

# **APPENDIX 'A'**

# **GEOTECHNICAL REPORT**



March 8, 2019

File No. 19-0535-001

3rd Floor  
865 Waverley Street  
Winnipeg,  
Manitoba  
R3T 5P4  
204.896.1209  
fax: 204.896.0754  
www.ksgroup.com

KGS Group  
865 Waverley Street  
Winnipeg, Manitoba  
R3T 5P4

ATTENTION: Mr. Craig Rowbotham, P.Eng.  
Senior Project Engineer

RE: 2019 City of Winnipeg Local Streets Package  
Raleigh Street (North), Raleigh Street (South), Jamison Avenue,  
Talbot Avenue, Edison Avenue, Sanford Fleming Road, Day Street  
Geotechnical Investigation – Final

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Dear Mr. Rowbotham:

This letter summarizes KGS Group's geotechnical investigation for Raleigh Street (North), Raleigh Street (South), Jamison Avenue, Talbot Avenue, Edison Avenue, Sanford Fleming Road, Day Street that was required as part of the City of Winnipeg Streets Package in Winnipeg, Manitoba.

## 1.0 INTRODUCTION

KGS Group has completed a geotechnical investigation consisting of 50 test holes for the design of the street pavement structures. The 2019 City of Winnipeg Local Streets Package includes the following streets:

- 305 m section of Raleigh Street extending north from Chalmers Avenue to Monroe Avenue;
- 709 m section of Raleigh Street extending north from Springfield Road to Donwood Drive;
- 650 m section of Jamison Avenue extending east from Henderson Highway to Roch Street;
- 220 m section of Talbot Avenue extending east from Grey Street to Foster Street;
- 792 m section of Edison Avenue extending east from Rothesay Street to De Graff Place;
- 723 m section of Sanford Fleming Road extending east from Plessis Road to Devonshire Drive; and

- 521 m section of Day Street extending north from Kildare Avenue West to McMeans Avenue West.

This report details the results of the geotechnical investigation completed by KGS Group in January and February 2019.

## 2.0 GEOTECHNICAL INVESTIGATION SERVICES

The scope of this assignment included the following:

- **Utility Clearances** – Prior to undertaking any drilling activities KGS Group obtained the necessary underground utility clearances.
- **Traffic Protection** – KGS Group arranged for traffic protection throughout the geotechnical investigation in accordance with City of Winnipeg Manual for Temporary Traffic Control requirements.
- **Geotechnical Investigation** – A geotechnical investigation was completed to investigate the subsurface conditions below the pavement surface in accordance with City of Winnipeg geotechnical requirements for public works projects. The breakdown of the requested number of pavement cores and test holes by street is outlined in the table below. All test holes were advanced to a total depth of 3.1 m.

STREET NAME	NUMBER OF CORE / TEST HOLES	PAVEMENT CORE HOLES ONLY
Raleigh Street (North)	7	None
Raleigh Street (South)	9	None
Jamison Avenue	7	None
Talbot Avenue	None	5
Edison Avenue	None	8
Sanford Fleming Road	None	8
Day Street	None	6
<b>Total</b>	<b>23</b>	<b>27</b>

- **Laboratory Testing** – Laboratory testing including grain size analyses, Atterberg limits and moisture contents were performed on select soil samples for correlation to relevant engineering properties of the soils.

## 3.0 GEOTECHNICAL INVESTIGATION

### 3.1 TEST HOLE DRILLING AND SOIL SAMPLING PROGRAM

A drilling and sampling program consisting of 50 cores through the pavement structure and 23 test holes advanced to depths of 3.1 m were completed from January 24, 2019 to February 14, 2019. Drilling services were provided by Maple Leaf Drilling Ltd. of

Winnipeg, Manitoba with KGS Group supervision. Test holes were completed using a mobile B40 truck mounted drill rig. Test holes were cored through the existing pavement and advanced the remaining depth using 125 mm diameter solid stem continuous flight augers. The locations of the test holes are shown on Figures attached in the Appendices with the approximate UTM coordinates (Zone 14) and ground elevations listed in Table 1 to 7.

The first soil sample in each test hole was obtained no deeper than 0.1 m below the existing pavement structure, with subsequent soil samples recovered at 0.3 m intervals to a total depth of 3.1 m. Soil samples were collected directly off the auger flights and visually classified in the field in accordance with the modified Unified Soil Classification System (USCS). Field Torvane's were complete on the clay soils to estimate the undrained shear strength.

Upon completion of drilling, the test holes were examined for indications of sloughing and seepage, and then backfilled to grade with bentonite chips, auger cuttings and cold-mix asphalt patch to the pavement surface. Detailed summary soil logs incorporating all field observations details are attached in the Appendices.

**TABLE 2**  
**RALEIGH STREET (NORTH) – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-01	5,533,530	639,164	230.70
TH19-02	5,533,494	639,131	230.76
TH19-03	5,533,452	639,098	230.79
TH19-04	5,533,414	639,074	230.81
TH19-05	5,533,396	639,055	230.86
TH19-06	5,533,373	639,042	230.88
TH19-07	5,533,328	639,002	231.05

**TABLE 3**  
**RALEIGH STREET (SOUTH) – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-11	5,530,888	637,114	230.61
TH19-12	5,530,837	637,074	230.75
TH19-13	5,530,769	637,022	230.51
TH19-14	5,530,684	636,960	231.21
TH19-15	5,530,611	636,904	230.77
TH19-16	5,530,535	636,845	230.33
TH19-17	5,530,478	636,801	230.53
TH19-18	5,530,392	636,734	230.98
TH19-19	5,530,337	636,693	231.12

**TABLE 4**  
**JAMISON AVENUE – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-21	5,531,328	635,566	231.01
TH19-22	5,531,285	635,653	231.07
TH19-23	5,531,240	635,748	231.21
TH19-24	5,531,211	635,809	230.94
TH19-25	5,531,169	635,897	230.94
TH19-26	5,531,125	635,988	230.27
TH19-27	5,531,072	636,098	230.68

**TABLE 5**  
**TALBOT AVENUE – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-31	5,529,800	636,853	230.75
TH19-32	5,529,777	636,946	232.32
TH19-33	5,529,764	636,996	230.95
TH19-34	5,529,787	636,906	231.95
TH19-35	5,529,805	636,831	230.87

**TABLE 6**  
**EDISON AVENUE – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-41	5,533,492	637,857	230.46
TH19-42	5,533,448	637,948	230.32
TH19-43	5,533,397	638,052	230.23
TH19-44	5,533,346	638,158	230.05
TH19-45	5,533,301	638,252	230.08
TH19-46	5,533,261	638,336	230.01
TH19-47	5,533,214	638,429	230.18
TH19-48	5,533,159	638,503	230.10

**TABLE 7**  
**SANFORD FLEMING ROAD – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-51	5,530,021	641,834	232.29
TH19-52	5,530,044	641,928	232.81
TH19-53	5,530,077	642,011	232.35
TH19-54	5,530,120	642,102	232.25
TH19-55	5,530,192	642,145	232.21
TH19-56	5,530,276	642,105	232.27
TH19-57	5,530,347	642,071	232.20
TH19-58	5,530,420	642,044	232.01

**TABLE 8**  
**DAY STREET – TEST HOLE COORDINATES AND ELEVATIONS**

TEST HOLE ID	APPROXIMATE UTM COORDINATES		GROUND ELEV. (m)
	NORTHING (m)	EASTING (m)	
TH19-61	5,529,965	643,432	233.21
TH19-62	5,529,908	643,433	233.18
TH19-63	5,529,809	643,435	232.95
TH19-64	5,529,720	643,436	232.95
TH19-65	5,529,648	643,437	233.04
TH19-66	5,529,530	643,439	232.77

Test hole UTM coordinates were surveyed using a hand held unit ( $\pm 5$  m) with ground elevations selected based on KGS Group's topographic survey.

### 3.2 LABORATORY TESTING

Laboratory testing was completed on select representative soil samples for correlation to relevant engineering properties of the subsurface soils. Laboratory testing included six (6) particle size analyses, six (6) Atterberg limits and one hundred fifty five (155) moisture contents. Laboratory testing was completed at a Canadian Council of Independent Laboratories (CCIL) certified soil testing laboratory in Winnipeg, Manitoba in general accordance with ASTM Standards.

## 4.0 INVESTIGATION RESULTS

### 4.1 STRATIGRAPHY – RALEIGH STREET (NORTH)

Seven (7) test holes were drilled on Raleigh Street extending north from Springfield Road to Donwood Drive. In general, the stratigraphy at the site was interpreted by KGS Group to consist of a concrete pavement structure and granular base, overlying fat clay and silt.

The location of the test holes are provided on Figure A1 in Appendix A. Atterberg limits and grain size analysis results are presented on the attached Figures A2 and A3 in Appendix A.

#### ***Concrete Pavement Structure with Partial Asphalt Overlay***

The existing pavement structure at the test hole locations with exception to TH19-01 consisted of 140 to 175 mm of concrete. The existing pavement structure at TH19-01 consisted of 50 mm of asphalt. Granular base was encountered below the pavement in all of the test holes and ranged in thickness from 50 to 560 mm. The granular base was brown in colour, frozen, well-graded, and contained fine to coarse grained sand and fine grained gravel. The granular base encountered in TH19-04 contained some clay. The moisture content of the granular base ranged from 3 to 19% as measured from six (6) samples. The granular base sample obtained from TH19-04 had a measured moisture content of 26%.

#### ***Fat Clay (CH)***

Fat clay was encountered below the granular base in all test holes. In all test holes, the fat clay extended to the end of each test hole at 3.1 m, with the exception of TH19-07 where silt was encountered at 2.1 m extending to the bottom of the test hole. The fat clay was black to brown in colour, damp to moist, stiff in consistency, of high plasticity and contained trace sand. At the time of the investigation the fat clay was frozen to a depth of 0.9 to 1.5 m.

The moisture content of the fat clay ranged from 12 to 45 %, as measured from 28 samples. Atterberg limits on two (2) fat clay samples at depths of 0.9 m measured a liquid limit of 74 to 75, a plastic limit of 20 to 21 and a plasticity index of 54, classifying the material as fat clay (CH). Grain size analyses completed on the same samples measured 71 to 75% clay sized particles, 22 to 24 % silt sized particles, 3 to 5% sand sized particles and 0 % gravel sized particles.

#### ***Silt (ML)***

A 0.3 to 1.3 m thick layer of silt was encountered within the fat clay at a depth ranging from 1.4 to 2.1 m below the top of pavement in TH19-02, TH19-03, TH19-04, TH19-05, TH19-06, and TH19-07. The silt was light brown in colour, moist, soft in consistency, with no to low plasticity. The moisture content of the silt was 22 to 31% as measured from seven (7) samples.

## **4.2 STRATIGRAPHY – RALEIGH STREET (SOUTH)**

Nine (9) test holes were drilled on Raleigh Street extending north Chalmers Avenue to Monroe Avenue. In general, the stratigraphy at the site was interpreted by KGS Group to consist of a concrete pavement structure and granular base, overlying fat clay and silt.

The location of the test holes are provided on Figure B1 in Appendix B. Atterberg limits and grain size analysis results are presented on the attached Figures B2 and B3 in Appendix B.

#### ***Concrete Pavement Structure with Partial Asphalt Overlay***

The existing pavement structure at the test hole locations with the exception of TH19-19 consisted of 125 to 255 mm of concrete. A 40 mm asphalt overlay was observed in TH19-19 overlying 200 mm of concrete and clay fill. Granular base was encountered below the pavement in all of the test holes with exception of TH19-19 and ranged in thickness from 125 to 585 mm. The granular base was brown in colour, frozen, well-graded, and contained medium to coarse grained sand and fine grained gravel. The moisture content of the granular base ranged from 6 to 11% as measured from eight (8) samples.

### ***Fat Clay (CH)***

Fat clay was encountered below the granular base in all test holes, with exception of TH19-14, TH19-17 and TH19-19. In all test holes, the fat clay extended to the end of each test hole at 3.1 m, with the exception of TH19-11, TH19-13, TH19-14, and TH19-15 where silt was encountered that extending to the bottom of the test hole. The fat clay was brown in colour, moist, stiff in consistency, of high plasticity. At the time of the investigation the fat clay was frozen to a depth of 1.3 to 1.5 m. In TH19-18, the fat clay contained with fine to coarse grained sand.

The moisture content of the fat clay ranged from 26 to 46 %, as measured from 35 samples. Atterberg limits on two (2) fat clay samples at depths of 0.6 and 0.8 m measured a liquid limit of 65 to 82, a plastic limit of 20 to 25 and a plasticity index of 45 to 57, classifying the material as fat clay (CH). Grain size analyses completed on the same samples measured 57 to 80 % clay sized particles, 18 to 20 % silt sized particles 3 to 20 % sand sized particles and 0 % gravel sized particles. One of the samples tested was from the fat clay with sand layer.

### ***Silt (ML)***

A 0.6 to 1.3 m thick layer of silt was encountered within the fat clay at a depth ranging from 1.5 to 2.1 m below the top of pavement in TH19-11, TH19-12, TH19-13, TH19-18, and TH19-19. The silt was light brown in colour, moist, soft in consistency, with no to low plasticity. The moisture content of the silt was 22 to 28% as measured from 19 samples.

