

APPENDIX 'A'

GEOTECHNICAL REPORT



Quality Engineering | Valued Relationships

Morrison Hershfield

2018 Local Streets Package (PW File #: 18-R-05)

Prepared for:

Morrison Hershfield
25 Scurfield Blvd, Unit 1
Winnipeg, MB R3Y 1G4
Attention: Ron Bruce

Distribution:

Ron Bruce, P.Eng.

Project Number:

0035 057 00

Date:

February 2, 2018
Final Report



Quality Engineering | Valued Relationships

February 2, 2018

Our File No. 0035 057 00

Ron Bruce, P.Eng.
Morrison Hershfield
25 Scurfield Blvd, Unit 1
Winnipeg, MB R3Y 1G4

**RE: Sub-Surface Investigation Report for
2018 Local Streets Package (PW File #: 18-R-05)**

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 2018 Local Streets Package (PW File #: 18-R-05).

Please contact the undersigned if you have any questions. Thank you for the opportunity to serve you on this assignment.

Sincerely,

TREK Geotechnical Inc.

Per:

A handwritten signature in blue ink, appearing to read "N. Ferreira".

Nelson John Ferreira, Ph.D., P. Eng.
Geotechnical Engineer, Principal
Tel: 204.975.9433 ext. 103

cc: Angela Fidler-Kliewer C.Tech. (TREK Geotechnical)

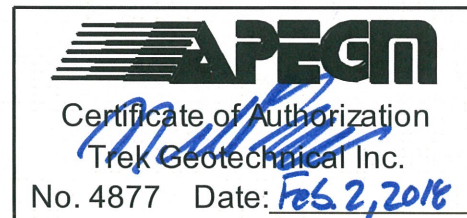
Revision History

Revision No.	Author	Issue Date	Description
0	AFK	February 2, 2018	Final Report

Authorization Signatures

Prepared By:


Angela Fidler-Kliwer C.Tech.



Reviewed By:

Nelson John Ferreira, Ph.D., P.Eng.
Geotechnical Engineer



Table of Contents

Letter of Transmittal

Revision History and Authorization Signatures

1.0	Introduction	1
2.0	Sub-Surface Investigation and Laboratory Program	1
3.0	Closure.....	1

List of Figures

~~Figure 01 Test Hole Location Plan – Tache Avenue~~

Figure 02 Test Hole Location Plan – Culross Bay

List of Appendices

~~Appendix A Test Hole Logs, Summary Table & Lab Data – Tache Avenue~~

Appendix B Test Hole Logs, Summary Table & Lab Data – Culross Bay

1.0 Introduction

This report summarizes the results of the sub-surface investigation completed for the 2018 Local Streets Package 18-R-05 project. The streets included ~~Tache Avenue, Oxford Street~~, and Culross Bay. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure.

2.0 Sub-Surface Investigation and Laboratory Program

For each street test holes were drilled approximately every 50m of street length with specific locations shown on Figure 01 to Figure 02. The test holes were drilled in order to determine sub-surface conditions for the reconstruction of the road segment.

The sub-surface investigation was conducted between December 14, 2017 and December 22, 2017. The test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using their B40 Mobile truck mounted drill rig equipped with 125 mm diameter solid stem augers. The pavement structure (asphalt or concrete) was cored by Harsimran Singh of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. The sub-surface conditions were observed during drilling and visually classified by Dawn Sellick of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Core samples were also retrieved and logged at TREK's material testing laboratory.

The laboratory testing program consisted of moisture content determination, Atterberg limits, and grain size analysis (mechanical sieve and hydrometer methods) on select samples between 0.5 and 1.0 m below pavement. Information gathered for each street is included in separate appendices (Appendices A and B). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores.

Test hole locations noted on the test hole logs and shown on ~~Figure 01 and~~ Figure 02 are based on their location relative to the nearest address, and measured distances from the edge of pavement or other permanent features.

3.0 Closure

The information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation, laboratory testing, geometries). Soil conditions are natural deposits that can be highly variable across a site. If sub-surface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and you are not

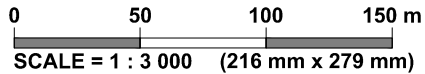
already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of Morrison Hershfield (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

Figures

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-01-29 Test Hole Plan(CULROSS BAY).0_A_Sl_0035 057 00.dwg_2/2/2018 2:44:30 PM



NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

Figure 02
Test Hole Plan

Appendix B

Culross Bay, Clouston Drive to Clouston Drive

Test Hole Logs, Summary Table, Lab Data and Photographs of Pavement Core Samples

GENERAL NOTES

- Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size				
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes #10 to #4 #40 to #10 #200 to #40 < #200				
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW					
		GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
		GC	Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7					
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075			
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW				
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols		
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7				
			Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)		Sils and Clays (Liquid limit less than 50)	ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity		Material Sand Coarse Medium Fine Silt or Clay
						CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
OL	Organic silts and organic silty clays of low plasticity									
Sils and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts								
	CH	Inorganic clays of high plasticity, fat clays								
	OH	Organic clays of medium to high plasticity, organic silts								
	Pt	Peat and other highly organic soils		Von Post Classification Limit	Strong colour or odour, and often fibrous texture					

