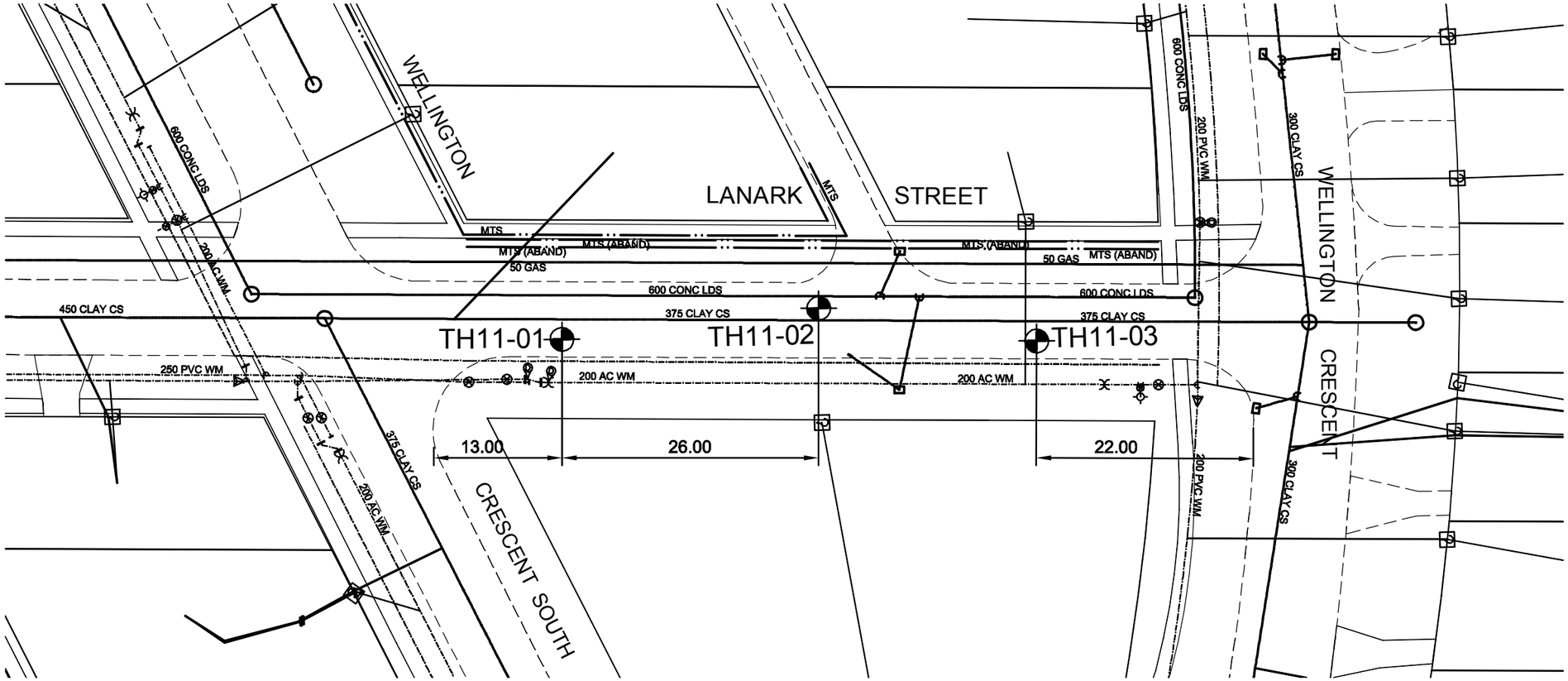
APPENDIX A
LANARK STREET
GEOTECHNICAL REPORT



City of Winnipeg
2011 Residential Package
Test Hole Locations

Lanark Street

Wellington Cres. South to Wellington Cres.

Figure - 2

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

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 ± 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.

