APPENDIX A

GEOTECHNICAL REPORT

AECOM

Victor Street

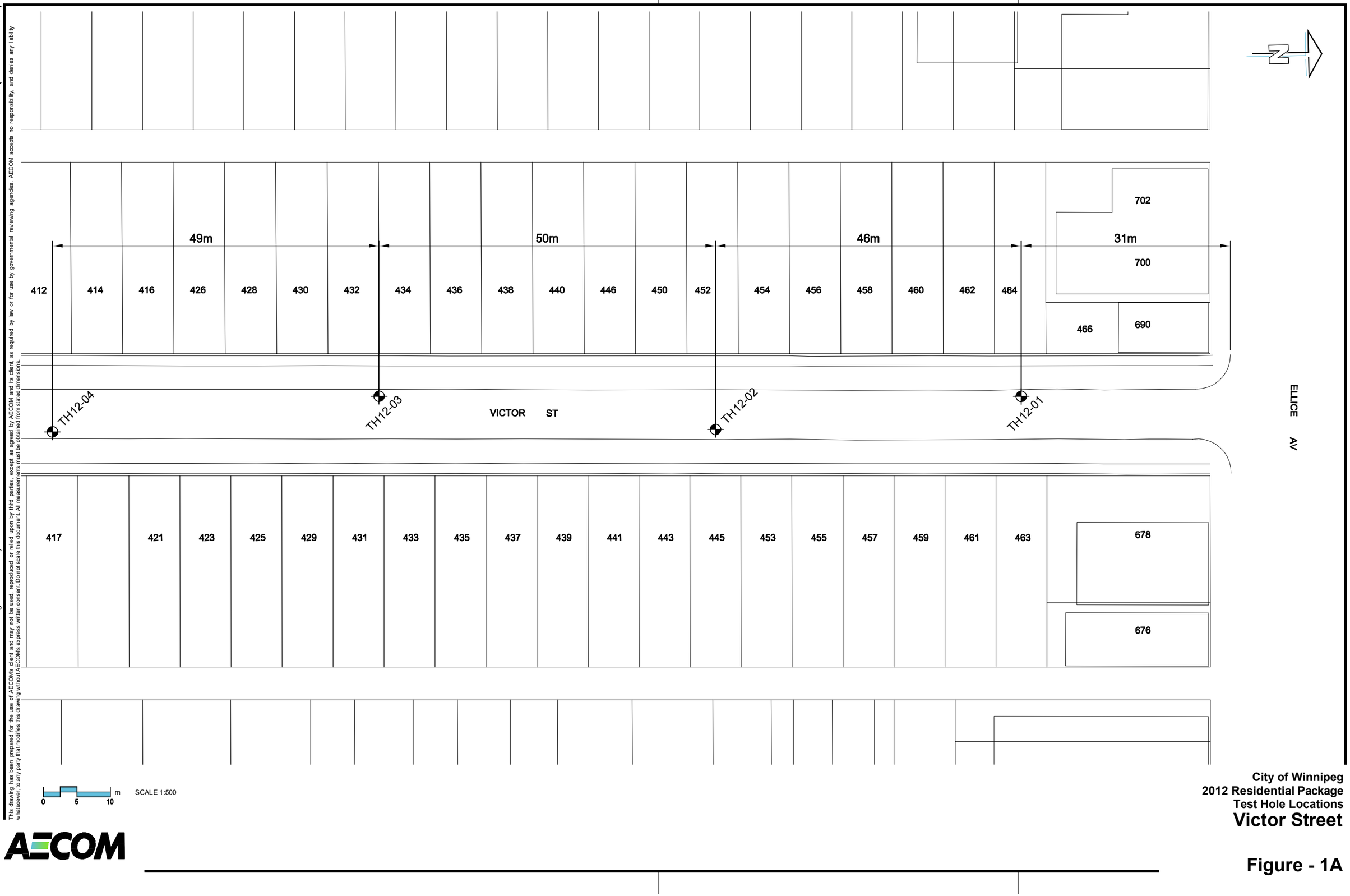
B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 12/02/10 4:53:13 PM

