APPENDIX ‘A’

GEOTECHNICAL REPORT

Corydon Avenue

B SIZE 11" x 17" (279.4mm x 431.8mm) PLOT: 12/02/07 11:19:12 AM Saved By: cloustonc

ISS/REV: 0A
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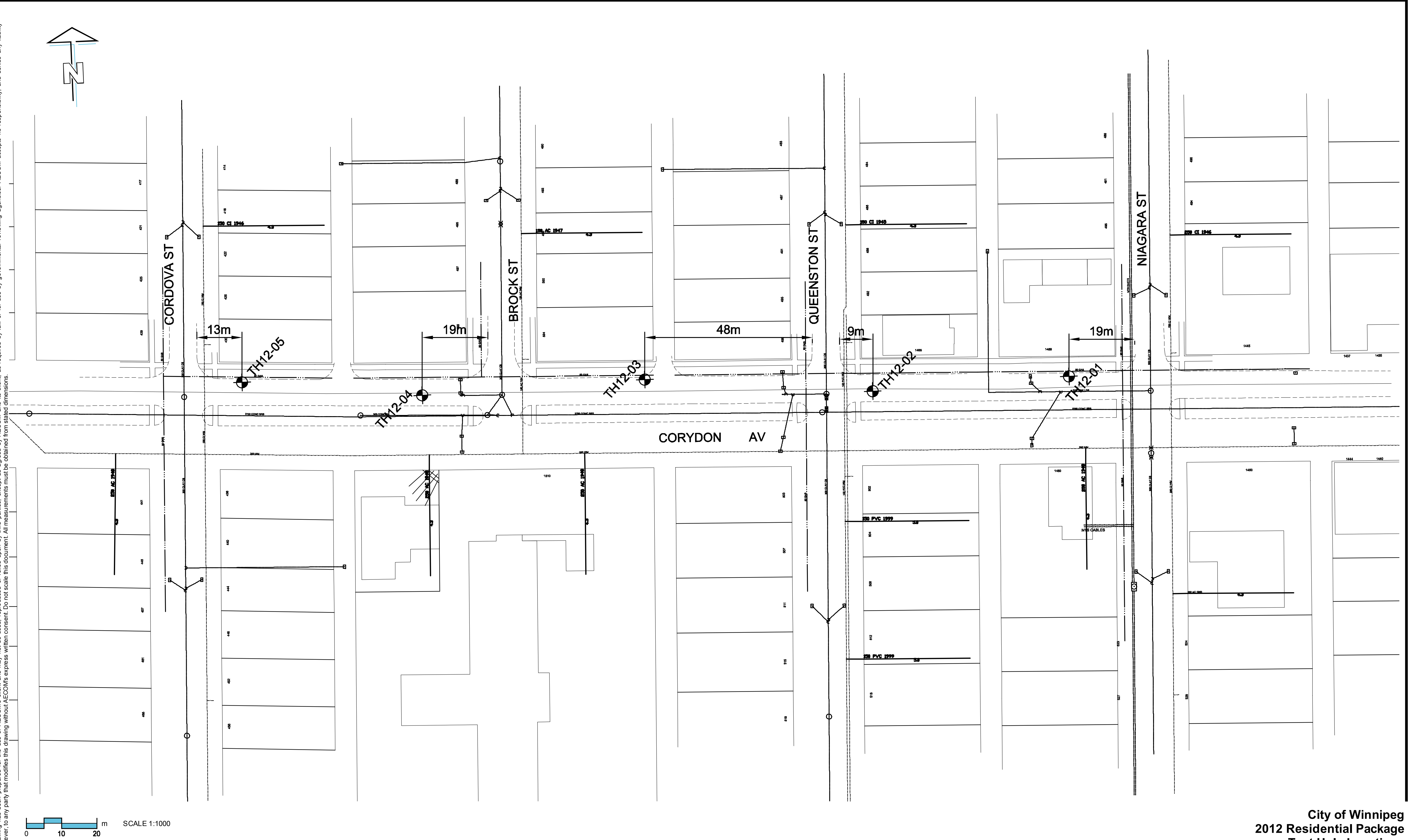


City of Winnipeg
2012 Residential Package
Test Hole Locations

Corydon Avenue Westbound
Niagara to Cordova
Figure - 01

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.