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Inclinometer	

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

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

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



Sub-Surface Log

Test Hole TH17-09

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 21

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
						16	17	18	19	20	21
0.0		CONCRETE - 140 mm thick									
0.0 - 0.5		SAND (Fill) - some gravel (<10 mm diameter), trace clay, trace silt - brown - frozen, moist and loose when thawed - no to low plasticity - poorly graded, sub-angular to angular gravel		G68							
0.5 - 1.0		CLAY - silty, trace sand, trace gravel (<10 mm diameter) - grey - frozen to 0.8 m, moist and soft to firm when thawed - high plasticity		G69							
1.0 - 1.5		CLAY - silty, trace sand - grey - moist, stiff - high plasticity		G70							
1.5 - 2.0				G71							
2.0 - 2.5				G72							
2.5 - 3.0				G73							
3.0 - 3.5				G74							
3.5 - 4.0				G75							

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings and bentonite.
- 3) Test hole located at house #28, 1.7 m Northeast from Southwest curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULLROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



Sub-Surface Log

Test Hole TH17-10

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 21

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
						16	17	18	19	20	21	0	50	100	150	200	250
0.00		ASPHALT - 76 mm thick															
0.05		CONCRETE - 127 mm thick															
0.10		CLAY (Fill) - sandy, some silt, some gravel (<20 mm diameter) - brown - frozen, moist and soft when thawed - intermediate plasticity - poorly graded, sub-angular to angular gravel		G76													
0.45		CLAY - silty, trace sand, trace gravel (<10 mm diameter) - brown - frozen to 0.6 m, moist and soft when thawed - high plasticity - trace silt inclusions (<10 mm diameter) below 0.8 m		G77													
0.75				G78													
1.10				G79													
1.45		- firm to stiff below 1.4 m		G80													
1.80				G81													
2.15				G82													
2.50																	
2.85																	
3.00				G83													

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings and bentonite.
- 3) Test hole located at house #19, 1.6 m Southwest from Northeast curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



Sub-Surface Log

Test Hole TH17-11

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 22

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
						16	17	18	19	20	21
0.0		CONCRETE - 139 mm thick									
0.1		CLAY (Fill) - sandy, some silt, some gravel (<20 mm diameter) - brown - frozen, moist and soft when thawed - intermediate plasticity - poorly graded, sub-angular to angular gravel		G84							
0.4		CLAY - silty, trace sand - brown - frozen to 0.6 m, moist and soft when thawed - high plasticity		G85							
0.8				G86							
1.2		- firm to stiff below 1.2 m		G87							
1.5				G88							
1.7		- trace precipitates below 1.7 m		G89							
2.0				G90							
3.0		- firm below 2.9 m		G91							

END OF TEST HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #55, 1.4 m Northeast from Southwest curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



Sub-Surface Log

Test Hole TH17-12

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 22

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
						16	17	18	19	20	21	0	50	100	150	200	250
0.0		CONCRETE - 139 mm thick															
0.0		CLAY (Fill) - sandy, some silt, some gravel (<20 mm diameter), brown, frozen, moist and soft when thawed, intermediate plasticity, poorly graded, sub-angular to angular gravel		G92													
0.5		CLAY - silty, trace sand - brown - frozen to 0.6 m, moist and soft when thawed - high plasticity		G93													
0.5				G94													
1.0		- stiff below 1.0 m		G95													
1.5		- firm to stiff below 1.5 m		G96													
1.5				G97													
2.0				G98													
3.0				G99													

END OF TEST HOLE AT 3.0 m DEPTH IN CLAY

- Notes:
- 1) No seepage or sloughing.
 - 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
 - 3) Test hole located at house #90, 1.0 m Southwest from Northeast curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



Sub-Surface Log

Test Hole TH17-13

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 22

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
						16	17	18	19	20	21	0	50	100	150	200	250
0.00 - 0.05		ASPHALT - 38 mm thick															
0.05 - 0.10		CONCRETE - 115 mm thick															
0.10 - 0.45		CLAY (Fill) - sandy, some silt, some gravel (<20 mm diameter), brown, frozen, moist and soft when thawed, intermediate plasticity, poorly graded, sub-angular to angular gravel		G100													
0.45 - 0.80		CLAY - silty, trace sand, trace gravel (<10 mm diameter) - brown - moist, soft - high plasticity		G101													
0.80 - 1.10		- stiff below 0.8 m		G102													
1.10 - 1.50		- trace sulphates below 1.1 m		G103													
1.50 - 2.00				G104													
2.00 - 2.50				G105													
2.50 - 3.00		- firm to stiff below 2.0 m		G106													
3.00				G107													

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings and bentonite.
- 3) Test hole located between house #105 and #107, 1.8 m Northeast from Southwest curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



