no f	s, with little	2121	GP	0-5	Not satisfying GW requirements		Dual symbols if 5				
OILS	fraction of gravel size)	DIRTY GRAVELS	Silty gravels, grav		NN	GM	> 12		Atterberg limits below "A" line or W <sub>P</sub> <4	12% fines. Dual symbols if above "A" line and				
AINED S(		(With some fines)	Clayey grav sandy g			GC	> 12		Atterberg limits above "A" line or W <sub>P</sub> <7	4 <w<sub>P&lt;7</w<sub>				
COARSE GRAINED SOILS		CLEAN SANDS	Well grade gravelly sand or no f	s, with little	0.0	sw	0-5	C <sub>U</sub> > 6 1 < C <sub>C</sub> < 3		$C_{U} = \frac{D_{60}}{D_{10}}$				
CO/	SANDS (More than 50% of	(Little or no fines)	Poorly grad gravelly sand or no f	s, with little	000	SP	0-5	Not satisfying SW requirements		$C_{U} = \frac{D_{60}}{D_{10}}$ $C_{C} = \frac{(D_{30})^{2}}{D_{10}xD_{6}}$				
	coarse fraction of sand size)	DIRTY SANDS	Silty sa sand-silt r			SM	> 12		Atterberg limits below "A" line or W <sub>P</sub> <4					
		(With some fines)	Clayey s sand-clay			SC	> 12		Atterberg limits above "A" line or W <sub>P</sub> <7					
	SILTS (Below 'A' line	W <sub>L</sub> <50	Inorganic si clayey fine s slight pla	ands, with		ML								
	negligible organic content)	W <sub>L</sub> >50	Inorganic si plasti			МН								
SOILS	CLAYS	W <sub>L</sub> <30	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays Inorganic clays and silty clays of medium plasticity			CL								
FINE GRAINED SOILS	(Above 'A' line negligible organic	30 <w∟<50< td=""><td></td><td>CI</td><td></td><td></td><td>Classification Is Based upon Plasticity Chart</td><td></td></w∟<50<>				CI			Classification Is Based upon Plasticity Chart					
	content)	W <sub>L</sub> >50	Inorganic cla plasticity,		$\mathbb{Z}$	сн								
	ORGANIC SILTS & CLAYS	W <sub>L</sub> <50	Organic s organic silty o plasti	clays of low		OL								
	(Below 'A' line)	W <sub>L</sub> >50	Organic cla plasti			он								
н	IGHLY ORGA	NIC SOILS	Peat and ot organic			Pt		/on Post ification Limit		r odour, and often s texture				
		Asphait			Till									
		Concrete			ledrock fferentiated)		_		AE	COM				
XX		Fill			ledrock mestone)									

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

#### NOT USED TO CLASSIFY SUBGRADE, REFER TO CITY OF WINN IPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



#### LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- qu undrained shear strength (kPa) derived from unconfined compression testing.
- T<sub>v</sub> undrained shear strength (kPa) measured using a torvane
- pp undrained shear strength (kPa) measured using a pocket penetrometer.
- L<sub>v</sub> undrained shear strength (kPa) measured using a lab vane.
- Fv undrained shear strength (kPa) measured using a field vane.
- $\gamma$  bulk unit weight (kN/m<sup>3</sup>).
- SPT Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w moisture content (WL, WP)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	CONSISTENCY
<12	very soft
12 - 25	soft
25 - 50	medium or firm
50 - 100	stiff
100 - 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0-4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

