

APPENDIX 'A'

GEOTECHNICAL REPORT

March 10, 2016

Mr. Kevin Rae
AECOM Canada Ltd.
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7

Dear Mr. Rae:

Project No: 60481143 (402)

Regarding: Local Streets Package 16-R-04 – Contract 2 – Geotechnical Summary

This report summarizes the results of the subsurface investigation completed for the proposed 2016 Local Street Renewals of Artillery Street and Flint Street. The objective of the investigation is to provide information related to the existing pavement and soil stratigraphy underneath.

Four test holes (TH16-01 to TH16-04) were drilled on Artillery Street and two test holes (TH16-05 and TH16-06) were drilled on Flint Street. The approximate location of the test holes are shown on Figures 01 and 02 in Appendix A.

Pavement coring was completed using a hollow 150 mm diameter diamond core drill bit. Core samples were recovered and logged at AECOM's Materials Laboratory. Photos of core samples are included in Appendix A.

The test hole drilling was completed by Paddock Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The test holes were advanced to a depth of 2.1 m below road surface. During the drilling, AECOM personnel observed subsurface conditions and visually classified the soil samples. Other pertinent information such as groundwater and drilling conditions were also recorded. Disturbed soil samples from auger cuttings retrieved during the field investigation were transported to AECOM's Materials Laboratory for further testing and classification.

The laboratory soil testing consisted of Moisture Content determination, Atterberg Limits and Grain Size Distribution tests. The test results are recorded on the test hole logs and in the laboratory testing summary Table 01, both included in Appendix A.

Sincerely,
AECOM Canada Ltd.



Aaron Kaluzniak, EIT
Geotechnical Engineering

Reviewed by:



Zeyad Shukri, M.Sc., P.Eng.
Senior Geotechnical Engineer

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by Consultant and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

Consultant accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of Consultant to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

F3. GEOTECHNICAL INVESTIGATION REQUIREMENTS FOR PUBLIC WORKS PROJECTS (SEPTEMBER 2015)

F3.1 Fieldwork

- (a) Clear all underground services at each test-hole location.
- (b) On most projects, test-holes are required every 50 metres with a minimum of three (3) test holes per Project Location. For street projects greater than 500 metres, test holes may be taken every 100 m. More or fewer test-holes may be required depending upon known Site conditions – confirm with the Project Manager.
- (c) Record location of test-hole (offset from curb, distance from cross street and house number).
- (d) Drill 150 mm-diameter cores in pavement.
- (e) Drill 125 mm-diameter test-holes into fill materials and subgrade.
- (f) If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
- (g) Test-holes shall be drilled to depth of 2 m \pm 150 mm below surface of the pavement.
- (h) Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
- (i) Measure and record pavement section exposed in the test-hole (thickness of concrete or asphalt and different types of pavement structure materials).
- (j) 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).
- (k) Log soil profile for the subgrade.
- (l) 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 test-hole.
- (m) Make note of any water seepage into the test-hole.
- (n) Backfill test-hole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
- (o) Return core sample from the pavement and soil samples to the laboratory.

F3.2 Lab Work

- (a) Test all soil samples for moisture content.
- (b) Photograph core samples recovered from the pavement surface.
- (c) 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.
- (d) Prepare test-hole 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
- (e) For Pavement Rehabilitations and Mill and Fill Pavement Rehabilitation Method pavement cores may be required. Contact the City's Project Manager to confirm requirements.
- (f) For any uncertain situations and/or locations, or clarification of these requirements, contact the Project Manager.

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.