Saved By: cloustonc

ISS/REV: 0A

AECOM FILE NAME: 60241488-01-B-F01-R0X.dwg



City of Winnipeg
2012 Residential Package
Test Hole Locations
Victor Street

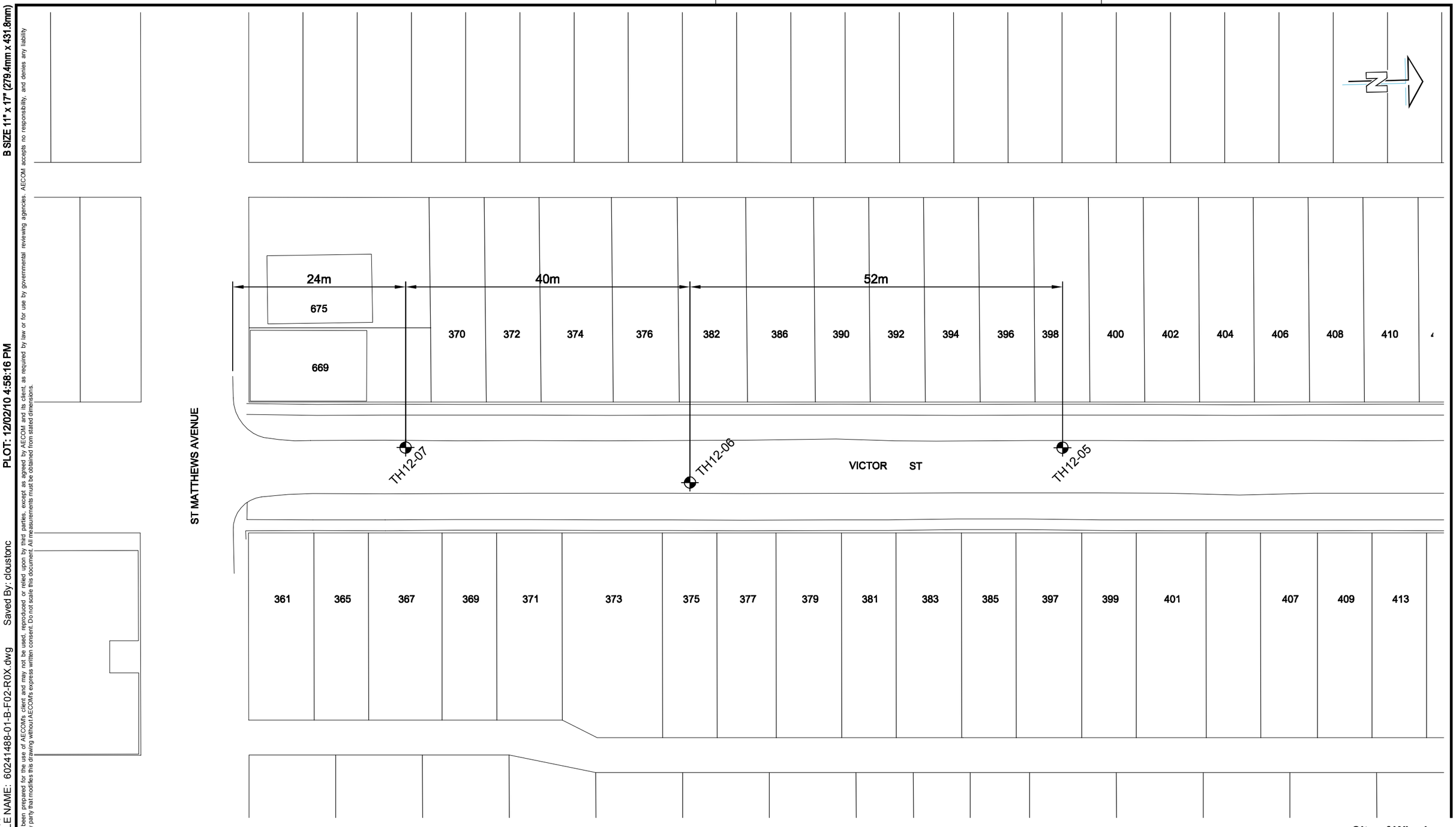
AECOM

Figure - 1A

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

PLOT: 12/02/10 4:58:16 PM

ISS/REV: 0A
AECOM FILE NAME: 60241488-01-B-F02-R0X.dwg Saved By: cloustonc



City of Winnipeg
2012 Residential Package
Test Hole Locations
Victor Street

Figure - 1B

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

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.

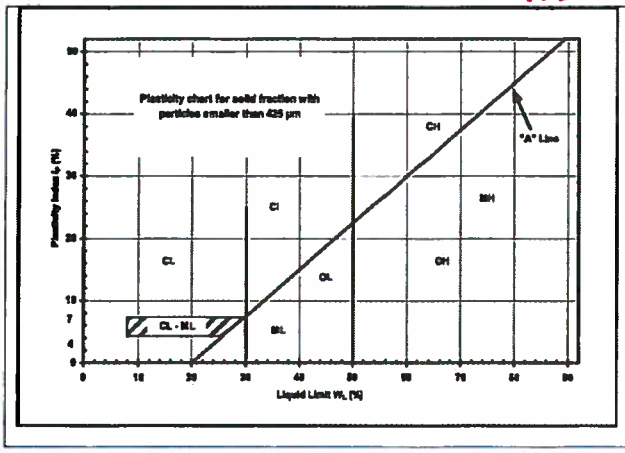
EXPLANATION OF FIELD & LABORATORY TEST DATA

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.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



