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APPENDIX 'A' GEOTECHNICAL REPORT



Morrison Hershfield

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

Prepared for:

Distribution:

Morrison Hershfield 25 Scurfield Blvd, Unit 1 Winnipeg, MB R3Y IG4 Attention: Ron Bruce 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:

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-Kliewer C.Tech.



Certificate of Authorization
Tiek Geotechnical Inc.
No. 4877 Date: Feb 2,2016

Reviewed By:

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



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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 subsurface 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)



LEGEND: TEST HOLE (TREK, 2018)

PAVEMENT CORE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016



Appendix B

Culross Bay, Clouston Drive to Clouston Drive

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



EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

- 1. 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.
- 2. 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.
- 3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Ma	jor Div	isions	USCS Classi- fication	Symbols	Typical Names		Laboratory Classific	cation Criteria		ς,			
	action	gravel no fines)	GW	36	Well-graded gravels, gravel-sand mixtures, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater than 4	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
sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GP	.A.	Poorly-graded gravels, gravel-sand mixtures, little or no fines	urve, 200 sievej nbols*	Not meeting all gradation	requirements for GW	0	STMS	#10	#40 t	* V
No. 200 s	Gray than half o	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	rain size c r than No. g dual sym	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-	Particle Size	⋖			
ained soils larger thar	(More	Gravel w (Appre amount	GC		Clayey gravels, gravel-sand-silt mixtures	vel from g on smaller llows: W, SP SM, SC ss sequiring	Atterberg limits above "A" line or P.I. greater than 7	line cases requiring use of dual symbols	Part		22	00 ۾د	9
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	action	sands no fines)	SW	****	Well-graded sands, gravelly sands, 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 case4s requiring dual symbols*	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6	$C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		E	2.00 to 4.75	0.425 to 2.00	< 0.075
half the r	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SP		Poorly-graded sands, gravelly sands, little or no fines	ages of sarentage of farentage of farentage of farentage of farentage.	Not meeting all gradation	requirements for SW			•	0 0	<i>i</i>
(More than	Sar than half c	Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	ne percentarion percentarion percentarion percentarion percentarion percentarion percentarion 12 percentarion	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-	rial				Clay
	(More	Sands w (Appre amount	SC		Clayey sands, sand-clay mixtures	Determin dependin coarse-g Less t More	Atterberg limits above "A" line or P.I. greater than 7	line cases requiring use of dual symbols	Material	0000	Coarse	Medium	Silt or Clay
size)	ys.		ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	80 Plasticity	Plasticity (Chart	i	Sizes	. <u>.</u> . <u>.</u> :	2	i ii
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clar	(Liquid limit less than 50)	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	70 – 60 –	an 0.425 mm	"I III" I III	9	ASTM Sieve Sizes	3 in. to 12 in.	3/4 in 40 3 in	3/4 III. (0 3 III #4 to 3/4 in.
soils er than No	is.	<u> </u>	OL		Organic silts and organic silty clays of low plasticity	NDEX (%)		CA CA	Particle Size	AS			_
e-Grained al is small	iys	t 50)	MH	Ш	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	PLASTICITY INDEX				mm *300	75 to 300	 	19 to 75 4.75 to 19
Fine the materi.	ts and Cla	(Liquid limit greater than 50)	СН		Inorganic clays of high plasticity, fat clays	20 -	0	MH OR OH		<u>-</u>	75 tu		4.75
than half	<u> </u>		ОН		Organic clays of medium to high plasticity, organic silts	7 4 0 10	ML or OL 16 20 30 40 50 LIQUID LIM	60 70 80 90 100 110 IIT (%)	rial	9	S S		
(More	Highly	Organic Soils	Pt	6 46 46 47 47 4	Peat and other highly organic soils	Von Post Class		rong colour or odour, nd often fibrous texture	Material	Double	Cobbles	Gravel	Fine

^{*} 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



EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

PL - Plastic Limit (%)
PI - Plasticity Index (%)

▼ Water Level at End of Drilling

MC - Moisture Content (%)

Water Level After Drilling as Indicated on Test Hole Logs

SPT - Standard Penetration Test Indicated on Test Hole Logs
RQD - Rock Quality Designation

Su - Undrained Shear Strength VW - Vibrating Wire Piezometer

Qu - Unconfined Compression

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
Verv dense	> 50

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

Descriptive Terms	<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:

Undrained Shear <u>Strength (kPa)</u>
< 12
12 to 25
25 to 50
50 to 100
100 to 200
> 200

