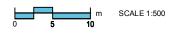
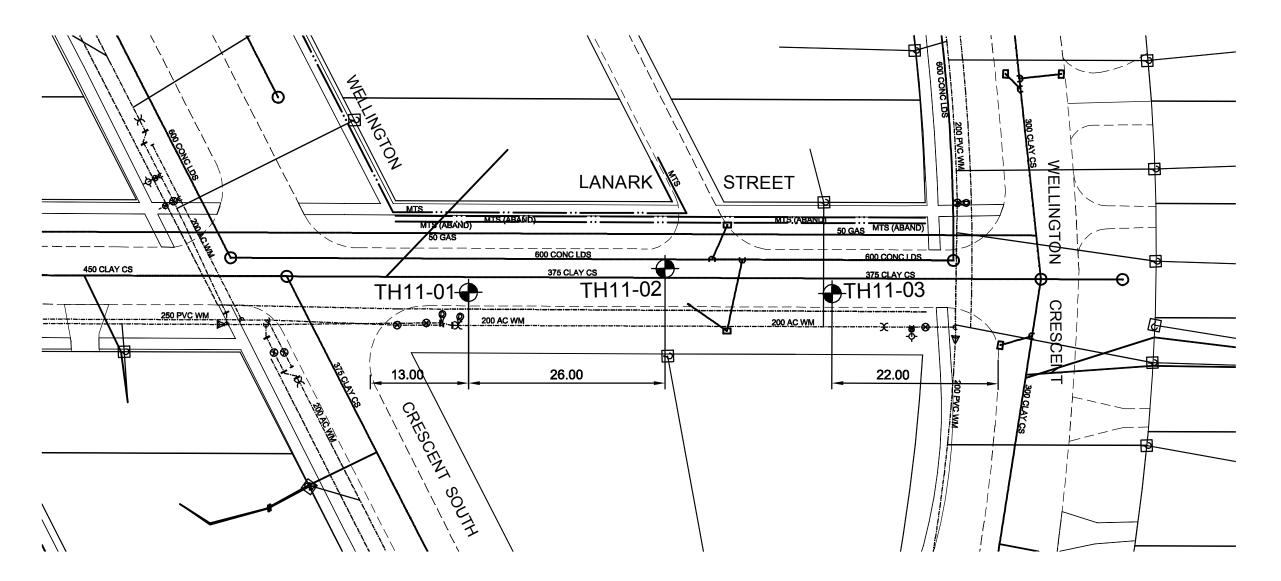
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APPENDIX A LANARK STREET GEOTECHNICAL REPORT









City of Winnipeg 2011 Residential Package Test Hole Locations Lanark Street



PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

<u>Fieldwork</u>

- 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.

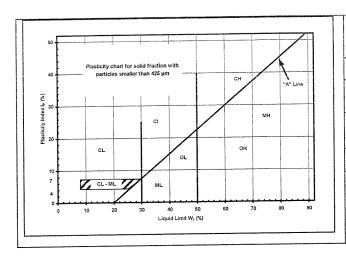
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced 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		Laborator	ory Classification Criteria			
		Descripti	on		Log Symbols	Classification	Fines (%)	Grading	Plasticity	Notes		
		CLEAN GRAVELS	Well graded sandy gravels or no fi	s, with little	2021	GW	0-5	C _U > 4 1 < C _C < 3				
	GRAVELS (More than 50% of	(Little or no fines)	Poorly grade sandy gravels or no fi	s, with little	22	GP	0-5	Not satisfying GW requirements		Dual symbols if 5- 12% fines.		
STIC	coarse fraction of gravel size)	DIRTY GRAVELS	Silty gravels, grave			GM	> 12		Atterberg limits below "A" line or W _P <4	Dual symbols if above "A" line and		
AINED SC		(With some fines)	Clayey grave sandy gr			GC	> 12		Atterberg limits above "A" line or W _P <7	4 <w<sub>P<7</w<sub>		
COARSE GRAINED SOILS		CLEAN SANDS	Well grade gravelly sand or no fi	s, with little	80 A	SW	0-5	C _U > 6 1 < C _C < 3		$C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$		
COA	SANDS (More than 50% of	(Little or no fines)	Poorly grade gravelly sand or no f	s, with little		SP	0-5	Not satisfying SW requirements		$C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$		
	coarse fraction of sand size)	DIRTY SANDS	Silty sa sand-silt n		M	SM	> 12		Atterberg limits below "A" line or W _P <4			
		(With some fines)	Clayey s sand-clay r			SC	> 12		Atterberg limits above "A" line or W _P <7			
	SILTS (Below 'A' line	W _L <50	Inorganic sil clayey fine s slight pla	ands, with	102/00/2010000 100 100 100 100 100 100 100 100 1	ML						
	negligible organic content)	W _L >50	Inorganic sil plastic		Ш	МН						
SOILS	CLAYS	W _L <30	Inorganic cl clays, sand low plasticity,	y clays of		CL						
FINE GRAINED SOILS	(Above 'A' line negligible organic	30 <w<sub>L<50</w<sub>	Inorganic clay clays of n plasti	nedium		CI			Classification is Based upon Plasticity Chart			
FINE G	content)	W _L >50	Inorganic cla plasticity, f			СН						
	ORGANIC SILTS & CLAYS	W _L <50	Organic s organic silty o plasti	lays of low	The second secon	OL						
	(Below 'A' line)	W _L >50	Organic clay plasti			ОН						
F	IIGHLY ORGA	INIC SOILS	Peat and otl organic			Pt	1	on Post ification Limit		or odour, and often s texture		
Ī		Asphalt	94		1 11							
Ŀ		Concrete	錣	_	Sedrock fferentiated)				AE	COM		
8	\boxtimes	Fill			sedrock 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.