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: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-01
LOCATION: Victor Street; In Front of House #464, Southbound Lane, 1.0 m East of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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 (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 145 mm)				
		CONCRETE (thickness = 80 mm)				
		CLAY - some silt, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G1		
				G2	Gradation: Sand = 1.9%, Silt = 17.7%, Clay = 80.4%	
				G3		
1		- below 1.2 m, silty, firm		G4		1
		SILT - trace clay - light brown - moist, soft - low plasticity		G5		
		SILTY CLAY - brown - moist, firm - intermediate plasticity		G6		
2				G7		2
		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 asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.225 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-02
LOCATION: Victor Street; In Front of House #445, Northbound Lane, 1.5 m West of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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 (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 150 mm)				
		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		
				G9		
1						1
		CLAYEY SILT - trace sand - light brown - frozen to 1.2 m, moist when thawed - intermediate plasticity - below 1.2 m, soft		G10		
		SILTY CLAY - trace sand - brown - moist, firm - intermediate to high plasticity		G11		
				G12		
2				G13		2
		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 asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-03
LOCATION: Victor Street; Along Property Line of House #432 and 434, Southbound Lane, 1.0 m East of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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 (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 120 mm)				
		CONCRETE (thickness = 105 mm)				
		CLAY (FILL) - trace silt, trace sand, trace rootlets - dark brown - frozen, moist when thawed - intermediate plasticity		G14		
				G15		
		CLAY - silty, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G16	Gradation: Sand = 7.2%, Silt = 27.3%, Clay = 65.5%	
1		- below 1.2 m, firm		G17		1
		SILT - trace clay - light brown - moist, soft - low plasticity		G18		
				G19		
2		CLAYEY SILT - brown - moist, soft - intermediate plasticity		G20		2
		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.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-04
LOCATION: Victor Street; In Front of House #417, Northbound Lane, 1.0 m West of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 150 mm)				
		CONCRETE (thickness = 125 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G21		
				G22		
		CLAY - some silt, trace sand - dark brown - frozen, moist when thawed		G23		
1						1
		- below 1.2 m, firm		G24		
		SILT - trace clay - light brown - moist, soft - low plasticity		G25		
		CLAY - silty - brown - moist, firm - high plasticity		G26		
2						2
				G27		
		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 asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.275 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-05
LOCATION: Victor Street; In Front of House #398, Southbound Lane, 1.0 m East of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 100 mm)				
		CONCRETE (thickness = 225 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - intermediate to high plasticity		G28		
1		CLAY - some silt, trace sand - dark brown - frozen, moist when thawed - intermediate to high plasticity		G29		1
				G30		
		SILT - trace clay, trace sand - moist, soft - low plasticity		G31		
		SILTY CLAY - trace sand - brown - moist, firm - high plasticity		G32		
2				G33		2
		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 asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.325 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-06
LOCATION: Victor Street; In Front of House #375, Northbound Lane, 1.5 m West of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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 (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 90 mm)				
		CONCRETE (thickness = 130 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G34		
		CLAY - silty, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G35	Gradation: Sand = 6.3%, Silt = 28.2%, Clay = 65.5%	
				G36		
1						1
		- below 1.2 m, firm		G37		
				G38		
		- below 1.7 m, silt pockets		G39		
2						2
				G40		
		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 asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.22 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-07
LOCATION: Victor Street; Opposite House #367, Southbound Lane, 1.0 m East of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf 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 =125 mm)					
		CONCRETE (thickness = 125 mm)					
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G41			
1		CLAY - silty, trace sand - brown - frozen to 1.3 m, moist when thawed - high plasticity		G42		Gradation: Sand = 2.5%, Silt = 23.3%, Clay = 74.2%	1
		- below 1.3 m, firm		G43			
		CLAYEY SILT - trace sand - brown - moist, soft to firm - intermediate plasticity		G44			
2		SILTY CLAY - trace sand - brown - moist, firm - high plasticity		G45			2
				G46			
3		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 asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.					