		Local Streets Package 12-R-03 : Chancellor Drive South Leg; 18 m West of Markham Ro		ENT: C					th of	Curh				STHOLE NO: TH12-(	
		TOR: Maple Leaf Drilling Ltd												OJECT NO.: 602414	88
	PLE T			HOD: PLIT SPC			SA \ B		100	inm C		NO PI	ECOVEI	EVATION (m):	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE SAMPLE #	◆ S 0 16 1	PENETR/ # B Oynai T (Stand (Blows 20 40 Tota (k 7 18 Plastic	ATION ecker mic C dard F s/300 6 I Unit N/m <sup>3</sup> ) 19 MC	ITESTS → one Pen Te mm) 0 8 Wt 20 Liquid	st) ♦ 0 100 0 21	-	INED SH + Tor ∠ C □ Lab △ Pocku � Field (ki	IEAR ST vane + QU × Vane □ et Pen. 2 I Vane <b>€</b> Pa)	RENGTH	COMMENTS	
0		ASPHALT (thickness = 90 mm)				20 40	6	0 8	0 100	5	0 1	<u>00 1</u>	150 200		+
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed		G47									· · · · · · · · · · · · · · · · · · ·		
		CLAY (FILL) - trace silt, trace sand, trace stone (<10 mm diameter) - brown - frozen, moist when thawed - high plasticity		G48		•						· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		
1		CLAY - some silt, trace sand - brown - frozen to 1.3 m, moist when thawed - high plasticity		G49		•						- · · · · · · · · · · · · · · · · · · ·			
		- below 1.3 m, firm		G50		•					<pre></pre>	<pre></pre>	· · · · · · · · · · · · · · · · · · ·		
		- below 1.5 m, silt pockets		G51			)					- - - - - - - - - - - - - -	· · · · · · · · · · · · · · · · · · ·		
2				G52 G53			•					- - - - - - - - - - - - - -	· · · · · · · · · · · · · · · · · · ·		
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.09 m, solid stem augers to 2.1 m.	,												
3													· · · · · · · · · · · · · · · · · · ·		
						GGED					9			ETION DEPTH: 2.10 m	
		AECOM				VIEWE				nalil		0	COMPL	ETION DATE: 2/2/12 Page	

		Local Streets Package 12-R-03 : Chancellor Drive South Leg; 49 m West of Markham Rc				Winnipe		of Curb			STHOLE NO: TH12-0	
		TOR: Maple Leaf Drilling Ltd							rina		ROJECT NO.: 6024148	58
	PLE T		<u>  ME   F</u>   Spl				<u>. with 150</u> BULK	mm Co	ring No F		EVATION (m):	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TTE	◆ SI 0 : 16 1	PENETRATIC ★ Beckit ◆ Dynamic PT (Standarco (Blows/30 0 40 ■ Total Un (kN/m	N TESTS er ¥ Cone ◇ I Pen Test) ◀ 00mm) 60 80 10 it Wt ■ i) 19 20 2 Liquid	21	ED SHEAR S + Torvane + XQU X Lab Vane [ Pocket Pen. Field Vane (kPa)	TRENGTH - 	COMMENTS	
0		ASPHALT (thickness = 95 mm)				· · ·	· · ·			:		
		CLAY (FILL) - some silt, trace sand, trace stones (<10 mm diameter) - brown - frozen, moist when thawed - low to intermediate plasticity	)	G54	• • • •							
		CLAY - trace to some silt, trace sand		G55					· · · · · · · · · · · · · · · · · · ·			
1		- brown - frozen to 1.2 m, moist when thawed - high plasticity		G56		·				· · · · · · · · · · · · · · · · · · ·	Gradation: Sand = 1.1%, Silt = 10.2%, Clay = 88.7%	
		- below 1.2 m, firm		G57		•			· · · · · · · · · · · · · · · · · · ·			
		- below 1.4 m, some silt - below 1.5 m, silt pockets		G58		••••			· · · · · · · · · · · · · · · · · · ·			
				G59		•						
2		END OF TEST HOLE AT 2.1 m in clay. NOTES:		G60		•						
		<ol> <li>No sloughing observed.</li> <li>No seepage observed.</li> <li>Test hole backfilled with auger cuttings, bentonite and high strength grout to surface.</li> <li>Drilled with 150 mm diamond core to 0.095 m, solid stem augers to 2.1 m.</li> </ol>	0							· · · · · · · · · · · · · · · · · · ·		
3					LO	GED BY	Stephen	Petsche	·····	COMPL	ETION DEPTH: 2.10 m	
		AECOM					BY: Faris k				ETION DATE: 2/2/12	