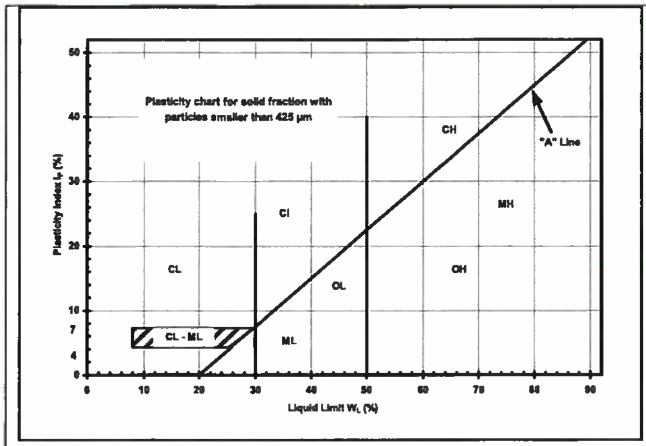
EXPLANATION OF FIELD & LABORATORY TEST DATA

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			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.

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

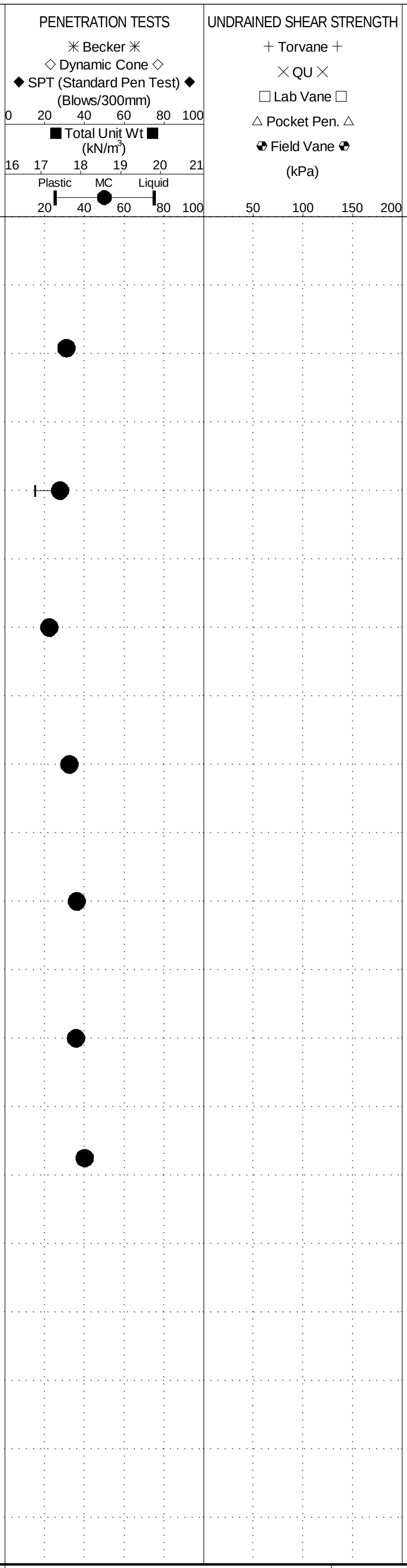
The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

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

PROJECT: Corydon Av/St. James St Package 12-C-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-01
LOCATION: Corydon Avenue W/B; 19 m West of Niagara Street, Curb Lane, 1.0 m South of Curb		PROJECT NO.: 60241459
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 DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS
0	ASPHALT (thickness = 80 mm)			
	CONCRETE (thickness = 200 mm)			
	CLAY (FILL) - trace to some silt, trace stone (<10 mm diameter) - black - frozen, moist when thawed - high plasticity	■	G1	
	CLAYEY SILT - some sand - light brown - frozen, moist when thawed - low plasticity	■ ■	G2 G3	Gradation: Sand = 16.1%, Silt = 57.6%, Clay = 26.3%
1	CLAY - trace silt, brown - frozen to 1.2 m, moist when thawed - high plasticity -below 1.2 m, firm	■ ■ ■ ■	G4 G5 G6 G7	
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, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.28 m, solid stem augers to 2.1 m.			
3				