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

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/26/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

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 Hole No.	Test Hole 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 (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-01	Victor Street; In Front of House #464, Southbound Lane, 1.0 m East of Curb	Asphalt	145	None	n/a	Clay	0.3	26.8							
						Clay	0.6	29.0	0.0	1.9	17.7	80.4	75.7	26.7	49.0
						Clay	0.9	28.0							
						Clay	1.2	24.3							
		Concrete	80			Silt	1.5	21.3							
						Silty Clay	1.8	35.3							
						Silty Clay	2.1	27.0							
TH12-02	Victor Street; In Front of House #445, Northbound Lane, 1.5 m West of Curb	Asphalt	150	Granular Base	50	Clay FIll	0.6	25.8							
						Clay Fill	0.9	24.7							
						Clayey Silt	1.2	16.5							
		Concrete	100			Silty Clay	1.5	23.8							
						Silty Clay	1.8	27.7							
						Silty Clay	2.1	33.1							
TH12-03	Victor Street; Along Property Line of House #432 and 434, Southbound Lane, 1.0 m East of Curb	Asphalt	120	None	n/a	Clay Fill	0.3	21.6							
						Clay Fill	0.6	21.4							
						Clay	0.9	21.5	0.0	7.2	27.3	65.5	66.6	22.4	44.2
						Clay	1.2	22.4							
		Concrete	105			Silt	1.5	17.1							
						Silt	1.8	16.4							
						Clayey Silt	2.1	19.0							
TH12-04	Victor Street; In Front of House #417, Northbound Lane, 1.0 m West of Curb	Asphalt	150	None	n/a	Clay Fill	0.3	27.8							
						Clay Fill	0.6	28.9							
						Clay	0.9	27.1							
						Clay	1.2	25.5							
		Concrete	125			Silt	1.5	14.9							
						Clay	1.8	27.0							
						Clay	2.1	33.7							
TH12-05	Victor Street; In Front of House #398, Southbound Lane, 1.0 m East of Curb	Asphalt	100	None	n/a	Clay Fill	0.6	24.5							
						Clay	0.9	24.3							
		Concrete	225			Clay	1.2	23.6							
						Silt	1.5	17.3							
						Silty Clay	1.8	23.6							
						Silty Clay	2.1	35.4							

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

Test Hole No.	Test Hole 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 (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-06	Victor Street; In Front of House #375, Northbound Lane, 1.5 m West of Curb	Asphalt	90	None	n/a	Clay Fill	0.3	29.5							
						Clay	0.6	25.9	0.0	6.3	28.2	65.5	64.5	25.6	39.0
						Clay	0.9	25.3							
		Concrete	130			Clay	1.2	25.6							
						Clay	1.5	26.6							
						Clay	1.8	29.3							
						Clay	2.1	24.8							
TH12-07	Victor Street; Opposite House #367, Southbound Lane, 1.0 m East of Curb	Asphalt	125	None	n/a	Clay Fill	0.6	28.4							
						Clay	0.9	25.5	0.0	2.5	23.3	74.2	69.7	29.9	39.8
						Clay	1.2	26.2							
		Asphalt	125			Clayey Silt	1.5	22.1							
						Silty Clay	1.8	30.3							
						Silty Clay	2.1	37.3							