Sub-Surface Log

Test Hole TH17-14

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 22

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
						16	17	18	19	20	21	0	50	100	150	200	250
0.0 - 0.05		CONCRETE - 153 mm thick															
0.05 - 0.4		CLAY (Fill) - trace silt, som sand, trace gravel (<10 mm diameter) - dark brown - frozen, moist and soft when thawed - intermediate plasticity		G108													
0.4 - 0.6		CLAY - silty, trace sand - brown - frozen to 0.6 m, moist and soft when thawed - high plasticity		G109													
0.6 - 0.8				G110													
0.8 - 1.0				G111													
1.0 - 1.2				G112													
1.2 - 1.5				G113													
1.5 - 1.7				G114													
1.7 - 2.0		- firm to stiff below 1.7 m		G115													
2.0 - 2.5																	
2.5 - 3.0																	

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings and bentonite.
- 3) Test hole located at house #126, 1.9 m Southwest from Northeast curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



Sub-Surface Log

Test Hole TH17-15

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00
 Project Name: Local Streets 18-R-05 - Culross Bay Location: Top of Pavement
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: _____
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 22

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
						16	17	18	19	20	21	0	50	100	150	200	250
0.0 - 0.1		CONCRETE - 153 mm thick															
0.1 - 0.4		SAND (Fill) - some clay, some silt, trace gravel (<20 mm diameter) - brown - frozen, moist and soft when thawed - intermediate plasticity		G116													
0.4 - 1.1		CLAY - silty, trace sand, trace gravel (<10 mm diameter) - brown - frozen to 0.6 m, moist and soft when thawed - high plasticity		G117													
1.1 - 1.7		- stiff below 1.1 m		G118													
1.7 - 2.0		- firm to stiff below 1.7 m		G119													
2.0 - 2.3				G120													
2.3 - 2.6				G121													
2.6 - 2.9				G122													
2.9 - 3.0				G123													

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings and bentonite.
- 3) Test hole located between house #137 and #141, 1.1 m Northeast from Southwest curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-25 LOCAL STREETS 18-R-05 CULLROSS 0035-057-00 0 B NM.GPJ TREK GEOTECHNICAL.GDT 18-2-1



www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-05 Culross Bay

Sample Date 14-Dec-17
Test Date 2-Jan-18
Technician DS

Test Pit	TH17-09	TH17-09	TH17-09	TH17-09	TH17-09	TH17-09
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G68	G69	G70	G71	G72	G73
Tare ID	E15	A1	E122	AB48	Z19	A17
Mass of tare	8.6	8.0	8.2	6.8	8.6	8.7
Mass wet + tare	334.3	321.6	406.9	300.9	311.9	308.8
Mass dry + tare	291.8	247.8	310.2	228.4	227.7	217.5
Mass water	42.5	73.8	96.7	72.5	84.2	91.3
Mass dry soil	283.2	239.8	302.0	221.6	219.1	208.8
Moisture %	15.0%	30.8%	32.0%	32.7%	38.4%	43.7%

Test Pit	TH17-09	TH17-09	TH17-10	TH17-10	TH17-10	TH17-10
Depth (m)	2.0 - 2.1	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G74	G75	G76	G77	G78	G79
Tare ID	D8	F1	E83	AB28	E17	E46
Mass of tare	8.5	8.7	8.6	6.6	8.8	8.6
Mass wet + tare	302.7	305.2	311.6	327.6	302.3	306.9
Mass dry + tare	208.6	204.8	247.0	245.0	229.0	231.3
Mass water	94.1	100.4	64.6	82.6	73.3	75.6
Mass dry soil	200.1	196.1	238.4	238.4	220.2	222.7
Moisture %	47.0%	51.2%	27.1%	34.6%	33.3%	33.9%

Test Pit	TH17-10	TH17-10	TH17-10	TH17-10	TH17-11	TH17-11
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6
Sample #	G80	G81	G82	G83	G84	G85
Tare ID	H29	AB011	N96	AB65	E36	W100
Mass of tare	8.5	6.8	8.5	6.7	8.5	8.4
Mass wet + tare	308.1	326.6	332.7	320.5	246.7	242.9
Mass dry + tare	216.5	224.9	224.0	214.1	201.2	183.3
Mass water	91.6	101.7	108.7	106.4	45.5	59.6
Mass dry soil	208.0	218.1	215.5	207.4	192.7	174.9
Moisture %	44.0%	46.6%	50.4%	51.3%	23.6%	34.1%



www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-05 Culross Bay

Sample Date 14-Dec-17
Test Date 2-Jan-18
Technician DS

Test Pit	TH17-11	TH17-11	TH17-11	TH17-11	TH17-11	TH17-11
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.9 - 3.0
Sample #	G86	G87	G88	G89	G90	G91
Tare ID	E33	AB96	AC03	N43	Z18	W19
Mass of tare	8.5	6.7	6.5	8.3	8.7	8.9
Mass wet + tare	406.2	218.2	328.2	270.9	292.1	354.7
Mass dry + tare	303.7	165.8	232.9	188.0	198.1	239.7
Mass water	102.5	52.4	95.3	82.9	94.0	115.0
Mass dry soil	295.2	159.1	226.4	179.7	189.4	230.8
Moisture %	34.7%	32.9%	42.1%	46.1%	49.6%	49.8%