CITY OF WINNIPER SPECT FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 02



FRAC	CTION	SEIVE	SIZE (mm)	DEFINING RANGES OF PERCENTAGE BY WEIG OF MINOR COMPONEN				
		Passing	Retained	Percent	Identifier			
0	Coarse	76	19	35-50	and			
Gravel	Fine	19	4.75	00-00				
	Coarse	4.75	2.00	20-35	"v" or "ev" *			
Sand	Medium	2.00	0.425	20 00	N3			
	Fine	0.425	0,075	10-20	some			
	n-plastic) (plastic)	< 0.0)75 mm	1-10	trace			

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

qu - undrained shear strength (kPa) derived from unconfined compression testing.

T_v - undrained shear strength (kPa) measured using a torvane

pp - undrained shear strength (kPa) measured using a pocket penetrometer.

L_v - undrained shear strength (kPa) measured using a lab vane.

F_v - undrained shear strength (kPa) measured using a field vane.

 γ - bulk unit weight (kN/m 3).

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 (W_L, W_P)

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					

PROJ	IECT:	2011 Residential Street Renewal	CLIENT										TESTHOLE NO: TH11-01				
		Lanark Street, 13 m North of Wellington Crescent S	S, Northbound Lane, 2.5 m West of curb METHOD: 125 mm SSA with 150 mm Coring									PROJECT NO.: 60212233					
CONT	TRAC	FOR: Paddock Drilling Ltd.	METHO	D:	125	mm	SSA	with	150	mm	Corin				DN (m):		
SAMP	LE TY	PE GRAB SHELBY TUBE	⊠sr	PLIT	SPO			BL					J	COVE	RY CORE	,	
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE #	◆ SP 0 2 16 1;	X E Dyna T (Star (Blov 0 4) ■ Tota (7 18	ATION Becker amic Condard F vs/300r 0 60 al Unit kN/m³) 8 19 MC 0 66	one ◇ Pen Te mm) 0 80 Wt ■ 1 20 Liquid	si) 💠 0 100	+ Torvane +			Δ	COMMENTS	DEPTH	
0	77	ASPHALT (thickness = 30 mm)						:	:				:	:			
T .	77	CONCRETE (thickness = 170 mm)												:			
		CLAY - dark brown - frozen to 1.8 m, moist when thawed - high plasticity			G1)									
_														:	Gradation:		
-					G2								·}·····	·}·····	Sand = 3.0%, Silt = 18.3%, Clay = 78.7%		
ſ															•		
-					G3								:	:			
														:		1	
-1						ļ	: :						÷	: :			
					G4								<u>:</u>	<u>:</u>			
_		- brown at 1.2m											:	:			
···							:							÷	•		
-					G5			.					÷	. .			
-		- trace silt at 1.5m					:					:	:				
_								1				}		:			
-		halam A Our Same to aliff			G6			•				: :		÷			
-		- below 1.8 m, firm to stiff										: : :		<u>.</u>		,	
-2					07											2	
-		END OF TEST HOLE AT 2.1 m in clay.			G7		 :	•		 :		 :	 !	<u></u>			
-		NOTES:					<u>:</u> :			: :		: :		<u>.</u>			
r		No sloughing observed No seepage observed							:								
		 Test hole backfilled with auger cuttings, bentonite, sand and a cold patch to surface. 					<u></u>		: :			: :		:	*	and the same of th	
		4. Drilled with 150 mm diamond core to 0.2 m, solid stem augers 2.1m.	s to				<u>.</u>		: :	: : · · · · ·		: :		<i>:</i>	,		
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4						10	CCEL) RV-	Stor	hen !	Petsch	·····	T,	COMPI	· <u> </u> _ETION DEPTH: 2.10 m		
-3		A ECOM						ED B							ETION DATE: 4/7/11		
4								TEN							Page	1 of	