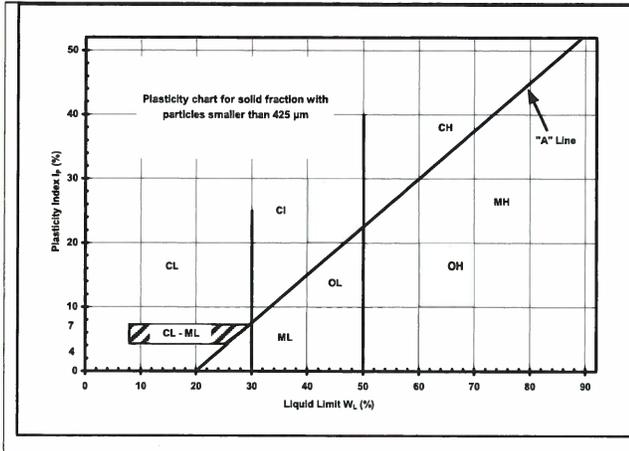
EXPLANATION OF FIELD & LABORATORY TEST DATA

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 $4 < W_p < 7$ $C_u = \frac{D_{60}}{D_{10}}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	
			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				
		$W_L > 50$	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		Classification is Based upon Plasticity Chart		
		$30 < W_L < 50$	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 ORGANIC 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 SPECIFICATIONS FOR GEOTECHNICAL INVESTIGATION REQUIREMENTS FOR PUBLIC WORKS PROJECTS (SEPTEMBER, 2015)

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECIFICATIONS FOR GEOTECHNICAL INVESTIGATION REQUIREMENTS FOR PUBLIC WORKS PROJECTS (SEPTEMBER, 2015)



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		
Silt (non-plastic) or Clay (plastic)	< 0.075 mm		10-20	some	
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/m³).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

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

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

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

Appendix A

- Test Hole Location Plans
- Test Hole Logs
- Summary of Laboratory Soil Testing
- Pavement Core Photographs