Test Pit	TH17-12	TH17-12	TH17-12	TH17-12	TH17-12	TH17-12
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G92	G93	G94	G95	G96	G97
Tare ID	E28	F70	Z70	F135	F137	K12
Mass of tare	8.3	8.4	8.6	8.7	8.4	8.5
Mass wet + tare	340.6	306.5	310.5	313.6	304.9	363.2
Mass dry + tare	266.9	221.1	230.0	230.4	220.9	258.2
Mass water	73.7	85.4	80.5	83.2	84.0	105.0
Mass dry soil	258.6	212.7	221.4	221.7	212.5	249.7
Moisture %	28.5%	40.2%	36.4%	37.5%	39.5%	42.1%

Test Pit	TH17-12	TH17-12	TH17-13	TH17-13	TH17-13	TH17-13
Depth (m)	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G98	G99	G100	G101	G102	G103
Tare ID	Z138	K22	F62	C22	H73	AC18
Mass of tare	8.5	8.6	8.4	8.5	8.6	6.6
Mass wet + tare	300.5	364.5	313.0	308.8	328.8	321.9
Mass dry + tare	207.1	248.6	244.8	222.3	243.0	237.8
Mass water	93.4	115.9	68.2	86.5	85.8	84.1
Mass dry soil	198.6	240.0	236.4	213.8	234.4	231.2
Moisture %	47.0%	48.3%	28.8%	40.5%	36.6%	36.4%



Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-05 Culross Bay

Sample Date 14-Dec-17
Test Date 2-Jan-18
Technician DS

Test Pit	TH17-13	TH17-13	TH17-13	TH17-13	TH17-14	TH17-14
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6
Sample #	G104	G105	G106	G107	G108	G109
Tare ID	E8	F123	AC01	F119	W01	Z05
Mass of tare	8.6	8.4	6.6	8.2	8.4	8.4
Mass wet + tare	304.9	344.4	348.2	332.9	314.5	320.6
Mass dry + tare	223.5	245.7	237.4	226.2	226.2	235.9
Mass water	81.4	98.7	110.8	106.7	88.3	84.7
Mass dry soil	214.9	237.3	230.8	218.0	217.8	227.5
Moisture %	37.9%	41.6%	48.0%	48.9%	40.5%	37.2%

Test Pit	TH17-14	TH17-14	TH17-14	TH17-14	TH17-14	TH17-14
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.9 - 3.0
Sample #	G110	G111	G112	G113	G114	G115
Tare ID	AC17	AC29	AC09	AC16	Z114	N105
Mass of tare	6.6	6.6	6.6	6.7	8.3	8.4
Mass wet + tare	334.2	346.2	321.9	314.2	337.1	321.9
Mass dry + tare	248.7	255.2	242.8	223.4	235.4	214.8
Mass water	85.5	91.0	79.1	90.8	101.7	107.1
Mass dry soil	242.1	248.6	236.2	216.7	227.1	206.4
Moisture %	35.3%	36.6%	33.5%	41.9%	44.8%	51.9%

Test Pit	TH17-15	TH17-15	TH17-15	TH17-15	TH17-15	TH17-15
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.3 - 1.5	1.7 - 1.8
Sample #	G116	G117	G118	G119	G120	G121
Tare ID	Lockey	E24	Z105	W29	N113	Z66
Mass of tare	357.4	8.6	8.3	8.5	8.3	8.4
Mass wet + tare	1407.2	323.4	300.2	324.1	315.7	333.1
Mass dry + tare	1191.3	236.7	234.1	242.2	225.9	235.0
Mass water	215.9	86.7	66.1	81.9	89.8	98.1
Mass dry soil	833.9	228.1	225.8	233.7	217.6	226.6
Moisture %	25.9%	38.0%	29.3%	35.0%	41.3%	43.3%



www.trekgeotechnical.ca
1712 St. James Street
Winnipeg, MB R3H 0L3
Tel: 204.975.9433 Fax: 204.975.9435

Moisture Content Report ASTM D2216-10

Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-05 Culross Bay

Sample Date 14-Dec-17
Test Date 2-Jan-18
Technician DS

Test Pit	TH17-15	TH17-15				
Depth (m)	2.0 - 2.1	2.9 - 3.0				
Sample #	G122	G123				
Tare ID	D5	W13				
Mass of tare	8.3	8.4				
Mass wet + tare	305.3	342.0				
Mass dry + tare	207.8	230.2				
Mass water	97.5	111.8				
Mass dry soil	199.5	221.8				
Moisture %	48.9%	50.4%				