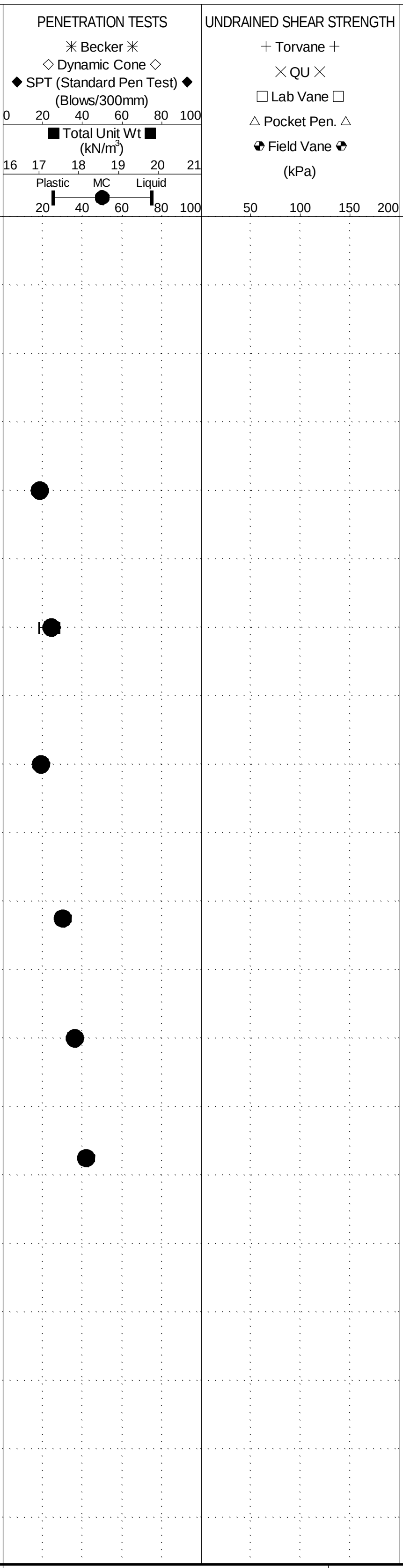
LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Tanya Worms	Page 1 of 1

AECOM

PROJECT: Corydon Av/St. James St Package 12-C-03	CLIENT: City of Winnipeg		TESTHOLE NO: TH12-02
LOCATION: Corydon Avenue W/B; 9 m East of Queenston Street, Median Lane, 2.0 m North of Curb			PROJECT NO.: 60241459
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 DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0	ASPHALT (thickness = 55 mm)				
	CONCRETE (thickness = 250 mm)				
	CLAYEY SILT - some sand - light brown - frozen to 1.2 m, moist when thawed - low plasticity				
		■	G8		
		■	G9	Gradation: Sand = 15.5%, Silt = 61.4%, Clay = 23.1%	
1					1
	- below 1.2 m, soft	■	G10		
	CLAY - trace silt - brown - moist, firm to stiff - high plasticity				
		■	G11		
		■	G12		
2					2
		■	G13		
	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, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.305 m, solid stem augers to 2.1 m.				
3					



LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Tanya Worms	Page 1 of 1

AECOM

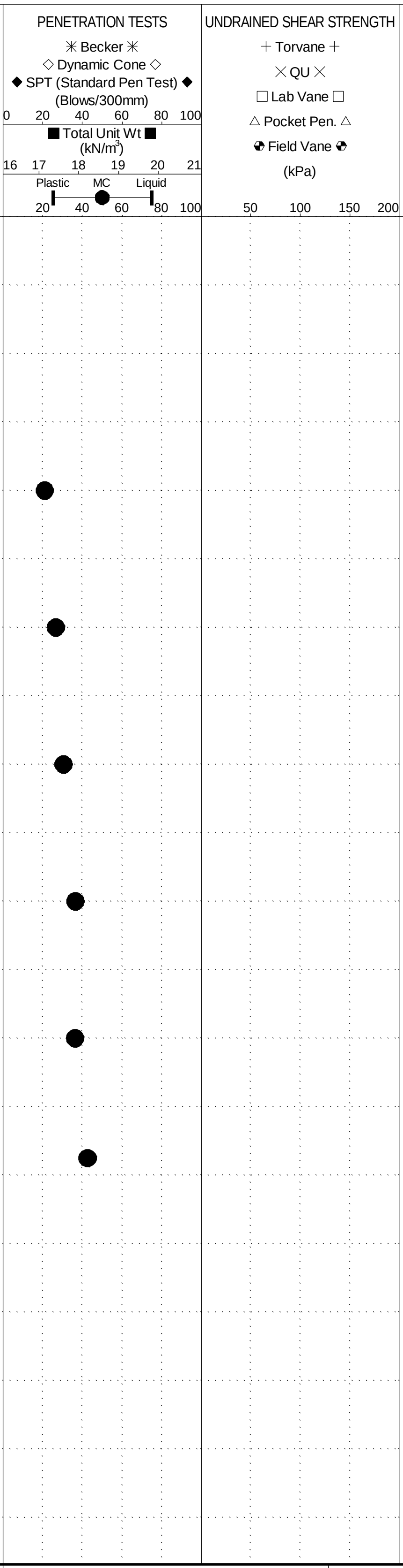
LOG OF TEST HOLE CORYDON AVENUE LOGS.GPJ UMA WINN.GDT 2/7/12

PROJECT: Corydon Av/St. James St Package 12-C-03
CLIENT: City of Winnipeg
TESTHOLE NO: TH12-03
LOCATION: Corydon Avenue W/B; 48 m West of Queenston Street, Curb Lane, 1.0 m South of Curb
PROJECT NO.: 60241459
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 DESCRIPTION
0	ASPHALT (thickness = 90 mm)
	CONCRETE (thickness = 240 mm)
	CLAY (FILL) - trace to some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity
	CLAYEY SILT - trace sand - light brown - frozen to 1.1 m, moist when thawed - low plasticity
1	-below 1.1 m, soft
	CLAY - trace silt - brown - moist, firm - high plasticity
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, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.330 m, solid stem augers to 2.1 m.
3	

SAMPLE TYPE	SAMPLE #
■	G14
■	G15
■	G16
■	G17
■	G18
■	G19



COMMENTS

DEPTH

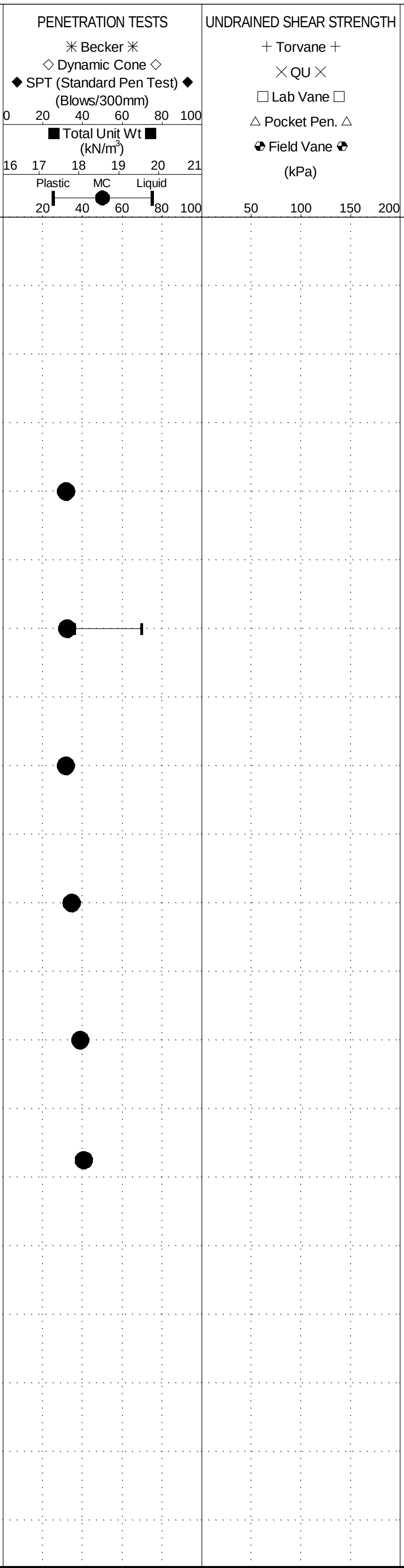
LOGGED BY: Stephen Petsche
REVIEWED BY: Faris Khalil
PROJECT ENGINEER: Tanya Worms
COMPLETION DEPTH: 2.10 m
COMPLETION DATE: 1/24/12