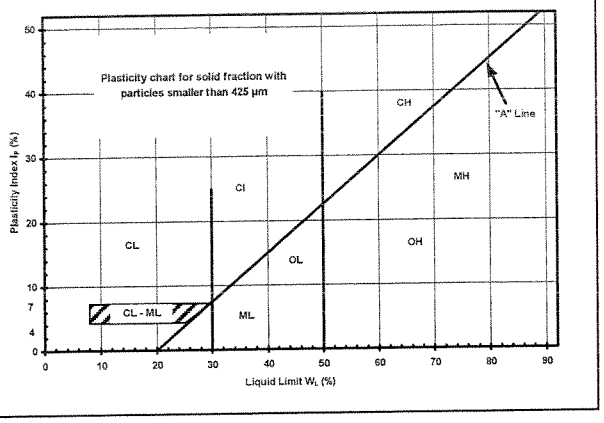
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till				AECOM
	Concrete		Bedrock (Undifferentiated)				
	Fill		Bedrock (Limestone)				

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 WINNIPEG SPEC: FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 08



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 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:

q_u - 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

PROJECT: 2011 Residential Street Renewal	CLIENT: City of Winnipeg	TESTHOLE NO: **TH11-01**
LOCATION: Lanark Street, 13 m North of Wellington Crescent S, Northbound Lane, 2.5 m West of curb		PROJECT NO.: 60212233
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 30 mm) CONCRETE (thickness = 170 mm)					
		CLAY - dark brown - frozen to 1.8 m, moist when thawed - high plasticity		G1			
				G2		Gradation: Sand = 3.0%, Silt = 18.3%, Clay = 78.7%	
				G3			
1							1
				G4			
		- brown at 1.2m		G5			
		- trace silt at 1.5m		G6			
		- below 1.8 m, firm to stiff		G7			
2							2
		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 0.2 m, solid stem augers to 2.1m.					
3							3
4							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◆ Field Vane ◆ (kPa) 50 100 150 200

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 4/7/11
PROJECT ENGINEER:	Page 1 of 1

LOG OF TEST HOLE LANARK AND WAVERLEY STREETS.GPJ UMA WINN.GDT 4/15/11

PROJECT: 2011 Residential Street Renewal	CLIENT: City of Winnipeg	TESTHOLE NO: **TH11-02**
LOCATION: Lanark Street, 39 m North of Wellington Crescent S, Southbound Lane, 3 m East of curb		PROJECT NO.: 60212233
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200	COMMENTS	DEPTH
0		ASPHALT (thickness = 20 mm)						
		CONCRETE (thickness = 140 mm)						
		CLAY - black - trace organics - high plasticity		G8				
		CLAY - trace sand - brown, frozen, moist when thawed - high plasticity		G9				
		CLAYEY SILT - trace sand - brown, frozen, moist when thawed - intermediate plasticity		G10				
1		CLAY - trace silt - brown, frozen to 1.7 m, moist when thawed - high plasticity		G11				1
				G12				
		- below 1.7 m, trace gypsum, firm		G13				
2				G14				2
		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 0.16 m, solid stem augers to 2.1 m.						
3								3
4								

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 4/7/11
PROJECT ENGINEER:	Page 1 of 1

LOG OF TEST HOLE LANARK AND WAVERLEY STREETS.GPJ UMA WINN.GDT 4/15/11

PROJECT: 2011 Residential Street Renewal	CLIENT: City of Winnipeg	TESTHOLE NO: **TH11-03**
LOCATION: Lanark Street, 22 m South of Wellington Crescent S, Northbound Lane, 2.5 m West of curb		PROJECT NO.: 60212233
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 55 mm)			✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100 + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ● Field Vane ● (kPa) 50 100 150 200		
		CONCRETE (thickness = 135 mm)					
		CLAY - dark brown - frozen, moist when thawed - high plasticity		G15			
		SILTY CLAY - some sand - brown, frozen, moist when thawed - intermediate plasticity		G16			
1				G17		Gradation: Sand = 26.4%, Silt = 39.2%, Clay = 34.4%	1
		CLAY - some silt, trace sand - brown, frozen to 1.7 m, moist when thawed		G18			
		- trace gypsum at 1.5m		G19			
		- below 1.7 m, firm		G20			
2				G21			2
		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.					
3							3
4							

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 4/7/11
PROJECT ENGINEER:	Page 1 of 1