PRO	JECT	2011 Residential Street Renewal	CLIEN	T: (City o	of Wi	nnipe	g					TESTHOLE NO: TH11-02				
		: Lanark Street, 39 m North of Wellington Crescent S	, Southbound Lane, 3 m East of curb METHOD: 125 mm SSA with 150 mm Coring										PROJECT NO.: 60212233				
		TOR: Paddock Drilling Ltd.) mm	Cori		<u> </u>		ON (m):		
SAMF	PLE T	PE GRAB SHELBY TUBE	SPLIT SPOON ■BULK							γ	K	NO RECOVERY CORE					
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE #	• SF	ODyna PT (Star (Blov 20 4 Tota 7 18 Plastic	Becke amic (ndard ws/300 0 (al Uni kN/m	Pen Tomm) 50 t Wt Liqu	est) • 80 10		+ Tol X (Lab △ Pock ♣ Field (F	vane + QU X Vane E et Pen. I Vane (] Δ	COMMENTS	DEPTH	
0	11	ASPHALT (thickness = 20 mm)		T					:	:		:	:	:			
-	4	CONCRETE (thickness = 140 mm) CLAY - black		-					<u>:</u> :	<u></u>				: :			
-		- trace organics - high plasticity			G8		•		<u>:</u> :				 				
-		CLAY - trace sand - brown, frozen, moist when thawed			G9		•		 					 			
-		- high plasticity CLAYEY SILT - trace sand														PARTY DE ARRESTA DE PARTY DE LA CALIFORNIA DE LA CALIFORN	
-	Щ	brown, frozen, moist when thawed intermediate plasticity			G10		•						 	<u></u>			
-		CLAY - trace silt - brown, frozen to 1.7 m, moist when thawed - high plasticity			G11			 D	: :				.i	<u></u>			
-						ļ											
-					G12	ļ		.						<u>.</u>			
-		- below 1.7 m, trace gypsum, firm			G13				<u>.</u>				 !	<u>.</u>			
- -2													· · · · · · · · · · · · · · · · · · ·				
-		END OF TEST HOLE AT 2.1 m in clay.			G14			•	<u>:</u>	<u>.</u>			<u>.</u>				
-		NOTES: 1. No sloughing observed.					<u>.</u>		<u>.</u>			<u>.</u>					
		No seepage observed. Test hole backfilled with auger cuttings, bentonite, sand and as	sphalt						: : : :								
	-	cold patch to surface. 4. Drilled with 150 mm diamond core to 0.16 m, solid stem augen							: :								
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4	<u> </u>					LOC	GED	BY:	Ster	hen f	Petsch	e	;	OMPL	 ETION DEPTH: 2.10 m		
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						PR(DJECT	EN	GINE	ER:					Page	1 of	