PROJECT: Corydon Av/St. James St Package 12-C-03
CLIENT: City of Winnipeg
TESTHOLE NO: TH12-04
LOCATION: Corydon Avenue W/B; 19 m West of Brock Street, Median Lane, 3.0 m North of Curb
PROJECT NO.: 60241459
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 DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS
0	ASPHALT (thickness = 75 mm)			
	CONCRETE (thickness = 230 mm)			
	CLAY (FILL) - trace to some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity	■	G20	
	CLAY - some silt, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity	■	G21	Gradation: Sand = 5.5%, Silt = 19.1%, Clay = 75.4%
1	- below 1.2 m, firm	■	G22	
		■	G23	
		■	G24	
2	SILT - some clay - light brown - moist, soft - intermediate plasticity	■	G25	
	END OF TEST HOLE AT 2.1 m in silt.			
3				

NOTES:
1. No sloughing observed.
2. No seepage observed.
3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface.
4. Drilled with 150 mm diamond core to 0.305 m, solid stem augers to 2.1 m.

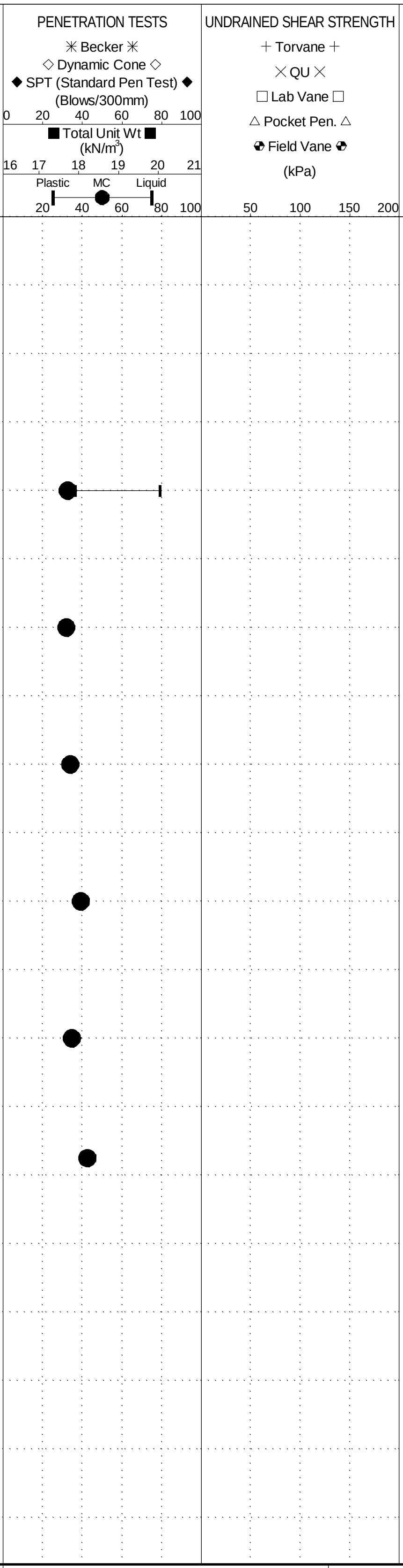


LOGGED BY: Stephen Petsche
COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil
COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Tanya Worms

PROJECT: Corydon Av/St. James St Package 12-C-03
CLIENT: City of Winnipeg
TESTHOLE NO: TH12-05
LOCATION: Corydon Avenue W/B; 13 m East of Cordova Street, Curb Lane, 1.0 m South of Curb
PROJECT NO.: 60241459
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 #	COMMENTS	DEPTH
0	■	ASPHALT (thickness = 110 mm)				
	∴	CONCRETE (thickness = 270 mm)				
	▩	CLAY (FILL) - some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity	■ ■	G26 G27	Gradation: Sand = 4.8%, Silt = 14.8%, Clay = 80.4%	
1	▧	CLAY - trace silt - brown - frozen to 1.2 m, moist when thawed - high plasticity - below 1.2 m, firm - below 1.7 m, light brown	■ ■ ■ ■	G28 G29 G30 G31		1
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, sand and asphalt cold patch to surface.4. Drilled with 150 mm diamond core to 0.380 m, solid stem augers to 2.1 m.				
3						



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LOGGED BY: Stephen Petsche
COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil
COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Tanya Worms