www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

Atterberg Limits
ASTM D4318-10e1

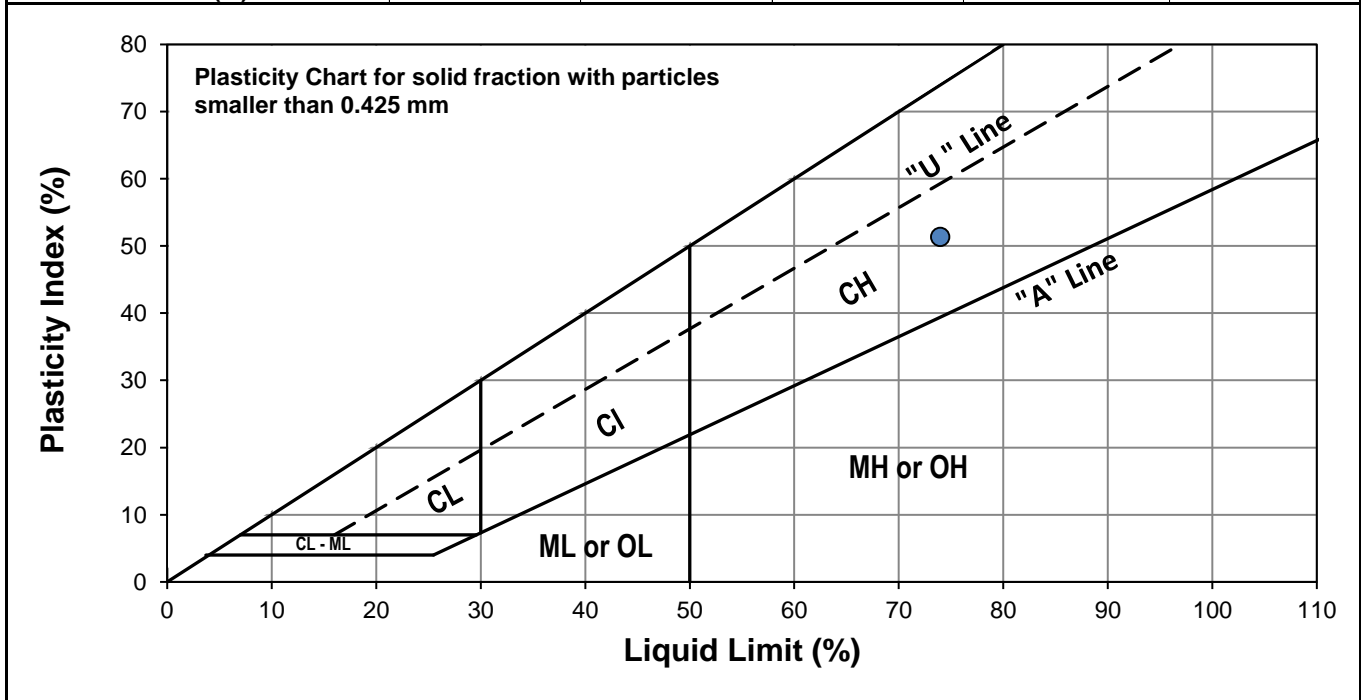
Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-05 Culross Bay

Test Hole TH17-09
Sample # G70
Depth (m) 0.8 - 0.9
Sample Date 21-Dec-17
Test Date 7-Jan-18
Technician DS

Liquid Limit	74
Plastic Limit	23
Plasticity Index	51

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	22	32		
Mass Wet Soil + Tare (g)	21.981	23.422	23.847		
Mass Dry Soil + Tare (g)	18.522	19.405	19.850		
Mass Tare (g)	14.191	14.060	14.246		
Mass Water (g)	3.459	4.017	3.997		
Mass Dry Soil (g)	4.331	5.345	5.604		
Moisture Content (%)	79.866	75.154	71.324		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	17.990	18.022			
Mass Wet Soil + Tare (g)	17.208	17.325			
Mass Dry Soil + Tare (g)	13.792	14.205			
Mass Water (g)	0.782	0.697			
Mass Dry Soil (g)	3.416	3.120			
Moisture Content (%)	22.892	22.340			



www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

Atterberg Limits
ASTM D4318-10e1

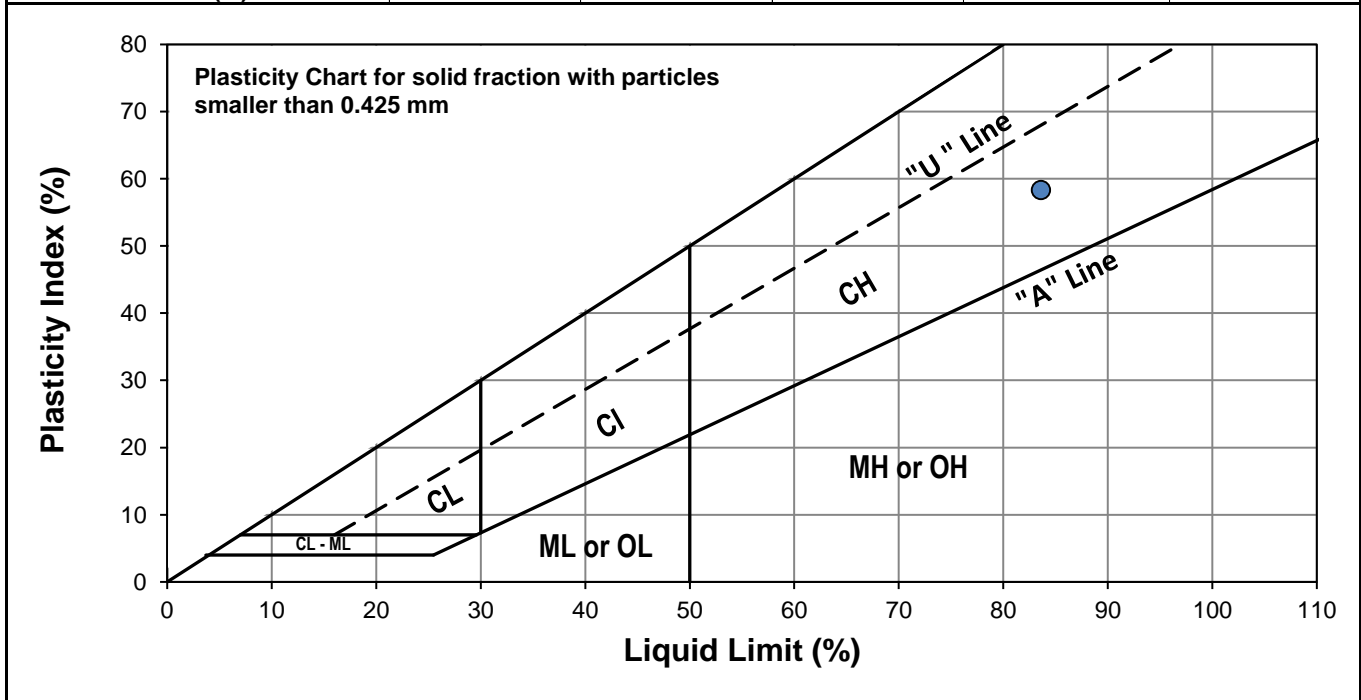
Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-05 Culross Bay