### ***Clay Fill (CH)***

Clay fill was encountered below the granular base in TH19-14, TH19-17 and TH19-19 at depths ranging from 0.3 to 0.8. The clay fill ranged in thickness from 0.4 to 1.1 m. The clay fill was dark brown to black in colour, of high plasticity and contained trace medium to coarse grained sand and trace fine grained gravel. At the time of the investigation the clay fill was frozen. The moisture content of the clay fill ranged from 27 to 34 %, as measured from seven (7) samples

## **4.3 STRATIGRAPHY – JAMISON AVENUE**

Seven (7) test holes were drilled on Jamison Avenue extending east from Henderson Highway to Roch Street. In general, the stratigraphy at the site was interpreted by KGS Group to consist of a concrete pavement structure, overlying fat clay and silt.

The location of the test holes are provided on Figure C1 in Appendix C. Atterberg limits and grain size analysis results are presented on the attached Figures C2 and C3 in Appendix C.

### ***Concrete Pavement Structure with Partial Asphalt Overlay***

The existing pavement structure at the test hole locations consisted of 40 to 85 mm of asphalt overlaying 100 to 185 mm of concrete. Granular base was encountered below the pavement in TH19-25, TH19-26 and TH19-27, ranging in thickness from 100 to 175 mm. The granular base was brown in colour, frozen, well-graded, and contained medium to coarse grained sand and fine grained gravel. The moisture content of the granular base was 10% as measured from one (1) samples.

### ***Fat Clay (CH)***

Fat clay was encountered below the pavement structure in all test holes. In all test holes, the fat clay extended to the end of each test hole at 3.1 m. The fat clay was black to brown in colour, moist, stiff in consistency, of high plasticity and contained trace fine to coarse grained sand. At the time of the investigation the fat clay was frozen to a depth of 1.2 to 1.4 m.



The moisture content of the fat clay ranged from 26 to 49 %, as measured from 34 samples. Atterberg limits on two (2) fat clay samples at depths of 0.6 m measured a liquid limit of 75 to 76, a plastic limit of 23 to 24 and a plasticity index of 52, classifying the material as fat clay (CH). Grain size analyses completed on the same samples measured 77 to 81 % clay sized particles, 18 to 23 % silt sized particles 1 to 2 % sand sized particles and 0 % gravel sized particles.

#### ***Silt (ML)***

A 0.6 to 1.1 m thick layer of silt was encountered within the fat clay at a depth ranging from 0.9 to 1.3 m below the top of pavement in TH19-23, TH19-24, TH19-25 and TH19-27. The silt was light brown in colour, moist, soft in consistency, with no to low plasticity. The moisture content of the silt was 19 to 28% as measured from 10 samples.

#### ***Lean Clay (CL)***

A 0.7 m layer of lean clay was encountered within the fat clay deposit in TH19-22 at a depth of 1.2 m below the top of the pavement structure. The lean clay was light brown in colour, moist, firm, and of low to intermediate plasticity. The moisture content of the lean clay ranged from 24 to 33 %, as measured from two (2) samples

### **4.4 STRATIGRAPHY – TALBOT AVENUE**

The existing pavement structure measured at five (5) test hole locations consisted of 35 to 90 mm of asphalt over approximately 175 to 230 mm of concrete, as listed in Table D1 in Appendix D. Only pavement coring was completed on Talbot Avenue.

### **4.5 STRATIGRAPHY – EDISON AVENUE**

The existing pavement structure measured at eight (8) locations consisted of 50 to 120 mm of asphalt over 140 to 210 mm of concrete, as listed in Table E1 in Appendix E. Only pavement coring was completed on Edison Avenue.

### **4.6 STRATIGRAPHY – SANFORD FLEMING ROAD**

The existing pavement structure measured at eight (8) locations consisted of 20 to 45 mm of asphalt over 155 to 220 mm of concrete, as listed in Table F11 in Appendix F. Only pavement coring was completed on Sanford Fleming Road.

### **4.7 STRATIGRAPHY – DAY STREET**

The existing pavement structure measured at six (6) locations consisted of 40 to 90 mm of asphalt over 185 to 210 mm of concrete, as listed in Table G1 in Appendix G. Only pavement coring was completed on Day Street.

### **4.8 GROUNDWATER CONDITIONS**

Upon completion of drilling the test holes were left open to observe potential groundwater inflow for five (5) minutes. All test holes were open and remained dry five (5) minutes after the completion of drilling within the exploration depths of 3.1 m.

Groundwater levels should be expected to fluctuate seasonally and following precipitation events; hence, the actual water level at the time of construction could differ from those reported in this report.

## 5.0 STATEMENT OF LIMITATIONS AND CONDITIONS

### 5.1 THIRD PARTY USE OF REPORT

This report has been prepared for KGS Group and any use a third party makes of this report or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

### 5.2 GEOTECHNICAL INVESTIGATION STATEMENT OF LIMITATIONS

The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at this site. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, this office should be notified in order that the recommendations can be reviewed and modified if necessary.

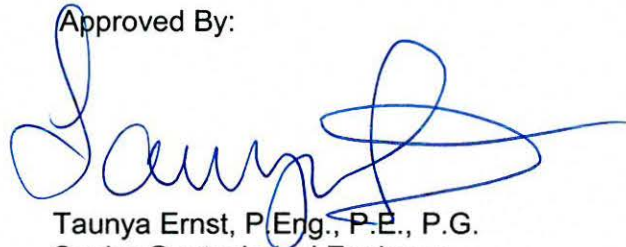
If you have any questions regarding the enclosed information or require additional information, please contact the undersigned.

Prepared By:



Jacqueline MacLennan, P.Eng.  
Geotechnical Engineer

Approved By:



Taunya Ernst, P.Eng., P.E., P.G.  
Senior Geotechnical Engineer

JRM/jr  
Enclosure

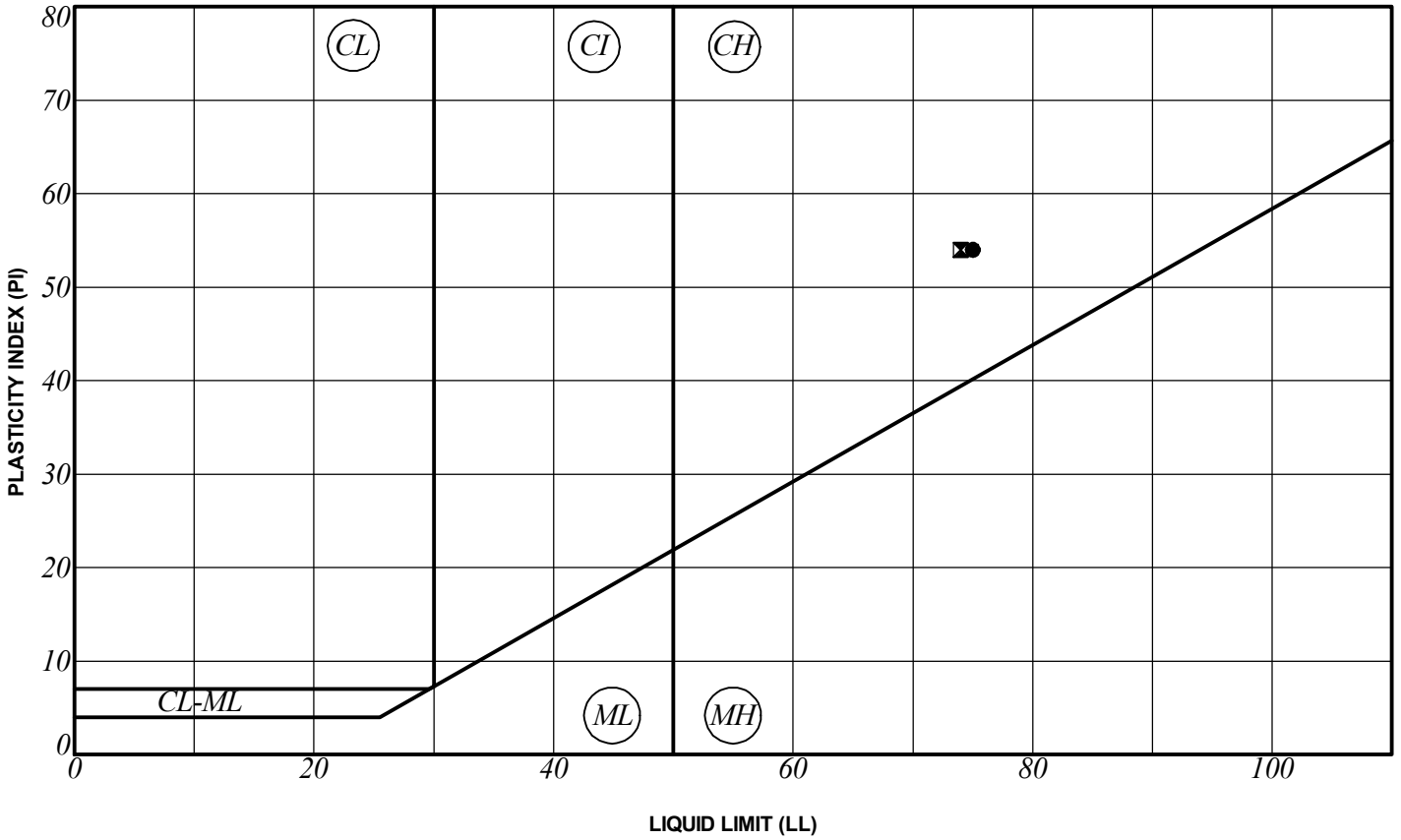
## **APPENDIX A**

**Raleigh Street (North)**  
Figure A1 – Test hole Locations  
Figure A2 – A-Line Plot  
Figure A3 – Grain Size Analyses  
Test Hole Logs



**FIGURE A1**  
**RALEIGH STREET (NORTH) – TEST HOLE LOCATIONS**





SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH19-01	0.9	S4	75	21	54	2.4	22.6	75.0	31.6	CH
⊠	TH19-05	0.9	S4	74	20	54	5.0	23.9	71.1	29.7	CH

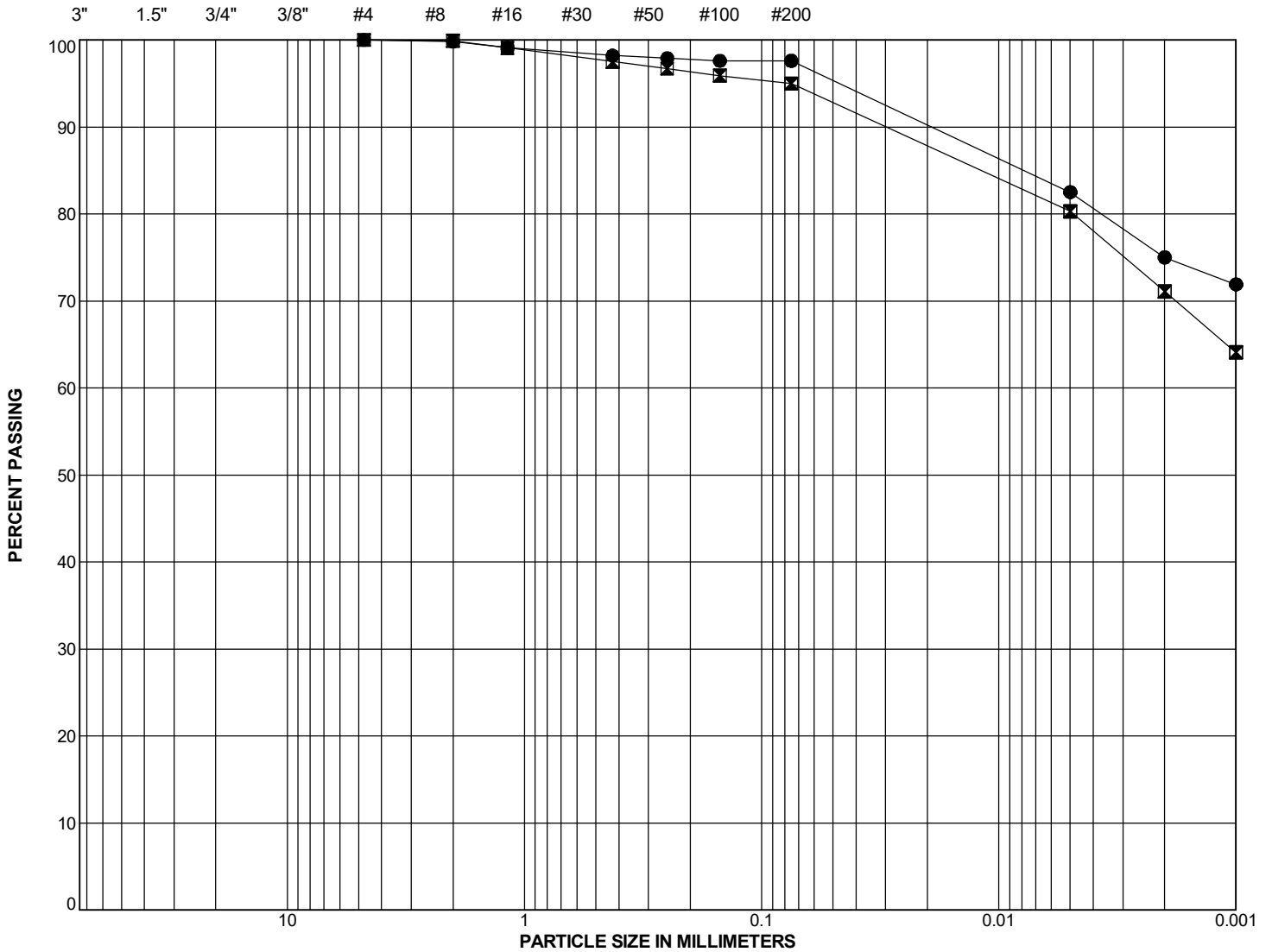
**Notes:**

- ML - Low Plasticity Silt
- MH - High Plasticity Silt
- CL-ML - Silty Clay
- CL - Low Plasticity Clay
- CI - Intermediate Plasticity Clay
- CH - High Plasticity Clay
- LL - Liquid Limit
- PL - Plastic Limit
- PI - Plasticity Index
- MC - Moisture Content
- NP - Non-Plastic