		Local Streets Package 12-R-03				Winnipe		of (	`urb				THOLE NO: TH12-				
		I: Chancellor Drive South Leg; 63 m East of Augusta Driv TOR: Maple Leaf Drilling Ltd				e, 3.0 m mm SSA				orina		PROJECT NO.: 60241488 ELEVATION (m):					
	PLE T			T SPO	ON		BULK	100			NO REC						
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	◆ S 0 : 16 1	PENETRATIC	er ¥ Cone ≎ I Pen Te 00mm) 60 8 it Wt ∎ 1) 19 2 Liqu	est) ♦ 80 100 0 21		+ Torv × C □ Lab △ Pocke ♥ Field (kf		NGTH 200	COMMENTS				
0		ASPHALT (thickness = 110 mm)															
	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	GRANULAR BASE - well graded (<12.5 mm diameter), trace clay - brown - frozen, mosit when thawed		G61			· · · · · · · · · · · · · · · · · · ·										
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G62		•	· · · · · ·										
1		CLAY - trace silt - brown - frozen to 1.3 m, moist when thawed - high plasticity		G63		•	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·									
		- below 1.3 m, firm		G64		•	· · · · · · · · · · · · · · · · · · ·										
		- at 1.5 m, some silt		G65		•	· · · · · · · · · · · · · · · · · · ·										
		- at 1.8 m, trace gypsum		G66		•		• • • • • • • •									
2		- at 2.0 m, silt pocket		G67		•	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		· · · · · · ·							
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.11 m, solid stem augers to 2.1 m.	0														
0							· · · · · · · · · · · · · · · · · · ·										
3				<u> </u>		GGED BY				Ə			TION DEPTH: 2.10 m				
		AECOM		REVIEWED BY: Faris Khalil ( PROJECT ENGINEER: Blair Cockrell						CO	COMPLETION DATE: 2/2/12 Page 1 (						

		Local Streets Package 12-R-03					Winnip		th of (	Jurb			ESTHOLE NO: TH12-1	
		: Chancellor Drive South Leg; 1 FOR: Maple Leaf Drilling Ltd	is in east of Augusta L				mm SS				rina		<u>ROJECT NO.: 6024148</u> _EVATION (m):	58
SAMP			SHELBY TUBE					4 Wiln BULK	1001					
DEPTH (m)	SOIL SYMBOL	SOIL DESC			SAMPLE IYPE SAMPLE #	♦ SF 0 2 16 1	PENETRATI	ION TEST ker ¥ c Cone < rd Pen To 60 mi 60 mi 19 2 19 2 Liqu	> est) ♦ 80 100	] م	ED SHEAR + Torvane ×QU× □ Lab Vane Pocket Per Field Vane (kPa)	STRENGTI + D	COMMENTS	
0		ASPHALT (thickness = 125 mm)												
		GRANULAR FILL - poorly graded (< - some clay - brown - frozen, moist when thawed	2.5 mm diameter)		G68			· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·			
		CLAYEY SILT - some sand, trace gra - light brown - frozen, moist when thawed - low plasticity	avel (< 5mm diameter)		G69	•	<b>⊢−1</b>	· · · · · · · · · · · · · · · · · · ·					Gradation: Gravel = 0.5%, Sand = 18.5%, Silt = 57.1%, Clay = 24.0%	
1		- below 0.9 m, some clay CLAY - trace silt, trace sand			G70			· · · · · · · · · · · · · · · · · · ·	· · · · · · · ·					
		<ul> <li>brown</li> <li>frozen to 1.3 m, moist when th</li> <li>high plasticity</li> <li>below 1.3 m, firm to stiff</li> </ul>	nawed		G71		· <b>F-</b> ●						Gradation: Sand = 1.1%, Silt = 6.0%, Clay = 92.9%	
					G72		•	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·		
		SILT - trace to some clay, trace sand - light brown - moist, soft - intermediate plasticity			G73		•	· · · · · · · · · · · · · · · · · · ·	· · · ·		• • • • • • • • • • •			
-2		CLAY - trace silt - brown - moist, firm - high plasticity END OF TEST HOLE AT 2.1 m in cla	у.		G74									
		NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cutt strength grout to surface. 4. Drilled with 150 mm diamond core 2.1 m.		ers to										
								· · · · · · · · · · · · · · · · · · ·	· • • • • • • • • • • • • • • • • • • •					
3						LOC	GED B	/:_Step	hen P	etsche	· · · · · · · · · · · · · · · · · · ·	COMPI	LETION DEPTH: 2.10 m	
		AECON				RE\	/IEWED	BY: Fa	aris Kh	alil		COMPI	LETION DATE: 2/2/12	