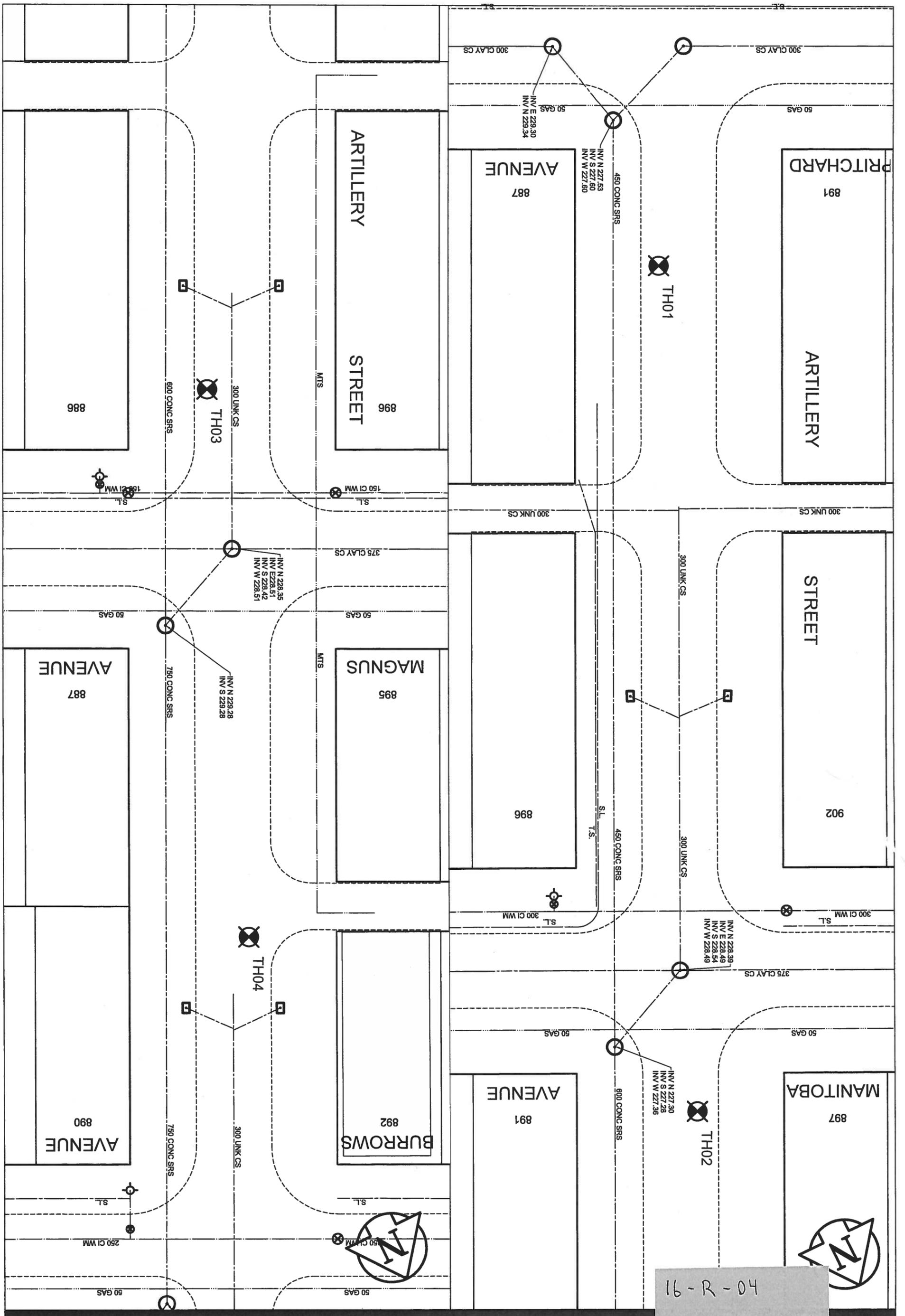


FIGURE 01: TEST HOLES LOCATION PLAN

16-R-04
 Artillery BH 1-4
 Flint BH 5-6

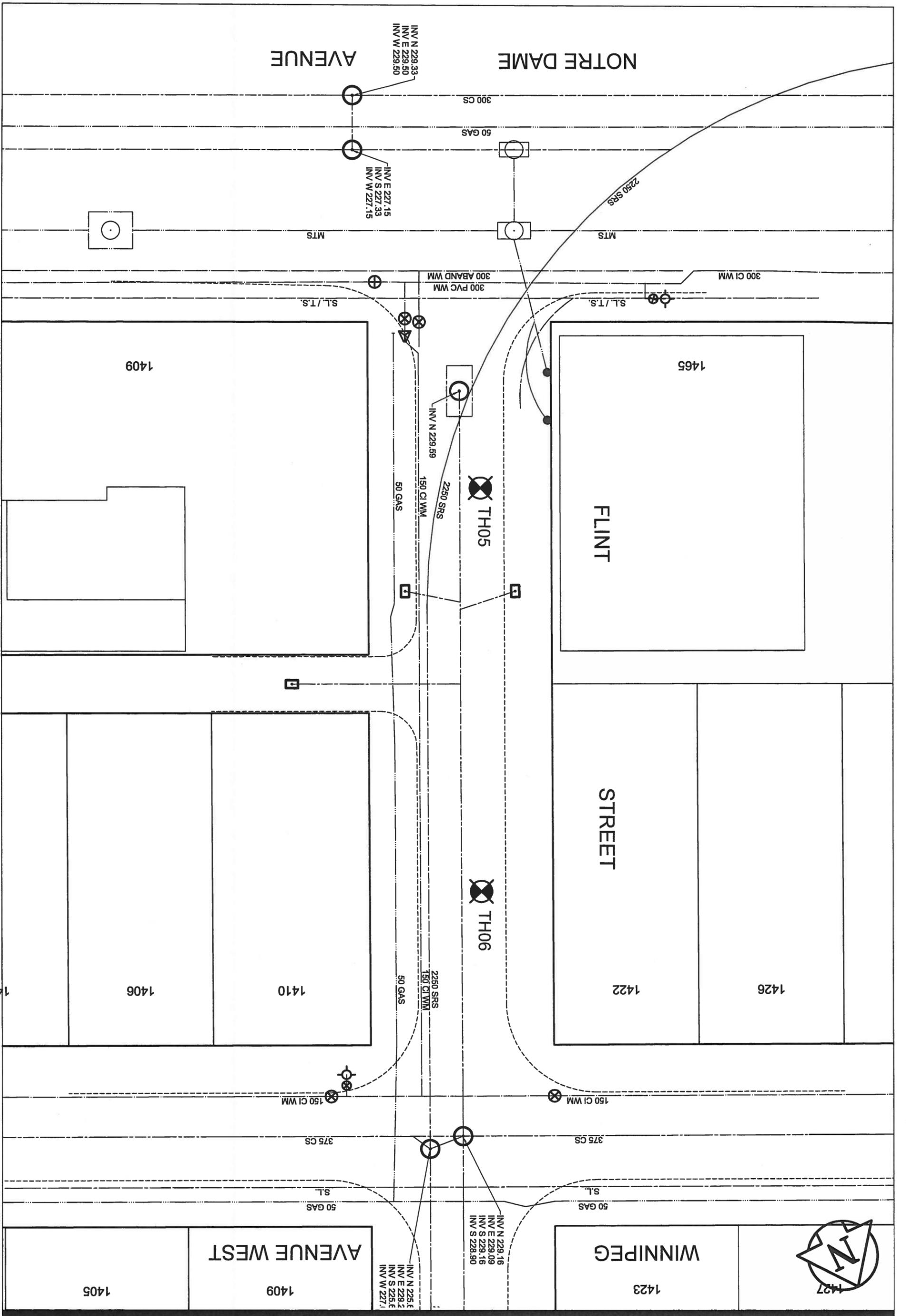


FIGURE 02: TEST HOLES LOCATION PLAN

PROJECT: 2016 Local Streets Pkg 16-R-04 Contract 2 CLIENT: City of Winnipeg TESTHOLE NO: **TH16-01**
 LOCATION: Artillery Street; 15 m N of Pritchard Avenue, Centreline, #891 Pritchard Avenue PROJECT NO.: 60481143
 CONTRACTOR: Paddock Drilling Ltd. METHOD: 125 mm SSA 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 20 40 60 80 100 (Blows/300mm)	16 17 18 19 20 21 (kN/m ²)	+ Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)			
0		Concrete (200 mm)								
		SILTY CLAY (FILL) - sandy - brown, moist, frozen - intermediate plasticity	<input checked="" type="checkbox"/>	G162	●				(G162): Gravel: 0.9%, Sand: 22.9%, Silt: 37.1%, Clay: 39.1%	
		SILTY CLAY - brown, moist - intermediate to high plasticity	<input checked="" type="checkbox"/>	G163	●					
			<input checked="" type="checkbox"/>	G164	●					
			<input checked="" type="checkbox"/>	G165	●					
		- frozen to 1.2 m - firm below 1.2 m	<input checked="" type="checkbox"/>	G166	●					
		- 150 mm thick silt and sand layer at 1.4 m	<input checked="" type="checkbox"/>	G167	●					
			<input checked="" type="checkbox"/>	G168	●					