<b>KGS GROUP</b>	<b>KGS GROUP</b>	
	2019 City of Winnipeg Local Streets Renewal Program	
<b>A-LINE PLOT</b>		
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**SIEVE ANALYSIS**

**HYDROMETER ANALYSIS**



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

SYMBOL	HOLE	DEPTH (m)	SAMPLE #	% GRAVEL	% SAND	% SILT	% CLAY	% SILT & CLAY	Cu	Cc	CLASSIFICATION
●	TH19-01	0.9	S4	0.0	2.4	22.6	75.0	97.6			CH
■	TH19-05	0.9	S4	0.0	5.0	23.9	71.1	95.0			CH

SIEVE ANALYSIS U:\FMS\19-0535-001\2019\_COW STREETS.GPJ

	<b>KGS GROUP</b>	
	2019 City of Winnipeg Local Streets Renewal Program	
<b>GRAIN SIZE ANALYSES</b>		
March 2019	Figure A3	Page 1 of 1

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Northbound Lane, 302 m North of Springfield Road  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.70  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,530  
 E 639,164

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★		Cu TORVANE (kPa) ◆		
	(m)	(ft)								PL	MC	LL	%	
230.7				<b>ASPHALT</b> - 50 mm thickness. <b>GRANULAR BASE</b> - 560 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 10 mm max particle size.	S1									
				S2										
230				<b>FAT CLAY (CH)</b> - Brown, frozen to 1.5 m, high plasticity. - Grain Size Distribution: Gravel (0.0%), Sand (2.7%), Silt (22.3%) and Clay (75.0%) at 0.9 m. - Atterberg Limits: Liquid Limit (75), Plastic Limit (21), Plasticity Index (54) at 0.9 m.  - Moist, stiff, trace silt inclusions below 1.5 m.	S3									
229.8	1				S4									
					S5									
	5				S6									
229					S7									
	2				S8									
					S9									
228														
227.7	3	10				END OF TEST HOLE AT 3.05 m  Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.								

GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 J. MACLENNAN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Southbound Lane, 254 m North of Springfield Road  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.76  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,492  
 E 639,135

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)							20	40	60	80	20	40
230.6				<b>CONCRETE</b> - 140 mm thickness.	S1									
				<b>GRANULAR BASE</b> - 470 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 10 mm max particle size.	S2									
230.2				<b>FAT CLAY (CH)</b> - Brown, frozen to 1.5 m, high plasticity.	S3									
230		1			S4									
229.2		5		<b>SILT</b> - Light brown, moist, soft, no to low plasticity.	S5									
229				<b>FAT CLAY (CH)</b> - Brown, damp, stiff, high plasticity.	S6									
228.9		2			S7									
228				- Mottled brown to grey below 2.3 m.	S8									
227.7		3			S9									
227		10		<b>END OF TEST HOLE AT 3.05 m</b>										
				Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location approximate.										

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 J. MACLENNAN

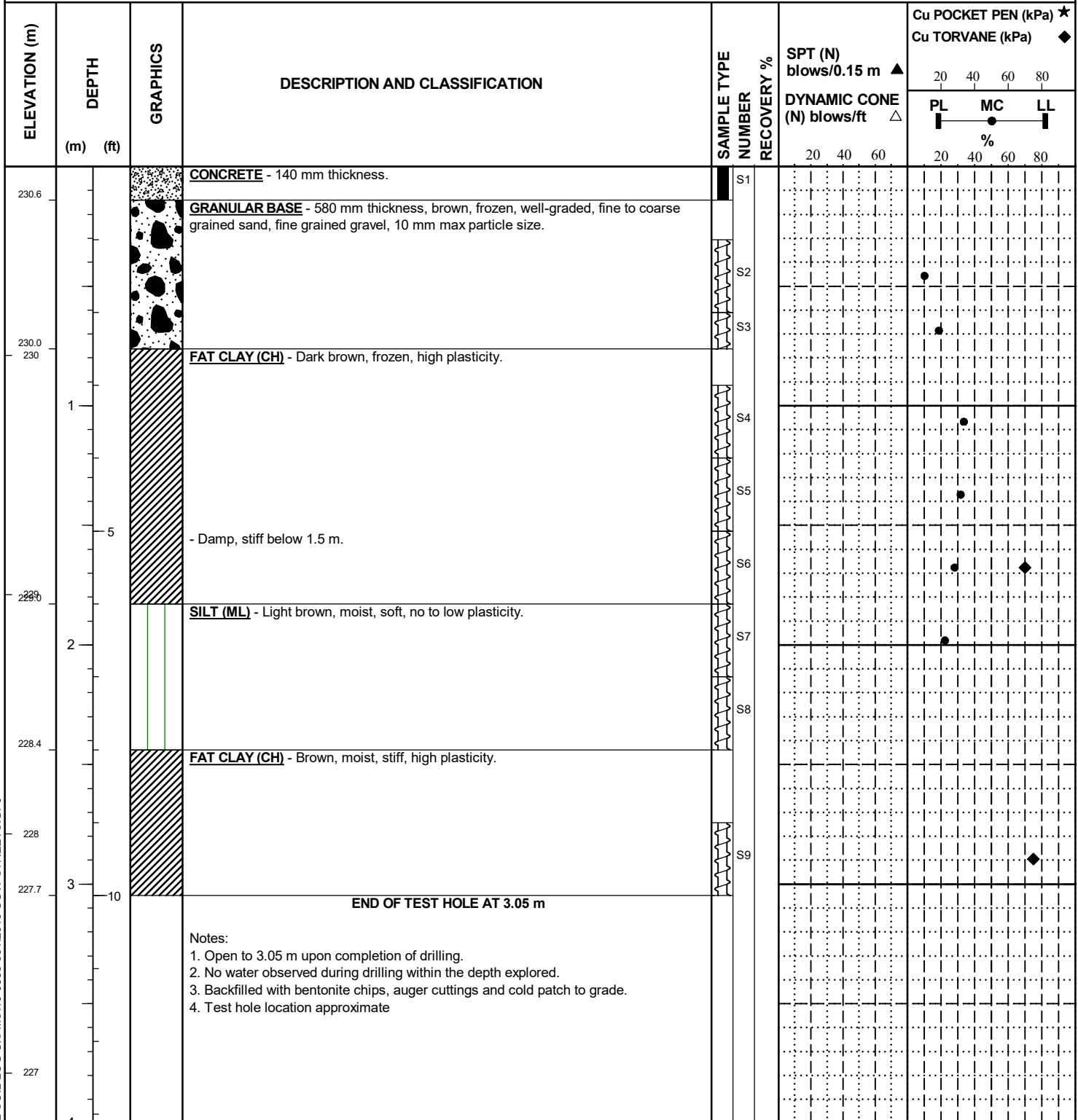
**APPROVED**  
 KWH

**DATE**  
 3/8/19



**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Southbound Lane, 200 m North of Springfield Road  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.79  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,454  
 E 639,096



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 J. MACLENNAN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Northbound Lane, 154 m North of Springfield Road  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.81  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,412  
 E 639,074

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)								20	40	60	80	20	40
230.6				<b>CONCRETE</b> - 165 mm thickness.	Core Barrel	S1									
230.4				<b>GRANULAR BASE</b> - 300 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 5 mm max particle size, some clay.	Auger Grab	S2									
230				<b>FAT CLAY (CH)</b> - Black, frozen, high plasticity, trace organics, trace fine to coarse grained sand.  - Brown, no organics, no fine to coarse grained sand below 0.8 m.	Auger Grab	S3									
229.1				- Damp, stiff below 1.5 m.	Auger Grab	S4									
229				<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.	Auger Grab	S5									
228.1				<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity.	Auger Grab	S6									
227.8				<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity.	Auger Grab	S7									
				<b>END OF TEST HOLE AT 3.05 m</b>		S8									
				Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location approximate.		S9									

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

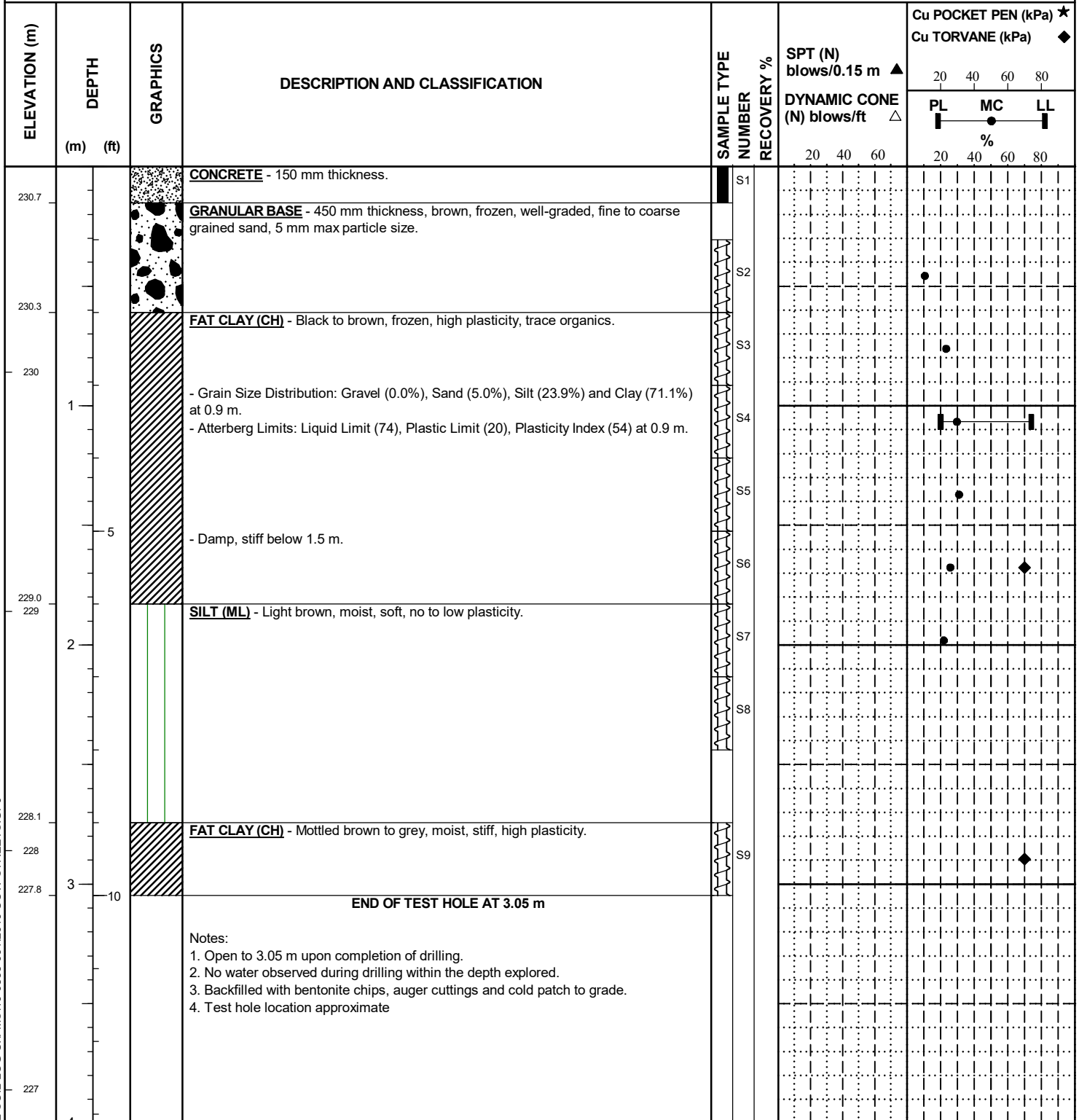
**INSPECTOR**  
 J. MACLENNAN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Southbound Lane, 128 m North of Springfield Road  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.86  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,396  
 E 639,053