LOCATION: Lanari Street, 22 m South of Wellington Crescort S, Northbound Lane, 2.5 m West of curb CONTRACTOR: Paddook Diffing Ltd. METHOD: 125 mm SSA with 150 mm Coting SAMPLE TYPE GRAP G			2011 Residential Street Renewal	CLIEN						et of	curh					E NO: TH11-03 NO.: 60212233	
SAMPLE TYPE GRAB GRAB SHELPY TUBE SPLIT SPOON BULK NO NECONERY COMMENTS SOIL DESCRIPTION SOIL DESCRI													na				
SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION DESCRIPTION SOIL DESCRIPTION DESCRIPTION SOIL DESCRIPTION														L			***********
CLAY - dark bown - boxed have thaved - high leadoly - boxed have and - brown, focase, moist when thaved - intermediate plasicity - intermediate plasicity - intermediate plasicity - intermediate plasicity - Gradulor - Sand *26.4%, Sit = 39.2%, Clay = 34.4% - Sit = 39.2%, Clay = 39.2			SOIL DESCRIPTION		TYPE	##	◆ SI 0	PENET * Dyr T (Sta (Blo 20 To 7 1	RATIO Beckenamic (andard wws/30) 40 tal Unit (kN/m 8 1	N TEST er ** Cone < Pen T Omm) 60 8 t Wt 13 19 2	est) • 100 100 21		+ Tor X 0 □ Lab Δ Pocke Prield (k	vane + QU X Vane E et Pen. , Vane € Pa)] △ ∌	COMMENTS	DEPTH
CLAY - dark brown - boxen, most when thawed - intermediate plasticity SILTY CLAY - some said - intermediate plasticity CLAY - some sait, trace sand - brown, frozen in 1.7 m, moist when thawed - brown, frozen in 1.7 m, moist when thawed - brown, frozen in 1.7 m, moist when thawed - brown, frozen in 1.7 m, moist when thawed - trace gypsum at 1.5m - below 1.7 m, firm CAD DIF TEST HOLE AT 2.1 m in day, NOTES. I. No singuing belowed. 3. Tast hole backfilled with suger cuttings, bentoning, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.	0	11			1			:	:		:		:	:	:		
- brown, frozen, moist when thawed - intermediate plasticity Gradation: Sand = 26.4%, Silt = 39.2%, Clay = 34.4% CLAY - some silt trace sand - brown, frozen to 1.7 m, moist when thawed G18 G19 Clay - some silt trace sand - brown, frozen to 1.7 m, moist when thawed G18 G19 G19 G19 G19 G19 G19 G19			CLAY - dark brown - frozen, moist when thawed			G15											
CLAY - some stilt, trace sand - brown, frozen to 1.7 m, moist when thawed - brown, frozen to 1.7 m, moist when thawed - class - brown, frozen to 1.7 m, moist when thawed - class - cl			 brown, frozen, moist when thawed 			G16		· · · · · · · ·									
- trace gypsum at 1.5m - below 1.7 m, firm - S20 END OF TEST HOLE AT 2.1 m in day. NOTES: 1. No slouphing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.	-1		CLAY - some silt trace sand			G17		•	· · · · · · · · · · · · · · · · · · ·							Sand = 26.4%, Silt =	
- trace gypsum at 1.5m - below 1.7 m, firm 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, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.										:							
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, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.						G19		! !		 					 		
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, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.			- below 1.7 m, firm			G20		: : : : :	•	÷							
2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.	-2		NOTES:			G21			•								
3			 No seepage observed. Test hole backfilled with auger cuttings, bentonite, sar cold patch to surface. Drilled with 150 mm diamond core to 0.19 m, solid ste 					<u>:</u>		· · · · · · · · · · · · · · · · · · ·							
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REVIEWED BY: Faris Khalil COMPLETION DATE: 4/7/11 PROJECT ENGINEER: Page 1			A=COM				RE	VIEW	ED E	Y: F	aris K					ETION DATE: 4/7/11	