Photograph 1. Chancellor Drive South Leg – TH12-08



Photograph 2. Chancellor Drive South Leg – TH12-09



Photograph 3. Chancellor Drive South Leg – TH12-10



Photograph 4. Chancellor Drive South Leg – TH12-11

# City of Winnipeg Local Streets Package 12-R-03 Geotechnical Investigation

Test		Pavement S	Surface	Pavement Structu	re Material	Subgrade	Sample	Moisture		Hydromete	er Analysis		At	terberg Lin	nits
Hole No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Description	Depth (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
						Granular Fill	0.3	11.7							
	Changellar Drive Couth Log.					Clay Fill	0.6	32.5							
	Chancellor Drive South Leg; 18 m West of Markham					Clay	0.9	40.0							
TH12-08	Road, Eastbound Lane, 2.0 m	Asphalt	90	Granular Fill	360	Clay	1.2	41.0							
	North of Curb					Clay	1.5	42.2							
						Clay	1.8	45.4							
						Clay	2.1	49.1							
						Clay Fill	0.3	13.5							
	Chancellor Drive South Leg;					Clay Fill	0.6	19.4							
TU40.00	49 m West of Markham		05		,	Clay	0.9	38.6	0.0	1.1	10.2	88.7	85.9	27.8	58.1
TH12-09	Road, Westbound Lane,	Asphalt	95	None	n/a	Clay	1.2	40.4							
	2.0 m South of Curb					Clay	1.5 1.8	40.6 45.1							
						Clay Clay	2.1	45.1 50.1							
						Granular Base	0.3	9.2							<u> </u>
						Clay Fill	0.5	28.7							
	Chancellor Drive South Leg;					Clay	0.0	32.5							
TH12-10	63 m East of Augusta Drive,	Asphalt	110	Granular Base	345	Clay	1.2	32.2							
	Eastbound Lane, 3.0 m North	, iop i ioi t			0.0	Clay	1.5	34.1							
	of Curb					Clay	1.8	43.4							
						Clay	2.1	45.6							
						Granular Fill	0.3	17.3							
						Clayey Silt	0.6	15.6	0.5	18.5	57.1	24.0	27.9	14.9	13.0
	Chancellor Drive South Leg;					Clayey Silt	0.9	20.1							
TH12-11	13 m East of Augusta Drive, Westbound Lane, 2.0 m	Asphalt	125	Granular Fill	325	Clay	1.2	38.8	0.0	1.1	6.0	92.9	99.8	27.4	72.4
	South of Curb					Clay	1.5	41.0							
						Silt	1.8	35.1							
						Clay	2.1	49.6							