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

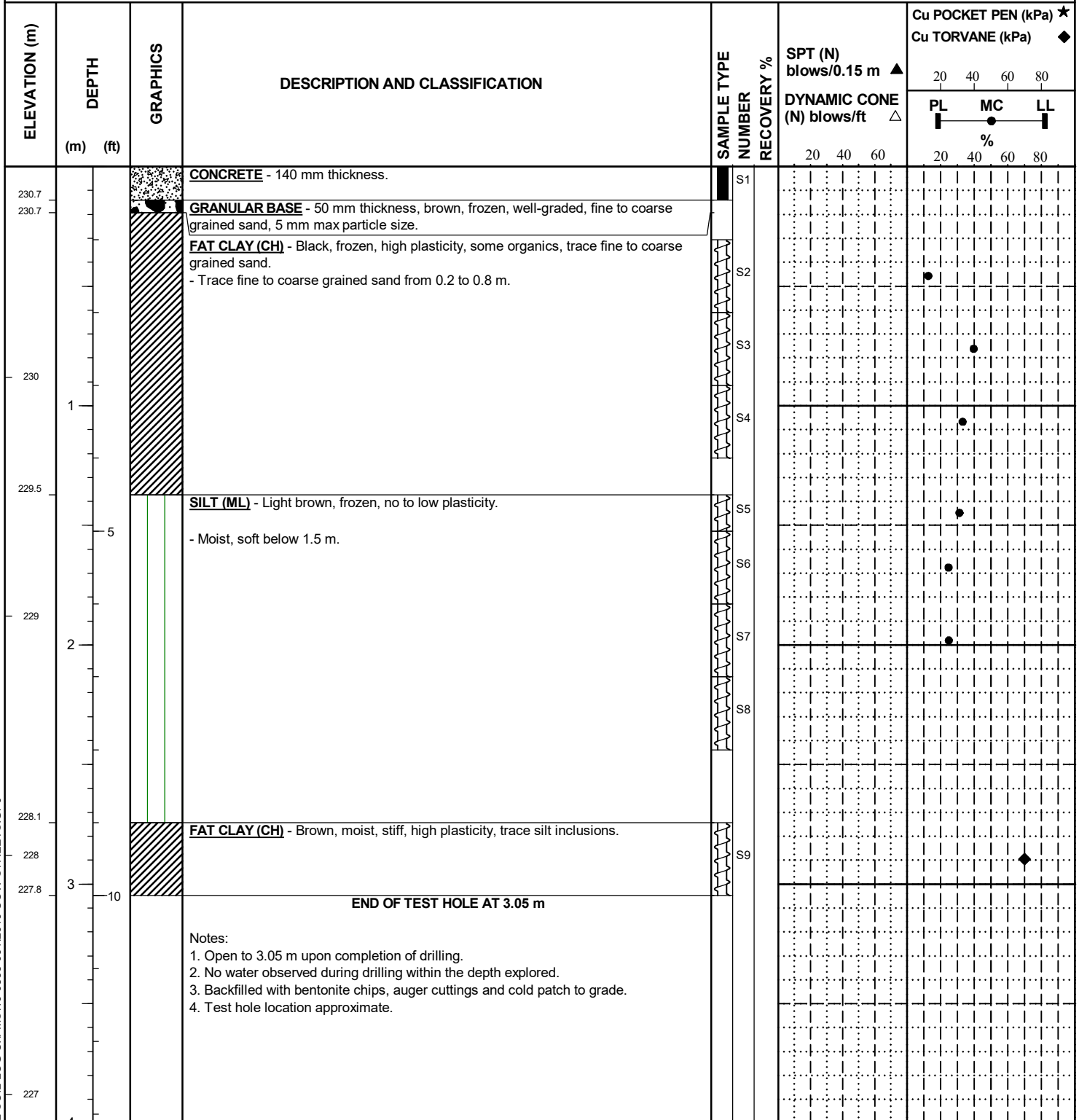
**INSPECTOR**  
 J. MACLENNAN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Northbound Lane, 102 m North of Springfield Road  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.88  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,373  
 E 639,041



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

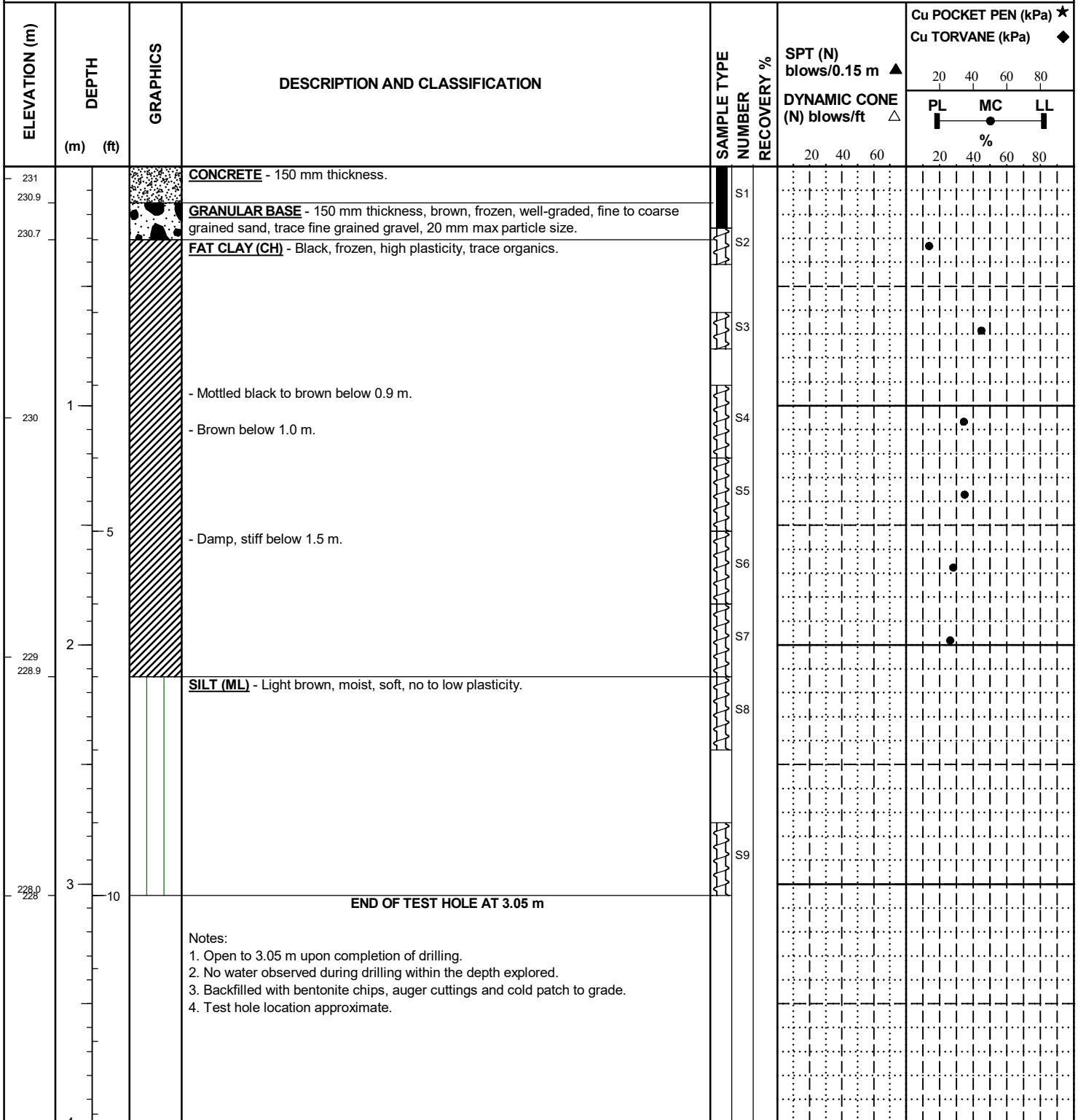
**INSPECTOR**  
 J. MACLENNAN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**LOCATION** Southbound Lane, 43 m North of Springfield Road  
**DRILLING METHOD** 150 mm  $\phi$  Core Barrel, 125 mm  $\phi$  Solid Stem Auger, GeoProbe Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 231.05  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 2/14/2019  
**UTM (m)** N 5,533,329  
E 639,000



SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR Maple Leaf Drilling

INSPECTOR J. MACLENNAN

APPROVED KWH

DATE 3/8/19

## **APPENDIX B**

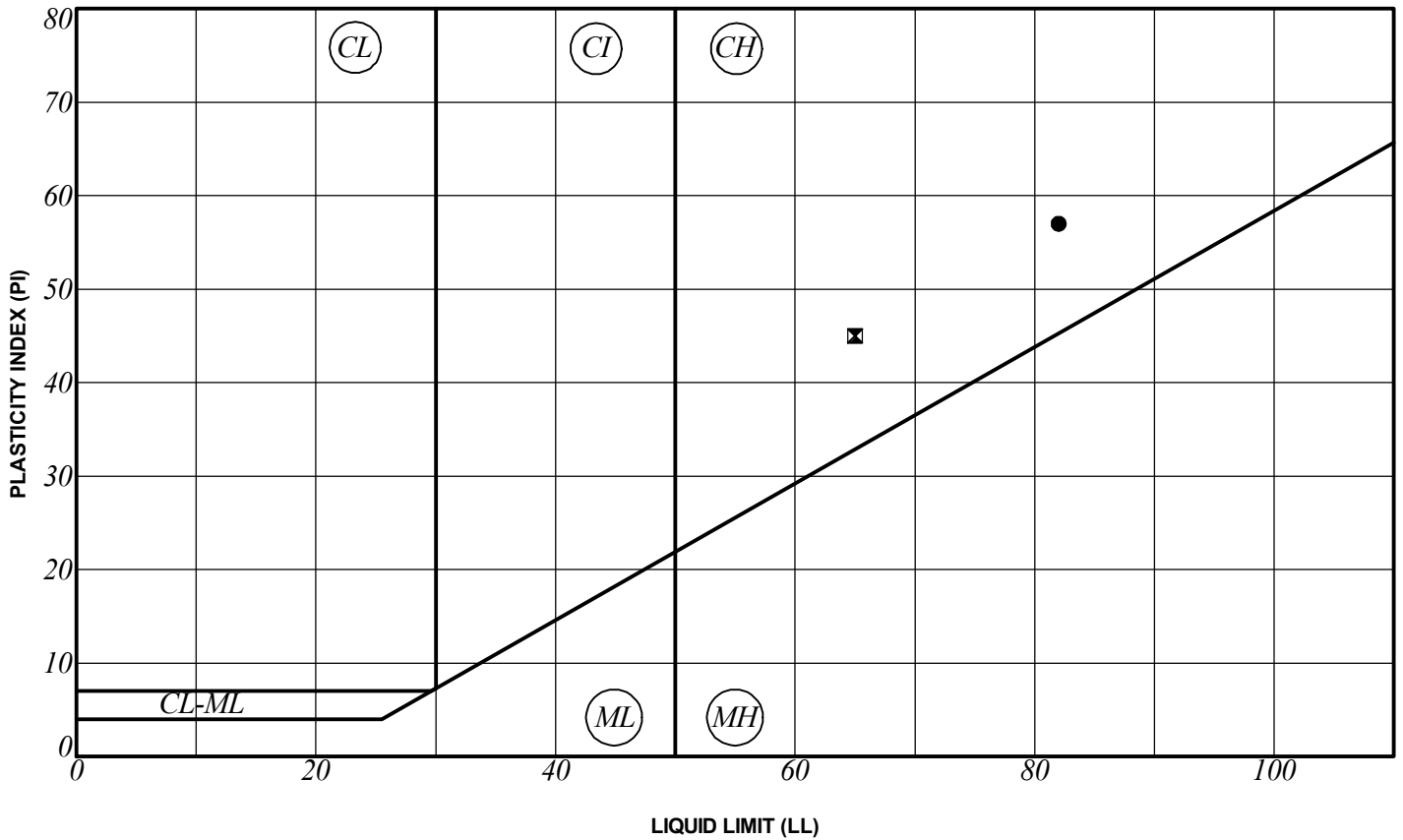
### **Raleigh Street (South)**

- Figure B1 – Test hole Locations
- Figure B2 – A-Line Plot
- Figure B3 – Grain Size Analyses
- Test Hole Logs



**FIGURE B1**  
**RALEIGH STREET (SOUTH) – TEST HOLE LOCATIONS**





SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH19-13	0.8	S3	82	25	57	2.7	17.5	79.8	36.3	CH
⊠	TH19-18	0.6	S3	65	20	45	19.8	22.9	57.1	26.5	CH