Photograph 1. Lanark Street – TH11-01



Photograph 2. Lanark Street – TH11-02



Photograph 3. Lanark Street - TH11-03

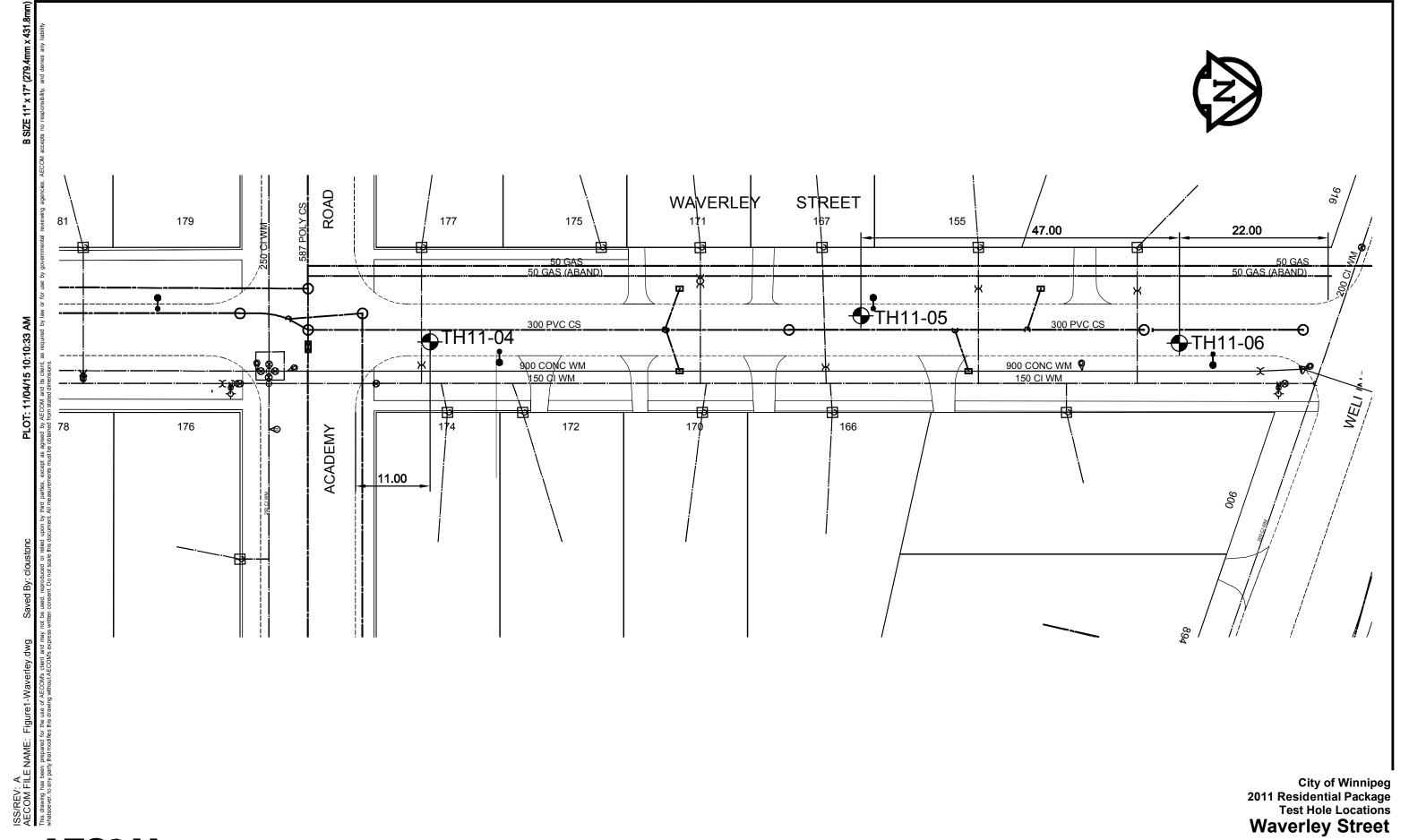


City of Winnipeg 2011 Residential Street Renewal – Lanark and Waverley Geotechnical Investigation

Test		Pavement S	urface	Pavement Structu	ıre Material	Subgrade	Sample	Moisture		Hydromete	er Analysis		At	terberg Lin	nits
Hole No.	Testhole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Description	Depth (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
						Clay	0.3	39.5							
		Asphalt	30			Clay	0.6	39.6	0.0	3.0	18.3	78.7	71.4	27.9	43.4
	Lanark Street, 13 m N of					Clay	0.9	38.9							
TH11-01	Wellington Cres. S., Northbound Lane, 2.5 m W of	/ of		None	n/a	Clay	1.2	40.2							
	Curb	Concrete	170			Clay	1.5	41.0							
	Curb	Concrete	170			Clay	1.8	42.1				<u> </u>			
						Clay	2.1	45.0							
						Clay	0.3	35.5							
	Langui Straat 20 m N of	Asphalt	20			Clay	0.6	29.1							
	Lanark Street, 39 m N of Wellington Cres. S.,					Clayey Silt	0.9	26.7							
TH11-02	Southbound Lane, 3 m E of			None	n/a	Clay	1.2	41.3							
	Curb	Concrete	140			Clay	1.5	40.1							
	54.5	Concrete	140			Clay	1.8	41.5					***************************************		
						Clay	2.1	44.0							
						Clay	0.3	40.8							
	Lanark Street, 22 m S of	Asphalt	55			Silty Clay	0.6	46.0				244	25.0	453	20.7
	Wellington Cres.,					Silty Clay	0.9	31.7	0.0	26.4	39.2	34.4	35.9	15.2	20.7
TH11-03	Northbound Lane, 2.5 m W of			None	n/a	Clay	1.2	43.2							
	Curb	Concrete	135			Clay	1.5	39.7							
			155			Clay	1.8	42.5							
1						Clay	2.1	42.4							

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APPENDIX B WAVERLEY STREET GEOTECHNICAL REPORT



A=COM

m SCALE 1:500

Waverley Street
Academy Road to Wellington Crescent
Figure - 1



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Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

- 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.