Markham Road

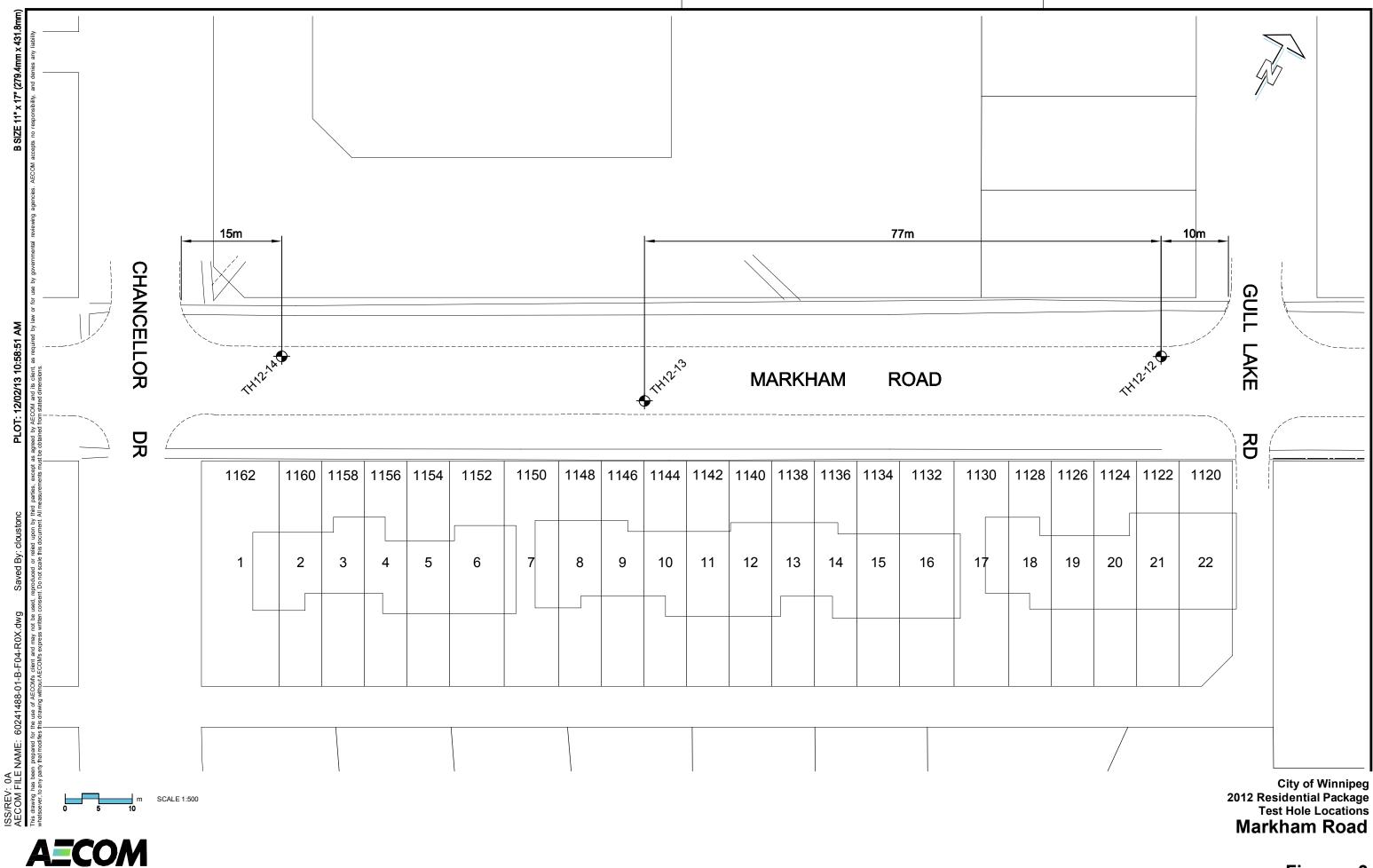


Figure - 3



#### PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

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# **GEOTECHNICAL INVESTIGATION**

## STREET RECONSTRUCTION

#### **Fieldwork**

Revised October 28<sup>th</sup>, 2008

- 1. Clear all underground services at each testhole location.
- 2. Test holes required every 50 m with a minimum of 3 test holes per street.
- 3. Record location of testhole (offset from curb, distance from cross street and house number).
- 4. Drill 150 mm-diameter core in pavement.
- 5. Drill 125 mm-diameter testhole into fill materials and subgrade
- 6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
- 7. Testhole to be drilled to depth of 2 m  $\pm$  150 mm below surface of the pavement.
- 8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
- 9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
- 10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
- 11. Log soil profile for the subgrade.
- 12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
- 13. Make note of any water seepage into the testhole.
- 14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
- 15. Return core sample from the pavement and soil samples to the laboratory.