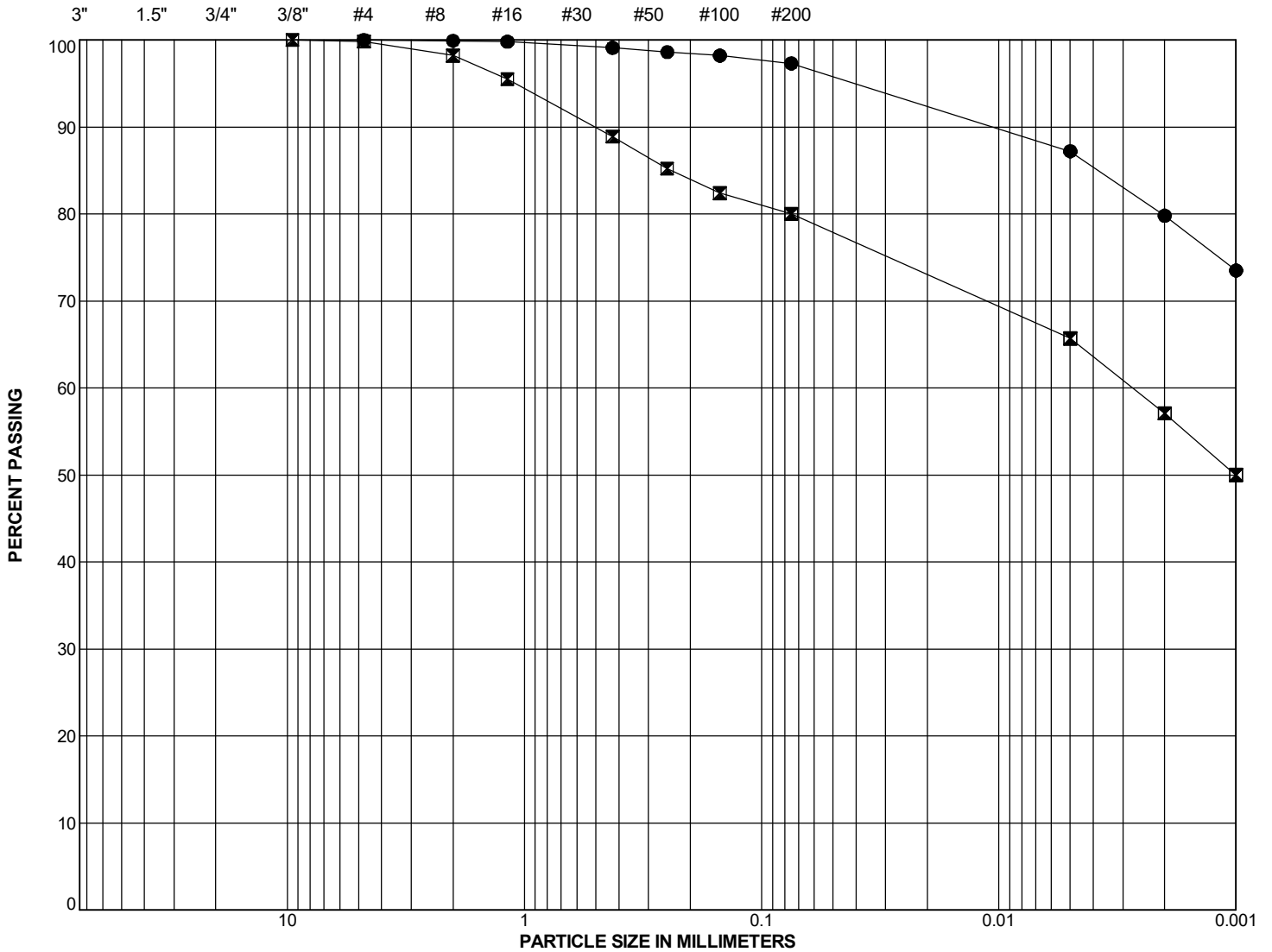
- Notes:**
- ML - Low Plasticity Silt
  - MH - High Plasticity Silt
  - CL-ML - Silty Clay
  - CL - Low Plasticity Clay
  - CI - Intermediate Plasticity Clay
  - CH - High Plasticity Clay
  - LL - Liquid Limit
  - PL - Plastic Limit
  - PI - Plasticity Index
  - MC - Moisture Content
  - NP - Non-Plastic

<b>KGS GROUP</b>	<b>KGS GROUP</b>
2019 City of Winnipeg Local Streets Renewal Program	
<b>A-LINE PLOT</b>	
March 2019	Page 1 of 1



**SIEVE ANALYSIS**

**HYDROMETER ANALYSIS**



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

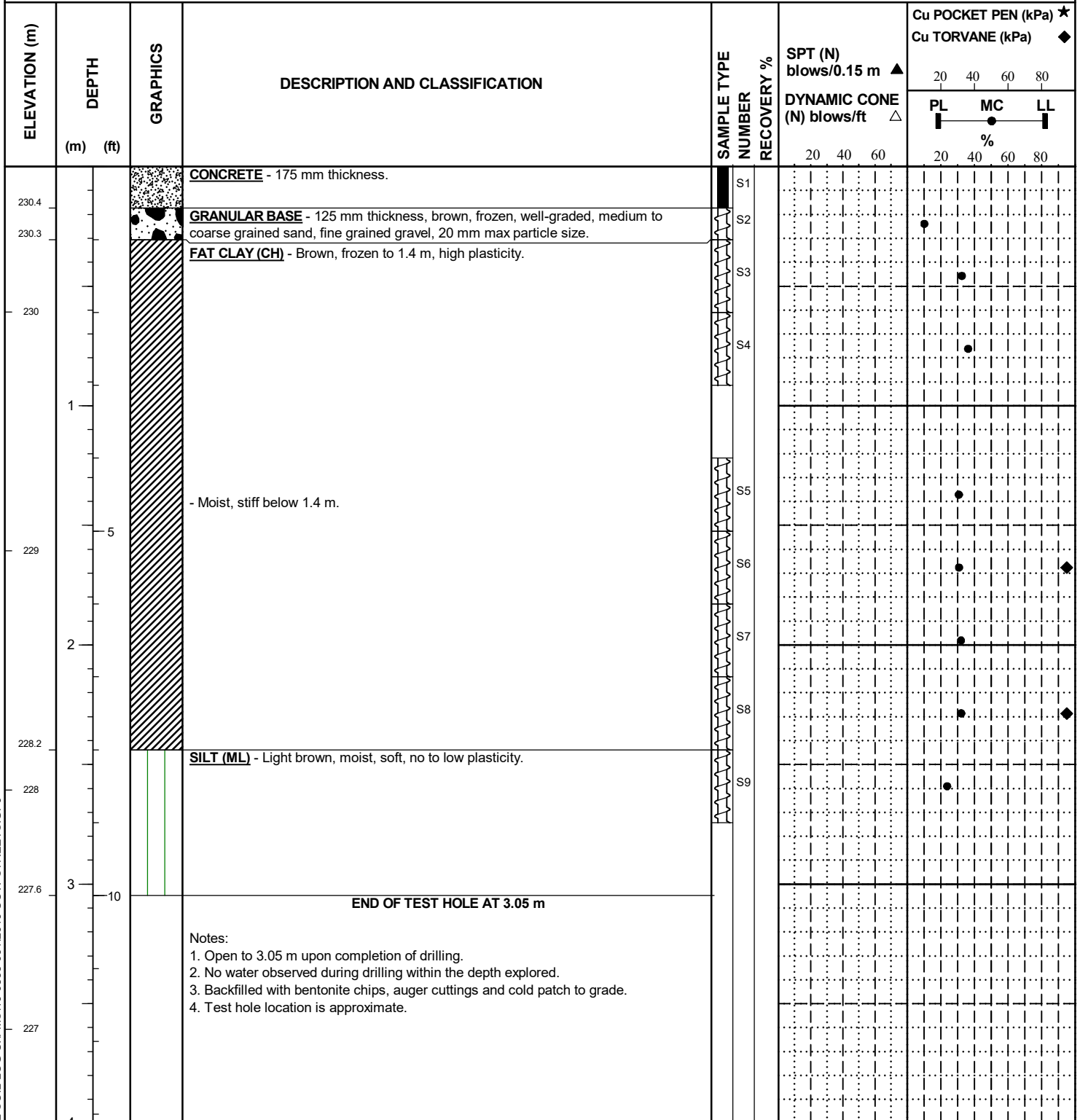
SYMBOL	HOLE	DEPTH (m)	SAMPLE #	% GRAVEL	% SAND	% SILT	% CLAY	% SILT & CLAY	Cu	Cc	CLASSIFICATION
●	TH19-13	0.8	S3	0.0	2.7	17.5	79.8	97.3			CH
■	TH19-18	0.6	S3	0.2	19.8	22.9	57.1	80.0			CH

SIEVE ANALYSIS U:\FMS\19-0535-001\2019\_COW STREETS.GPJ

	<b>KGS GROUP</b>	
	2019 City of Winnipeg Local Streets Renewal Program	
<b>GRAIN SIZE ANALYSES</b>		
March 2019	Figure B3	Page 1 of 1

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 758 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.61  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,888  
 E 637,114



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 693 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.75  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,837  
 E 637,074

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)							20	40	60	80	20	40
230.6				CONCRETE - 175 mm thickness.	S1									
230.3				GRANULAR BASE - 280 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	S2									
230	1			FAT CLAY (CH) - Dark brown, frozen, high plasticity.	S3									
229.2	5			SILT (ML) - Light brown, moist, soft, no to low plasticity.	S4									
229					S5									
228.6	2			FAT CLAY (CH) - Brown, moist, stiff, high plasticity.	S6									
228					S7									
227.7	3	10		FAT CLAY (CH) - Brown, moist, stiff, high plasticity.	S8									
				END OF TEST HOLE AT 3.05 m	S9									
227	4			Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.										

GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 608 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.51  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,769  
 E 637,022

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)								20	40	60	80	20	40
230.3				<b>CONCRETE</b> - 175 mm thickness.	S1										
230				<b>GRANULAR BASE</b> - 585 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	S2										
229.8				<b>FAT CLAY (CH)</b> - Dark brown, frozen to 1.4 m, high plasticity, trace fine grained sand. - Grain Size Distribution: Gravel (0.0%), Sand (2.7%), Silt (17.5%) and Clay (79.8%) at 0.8 m. - Atterberg Limits: Liquid Limit (82), Plastic Limit (25), Plasticity Index (57) at 0.8 m.  - Moist, stiff below 1.4 m.	S3										
229	5				S4										
228.8				<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity, trace clay pockets.	S5										
228					S6										
227.5	3	10			S7										
227					S8										
					S9										
				END OF TEST HOLE AT 3.05 m  Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.											

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 502 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 231.21  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,684  
 E 636,960

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★		Cu TORVANE (kPa) ◆	
	(m)	(ft)								PL	MC	LL	PL
231.0				<b>CONCRETE</b> - 200 mm thickness.	Core Barrel	S1							
231.0				<b>GRANULAR BASE</b> - 560 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	Auger Grab	S2							
230.4				<b>CLAY FILL (CH)</b> - Black, frozen, high plasticity, trace coarse grained sand, trace fine to coarse grained gravel.	Auger Grab	S3							
229.0		1		<b>FAT CLAY (CH)</b> - Dark brown, frozen to 1.4 m, high plasticity. - Moist, stiff below 1.4 m.	Auger Grab	S4							
228.0		5		<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.	Auger Grab	S5							
228.0				- Moist, stiff below 1.4 m.	Auger Grab	S6							
228.0				- Moist, stiff below 1.4 m.	Auger Grab	S7							
228.0				- Moist, stiff below 1.4 m.	Auger Grab	S8							
228.0				- Moist, stiff below 1.4 m.	Auger Grab	S9							
228.2		3		<b>END OF TEST HOLE AT 3.05 m</b>									
228.2		10		Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.									

SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR  
**Maple Leaf Drilling**

INSPECTOR  
**C. FRIESEN**

APPROVED  
**KWH**

DATE  
**3/8/19**

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 411 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.77  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,611  
 E 636,904

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)								20	40	60	80	20	40
230.6				<b>CONCRETE</b> - 190 mm thickness.	Core Barrel	S1									
230.2				<b>GRANULAR BASE</b> - 420 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	Auger Grab	S2									
230				<b>FAT CLAY (CH)</b> - Brown, frozen to 1.4 m, high plasticity.	Auger Grab	S3									
229	1			- Moist, stiff below 1.4 m.	Auger Grab	S4									
228.9	5				Auger Grab	S5									
228				<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.	Auger Grab	S6									
227.9				- Trace clay from 2.1 to 2.3 m.	Auger Grab	S7									
227.7				- Increased moisture content between 2.4 to 2.6 m.	Auger Grab	S8									
227	3	10		<b>END OF TEST HOLE AT 3.05 m</b>	Auger Grab	S9									
				Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.											

SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR  
**Maple Leaf Drilling**

INSPECTOR  
**C. FRIESEN**

APPROVED  
**KWH**

DATE  
**3/8/19**

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Raliegth Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 313 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.33  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,535  
 E 636,845

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)							20	40	60	80	20	40
230.2				<b>CONCRETE</b> - 180 mm thickness.	S1									
230				<b>GRANULAR BASE</b> - 430 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	S2									
229.7				<b>FAT CLAY (CH)</b> - Brown, frozen to 1.3 m, high plasticity.	S3									
1				- Moist, stiff below 1.3 m.	S4									
229.6				<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.	S5									
5					S6									
2					S7									
228.1				<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity, trace silt nodules.	S8									
228					S9									
227.3				<b>END OF TEST HOLE AT 3.05 m</b>										
227				Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.										

SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR **Maple Leaf Drilling** INSPECTOR **C. FRIESEN** APPROVED **KWH** DATE **3/8/19**

GEO-TECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 242 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.53  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,478  
 E 636,801

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)								20	40	60	80	20	40
230.3				<b>CONCRETE</b> - 255 mm thickness. Top 180 mm intact. Bottom 75 mm very poor quality, broken.	Core Barrel	S1									
230				<b>GRANULAR BASE</b> - 430 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	Auger Grab	S2									
229.9				<b>CLAY FILL (CH)</b> - Dark brown, frozen, high plasticity, trace coarse grained sand, trace fine grained gravel.	Auger Grab	S3									
229.4	1			<b>FAT CLAY (CH)</b> - Brown, frozen to 1.4 m, high plasticity.  - Moist, stiff below 1.4 m.	Auger Grab	S4									
229.0	5			<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.	Auger Grab	S5									
229.0					Auger Grab	S6									
228.2	2			<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity, trace silt nodules.	Auger Grab	S7									
228.2					Auger Grab	S8									
228					Auger Grab	S9									
227.5	3	10		<b>END OF TEST HOLE AT 3.05 m</b>											
227	4			Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.											

SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR  
**Maple Leaf Drilling**

INSPECTOR  
**C. FRIESEN**

APPROVED  
**KWH**

DATE  
**3/8/19**



**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 132 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.98  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,392  
 E 636,734

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★		Cu TORVANE (kPa) ◆	
	(m)	(ft)							PL	MC	LL	PL
230.8				<b>CONCRETE</b> - 200 mm thickness.	S1							
230.4				<b>GRANULAR BASE</b> - 410 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.	S2							
229.0	1			<b>FAT CLAY WITH SAND (CH)</b> - Grey, frozen, high plasticity, some medium to coarse grained sand, trace fine grained gravel. - Grain Size Distribution: Gravel (0.2%), Sand (19.8%), Silt (22.9%) and Clay (57.1%) at 0.6 m. - Atterberg Limits: Liquid Limit (65), Plastic Limit (20), Plasticity Index (45) at 0.6 m.	S3							
229.5	5			<b>FAT CLAY (CH)</b> - Brown, frozen, high plasticity.	S4							
229.5	5			<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.	S5							
229	2				S6							
229	2				S7							
229	2				S8							
228.2				<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity, trace silt nodules.	S9							
228	3			<b>END OF TEST HOLE AT 3.05 m</b>								
227.9	10			Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.								

GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR  
**Maple Leaf Drilling**

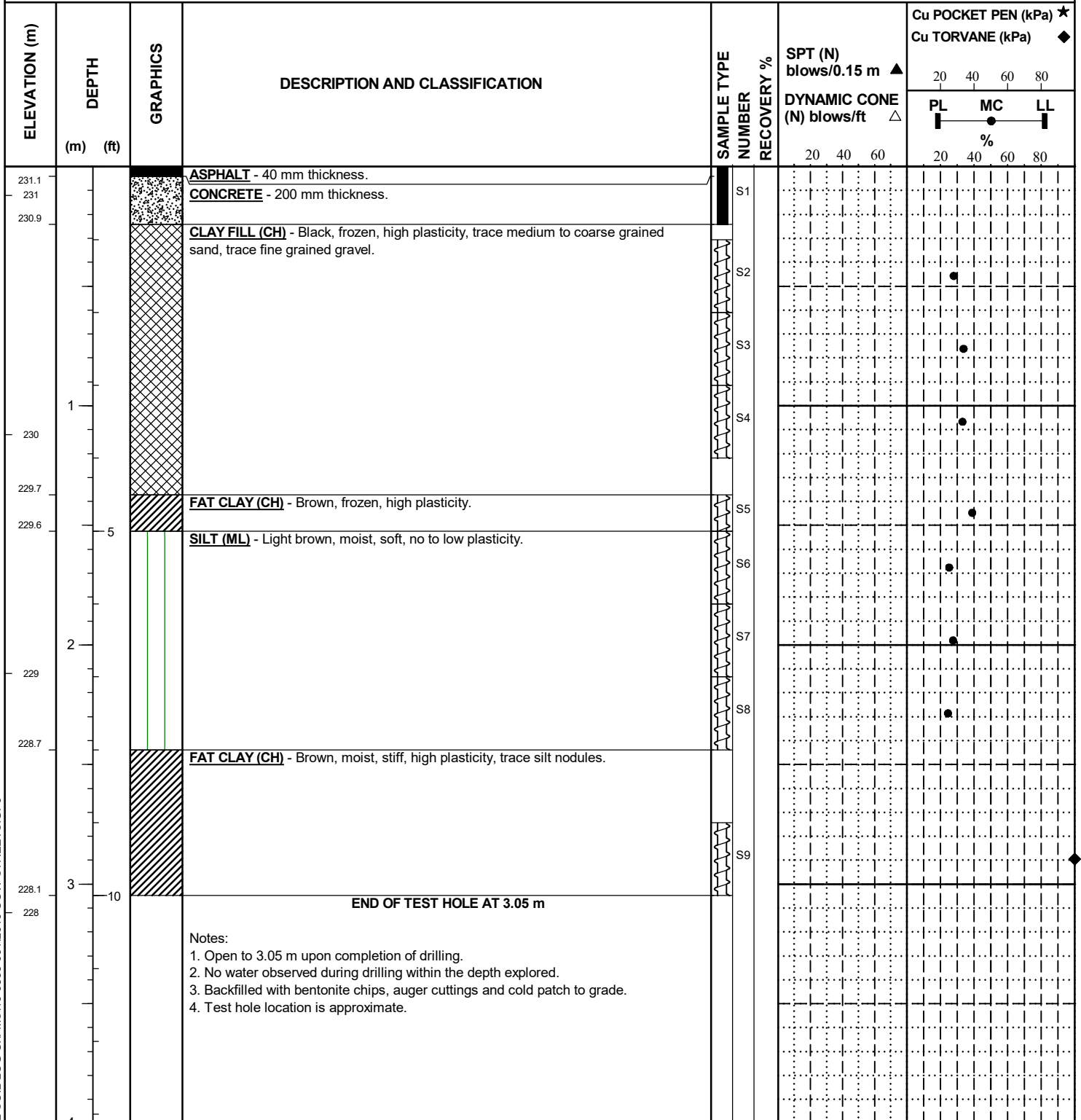
INSPECTOR  
**C. FRIESEN**

APPROVED  
**KWH**



DATE  
**3/8/19**

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Ralieg Street Extending North from Chalmers Avenue to Monroe Avenue  
**LOCATION** Southbound Lane, 64 m North of Chalmers Avenue  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 231.12  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/24/2019  
**UTM (m)** N 5,530,337  
 E 636,693



- Notes:
- Open to 3.05 m upon completion of drilling.
  - No water observed during drilling within the depth explored.
  - Backfilled with bentonite chips, auger cuttings and cold patch to grade.
  - Test hole location is approximate.

SAMPLE TYPE  Core Barrel  Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

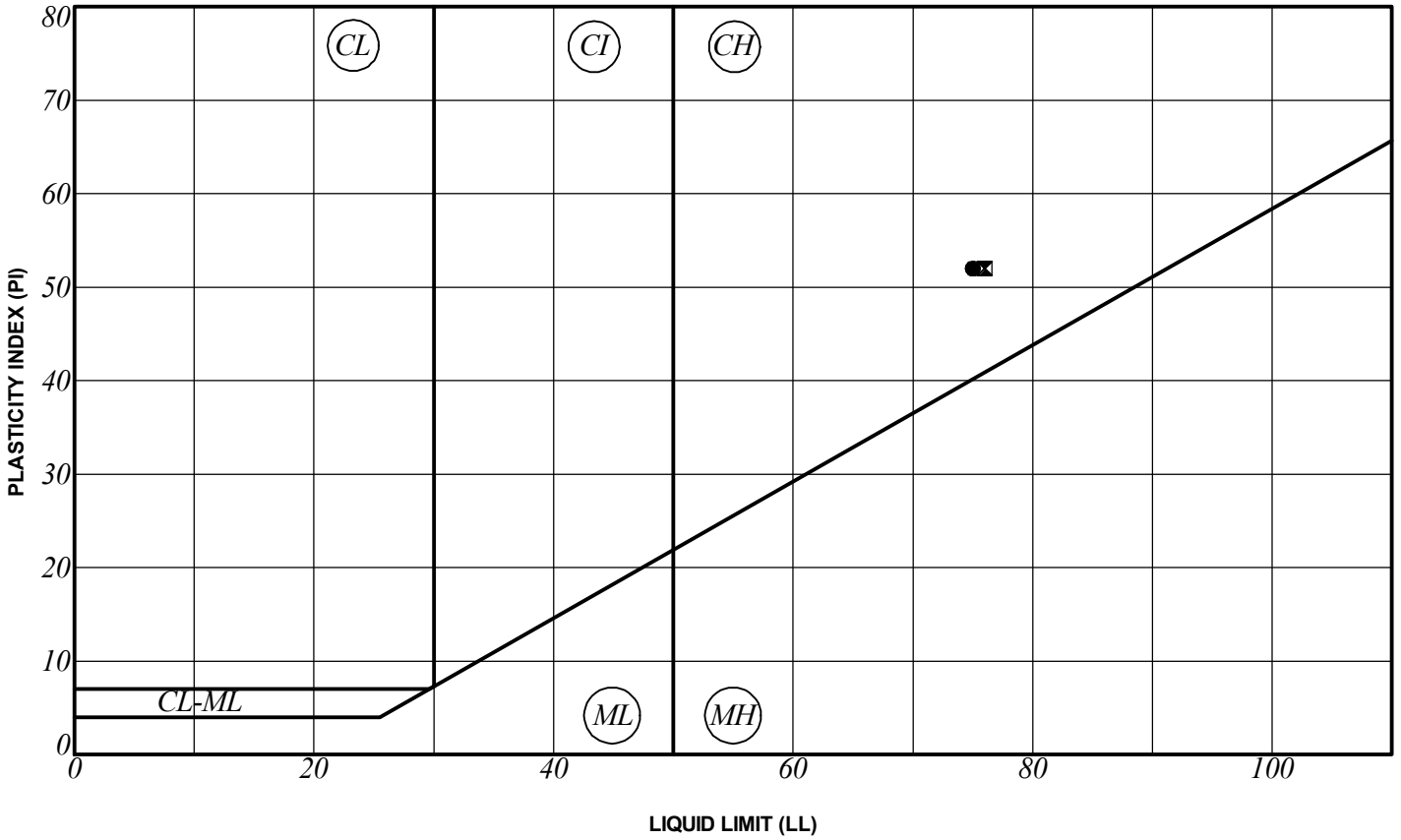
## **APPENDIX C**

### **Jamison Avenue**

- Figure C1 – Test hole Locations
- Figure C2 – A-Line Plot
- Figure C3 – Grain Size Analyses  
Test Hole Logs

**FIGURE C1**  
**JAMISON AVENUE – TEST HOLE LOCATIONS**





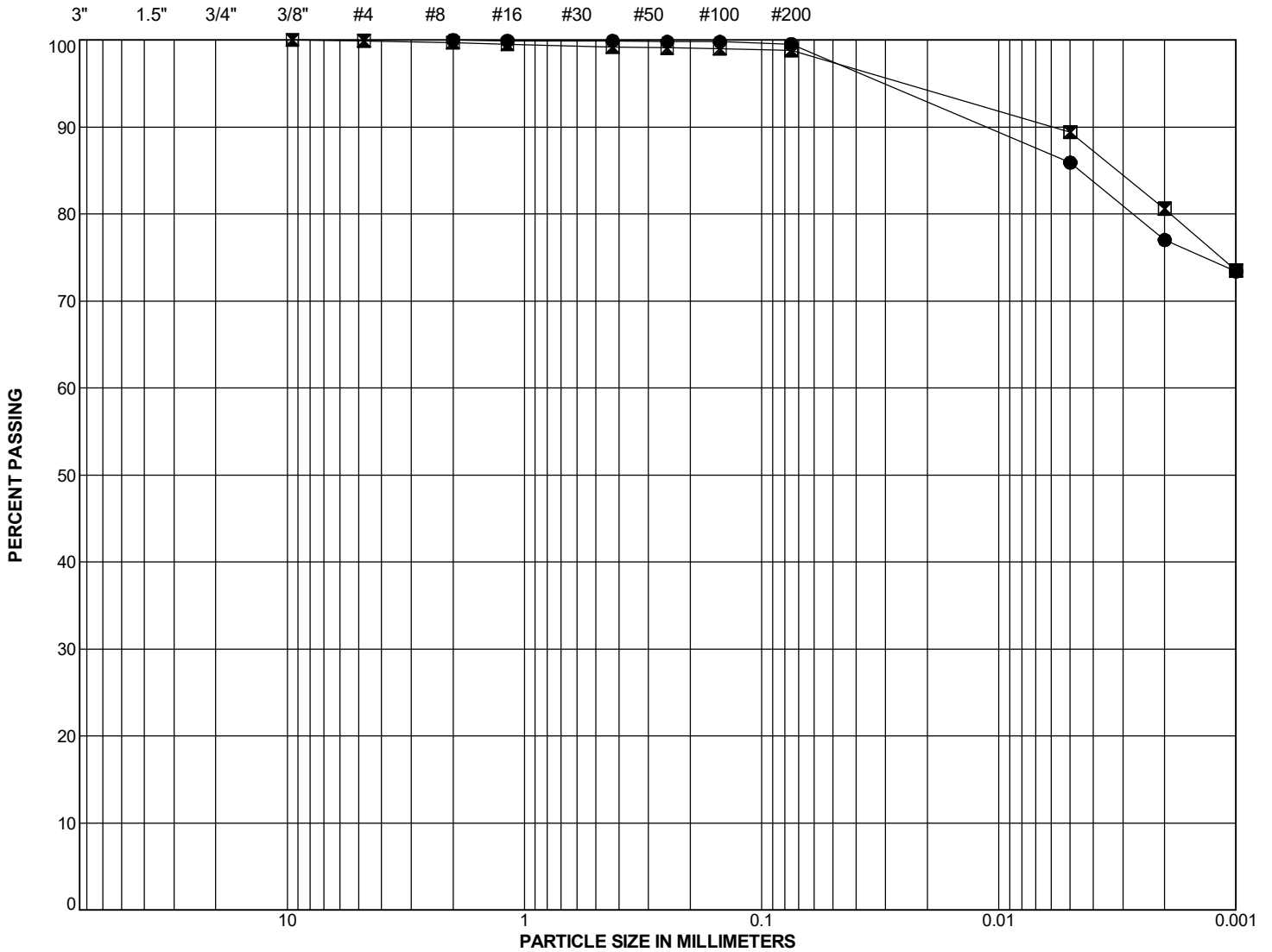
SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH19-23	0.6	S3	75	23	52	0.5	22.5	77.0	31.3	CH
⊠	TH19-25	0.6	S3	76	24	52	1.1	18.2	80.6	31.6	CH