Photograph 1. Corydon Avenue – TH12-01

Photograph 2. Corydon Avenue – TH12-02

Photograph 3. Corydon Avenue – TH12-03

Photograph 4. Corydon Avenue – TH12-04

Photograph 5. Corydon Avenue – TH12-05

City of Winnipeg
Corydon Av / St. James St Package 12-C-03
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 (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-01	Corydon Avenue W/B; 19 m West of Niagara Street, Curb Lane, 1.0 m South of Curb	Asphalt	80	None	n/a	Clay Fill	0.3	30.9							
						Clayey Silt	0.6	27.7	0.0	16.1	57.6	26.3	27.8	15.1	12.7
						Clayey Silt	0.9	22.3							
		Concrete	200			Clay	1.2	32.4							
						Clay	1.5	36.1							
						Clay	1.8	35.7							
						Clay	2.1	40.1							
TH12-02	Corydon Avenue W/B; 9 m East of Queenston Street, Median Lane, 2.0 m North of Curb	Asphalt	55	None	n/a	Clayey Silt	0.6	18.5							
						Clayey Silt	0.9	24.4	0.0	15.5	61.4	23.1	27.9	18.1	9.7
		Concrete	250			Clayey Silt	1.2	19.1							
						Clay	1.5	30.1							
						Clay	1.8	36.2							
						Clay	2.1	41.9							
TH12-03	Corydon Avenue W/B; 48 m West of Queenston Street, Curb Lane, 1.0 m South of Curb	Asphalt	90	None	n/a	Clayey Silt	0.6	21.0							
						Clayey Silt	0.9	26.6							
		Concrete	240			Clay	1.2	30.5							
						Clay	1.5	36.5							
						Clay	1.8	36.3							
						Clay	2.1	42.6							
TH12-04	Corydon Avenue W/B; 19 m West of Brock Street, Median Lane, 3.0 m North of Curb	Asphalt	75	None	n/a	Clay Fill	0.6	31.7							
						Clay	0.9	32.2	0.0	5.5	19.1	75.4	69.7	35.7	34.0
		Concrete	230			Clay	1.2	31.6							
						Clay	1.5	34.5							
						Clay	1.8	38.8							
						Silt	2.1	40.6							
TH12-05	Corydon Avenue W/B; 13 m East of Cordova Street, Curb Lane, 1.0 m South of Curb	Asphalt	110	None	n/a	Clay Fill	0.6	32.6	0.0	4.8	14.8	80.4	79.1	36.4	42.7
						Clay Fill	0.9	31.9							
		Concrete	270			Clay	1.2	33.9							
						Clay	1.5	39.2							
						Clay	1.8	34.7							
						Clay	2.1	42.5							