#### Lab Work

- 1. Test all soil samples for moisture content.
- 2. Photograph core samples recovered from the pavement surface.
- 3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
- 4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

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#### AECOM Canada Ltd.

#### **GENERAL STATEMENT**

#### NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

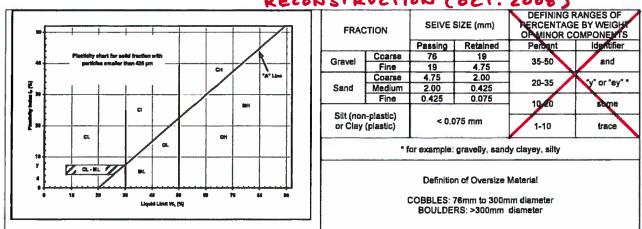
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

# **EXPLANATION OF FIELD & LABORATORY TEST DATA**

					UMA USCS	Laboratory Classification Criteria							
		Descripti	ion		Log Symbols	Classification	Fines (%)	Grading	Plasticity	Notes			
		CLEAN GRAVELS	Weli grade sandy gravel or no t	s, with little	2001	GW	0-5	C <sub>U</sub> > 4 1 < C <sub>C</sub> < 3					
	GRAVELS (More than 50% of coarse	(Little or no fines)	Poorly grade sandy gravel or no f	s, with little	2121	GP	0-5	Not satisfying GW requirements		Dual symbols if 5			
OILS	fraction of gravel size)	DIRTY GRAVELS	Silty gravels, grav		NN	GM	> 12		Atterberg limits below "A" line or W <sub>P</sub> <4	12% fines. Dual symbols if above "A" line and			
AINED S(		(With some fines)	Clayey grav sandy g			GC	> 12		Atterberg limits above "A" line or W <sub>P</sub> <7	4 <w<sub>P&lt;7</w<sub>			
COARSE GRAINED SOILS		CLEAN SANDS	Well grade gravelly sand or no f	s, with little	0.0	sw	0-5	C <sub>U</sub> > 6 1 < C <sub>C</sub> < 3		$C_{U} = \frac{D_{60}}{D_{10}}$			
CO CO	SANDS (More than 50% of	(Little or no fines)	Poorly grad gravelly sand or no f	s, with little	000	SP	0-5	Not satisfying SW requirements		$C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$			
	coarse fraction of sand size)	DIRTY SANDS	Silty sa sand-silt r			SM	> 12		Atterberg limits below "A" line or W <sub>P</sub> <4				
		(With some fines)	Clayey s sand-clay			SC	> 12		Atterberg limits above "A" line or W <sub>P</sub> <7				
	SILTS (Below 'A' line	W <sub>L</sub> <50	Inorganic si clayey fine s slight pla	ands, with		ML							
	negligible organic content)	W <sub>L</sub> >50	Inorganic si plasti			МН							
SOILS	CLAYS	W <sub>L</sub> <30	Inorganic c clays, sand low plasticity,	y clays of		CL							
FINE GRAINED SOILS	(Above 'A' line negligible organic	30 <w∟<50< td=""><td>Inorganic cla clays of n plasti</td><td>nedium</td><td></td><td>СІ</td><td></td><td></td><td>Classification Is Based upon Plasticity Chart</td><td></td></w∟<50<>	Inorganic cla clays of n plasti	nedium		СІ			Classification Is Based upon Plasticity Chart				
FINE	content)	W <sub>L</sub> >50	Inorganic cla plasticity, t		$\mathbb{Z}$	СН							
	ORGANIC SILTS & CLAYS	W <sub>L</sub> <50	Organic s organic silty o plasti	clays of low		OL							
	(Below 'A' line)	W <sub>L</sub> >50	Organic cla plasti			он			1				
н	IGHLY ORGA	NIC SOILS	Peat and ot organic			Pt		on Post		r odour, and often s texture			
		Asphait			Till	9 - 97							
		Concrete			ledrock fferentiated)		_		AE	COM			
X		Fill			ledrock mestone)								