		END OF TEST HOLE AT 2.1 m IN SILTY CLAY. NOTES: 1. No sloughing. 2. No seepage. 3. Test hole backfilled with auger cuttings and bentonite seal, and 150 mm asphalt patch at surface.								

LOG OF TEST HOLE TH16-01 CONTRACT 2_60481143.GPJ UMA WINN.GDT 3/10/16



LOGGED BY: Matt Lotecki COMPLETION DEPTH: 2.13 m
 REVIEWED BY: Aaron Kaluzniak COMPLETION DATE: 2/24/16
 PROJECT ENGINEER: Kevin Rae Page 1 of 1

PROJECT: 2016 Local Streets Pkg 16-R-04 Contract 2 CLIENT: City of Winnipeg TESTHOLE NO: **TH16-02**
 LOCATION: Artillery Street; 5 m N of Manitoba Avenue, Centreline, #897 Manitoba Avenue PROJECT NO.: 60481143
 CONTRACTOR: Paddock Drilling Ltd. METHOD: 125 mm SSA 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
					* 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	+ Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200				
0	▲▲▲▲▲	Concrete (200 mm)								
	▨	CLAY - some silt, trace silt inclusions - brown, moist, firm - high plasticity		G169	●					
	▨			G170	●					
	▨			G171	●					
1	▨	- 150 mm thick silt and sand layer at 0.9 m		G172	●					
	▨			G173	●					
	▨			G174	●	—			(G174): Gravel: 0.0%, Sand: 0.0%, Silt: 11.4%, Clay: 88.6%	
	▨			G175	●					
		END OF TEST HOLE AT 2.1 m IN CLAY. NOTES: 1. No sloughing. 2. No seepage. 3. Test hole backfilled with auger cuttings and bentonite seal, and 150 mm asphalt patch at surface.								