Test Hole TH17-11
Sample # G86
Depth (m) 0.8 - 0.9
Sample Date 22-Dec-17
Test Date 7-Jan-18
Technician JB

Liquid Limit	84
Plastic Limit	25
Plasticity Index	58

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	21	30	35		
Mass Wet Soil + Tare (g)	24.298	23.159	24.160		
Mass Dry Soil + Tare (g)	19.721	19.207	19.622		
Mass Tare (g)	14.330	14.417	13.986		
Mass Water (g)	4.577	3.952	4.538		
Mass Dry Soil (g)	5.391	4.790	5.636		
Moisture Content (%)	84.901	82.505	80.518		



Plastic Limit

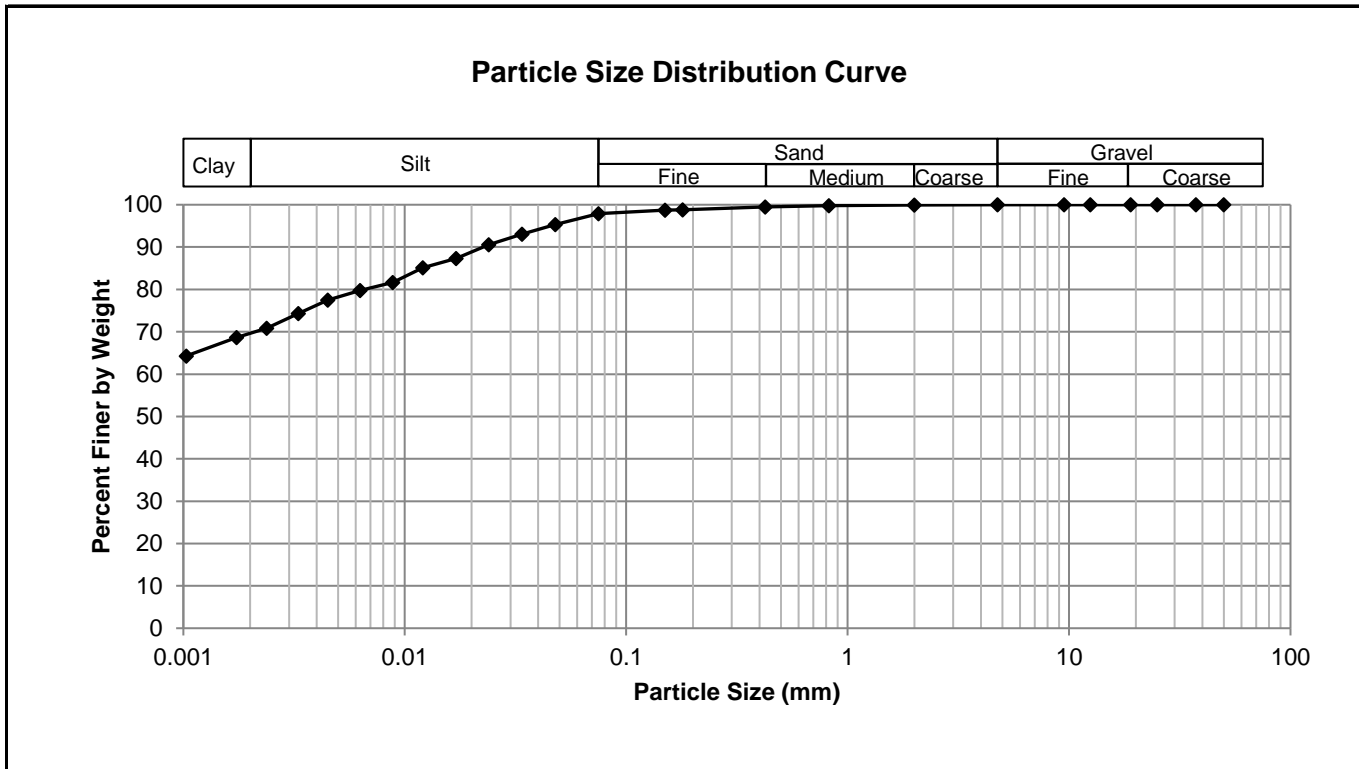
Trial #	1	2	3	4	5
Mass Tare (g)	20.776	19.419			
Mass Wet Soil + Tare (g)	19.411	18.363			
Mass Dry Soil + Tare (g)	14.112	14.101			
Mass Water (g)	1.365	1.056			
Mass Dry Soil (g)	5.299	4.262			
Moisture Content (%)	25.760	24.777			



Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-03 Culcross Bay

Test Hole TH17-09
Sample # G70
Depth (m) 0.8 - 0.9
Sample Date 21-Dec-17
Test Date 5-Jan-18
Technician LI/DS

Gravel	0.0%
Sand	2.1%
Silt	28.4%
Clay	69.5%



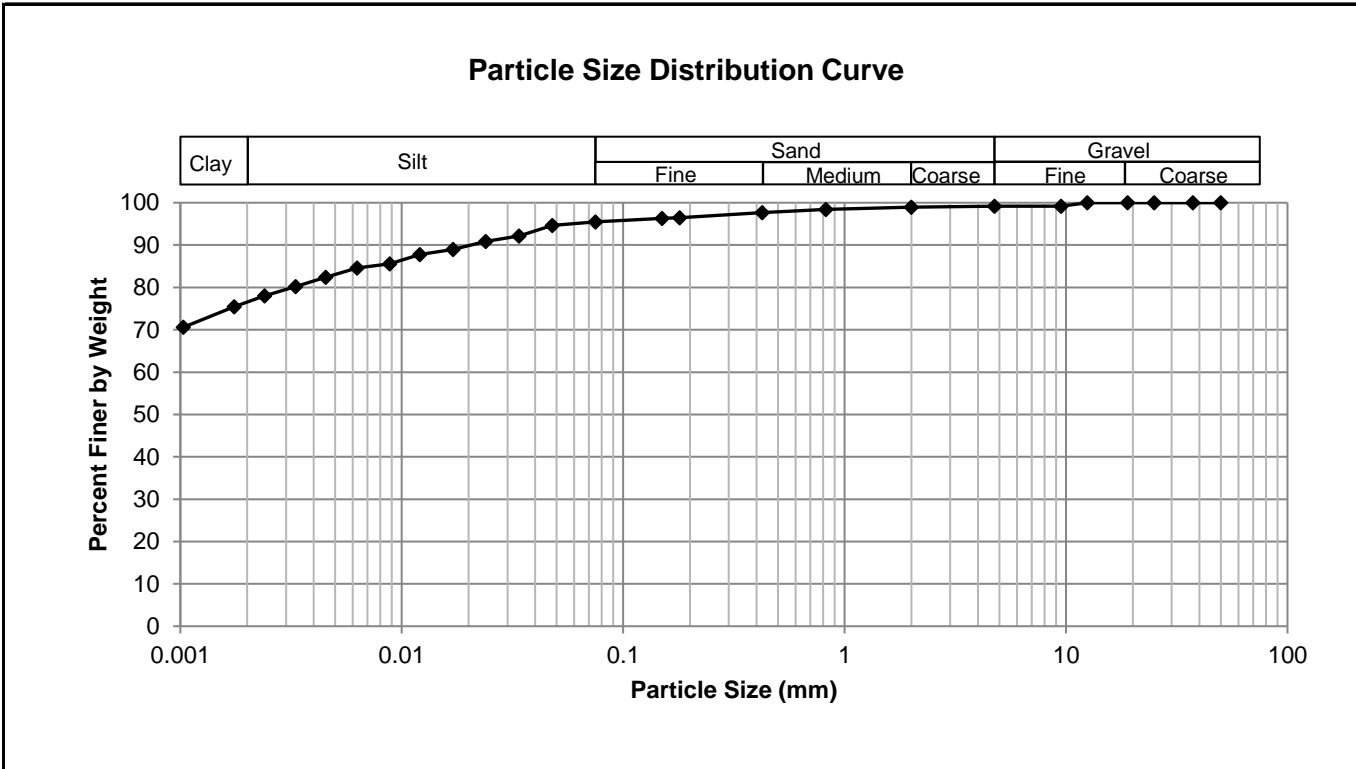
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.93
37.5	100.00	2.00	99.96	0.0479	95.29
25.0	100.00	0.825	99.82	0.0338	93.07
19.0	100.00	0.425	99.48	0.0239	90.53
12.5	100.00	0.180	98.82	0.0171	87.35
9.50	100.00	0.150	98.70	0.0121	85.13
4.75	100.00	0.075	97.93	0.0088	81.64
				0.0063	79.73
				0.0045	77.51
				0.0033	74.33
				0.0024	70.84
				0.0017	68.62
				0.0010	64.30



Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-03 Culcross Bay

Test Hole TH17-11
Sample # G86
Depth (m) 0.8 - 0.9
Sample Date 22-Dec-17
Test Date 5-Jan-18
Technician LI/DS