St. James Street

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

PLOT: 12/02/07 11:54:31 AM

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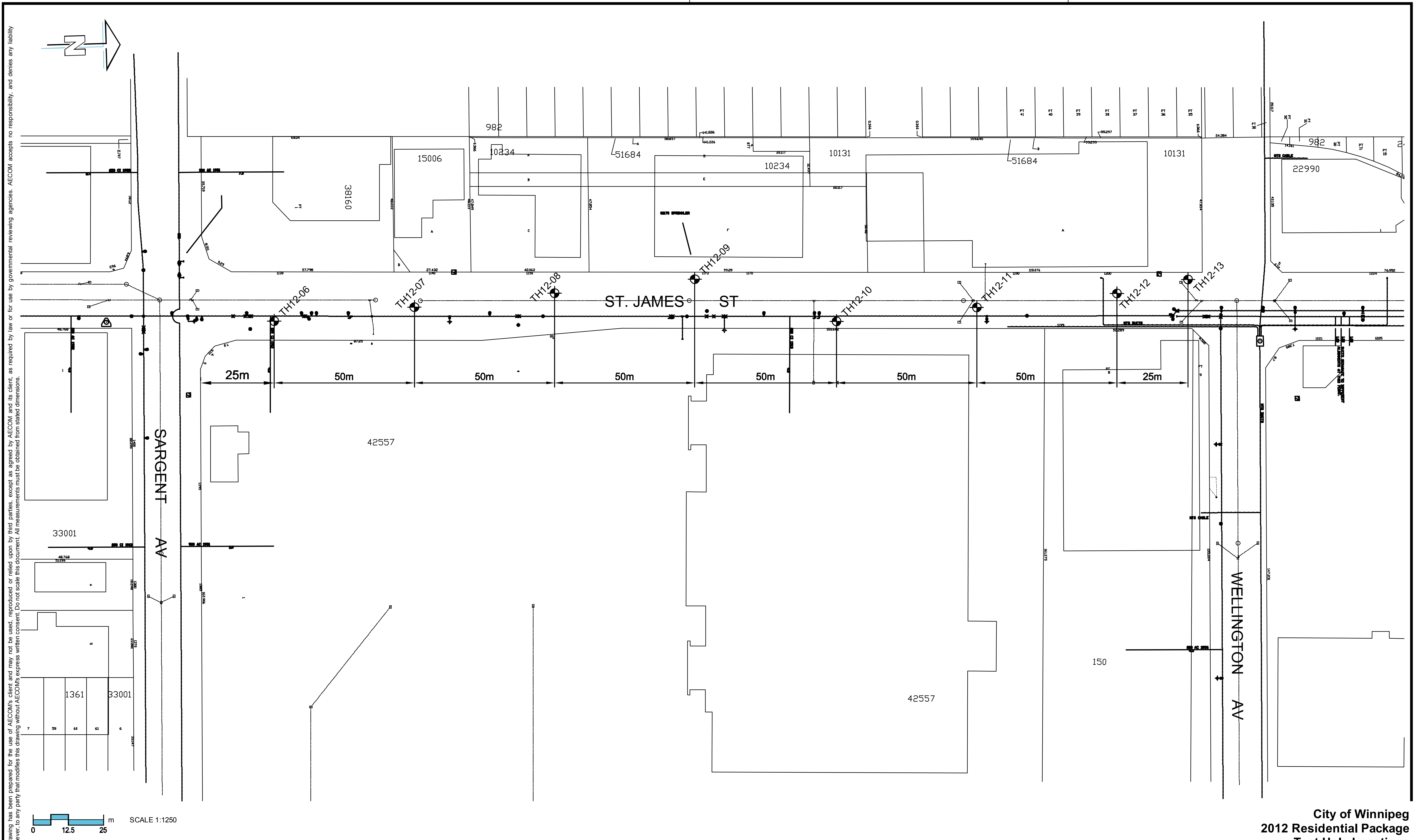

City of Winnipeg
2012 Residential Package
Test Hole Locations

St. James
Sargent to Wellington
Figure - 02

Photograph 1. St. James Street – TH12-06

Photograph 2. St. James Street – TH12-07

Photograph 3. St. James Street – TH12-08

Photograph 4. St. James Street – TH12-09

Photograph 5. St. James Street – TH12-10

Photograph 6. St. James Street – TH12-11

Corydon Av/St. James St Package 12-C-03
60241459
St. James Street
TH12-12

Photograph 7. St. James Street – TH12-12

Corydon Av/St. James St Package 12-C-03
60241459
St. James Street
TH12-13

Photograph 8. St. James Street – TH12-13

City of Winnipeg
Corydon Av / St. James St Package 12-C-03
Geotechnical Investigation

Test Hole No.	Test Hole Location	Pavement Surface	
		Type	Thickness (mm)
TH12-06	St. James Street; 25 m North of Sargent Avenue; Northbound Curb Lane, Along Centreline	Asphalt	30
		Concrete	245
TH12-07	St. James Street; 75 m North of Sargent Avenue; Northbound Median Lane, Along Centreline	Asphalt	47
		Concrete	183
TH12-08	St. James Street; 125 m North of Sargent Avenue; Southbound Median Lane, Along Centreline	Asphalt	80
		Concrete	210
TH12-09	St. James Street; 175 m North of Sargent Avenue; Southbound Curb Lane, Along Centreline	Asphalt	75
		Concrete	235
TH12-10	St. James Street; 225 m North of Sargent Avenue; Northbound Curb Lane, Along Centreline	Asphalt	50
		Concrete	215
TH12-11	St. James Street; 275 m North of Sargent Avenue; Northbound Median Lane, Along Centreline	Asphalt	70
		Concrete	220
TH12-12	St. James Street; 325 m North of Sargent Avenue; Southbound Median Lane, Along Centreline	Asphalt	55
		Concrete	210
TH12-13	St. James Street; 350 m North of Sargent Avenue; Southbound Curb Lane, Along Centreline	Asphalt	120
		Concrete	250