LOG OF TEST HOLE LANARK AND WAVERLEY STREETS.GPJ UMA WINN.GDT 4/15/11

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 Hole No.	Testhole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
TH11-01	Lanark Street, 13 m N of Wellington Cres. S., Northbound Lane, 2.5 m W of Curb	Asphalt	30	None	n/a	Clay	0.3	39.5							
						Clay	0.6	39.6	0.0	3.0	18.3	78.7	71.4	27.9	43.4
						Clay	0.9	38.9							
		Concrete	170			Clay	1.2	40.2							
						Clay	1.5	41.0							
						Clay	1.8	42.1							
						Clay	2.1	45.0							
TH11-02	Lanark Street, 39 m N of Wellington Cres. S., Southbound Lane, 3 m E of Curb	Asphalt	20	None	n/a	Clay	0.3	35.5							
						Clay	0.6	29.1							
						Clayey Silt	0.9	26.7							
		Concrete	140			Clay	1.2	41.3							
						Clay	1.5	40.1							
						Clay	1.8	41.5							
						Clay	2.1	44.0							
TH11-03	Lanark Street, 22 m S of Wellington Cres., Northbound Lane, 2.5 m W of Curb	Asphalt	55	None	n/a	Clay	0.3	40.8							
						Silty Clay	0.6	46.0							
						Silty Clay	0.9	31.7	0.0	26.4	39.2	34.4	35.9	15.2	20.7
		Concrete	135			Clay	1.2	43.2							
						Clay	1.5	39.7							
						Clay	1.8	42.5							
						Clay	2.1	42.4							