Gravel	0.8%
Sand	3.7%
Silt	19.0%
Clay	76.4%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	99.17	0.0750	95.45
37.5	100.00	2.00	98.97	0.0479	94.66
25.0	100.00	0.825	98.42	0.0338	92.15
19.0	100.00	0.425	97.66	0.0239	90.89
12.5	100.00	0.180	96.49	0.0171	89.00
9.50	99.17	0.150	96.28	0.0121	87.75
4.75	99.17	0.075	95.45	0.0088	85.55
				0.0063	84.60
				0.0045	82.40
				0.0033	80.20
				0.0024	78.00
				0.0018	75.49
				0.0010	70.58



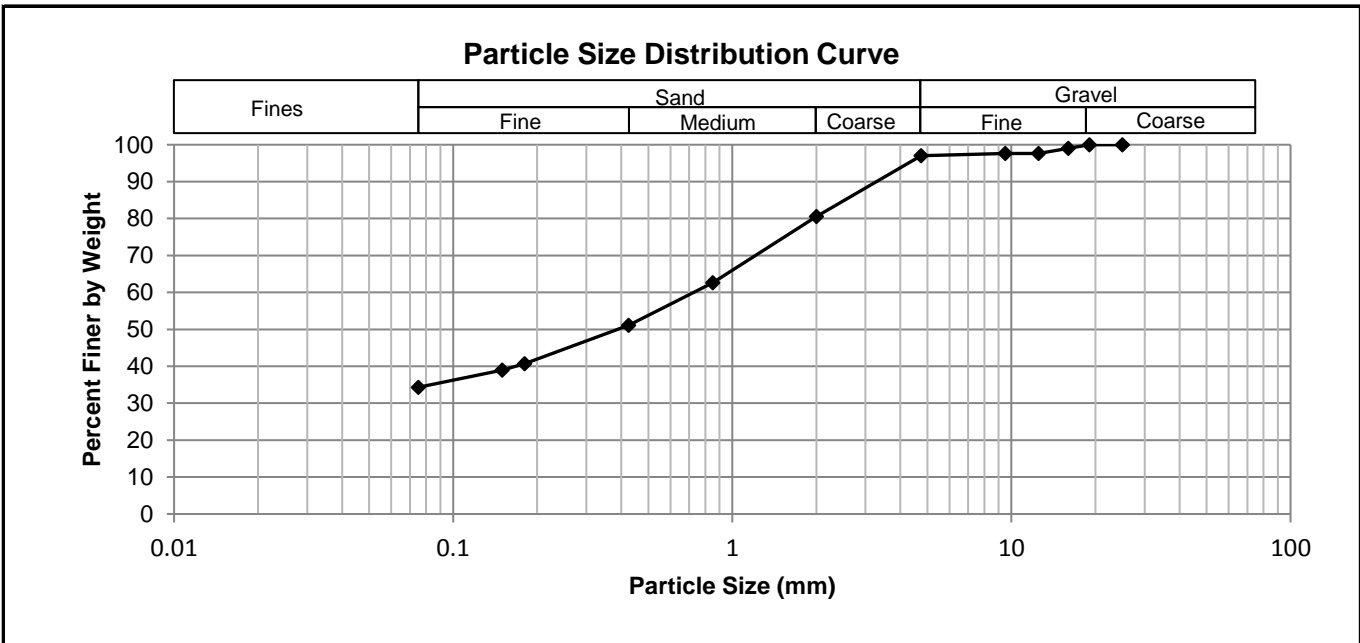
www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No. 0035-057-00
Client Morrison Hershfield
Project Local Streets 18-R-03 Culcross Bay

Test Hole TH17-15
Sample # G116
Depth (m) 0.5 - 1.0
Date Sampled 22-Dec-17
Date Tested 7-Jan-18
Technician DS

Total Weight (g)	760.6
Gravel %	3.0
Sand %	62.7
Fines %	34.3



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
6"	150		
5"	125		
4"	100		
3"	75.0		
2"	50.0		
1 1/2"	37.5		
1"	25.0	100	
3/4"	19.0	100	
5/8"	16.0	99	
1/2"	12.5	98	
3/8"	9.50	98	
no. 4	4.75	97	
no. 10	2.00	81	
no. 20	0.850	63	
no. 40	0.425	51	
no. 80	0.180	41	
no. 100	0.150	39	
no. 200	0.075	34	



Photo 1: Pavement Core Sample at Test Hole TH17-09



Photo 2: Pavement Core Sample at Test Hole TH17-10



Photo 3: Pavement Core Sample at Test Hole TH17-11



Photo 4: Pavement Core Sample at Test Hole TH17-12



Photo 5: Pavement Core Sample at Test Hole TH17-13



Photo 6: Pavement Core Sample at Test Hole TH17-14



Photo 7: Pavement Core Sample at Test Hole TH17-15



Photo 8: Pavement Core Sample at Pavement Hole PC17-01



Photo 9: Pavement Core Sample at Pavement Hole PC17-02



Photo 10: Pavement Core Sample at Pavement Hole PC17-03



Photo 11: Pavement Core Sample at Pavement Hole PC17-04



Photo 12: Pavement Core Sample at Pavement Hole PC17-05



Photo 13: Pavement Core Sample at Pavement Hole PC17-06