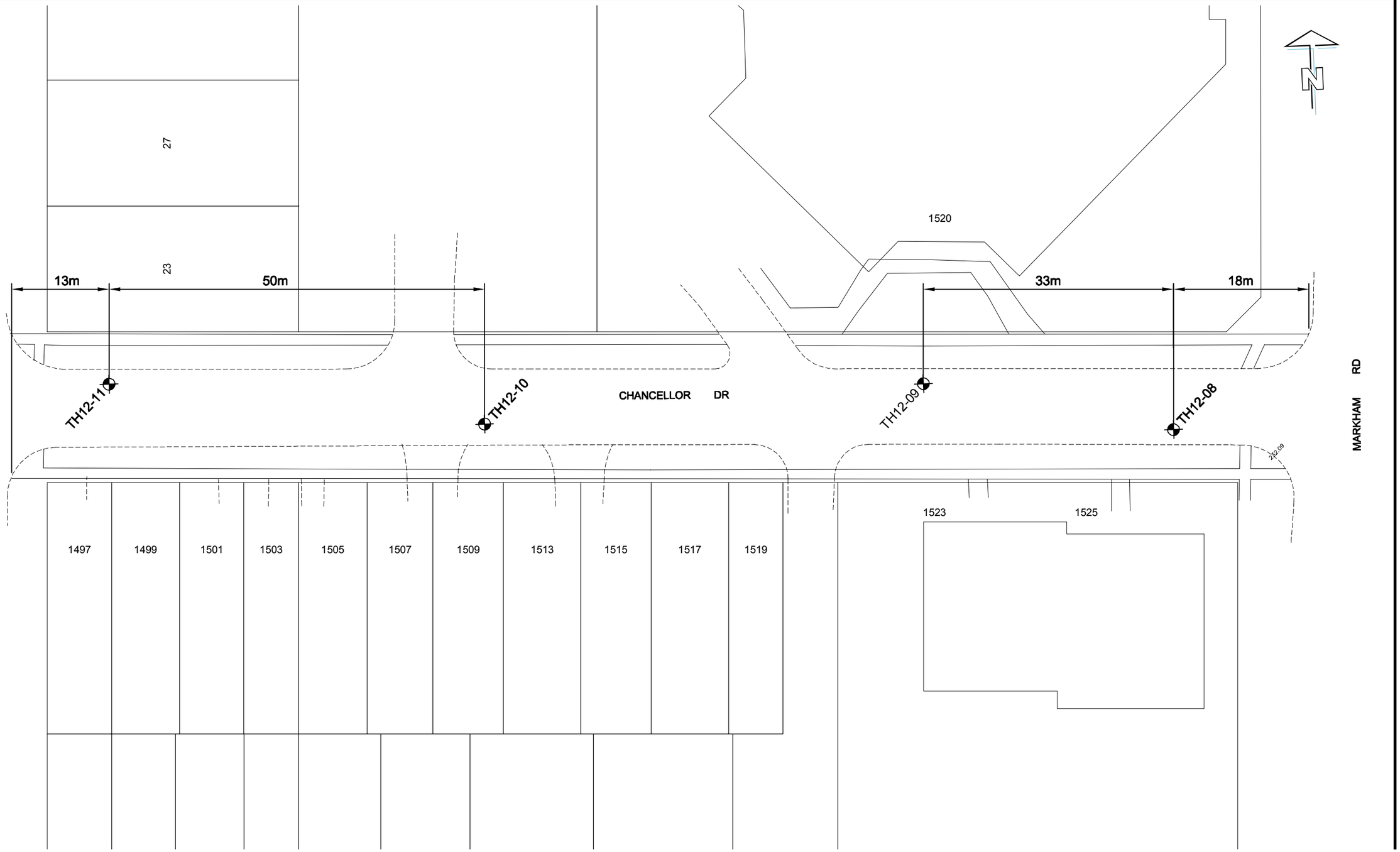
Chancellor Drive South Leg

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

PLOT: 12/02/13 10:15:05 AM

Saved By: cloustonc

ISS/REV: 0A
AECOM FILE NAME: 60241488-01-B-F03-R0X.dwg



City of Winnipeg
2012 Residential Package
Test Hole Locations
Chancellor Drive

AECOM

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

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.

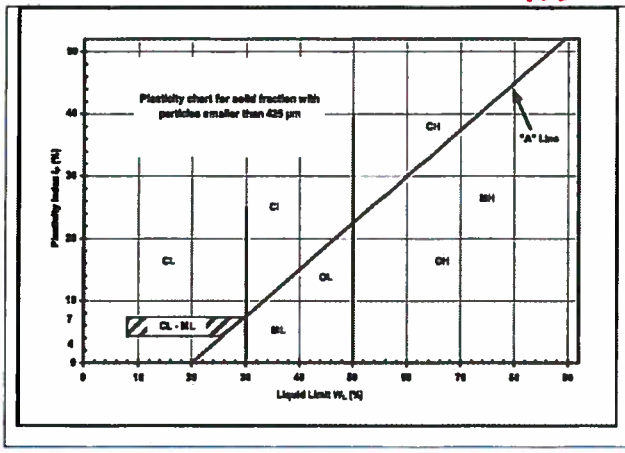
EXPLANATION OF FIELD & LABORATORY TEST DATA

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.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



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: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-08
LOCATION: Chancellor Drive South Leg; 18 m West of Markham Road, Eastbound Lane, 2.0 m North of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 90 mm)				
		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		
		CLAY - some silt, trace sand - brown - frozen to 1.3 m, moist when thawed - high plasticity		G49		
1						1
				G50		
		- below 1.3 m, firm				
		- below 1.5 m, silt pockets		G51		
				G52		
2						2
				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						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-09
LOCATION: Chancellor Drive South Leg; 49 m West of Markham Road, Westbound Lane, 2.0 m South of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf 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)					
		CLAY (FILL) - some silt, trace sand, trace stones (<10 mm diameter) - brown - frozen, moist when thawed - low to intermediate plasticity		G54			
				G55			
		CLAY - trace to some silt, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G56		Gradation: Sand = 1.1%, Silt = 10.2%, Clay = 88.7%	
1							1
		- below 1.2 m, firm		G57			
		- below 1.4 m, some silt					
		- below 1.5 m, silt pockets		G58			
				G59			
2							2
				G60			
		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 0.095 m, solid stem augers to 2.1 m.					
3							