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

#### NOT USED TO CLASSIFY SUBGRADE, REFER TO CITY OF WINN IPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



#### LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- qu undrained shear strength (kPa) derived from unconfined compression testing.
- T<sub>v</sub> undrained shear strength (kPa) measured using a torvane
- pp undrained shear strength (kPa) measured using a pocket penetrometer.
- L<sub>v</sub> undrained shear strength (kPa) measured using a lab vane.
- Fv undrained shear strength (kPa) measured using a field vane.
- $\gamma$  bulk unit weight (kN/m<sup>3</sup>).
- SPT Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w moisture content (WL, WP)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	CONSISTENCY
<12	very soft
12 - 25	soft
25 - 50	medium or firm
50 - 100	stiff
100 - 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0-4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

		Local Streets Package 12-R-03 : Markham Road; 10 m West of Gull Lake Road, Westb	CLIEN									<u>STHOLE NO: TH12-1</u> DJECT NO.: 6024148	
		TOR: Maple Leaf Drilling Ltd	METH					50 mm	Corina			EVATION (m):	.0
SAMP							BULK			NO REC			
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	<ul> <li>♦ SPT</li> <li>0 20</li> <li>16 17</li> </ul>	Total Un (kN/m 18 stic MC	er ¥ Cone ◇ I Pen Test 0mm) 60 80 it Wt ∎ <sup>3</sup> ) 19 20	100 21	+ Torv ×Q □ Lab ' △ Pocke � Field (kF	Vane <del>®</del> Pa)	NGTH 200	COMMENTS	
0		CONCRETE (thickness = 200 mm) GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed CLAY (FILL) - silty, sandy - black to dark brown - frozen, moist when thawed - high plasticity - at 0.7 m, large rock (diameter undetermined) encountered CLAY - some silt to silty, trace sand - black - frozen to 1.5 m, moist when thawed - high plasticity		G75 G76 G77 G78		) 						Gradation: Sand = 23.0%, Silt = 27.9%, Clay = 49.1% Gradation: Sand = 4.2%, Silt = 20.3%, Clay = 75.4%	
		- below 1.5 m, firm - below 1.7 m, brown		G79 G80		•							
-2		SILTY CLAY - trace sand - light brown - moist, soft - intermediate plasticity END OF TEST HOLE AT 2.1 m in silty clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.20 m, solid stem augers 2.1 m.	to	G81		•							
3		AECOM				GED BY EWED E			he			TION DEPTH: 2.10 m TION DATE: 2/2/12	

		Local Streets Package 12-R-03 : Markham Road; Along Property Line of House #1144 a	CLIE	<u>ENT: C</u> 46, Eas	ity o stbou	<sup>f</sup> Winni Ind Lar	<u>peg</u> 1e, 2.0	m No	orth of	Curb			<u>HOLE NO</u> JECT NO.:		
		TOR: Maple Leaf Drilling Ltd		HOD:									ATION (m		
SAMF	PLE T	YPE GRAB SHELBY TUBE		PLIT SPO			BULK				NO REC				
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE SAMPLE #		<ul> <li>◇ Dynan</li> <li>PT (Stand (Blows</li> <li>20 40</li> <li>■ Total (kl</li> <li>17 18</li> </ul>	cker ¥ nic Cone ard Pen /300mm) 60 Unit Wt V/m <sup>3</sup> ) 19 WC Lic	♦ Test) ♦ 80 100	<u>0</u> 1_	INED SHE + Torva	J × ′ane □ t Pen. ∆ ⁄ane	NGTH 200	Comme	INTS	
0		ASPHALT (thickness = 125 mm)				· · ·				· · ·					
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed CLAY (FILL) - some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G82	•	•									
1		CLAY - trace silt, trace sand - dark brown - frozen to 1.3 m, moist when thawed - high plasticity		G84		•									
		- below 1.3 m, stiff		G85 G86		•									
2		- below 1.9 m, some silt to silty		G87 G88		•									
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.125 m, solid stem augers 2.1 m.	to												
3															
		AECOM			RE	gged e Viewee Oject	) BY: F	aris K	halil				ion depth Ion date:		