LOG OF TEST HOLE TH_16-02 CONTRACT 2_60481143.GPJ UMA WINN.GDT 3/10/16



LOGGED BY: Matt Lotecki COMPLETION DEPTH: 2.13 m
 REVIEWED BY: Aaron Kaluzniak COMPLETION DATE: 2/24/16
 PROJECT ENGINEER: Kevin Rae Page 1 of 1

PROJECT: 2016 Local Streets Pkg 16-R-04 Contract 2 CLIENT: City of Winnipeg TESTHOLE NO: **TH16-03**
 LOCATION: Artillery Street; 5 m S of Magnus Avenue, Centreline, #896 Magnus Avenue PROJECT NO.: 60481143
 CONTRACTOR: Paddock Drilling Ltd. METHOD: 125 mm SSA 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
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)				
0		Concrete (150 mm)								
0		SILTY CLAY - trace sand, trace silt inclusions - brown, moist - intermediate plasticity	<input checked="" type="checkbox"/>	G176	●					
			<input checked="" type="checkbox"/>	G177	●					
			<input checked="" type="checkbox"/>	G178	●					
1		- frozen to 1.1 m - firm below 1.1 m	<input checked="" type="checkbox"/>	G179	●					1
			<input checked="" type="checkbox"/>	G180	●					
			<input checked="" type="checkbox"/>	G181	●					
2			<input checked="" type="checkbox"/>	G182	●					2
		END OF TEST HOLE AT 2.1 m IN SILTY CLAY. NOTES: 1. No sloughing. 2. No seepage. 3. Test hole backfilled with auger cuttings and bentonite seal, and 150 mm asphalt patch at surface.								

LOG OF TEST HOLE TH_ CONTRACT 2_60481143.GPJ UMA WINN.GDT 3/10/16



LOGGED BY: Matt Lotecki COMPLETION DEPTH: 2.13 m
 REVIEWED BY: Aaron Kaluzniak COMPLETION DATE: 2/24/16
 PROJECT ENGINEER: Kevin Rae Page 1 of 1

PROJECT: 2016 Local Streets Pkg 16-R-04 Contract 2 CLIENT: City of Winnipeg TESTHOLE NO: **TH16-04**
 LOCATION: Artillery Street; 30 m S of Burrows Avenue, Centreline, #892 Burrows Avenue PROJECT NO.: 60481143
 CONTRACTOR: Paddock Drilling Ltd. METHOD: 125 mm SSA 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	100	50	200		
0		Concrete (150 mm)								
		CLAY - silty - brown, moist - intermediate to high plasticity	<input checked="" type="checkbox"/>	G183	●					
			<input checked="" type="checkbox"/>	G184	●					
			<input checked="" type="checkbox"/>	G185	●					
1		- frozen to 0.9 m - firm below 0.9 m								
		CLAYEY SILT - brown, moist to wet, soft - low plasticity - homogenous	<input checked="" type="checkbox"/>	G186	●					
			<input checked="" type="checkbox"/>	G187	●				(G187): Gravel: 0.1%, Sand: 16.9%, Silt: 66.0%, Clay: 17.0%	
			<input checked="" type="checkbox"/>	G188	●					
			<input checked="" type="checkbox"/>	G189	●					
2		END OF TEST HOLE AT 2.1 m IN CLAYEY SILT. NOTES: 1. No sloughing. 2. No seepage. 3. Test hole backfilled with auger cuttings and bentonite seal, and 150 mm asphalt patch at surface.								