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

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

AECOM

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-10
LOCATION: Chancellor Drive South Leg; 63 m East of Augusta Drive, Eastbound Lane, 3.0 m North of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 110 mm)				
		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		
		CLAY - trace silt - brown - frozen to 1.3 m, moist when thawed - high plasticity		G63		
1				G64		1
		- below 1.3 m, firm				
		- at 1.5 m, some silt		G65		
		- at 1.8 m, trace gypsum		G66		
2		- at 2.0 m, silt pocket		G67		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 and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.11 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-11
LOCATION: Chancellor Drive South Leg; 13 m East of Augusta Drive, Westbound Lane, 2.0 m South of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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 (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 125 mm)				
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed		G68		
		CLAYEY SILT - some sand, trace gravel (< 5mm diameter) - light brown - frozen, moist when thawed - low plasticity		G69	Gradation: Gravel = 0.5%, Sand = 18.5%, Silt = 57.1%, Clay = 24.0%	
		- below 0.9 m, some clay		G70		
1		CLAY - trace silt, trace sand - brown - frozen to 1.3 m, moist when thawed - high plasticity		G71	Gradation: Sand = 1.1%, Silt = 6.0%, Clay = 92.9%	1
		- below 1.3 m, firm to stiff		G72		
		SILT - trace to some clay, trace sand - light brown - moist, soft - intermediate plasticity		G73		
2		CLAY - trace silt - brown - moist, firm - high plasticity		G74		2
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 and high strength grout to surface.
4. Drilled with 150 mm diamond core to 0.125 m, solid stem augers to 2.1 m.

AECOM

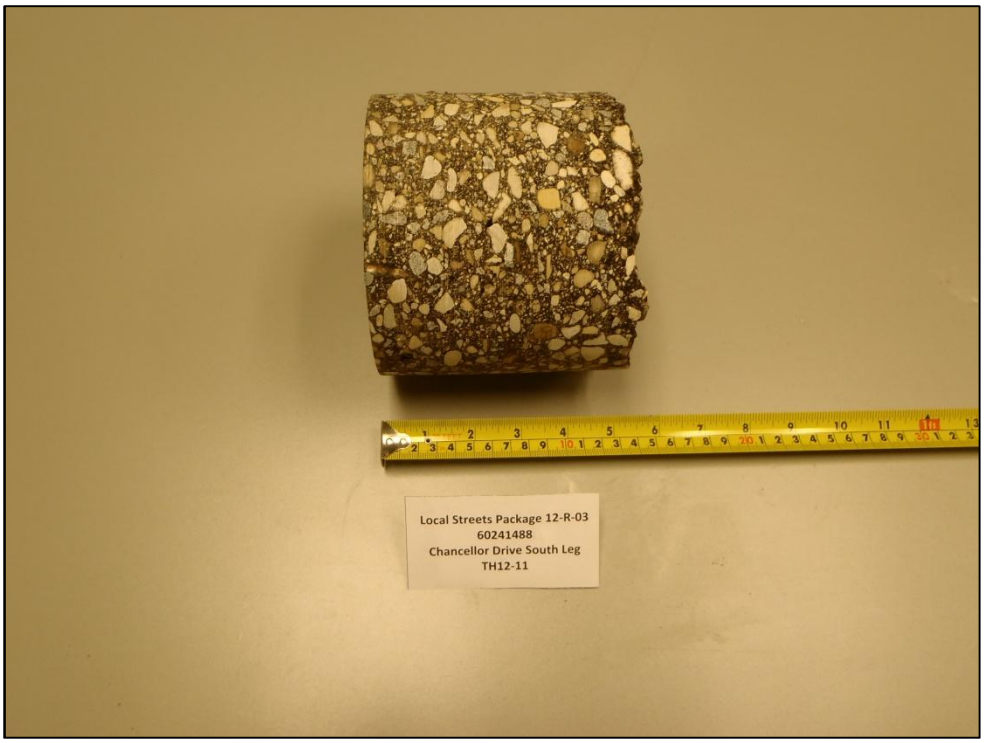
LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