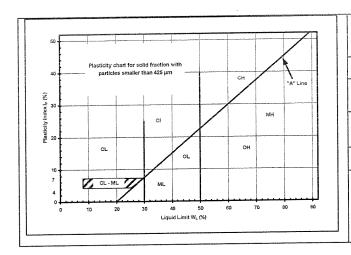
Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction 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		Laborator	/ Classification Crite	eria
		Description	on		Log Symbols	Classification	Fines (%)	Grading	Plasticity	Notes
		CLEAN GRAVELS	Well graded g sandy gravels, or no fin	with little	2021	GW	0-5	C _U > 4 1 < C _C < 3		
	GRAVELS (More than 50% of	(Little or no fines)	Poorly graded sandy gravels, or no fin	with little	\mathbf{R}	GP	0-5	Not satisfying GW requirements		Dual symbols if 5- 12% fines.
STIC	coarse fraction of gravel size)	DIRTY GRAVELS	Silty gravels, si gravels			GM	> 12		Atterberg limits below "A" line or W _P <4	Dual symbols if above "A" line and
AINED SC		(With some fines)	Clayey gravels sandy gra			GC	> 12		Atterberg limits above "A" line or W _P <7	4 <w<sub>P<7</w<sub>
COARSE GRAINED SOILS		CLEAN SANDS	Well graded gravelly sands, or no fin	with little		sw	0-5	C _U > 6 1 < C _C < 3		$C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
COA	SANDS (More than 50% of	(Little or no fines)	Poorly graded gravelly sands, or no fin	with little	000	SP	0-5	Not satisfying SW requirements		$C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
	coarse fraction of sand size)	DIRTY SANDS	Silty san sand-silt mi		M	SM	> 12		Atterberg limits below "A" line or W _P <4	
		(With some fines)	Clayey sa sand-clay m			SC	> 12		Atterberg limits above "A" line or W _P <7	
	SILTS (Below 'A' line	W _L <50	Inorganic silts clayey fine sa slight plas	nds, with		ML				
	negligible organic content)	W _L >50	Inorganic silts plastici		Ш	MH				
SOILS	CLAYS	W _L <30	Inorganic cla clays, sandy low plasticity, l	clays of		CL				
FINE GRAINED SOILS	(Above 'A' line negligible organic	30 <w<sub>L<50</w<sub>	Inorganic clays clays of me plastici	edium		CI			Classification is Based upon Plasticity Chart	
FINE	content)	W _L >50	Inorganic clay plasticity, fa			СН				
	ORGANIC SILTS & CLAYS	W _L <50	Organic silt organic silty cla plastici	ays of low	The state of the s	OL				
	(Below 'A' line)	W _L >50	Organic clays plastici			ОН				
ŀ	HIGHLY ORGA	INIC SOILS	Peat and othe organic s			Pt		Von Post sification Limit		or odour, and often as texture
		Asphalt	MA		Till					
	₹.]	Concrete			Bedrock fferentiated)				AĒ	COM
XXX		Fill		(Li	Bedrock mestone)				signated fracti	

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



FRAC	TION	SEIVE	SIZE (mm)	DEFINING R PERCENTAGE OF MINOR CO	BY WEIGHT OMPONENTS
		Passing	Retained	Percent	Identifier
01	Coarse	76	19	35-50	and
Gravel	Fine	19	4.75	33-50	una
	Coarse	4.75	2.00	20-35	"v" or "ey" *
Sand	Medium	2.00	0.425	20-00	7 0, 0,
	Fine	0.425	0.075	10-20	some
	n-plastic) (plastic)	< 0.0)75 mm	1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

qu - undrained shear strength (kPa) derived from unconfined compression testing.

T_v - undrained shear strength (kPa) measured using a torvane

pp - undrained shear strength (kPa) measured using a pocket penetrometer.

 $L_{\rm v}$ - undrained shear strength (kPa) measured using a lab vane.

F_v - undrained shear strength (kPa) measured using a field vane.

 γ - bulk unit weight (kN/m³).