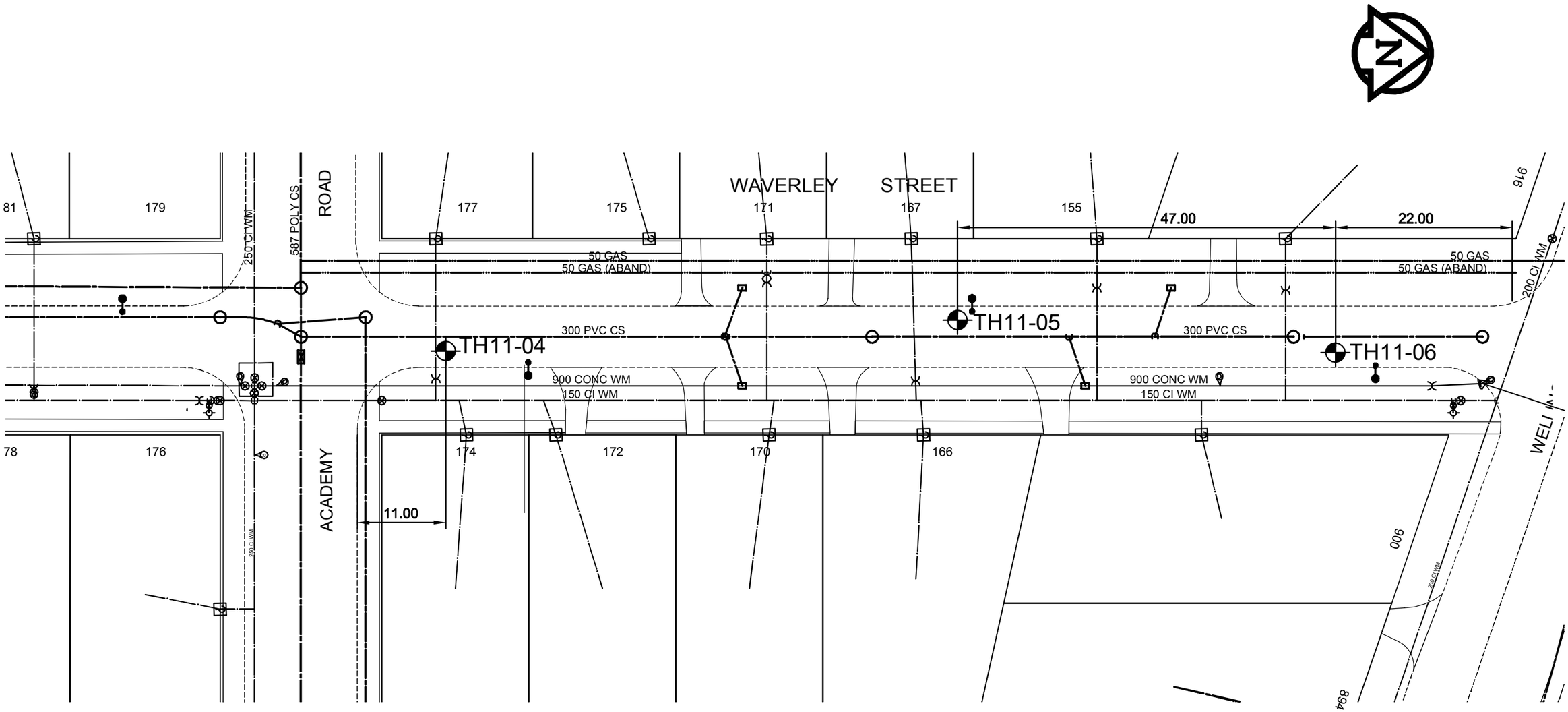
AECOM

APPENDIX B
WAVERLEY STREET
GEOTECHNICAL REPORT

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 11/04/15 10:10:33 AM

ISS/REV: A
AECOM FILE NAME: Figure1-Waverley.dwg Saved By: cloustonc



0 5 10 m SCALE 1:500

AECOM

City of Winnipeg
2011 Residential Package
Test Hole Locations

Waverley Street

Academy Road to Wellington Crescent

Figure - 1

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

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 ± 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

106 – 1155 Pacific Avenue • 1155, avenue Pacific, bureau 106 • Winnipeg • Manitoba • R3E 3P1
Fax/télec. (204) 986-5302 • www.city.winnipeg.mb.ca

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.

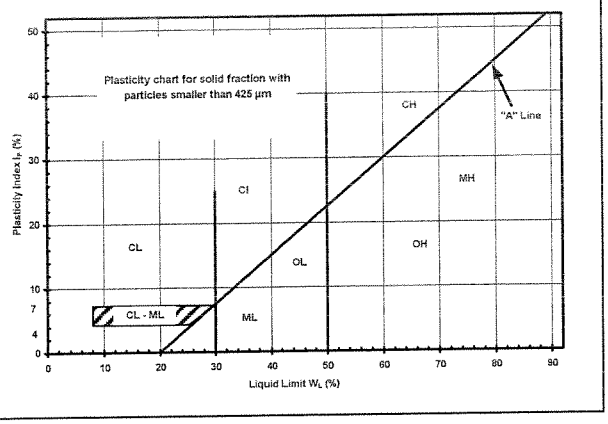
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

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 WINNIPEG SPEC. FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 08



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 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:

q_u - 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

PROJECT: 2011 Residential Street Renewal	CLIENT: City of Winnipeg	TESTHOLE NO: **TH11-04**
LOCATION: Waverley Street, 11 m North of Academy Road, Northbound Lane, 2.5 m West of curb		PROJECT NO.: 60212233
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 110 mm)					
		CONCRETE (thickness = 115 mm)					
		CLAY - dark brown - firm, moist - high plasticity	■	G22			
		SILTY CLAY - trace sand - brown, frozen, moist when thawed	■	G23			
		SILT - some sand - light brown, frozen, moist when thawed - low plasticity	■	G24			
1			■	G25			1
		CLAY - trace silt, trace sand - brown, frozen to 2 m, moist when thawed - high plasticity	■	G26			
			■	G27			
2		- below 2 m, stiff	■	G28			2
		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 2.1 m.					
3							3
4							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100
■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21
Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◆ Field Vane ◆ (kPa) 50 100 150 200

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 4/7/11
PROJECT ENGINEER:	Page 1 of 1