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 Hole No.	Test Hole 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 (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-08	Chancellor Drive South Leg; 18 m West of Markham Road, Eastbound Lane, 2.0 m North of Curb	Asphalt	90	Granular Fill	360	Granular Fill	0.3	11.7							
						Clay Fill	0.6	32.5							
						Clay	0.9	40.0							
						Clay	1.2	41.0							
						Clay	1.5	42.2							
						Clay	1.8	45.4							
						Clay	2.1	49.1							
TH12-09	Chancellor Drive South Leg; 49 m West of Markham Road, Westbound Lane, 2.0 m South of Curb	Asphalt	95	None	n/a	Clay Fill	0.3	13.5							
						Clay Fill	0.6	19.4							
						Clay	0.9	38.6	0.0	1.1	10.2	88.7	85.9	27.8	58.1
						Clay	1.2	40.4							
						Clay	1.5	40.6							
						Clay	1.8	45.1							
						Clay	2.1	50.1							
TH12-10	Chancellor Drive South Leg; 63 m East of Augusta Drive, Eastbound Lane, 3.0 m North of Curb	Asphalt	110	Granular Base	345	Granular Base	0.3	9.2							
						Clay Fill	0.6	28.7							
						Clay	0.9	32.5							
						Clay	1.2	32.2							
						Clay	1.5	34.1							
						Clay	1.8	43.4							
						Clay	2.1	45.6							
TH12-11	Chancellor Drive South Leg; 13 m East of Augusta Drive, Westbound Lane, 2.0 m South of Curb	Asphalt	125	Granular Fill	325	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
						Clayey Silt	0.9	20.1							
						Clay	1.2	38.8	0.0	1.1	6.0	92.9	99.8	27.4	72.4
						Clay	1.5	41.0							
						Silt	1.8	35.1							
						Clay	2.1	49.6							

AECOM

Markham Road

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

PLOT: 12/02/13 10:58:51 AM

Saved By: cloustonc

ISS/REV: 0A

AECOM FILE NAME: 60241488-01-B-F04-R0X.dwg

City of Winnipeg
2012 Residential Package
Test Hole Locations
Markham Road

AECOM

Figure - 3

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

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.

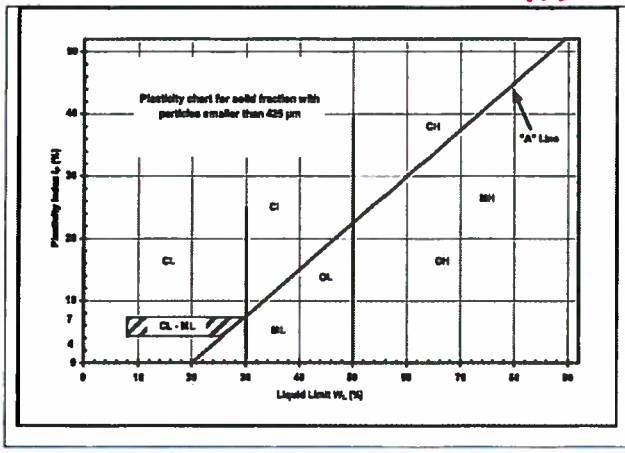
EXPLANATION OF FIELD & LABORATORY TEST DATA

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.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



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: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-12
LOCATION: Markham Road; 10 m West of Gull Lake Road, Westbound Lane, 1.5 m South of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

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

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		CONCRETE (thickness = 200 mm)				
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed		G75		
		CLAY (FILL) - silty, sandy - black to dark brown - frozen, moist when thawed - high plasticity		G76		
		- at 0.7 m, large rock (diameter undetermined) encountered		G77	Gradation: Sand = 23.0%, Silt = 27.9%, Clay = 49.1%	
1		CLAY - some silt to silty, trace sand - black - frozen to 1.5 m, moist when thawed - high plasticity		G78	Gradation: Sand = 4.2%, Silt = 20.3%, Clay = 75.4%	1
		- below 1.5 m, firm		G79		
		- below 1.7 m, brown		G80		
2		SILTY CLAY - trace sand - light brown - moist, soft - intermediate plasticity		G81		2
		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 to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-13
LOCATION: Markham Road; Along Property Line of House #1144 and 1146, Eastbound Lane, 2.0 m North of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf 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 #
0		ASPHALT (thickness = 125 mm)		
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed		G82
		CLAY (FILL) - some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G83
		CLAY - trace silt, trace sand - dark brown - frozen to 1.3 m, moist when thawed - high plasticity		G84
1				G85
		- below 1.3 m, stiff		G86
				G87
2		- below 1.9 m, some silt to silty		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 diameter core to 0.125 m, solid stem augers to 2.1 m.		
3				

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

COMMENTS

DEPTH

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
	REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
	PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