- Notes:**  
 ML - Low Plasticity Silt  
 MH - High Plasticity Silt  
 CL-ML - Silty Clay  
 CL - Low Plasticity Clay  
 CI - Intermediate Plasticity Clay  
 CH - High Plasticity Clay  
 LL - Liquid Limit  
 PL - Plastic Limit  
 PI - Plasticity Index  
 MC - Moisture Content  
 NP - Non-Plastic

<b>KGS GROUP</b>	<b>KGS GROUP</b>	
	2019 City of Winnipeg Local Streets Renewal Program	
<b>A-LINE PLOT</b>		
March 2019	Figure C2	Page 1 of 1

**SIEVE ANALYSIS**

**HYDROMETER ANALYSIS**



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

SYMBOL	HOLE	DEPTH (m)	SAMPLE #	% GRAVEL	% SAND	% SILT	% CLAY	% SILT & CLAY	Cu	Cc	CLASSIFICATION
●	TH19-23	0.6	S3	0.0	0.5	22.5	77.0	99.5			CH
■	TH19-25	0.6	S3	0.1	1.1	18.2	80.6	98.8			CH

SIEVE ANALYSIS U:\FMS\19-0535-001\2019\_COW STREETS.GPJ

	<b>KGS GROUP</b>	
	2019 City of Winnipeg Local Streets Renewal Program	
<b>GRAIN SIZE ANALYSES</b>		
March 2019	Figure C3	Page 1 of 1

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Westbound Lane, 36 m East of Henderson Highway  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 231.01  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,328  
 E 635,566

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆				
	(m)	(ft)								20	40	60	80	PL	MC	LL	20
231.0				ASPHALT - 50 mm thickness.	S1												
230.8				CONCRETE - 140 mm thickness.													
				FAT CLAY (CH) - Black, frozen, high plasticity. - Trace fine to coarse grained gravel at 0.3 m.	S2												
					S3												
230	1				S4												
				- Brown, stiff, moist below 1.2 m.	S5												
	5				S6												
					S7												
229	2				S8												
					S9												
228.8	3	10		END OF TEST HOLE AT 3.05 m													

- Notes:  
 1. Open to 3.05 m upon completion of drilling.  
 2. No water observed during drilling within the depth explored.  
 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.  
 4. Test hole location is approximate.

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
Maple Leaf Drilling

**INSPECTOR**  
C. FRIESEN

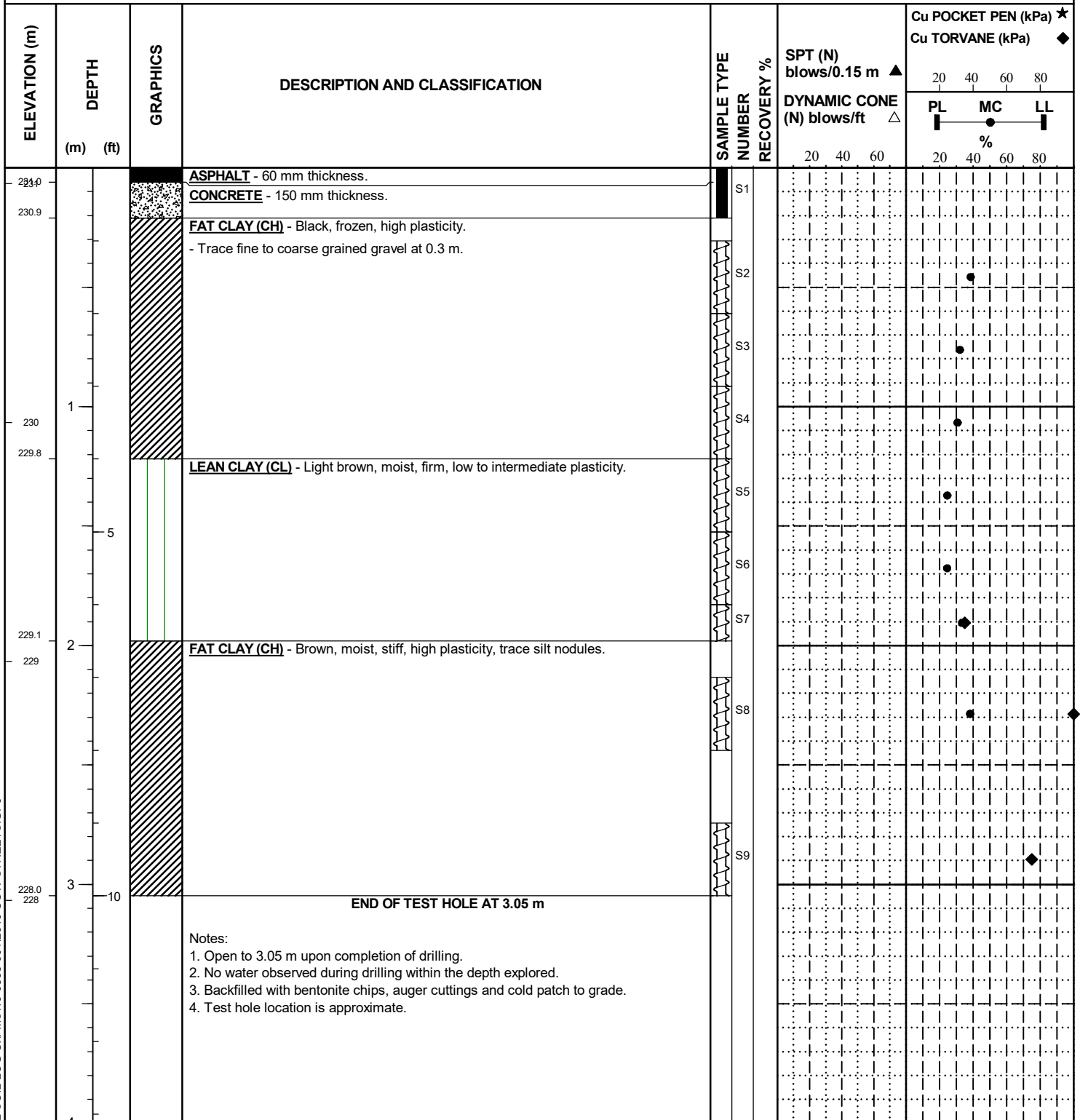
**APPROVED**  
KWH

**DATE**  
3/8/19



**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Westbound Lane, 134 m East of Henderson Highway  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 231.07  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,285  
 E 635,653



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE  Core Barrel  Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19



**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Eastbound Lane, 240 m East of Henderson Highway  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 231.21  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,240  
 E 635,748

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆		
	(m)	(ft)								20	40	60	80	20	40
231.2				<b>ASPHALT</b> - 50 mm thickness.											
231.0				<b>CONCRETE</b> - 160 mm thickness, very poor quality, broken, unable to remove core.											
229.9				<b>FAT CLAY (CH)</b> - Brown, frozen, high plasticity.											
230				- Grain Size Distribution: Gravel (0.0%), Sand (0.5%), Silt (22.5%) and Clay (77.0%) at 0.6 m.											
229.9				- Atterberg Limits: Liquid Limit (75), Plastic Limit (23), Plasticity Index (52) at 0.6 m.											
230				- Moist, stiff below 1.2 m.											
229.9				<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.											
229.1															
229				<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity.											
228.2				- Trace silt nodules below 2.4 m.											
228.2				<b>END OF TEST HOLE AT 3.05 m</b>											
228				Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.											

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

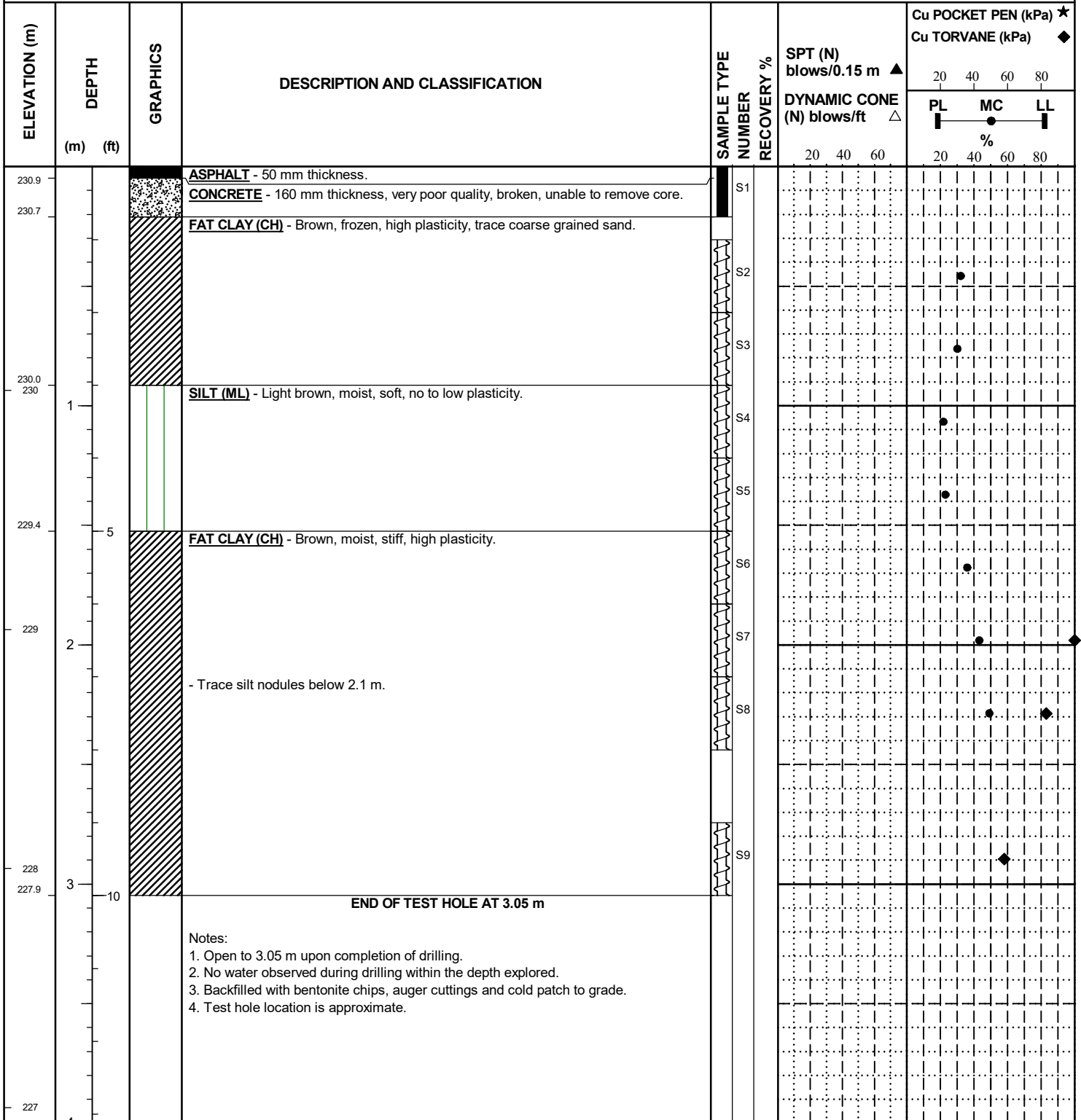
**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Westbound Lane, 306 m East of Henderson Highway  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.94  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,211  
 E 635,809



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE [Core Barrel] Core Barrel [Auger Grab] Auger Grab

**CONTRACTOR** Maple Leaf Drilling      **INSPECTOR** C. FRIESEN      **APPROVED** KWH      **DATE** 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Westbound Lane, 401 m East of Henderson Highway  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.94  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,169  
 E 635,897

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★			Cu TORVANE (kPa) ◆				
	(m)	(ft)								20	40	60	80	PL	MC	LL	20
230.9				<b>ASPHALT</b> - 40 mm thickness.													
230.8				<b>CONCRETE</b> - 140 mm thickness, very poor quality, broken, unable to remove core.													
230.7				<b>GRANULAR BASE</b> - 420 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.													
				<b>FAT CLAY (CH)</b> - Brown, frozen, high plasticity, trace fine to coarse grained sand.  - Grain Size Distribution: Gravel (0.1%), Sand (1.1%), Silt (18.2%) and Clay (80.6%) at 0.6 m. - Atterberg Limits: Liquid Limit (76), Plastic Limit (24), Plasticity Index (52) at 0.6 m.		S1											
230	1					S2											
						S3											
						S4											
229.6				<b>SILT (ML)</b> - Light brown, moist, soft, no to low plasticity.		S5											
		5				S6											
229	2					S7											
						S8											
228.5				<b>FAT CLAY (CH)</b> - Brown, moist, stiff, high plasticity, trace silt nodules.		S9											
228																	
227.9	3	10		<b>END OF TEST HOLE AT 3.05 m</b>													
				Notes: 1. Open to 3.05 m upon completion of drilling. 2. No water observed during drilling within the depth explored. 3. Backfilled with bentonite chips, auger cuttings and cold patch to grade. 4. Test hole location is approximate.													

GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

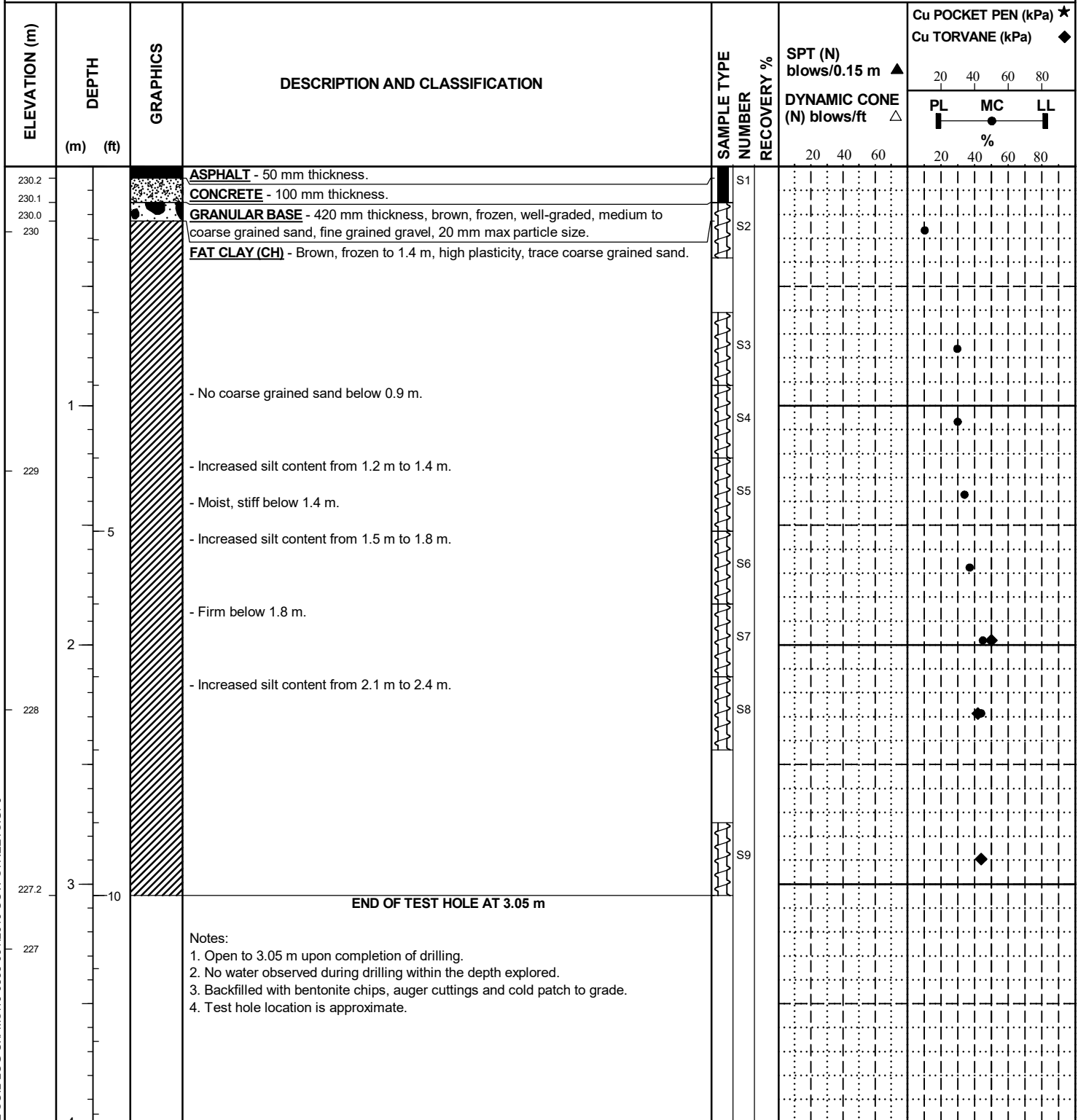
**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Westbound Lane, 506 m East of Henderson Highway  
**DRILLING METHOD** 150 mm  $\varnothing$  Core Barrel, 125 mm  $\varnothing$  Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.27  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,125  
 E 635,988



GEOTECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

**CONTRACTOR**  
 Maple Leaf Drilling

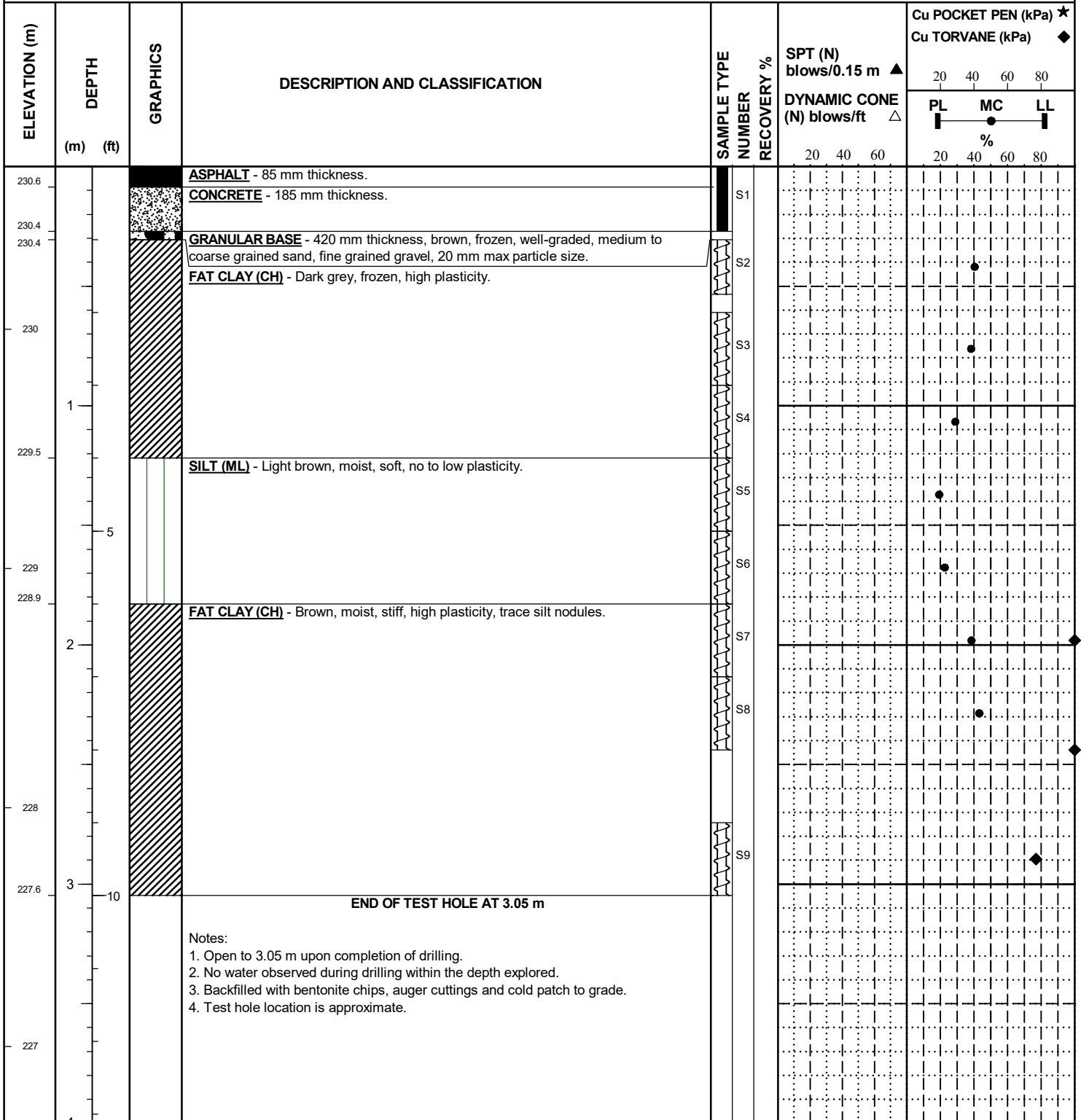
**INSPECTOR**  
 C. FRIESEN

**APPROVED**  
 KWH

**DATE**  
 3/8/19

**CLIENT** KGS GROUP  
**PROJECT** 2019 City of Winnipeg Local Streets Renewal Program  
**SITE** Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION** Eastbound Lane, 627 m East of Henderson Highway  
**DRILLING METHOD** 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**JOB NO.** 19-0535-001  
**GROUND ELEV.** 230.68  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 1/25/2019  
**UTM (m)** N 5,531,072  
 E 636,098



GEO-TECHNICAL-SOIL LOG U:\FMS\19-0535-001\2019 COW STREETS.GPJ

SAMPLE TYPE Core Barrel Auger Grab

CONTRACTOR **Maple Leaf Drilling**      INSPECTOR **C. FRIESEN**      APPROVED **KWH**      DATE **3/8/19**

## **APPENDIX D**

### **Talbot Avenue**

Figure D1 – Test hole Locations

Table D1 – Pavement Section Thicknesses



**FIGURE D1**  
**TALBOT AVENUE – PAVEMENT CORING LOCATIONS**



**TABLE D1**  
**PAVEMENT SECTION THICKNESSES**

<b>Test hole ID</b>	<b>Location</b>	<b>Asphalt Thickness (mm)</b>	<b>Concrete Thickness (mm)</b>
TH19-31	EBL, 54 m E of Grey Street	40 to 70	200 to 230
TH19-32	EBL, 148 m E of Grey Street	35	190
TH19-33	WBL, 198 m E of Grey Street	45	175
TH19-34	WBL, 106 m E of Grey Street	90	180
TH19-35	WBL, 29 m E of Grey Street	80	200

## **APPENDIX E**

### **Adison Avenue**

Figure E1 – Test hole Locations

Table E1 – Pavement Section Thicknesses



**FIGURE E1**  
**EDISON AVENUE – PAVEMENT CORING LOCATIONS**



**TABLE E1**  
**PAVEMENT SECTION THICKNESSES**

Test hole ID	Location	Asphalt Thickness (mm)	Concrete Thickness (mm)	Notes
TH19-41	WBL (Parking Area), 54 m E of Rothesay Street	75	190	
TH19-42	Eastbound Lane, 152 m E of Rothesay Street	50	200	Horizontal crack at 175 mm
TH19-43	WBL (Parking Area), 268 m E of Rothesay Street	50	200	
TH19-44	EBL, 385 m E of Rothesay Street	90 to 100	200 to 210	
TH19-45	WBL (Parking Area), 491 m E of Rothesay Street	55	140	
TH19-46	EBL, 583 m E of Rothesay Street	50 to 55	165 to 170	
TH19-47	WBL (Parking Area), 688 m E of Rothesay Street	75	180	
TH19-48	WBL, 778 m E of Rothesay Street	100 to 120	145 to 165	

## **APPENDIX F**

### **Sandford Fleming Road**

Figure F1 – Test hole Locations

Table F1 – Pavement Section Thicknesses



**FIGURE F1**  
**SANFORD FLEMING ROAD – PAVEMENT CORING LOCATIONS**



**TABLE F1**  
**PAVEMENT SECTION THICKNESSES**

Test hole ID	Location	Asphalt Thickness (mm)	Concrete Thickness (mm)	Notes
TH19-51	WBL, 46 m E of Sanford Fleming Road	40	180	Upper 80 mm broken and very poor quality unable to remove lower piece of concrete, lower portion of concrete appeared to be intact
TH19-52	EBL, 142 m E of Sanford Fleming Road	20 to 35	205 to 220	Unable to remove bottom 25 to 50 mm of concrete
TH19-53	WBL, 233 m E of Sanford Fleming Road	35	195	Top 75 mm broken and very poor
TH19-54	EBL, 331 m E of Sanford Fleming Road	25	185	Top 30 mm broken and very poor quality
TH19-55	SBL, 279 m S of Devonshire Drive	25	175	Broken, very poor quality
TH19-56	Northbound Lane, 188 m S of Devonshire Drive	40	170	Top 20 to 60 mm poor quality, core remained intact
TH19-57	SBL, 108 m S of Devonshire Drive	45	155	Very poor quality, broken
TH19-58	Northbound Lane, 31 m S of Devonshire Drive	30	200	Very poor quality, broken, unable to remove core

## **APPENDIX G**

### **Day Street**

Figure G1 – Test hole Locations

Table G1 – Pavement Section Thicknesses



**FIGURE H1**  
**DAY STREET – PAVEMENT CORING LOCATIONS**



**TABLE G1**  
**PAVEMENT SECTION THICKNESSES**

Test hole ID	Location	Asphalt Thickness (mm)	Concrete Thickness (mm)	Notes
TH19-61	SBL, 459 m N of Kildare Avenue	40 to 60	190 to 210	Horizontal joint at 130, unable to remove core below joint
TH19-62	NBL, 402 m N of Kildare Avenue	75	190	Top 20 mm slightly broken at asphalt-concrete interface
TH19-63	SBL, 303 m N of Kildare Avenue	75	205	
TH19-64	NBL, 214 m N of Kildare Avenue	60	185	20 to 30 mm of granular frozen to bottom of core
TH19-65	SBL, 142 m N of Kildare Avenue	90	180	Horizontal joint at 210 mm
TH19-66	NBL, 25 m N of Kildare Avenue	80	190	