		Local Streets Package 12-R-03 : Markham Road; 15 m East of Chancellor Drive, Westbo				Winnipeg		TESTHOLE NO: TH1 PROJECT NO.: 6024	
		TOR: Maple Leaf Drilling Ltd				mm SSA with 150 r	mm Coring	ELEVATION (m):	1468
	PLE T						NO REC		
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION			◆ SI 0 2 16 1	PENETRATION TESTS	UNDRAINED SHEAR STRE + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ � Field Vane � (kPa)		- H L L
0		ASPHALT (thickness = 110 mm)							
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G89 G90		•			
1		CLAYEY SILT - some sand - grey - frozen to 1.2 m, moist when thawed - intermediate plasticity - below 1.0 m, light brown		G91	·····	●-1		Gradation: Sand = 15.8%, Silt = 60.1%, Clay = 24.1%	
		- below 1.2 m, soft to firm		G92 G93					
2		CLAY - trace silt - brown - moist, firm - high plasticity		G94 G95		•			
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.110 m, solid stem augers 2.1 m.	to			•		· · · · · · · · · · · · · · · · · · ·	
3						GGED BY: Stephen P		DMPLETION DEPTH: 2.10	n
		AECOM				/IEWED BY: Faris Kh	alil CC Blair Cockrell	OMPLETION DATE: 2/2/12	ge 1 c



Photograph 1. Markham Road – TH12-12



Photograph 2. Markham Road – TH12-13



Photograph 3. Markham Road – TH12-14

# City of Winnipeg Local Streets Package 12-R-03 Geotechnical Investigation

Test		Pavement Su	urface	Pavement Structu	re Material	Subgrade	Sample	Moisture		Hydromet	er Analysis		Atterberg Limits			
Hole No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Description	Depth (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index	
						Granular Fill	0.3	13.9								
	Markham Dood, 10 m West					Clay Fill	0.6	21.5								
	Markham Road; 10 m West of Gull Lake Road,					Clay Fill	0.9	22.8	0.0	23.0	27.9	49.1	58.4	24.0	34.4	
TH12-12	Westbound Lane, 1.5 m	Concrete	200	Granular Fill	100	Clay	1.2	35.5	0.0	4.2	20.3	75.4	79.7	26.9	52.8	
	South of Curb					Clay	1.5	34.5								
						Clay	1.8	35.4								
						Silty Clay	2.1	40.0								
						Granular Fill	0.3	6.3								
	Markham Doady Along					Clay Fill	0.6	22.8								
	Markham Road; Along Property Line of House #1144					Clay	0.9	36.1								
TH12-13	and 1146, Eastbound Lane,	Asphalt	125	Granular Fill	175	Clay	1.2	37.3								
	2.0 m North of Curb					Clay	1.5	36.0								
	2.0 11 101 0015					Clay	1.8	36.4								
						Clay	2.1	38.8								
						Granular Fill	0.3	21.8								
						Clay Fill	0.6	29.1								
	Markham Road; 15 m East of					Clayey Silt	0.9	21.1	0.0	15.8	60.1	24.1	32.5	16.7	15.9	
TH12-14	Chancellor Drive, Westbound	Asphalt	110	Granular Fill	190	Clayey Silt	1.2	20.0								
	Lane, 1.5 m South of Curb					Clayey Silt	1.5	21.8								
						Clay	1.8	46.3								
						Clay	2.1	48.3								