PROJECT: Local Streets Package 12-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-14
LOCATION: Markham Road; 15 m East of Chancellor Drive, Westbound Lane, 1.5 m South of Curb		PROJECT NO.: 60241488
CONTRACTOR: Maple Leaf 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)					
		GRANULAR FILL - poorly graded (<12.5 mm diameter) - some clay - brown - frozen, moist when thawed		G89			
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G90			
		CLAYEY SILT - some sand - grey - frozen to 1.2 m, moist when thawed - intermediate plasticity		G91		Gradation: Sand = 15.8%, Silt = 60.1%, Clay = 24.1%	
1		- below 1.0 m, light brown		G92			1
		- below 1.2 m, soft to firm		G93			
		CLAY - trace silt - brown - moist, firm - high plasticity		G94			
2				G95			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 and high strength grout to surface. 4. Drilled with 150 mm diamond core to 0.110 m, solid stem augers to 2.1 m.					
3							

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

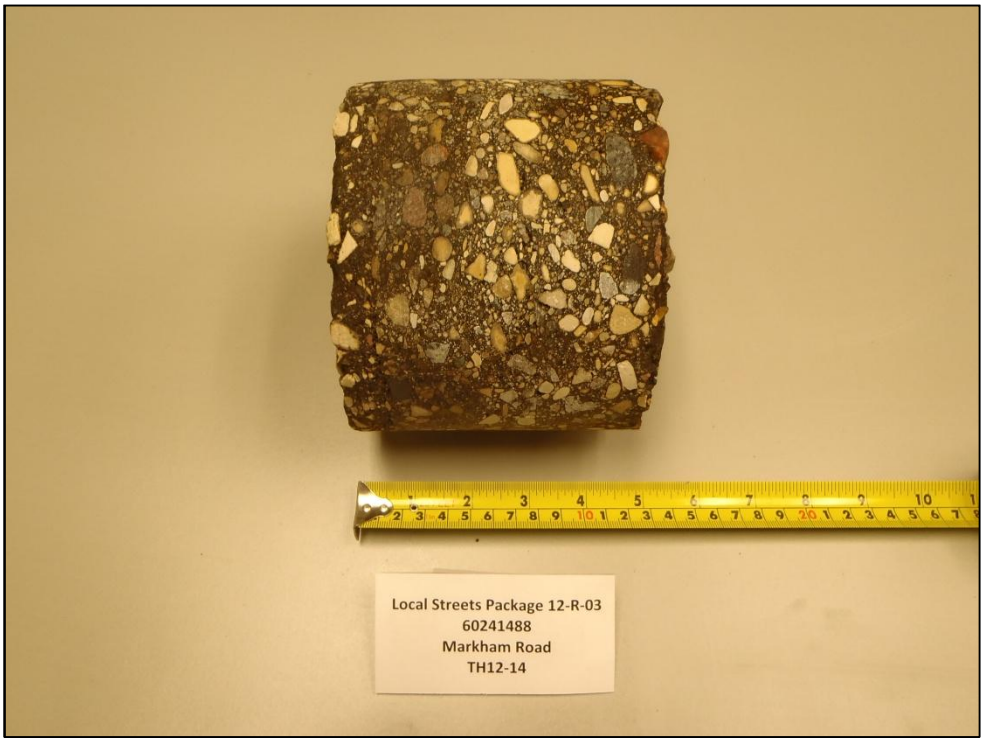
UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
	REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/2/12
	PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE VICTOR, CHANCELLOR, MARKHAM LOGS.GPJ UMA WINN.GDT 2/14/12

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 Hole No.	Test Hole 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 (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-12	Markham Road; 10 m West of Gull Lake Road, Westbound Lane, 1.5 m South of Curb	Concrete	200	Granular Fill	100	Granular Fill	0.3	13.9							
						Clay Fill	0.6	21.5							
						Clay Fill	0.9	22.8	0.0	23.0	27.9	49.1	58.4	24.0	34.4
						Clay	1.2	35.5	0.0	4.2	20.3	75.4	79.7	26.9	52.8
						Clay	1.5	34.5							
						Clay	1.8	35.4							
						Silty Clay	2.1	40.0							
TH12-13	Markham Road; Along Property Line of House #1144 and 1146, Eastbound Lane, 2.0 m North of Curb	Asphalt	125	Granular Fill	175	Granular Fill	0.3	6.3							
						Clay Fill	0.6	22.8							
						Clay	0.9	36.1							
						Clay	1.2	37.3							
						Clay	1.5	36.0							
						Clay	1.8	36.4							
						Clay	2.1	38.8							
TH12-14	Markham Road; 15 m East of Chancellor Drive, Westbound Lane, 1.5 m South of Curb	Asphalt	110	Granular Fill	190	Granular Fill	0.3	21.8							
						Clay Fill	0.6	29.1							
						Clayey Silt	0.9	21.1	0.0	15.8	60.1	24.1	32.5	16.7	15.9
						Clayey Silt	1.2	20.0							
						Clayey Silt	1.5	21.8							
						Clay	1.8	46.3							
						Clay	2.1	48.3							