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 (W_L, W_P)

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

		2011110010011001	CLIENT: City of Winnipeg										_		NO: TH11-04					
		: Waverley Street, 11 m North of Academy Road, Northbou				2.5 m West of curb mm SSA with 150 mm Coring								PROJECT NO.: 60212233 ELEVATION (m):						
						n S				mm	Corir			RECOVE						
DEPTH (m)	SOIL SYMBOL	PE GRAB SHELBY TUBE SOIL DESCRIPTION	SAMDI CAMAD	SAMPLE # Ods 11	• 5	PENETRATION TESTS			est) 🗢 0 100	UNDRAINED SH + Tor X (↓ Lab 100			STRENGTI +		DEPTH					
0	4.4	ASPHALT (thickness = 110 mm) CONCRETE (thickness = 115 mm)			 	Plast		60 60		0 100		50	100	150 20						
-		CLAY - dark brown - firm, moist - high plasticity		G22			•													
- -		SILTY CLAY - trace sand - brown, frozen, moist when thawed SILT - some sand		G23)					; ; ; ; ; ;								
-1 -		 light brown, frozen, moist when thawed low plasticity 		G24 G25												AND THE PROPERTY OF THE PROPER				
- - -		CLAY - trace silt, trace sand - brown, frozen to 2 m, moist when thawed - high plasticity		G26			•									THE COLUMN TO TH				
- - -2		below 2 m, stiff		G27												And in contrast to the contrast of the contras				
-3		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, sand and asphalt cold patch to surface. 2. Drilled with 150 mm diamond core to 0.23 m, solid stem augers to 2. m.		G28																
3										· · · · · · · · · · · · · · · · · · ·						And the second s				
			And the second s								-									
			Cold and the cold				:		:			:	:							
4		AECOM	L		R	EVI	EWE	DB'		aris k	Petsc (halil	he			PLETION DEPTH: 2.10 m PLETION DATE: 4/7/11 Page	1				

	OJECT: 2011 Residential Street Renewal CLIENT: City of Winnipeg CATION: Waverley Street, 69 m South of Wellington Crescent, Southbound Lane, 3 m East of curb											TESTHOLE NO: TH11-05 PROJECT NO.: 60212233					
			uthbo	ound L	ane,	3 m	Easi	OT C	urb Lmm	Coring				NO., 60212233 N (m):			
				J: 125 .IT SPO		100/			7 111111	COIIIQ			COVER				
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	NAME OF THE PROPERTY OF THE PR		PENETRATION TESTS				UNDRAINED + T Control Test) 0			EAR ST	RENGTH	COMMENTS			
0		ASPHALT (thickness = 95 mm)			-	20 -	40	60	80 100 :	50) 10	00 1	50 200 :		-		
J	4 4	CONCRETE (thickness = 145 mm)	-				<u>:</u>	<u>:</u>	:								
	33							:	:				:				
		CLAY - trace organics, trace rootlets - black		G29) ! !	÷	·····				<u>.</u>				
	M	- firm, moist - high plasticity	\prod				. .	. <u>.</u>	<u>.</u>			· · · · · ·	. .		-		
		SILTY CLAY - trace sand		G30		Н	·	-1						Gradation: Sand = 9.9%, Silt =			
		 dark brown, frozen, moist when thawed high plasticity 				ĬŢ		-		1			:	36.1%, Clay = 54.0%			
	1111	SILT - trace sand	_			<u>.</u>						; :	÷				
		- light brown, frozen, moist when thawed		G31		•	. ;	<u>:</u>									
l		- low plasticity					:	:	:				:				
						1	· i · · · ·	 :		1							
				G32	ļ	•		<u>:</u>					. <u>.</u>		-		
							:								-		
-						1											
		CLAY - trace silt - brown, frozen to 1.8 m, moist when thawed		G33		7	· į	<u></u>									
		- high plasticity					. j			ļ;							
				G34								:	:				
		- at 1.8 m, trace stone (<10mm)				Ť	 :	:				; :	· · · · · · · · · · · · · · · · · · ·				
2		- trace gypsum - firm				!	\ <u> </u>	. <u>:</u>				: }	ġ				
•				G35			•				,		: .;				
		END OF TEST HOLE AT 2.1 m in clay. NOTES:					:		:			:	:				
		No sloughing observed.				÷ · · · ·	:		• • • • • • •	1			:	•			
		No seepage observed. Test hole backfilled with auger cuttings, bentonite, sand and asphale.	t			<u>:</u>		<u> </u>				<u>.</u> 	<u> </u>				
		cold patch to surface. 2. Drilled with 150 mm diamond core to 0.24 m, solid stem augers to 2	2.1														
		m.				:		:				:	:				
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}								<u>.</u>			: : :	: : :					
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4					110	CCF		· Cto	nhen	Petsch	; · · · · · · · · · · · · · · · · · · ·	·····	COMPI	· LETION DEPTH: 2.10 m			
		AECOM							aris h					ETION DATE: 4/7/11			
								~~~~	EER:					Page	1		