LOG OF TEST HOLE LANARK AND WAVERLEY STREETS.GPJ UMA WINN.GDT 4/15/11

PROJECT: 2011 Residential Street Renewal	CLIENT: City of Winnipeg	TESTHOLE NO: **TH11-05**
LOCATION: Waverley Street, 69 m South of Wellington Crescent, Southbound Lane, 3 m East of curb		PROJECT NO.: 60212233
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 95 mm)					
		CONCRETE (thickness = 145 mm)					
		CLAY - trace organics, trace rootlets - black - firm, moist - high plasticity	■	G29			
		SILTY CLAY - trace sand - dark brown, frozen, moist when thawed - high plasticity	■	G30		Gradation: Sand = 9.9%, Silt = 36.1%, Clay = 54.0%	
1		SILT - trace sand - light brown, frozen, moist when thawed - low plasticity	■	G31			1
			■	G32			
		CLAY - trace silt - brown, frozen to 1.8 m, moist when thawed - high plasticity	■	G33			
			■	G34			
2		- at 1.8 m, trace stone (<10mm) - trace gypsum - firm	■	G35			2
		END OF TEST HOLE AT 2.1 m in clay.					
3		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 0.24 m, solid stem augers to 2.1 m.					3
4							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ◆ Field Vane ◆ (kPa) 50 100 150 200

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 4/7/11
PROJECT ENGINEER:	Page 1 of 1

LOG OF TEST HOLE LANARK AND WAVERLEY STREETS.GPJ UMA WINN.GDT 4/15/11

PROJECT: 2011 Residential Street Renewal	CLIENT: City of Winnipeg	TESTHOLE NO: **TH11-06**
LOCATION: Waverley Street, 22 m South of Wellington Crescent, Northbound Lane, 3 m West of curb		PROJECT NO.: 60212233
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS
0		ASPHALT (thickness = 100 mm)			
		CONCRETE (thickness = 140 mm)			
		CLAY - trace silt - dark brown, frozen, moist when thawed - high plasticity		G36	
		SILTY CLAY - trace sand - light brown, frozen, moist when thawed - intermediate plasticity		G37 G38 G39	Gradation: Sand = 9.3%, Silt = 45.0%, Clay = 45.7%
1					
		CLAY - some silt - brown, frozen to 1.8 m, moist when thawed - high plasticity		G40 G41	
		- at 1.8 m, trace silt - below 1.8 m, stiff		G42	
2					
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. Observed water seepage below pavement into test hole. 3. Test hole backfilled with auger cuttings, bentonite, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.24 m, hollow stem augers to 2.1 m.			
3					
4					

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ● Field Vane ● (kPa) 50 100 150 200

DEPTH: 1 2 3

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
	REVIEWED BY: Faris Khalil	COMPLETION DATE: 4/7/11
	PROJECT ENGINEER:	Page 1 of 1

LOG OF TEST HOLE LANARK AND WAVERLEY STREETS.GPJ UMA WINN.GDT 4/15/11

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 Hole No.	Testhole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
TH11-04	Waverley Street, 11 m N of Academy Road, Northbound Lane, 2.5 m W of Curb	Asphalt	110	None	n/a	Clay	0.3	37.0							
						Silty Clay	0.6	26.2							
						Silt	0.9	25.0							
		Concrete	115			Silt	1.2	20.2							
						Clay	1.5	33.2							
						Clay	1.8	33.7							
						Clay	2.1	33.5							
TH11-05	Waverley Street, 69 m S of Wellington Cres., Southbound Lane, 3 m E of Curb	Asphalt	95	None	n/a	Clay	0.3	32.3							
						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							
		Concrete	145			Silt	1.2	21.5							
						Clay	1.5	28.5							
						Clay	1.8	30.8							
						Clay	2.1	37.6							
TH11-06	Waverley Street, 22 m S of Wellington Cres., Northbound Lane, 3 m W of Curb	Asphalt	100	None	n/a	Clay	0.3	32.1							
						Silt	0.6	32.1							
						Silty Clay	0.9	36.2	0.0	9.3	45.0	45.7	37.8	18.0	19.8
		Concrete	140			Silt	1.2	29.2							
						Clay	1.5	27.5							
						Clay	1.8	35.7							
						Clay	2.1	43.7							