LOG OF TEST HOLE TH16-04 CONTRACT 2.60481143.GPJ UMA WINN.GDT 3/10/16



LOGGED BY: Matt Lotecki COMPLETION DEPTH: 2.13 m
 REVIEWED BY: Aaron Kaluzniak COMPLETION DATE: 2/24/16
 PROJECT ENGINEER: Kevin Rae Page 1 of 1

PROJECT: 2016 Local Streets Pkg 16-R-04 Contract 2 CLIENT: City of Winnipeg TESTHOLE NO: **TH16-05**
 LOCATION: Flint Street; 20 m N of Notre Dame Avenue, Centreline, #1465 Notre Dame Avenue PROJECT NO.: 60481143
 CONTRACTOR: Paddock Drilling Ltd. METHOD: 125 mm SSA 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
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m ²) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	+ Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200				
0		Asphalt (50 mm)								
		Concrete (150 mm)								
		SILTY CLAY - trace sand, trace gravel - brown, moist - high plasticity	<input checked="" type="checkbox"/>	G190	●					
			<input checked="" type="checkbox"/>	G191	●					
1		- frozen to 0.9 m - firm below 0.9 m		G192	●				(G192): Gravel: 0.1%, Sand: 8.1%, Silt: 32.6%, Clay: 59.2%	1
			<input checked="" type="checkbox"/>	G193	●					
			<input checked="" type="checkbox"/>	G194	●					
		CLAYEY SILT - trace sand - brown, moist to wet, soft to firm - low to intermediate plasticity	<input checked="" type="checkbox"/>	G195	●					
			<input checked="" type="checkbox"/>	G196	●					
		END OF TEST HOLE AT 2.1 m IN CLAYEY SILT. NOTES: 1. No sloughing. 2. No seepage. 3. Test hole backfilled with auger cuttings and bentonite seal, and 150 mm asphalt patch at surface.								

LOG OF TEST HOLE TH_ CONTRACT 2_60481143.GPJ UMA WINN.GDT 3/10/16



LOGGED BY: Matt Lotecki COMPLETION DEPTH: 2.13 m
 REVIEWED BY: Aaron Kaluzniak COMPLETION DATE: 2/24/16
 PROJECT ENGINEER: Kevin Rae Page 1 of 1

PROJECT: 2016 Local Streets Pkg 16-R-04 Contract 2 CLIENT: City of Winnipeg TESTHOLE NO: **TH16-06**
 LOCATION: Flint Street; 20 m S of Winnipeg Avenue West, Centreline, #1422 Winnipeg Avenue West PROJECT NO.: 60481143
 CONTRACTOR: Paddock Drilling Ltd. METHOD: 125 mm SSA 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
					* 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	+ Torvane + × QU/2 × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200				
0		Concrete (150 mm)								
		SAND and CLAY (FILL) - silty, some gravel - brown, moist, frozen - intermediate plasticity		G197	●				(G197): Gravel: 14.4%, Sand: 32.3%, Silt: 22.4%, Clay: 30.9%	
		CLAY - silty, trace sand, trace gravel - brown, moist - intermediate plasticity		G198	●					
		- frozen to 0.9 m - firm below 0.9 m		G199	●					
				G200	●					
				G201	●					
		CLAYEY SILT - trace sand - brown, moist to wet, firm to soft - low plasticity		G202	●					
				G203	●				(G203): Gravel: 0.1%, Sand: 22.4%, Silt: 63.6%, Clay: 14.2%	
		END OF TEST HOLE AT 2.1 m IN CLAYEY SILT. NOTES: 1. No sloughing. 2. No seepage. 3. Test hole backfilled with auger cuttings and bentonite seal, and 150 mm asphalt patch at surface.								