		2011 Residential Street Renewal	CLIENT: City of Winnipeg										TESTHOLE NO: TH11-06						
LOCA	TION	: Waverley Street, 22 m South of Wellington Cresco	nt, Northbound Lane, 3 m West of curb										PROJECT NO.: 60212233						
CONT	TRAC	TOR: Paddock Drilling Ltd.	METH	DD:	125	mn	1 SS	A wit	h 150	) mm	Corir				ON (m):				
SAMP	LE TY	PE GRAB SHELBY TUBE	⊠s	PLIT	SPO	ON			BULK		Ι		<del></del>	ECOVE	RY CORE				
DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE #	0	⇒ Dy PT (Si PT (Bi 20	ows/30 40 otal Ur (kN/n 18	er ** Cone ( d Pen 1 00mm) 60 nit Wt  1 19	≎ Fest) <b>◆</b> 80 10		+ To X: □ Lab Δ Pock <b>④</b> Field (I	rvane + QU X Vane E ket Pen. d Vane € kPa)	] Δ	COMMENTS	DEPTH			
0		ASPHALT (thickness = 100 mm)					:	:	:	:		:	:	:					
ľ	7.4	CONCRETE (thickness = 140 mm)					. <u>:</u>	·	<u>:</u>			ļ	<u>.</u>	<u></u>					
-		CLAY - trace silt - dark brown, frozen, moist when thawed - high plasticity			G36		•	<b>)</b>											
		SILTY CLAY - trace sand - light brown, frozen, moist when thawed - intermediate plasticity			G37			<b>)</b>				· · · · · · · · · · · · · · · · · · ·							
1					G38										Gradation: Sand = 9.3%, Silt = 45.0%, Clay = 45.7%	1-			
(					G39		•	)											
		CLAY - some silt - brown, frozen to 1.8 m, moist when thawed - high plasticity			G40		•												
		- at 1.8 m, trace silt			G41			•											
-2		- below 1.8 m, stiff  END OF TEST HOLE AT 2.1 m in clay.			G42											2-			
		NOTES:  1. No sloughing observed.  2. Observed water seepage below pavement into test hole.  3. Test hole backfilled with auger cuttings, bentonite, sand an cold patch to surface.	d asphalt				::												
		4. Drilled with 150 mm diamond core to 0.24 m, hollow stem a 2.1 m.	augers to																
-3																3			
<b>-</b>									 : : : : :										
												. <u></u>							
4						1	<del>.</del>	j		nhar	Dotac	.;	<u>;</u>	COMP	ETION DEPTH: 2.10 m				
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		AECOM	<i>,</i> 0/41								Vilain		Page 1 of						



Photograph 1. Waverley Street - TH11-04



Photograph 2. Waverley Street – TH11-05



Photograph 3. Waverley Street - TH11-06



### City of Winnipeg 2011 Residential Street Renewal – Lanark and Waverley Geotechnical Investigation

Test		Pavement S	urface	Pavement Structu	ıre Material	Subgrade	Sample	Moisture		Hydromet	er Analysis		Atterberg Limits			
Hole No.	Testhole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Description	(m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index	
						Clay	0.3	37.0								
		Asphalt	110		n/a	Silty Clay	0.6	26.2								
	Waverley Street, 11 m N of					Silt	0.9	25.0								
TH11-04	Academy Road, Northbound			None		Silt	1.2	20.2								
	Lane, 2.5 m W of Curb	Concrete	115			Clay	1.5	33.2								
		Concrete	113			Clay	1.8	33.7								
						Clay	2.1	33.5								
					n/a	Clay	0.3	32.3				F40		24.7	1 27.0	
	Waverley Street, 69 m S of Wellington Cres., Southbound Lane, 3 m E of	Asphalt	95			Silty Clay	0.6	32.1	0.0	9.9	36.1	54.0	62.6	24.7	37.9	
						Silt	0.9	25.7								
TH11-05		Concrete	145	None		Silt	1.2	21.5								
	Curb					Clay	1.5	28.5								
		22				Clay	1.8	30.8								
			<b>-</b>			Clay	2.1	37.6								
						Clay	0.3	32.1								
	Waverley Street, 22 m S of	Asphalt	100			Silt	0.6	32.1	~ ~	0.3	45.0	45.7	37.8	18.0	19.8	
	Wellington Cres.,			None	n/a	Silty Clay	0.9	36.2	0.0	9.3	45.0	45.7	37.8	18.0	19.8	
TH11-06	Northbound Lane, 3 m W of		140			Silt	1.2	29.2								
	Curb	Concrete				Clay	1.5	27.5								
						Clay Clay	1.8 2.1	35.7 43.7								