LOG OF TEST HOLE TH_ CONTRACT 2_60481143.GPJ UMA WINN.GDT 3/10/16



LOGGED BY: Matt Lotecki COMPLETION DEPTH: 2.13 m
 REVIEWED BY: Aaron Kaluzniak COMPLETION DATE: 2/24/16
 PROJECT ENGINEER: Kevin Rae Page 1 of 1

City of Winnipeg

Local Streets Pkg 16-R-04 – Contract 2

Geotechnical Investigation

Table 01- Summary of Laboratory Soil Testing

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
TH16-01	Artillery Street; 15 m N of Pritchard Avenue, Centreline, #891 Pritchard Avenue	Asphalt	N/A	None	N/A	SILTY CLAY	0.3	29.2	0.9	22.9	37.1	39.1	49.1	17.7	31.4
						SILTY CLAY	0.6	34.0							
						SILTY CLAY	0.9	23.3							
		Concrete	200			SILTY CLAY	1.2	24.4							
						SILTY CLAY	1.5	28.7							
						SILTY CLAY	1.8	30.4							
						SILTY CLAY	2.1	43.5							
TH16-02	Artillery Street; 5 m N of Manitoba Avenue, Centreline, #897 Manitoba Avenue	Asphalt	N/A	None	N/A	CLAY	0.3	27.6							
						CLAY	0.6	28.3							
						CLAY	0.9	24.6							
		Concrete	200			CLAY	1.2	23.9							
						CLAY	1.5	31.8							
						CLAY	1.8	42.9	0.0	0.0	11.4	88.6	92.1	26.3	65.8
						CLAY	2.1	42.1							
TH16-03	Artillery Street; 5 m S of Magnus Avenue, Centreline, #896 Magnus Avenue	Asphalt	N/A	None	N/A	SILTY CLAY	0.3	27.7							
						SILTY CLAY	0.6	37.1							
						SILTY CLAY	0.9	27.4							
		Concrete	150			SILTY CLAY	1.2	23.2							
						SILTY CLAY	1.5	32.0							
						SILTY CLAY	1.8	34.8							
						SILTY CLAY	2.1	44.0							
TH16-04	Artillery Street; 30 m S of Burrows Avenue, Centreline, #892 Burrows Avenue	Asphalt	N/A	None	N/A	CLAY	0.3	39.4							
						CLAY	0.6	32.9							
						CLAY	0.9	31.3							
		Concrete	150			CLAYEY SILT	1.2	23.1							
						CLAYEY SILT	1.5	22.9	0.1	16.9	66.0	17.0	19.9	12.8	7.1
						CLAYEY SILT	1.8	25.9							
						CLAYEY SILT	2.1	31.8							
TH16-05	Flint Street; 20 m N of Notre Dame Avenue, Centreline, #1465 Notre Dame Avenue	Asphalt	50	None	N/A	SILTY CLAY	0.3	27.4							
						SILTY CLAY	0.6	29.9							
						SILTY CLAY	0.9	27.0	0.1	8.1	32.6	59.2	61.9	18.8	43.1
		Concrete	150			SILTY CLAY	1.2	27.7							
						SILTY CLAY	1.5	25.8							
						CLAYEY SILT	1.8	23.6							
						CLAYEY SILT	2.1	24.0							

* Note – Subgrade Description based on City of Winnipeg Specifications for Geotechnical Investigation Requirements for Public Works Projects (September 2015)

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			
TH16-06	Flint Street; 20 m S of Winnipeg Avenue West, Centreline, #1422 Winnipeg Avenue West	Asphalt	N/A	None	N/A	SAND & CLAY	0.3	24.4	14.4	32.3	22.4	30.9	46.8	17.4	29.4			
						CLAY	0.6	30.9										
						CLAY	0.9	28.3										
		Concrete	150			CLAY	1.2	28.3										
						CLAY	1.5	23.6										
						CLAYEY SILT	1.8	25.0										
						CLAYEY SILT	2.1	23.3	0.1	22.4	63.6	14.2	21.8	14.0	7.8			

* Note – Subgrade Description based on City of Winnipeg Specifications for Geotechnical Investigation Requirements for Public Works Projects (September 2015)



Photograph 1. Artillery Street – TH16-01



Photograph 2. Artillery Street – TH16-02



Photograph 3. Artillery Street – TH16-03



Photograph 4. Artillery Street – TH16-04



Photograph 5. Flint Street – TH16-05



Photograph 6. Flint Street – TH16-06