1 of 1



Clie	nt:	Morrison Hershfield Project Num	ber:	003	5-057-00
Proj	ect Nam	e: Local Streets 18-R-05 - Culross Bay Location:		Тор	of Pavement
Cont	tractor:	Maple Leaf Drilling Ground Elev	ation:		
Meth	nod:	125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled:		201	7 December 21
	Sample	Type: Grab (G) Shelby Tube (T) Split Sp	oon (S	SS)	Split Barrel (SB) Core (C)
	Particle	Size Legend: Fines Clay Silt Sa	nd		Gravel Cobbles Boulders
Depth (m)	So	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt Undrained Shear Strength (kPa)
	0 4 4 5 A	CONCRETE - 140 mm thick			
-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 CLAY - silty, trace sand, trace gravel (<10 mm diameter) - grey - frozen to 0.8 m, moist and soft to firm when thawed - high plasticity		G68 G69	
18-2-1 -0-1				G70	
(GEOTECHNICAL.C		CLAY - silty, trace sand - grey - moist, stiff - high plasticity		G71	
S 0035-057-00_0 B NM.GPJ TREK GEOTECHNICAL GDT 18-2-1				G72	
00-250-33 -2.0-		firm below 1.9 m			
SUB-SURFACE LOG LOGS 2018-01-25_LOCAL STREETS 18-R-05 CULROSS_01				G74	
57-10-810-7 -3.0-				G75	• •
RFACE LOG LOGS.		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.			
Food	aed Bv:	Dawn Sellick Reviewed By: Nelson Ferreira			Project Engineer: Nelson Ferreira
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1 of 1



Cli	ent:	Morrison Hershfield Project	t Number:	003	5-057-00
Pro	oject Nam	e: Local Streets 18-R-05 - Culross Bay Location	on:	Тор	of Pavement
Со	ntractor:	Maple Leaf Drilling Ltd. Ground	d Elevation:		
Me	thod:	125mm Solid Stem Auger, B40 Mobile Truck Mount Date D	rilled:	201	7 December 21
	Sample	e Type: Grab (G) Shelby Tube (T) S	olit Spoon (S	SS)	Split Barrel (SB) Core (C)
	Particle	e Size Legend: Fines Clay Silt	Sand		Gravel Cobbles Boulders
Depth	(m) Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt Undrained Shear Strength (kPa)
-	54000,000,000	ASPHALT - 76 mm thick			
- - - - -	5-	CONCRETE - 127 mm thick CLAY (Fill) - sandy, some silt, some gravel (<20 mm diameter) - brown - frozen, moist and soft when thawed - intermediate plasticity - poorly graded, sub-agular to angular gravel		G76	
•		CLAY - silty, trace sand, trace gravel (<10 mm diameter)		G77	_
18-2-1		 brown frozen to 0.6 m, moist and soft when thawed high plasticity trace silt inclusions (<10 mm diameter) below 0.8 m 		G78	
<u>-</u> 1.	0-				
S_0035-057-00_0 B_NM.GPJ_TREK_GEOTECHNICAL_GDT_18-2-1				G79	
GPJ TREK G	5-	- firm to stiff below 1.4 m		G80	- 40
B NM				G81	• \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
02-7-00 (
-2.	0-			G82	• \ __
CAL STREETS	5-				
. 2018-01-25 LO	0-			G83	
SUB-SURFACE LOG LOGS 2018-01-25, LOCAL STREETS 18-R-05 CULROS C		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.			
S-H 1-C	aaed Bv.	Dawn Sellick Reviewed By: Nelson Ferreira			Project Engineer: Nelson Ferreira
ಶ	ggcu Dy.	Teriened by. Noticella			1 10 Just Engineer: 110 Just 1 Cholid

1 of 1



Clien	t:	Morrison Hershfield	Project Number:	003	5-057-00
Proje	ct Nam	e: Local Streets 18-R-05 - Culross Bay	Location:	Top	of Pavement
Cont	ractor:	Maple Leaf Drilling Ltd.	Ground Elevation:		
Meth	od:	125mm Solid Stem Auger, B40 Mobile Truck Mount	Date Drilled:	201	7 December 22
	Sample	e Type: Grab (G) Shelby Tu	ube (T) Split Spoon (S	SS)	Split Barrel (SB) Core (C)
					
-	Particle	e Size Legend: Fines Clay	Silt Sand		Gravel Cobbles Boulders Bulk Unit Wt Undrained Shear
Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	□ Bulk Unit Wt Undrained Shear Strength (kPa) □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
<u> </u>	7 4 4	CONCRETE - 139 mm thick			
		CLAY (Fill) - sandy, some silt, some gravel (<20 mm diame - brown - frozen, moist and soft when thawed - intermediate plasticity - poorly graded, sub-agular to angular gravel	eter)	G84	
-0.5-		CLAY - silty, trace sand - brown - frozen to 0.6 m, moist and soft when thawed - high plasticity		G85	•
				G86	
		- firm to stiff below 1.2 m		G87	
-1.5-				G88	• •
		- trace precipitates below 1.7 m		G89	
-2.0-					-
-1.5				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 asphalt.		•	
<u> </u>		3) Test hole located at house #55, 1.4 m Northeast from S	outhwest curb.		
Logg	ed By:	Dawn Sellick Reviewed By: No	elson Ferreira		Project Engineer: Nelson Ferreira

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Client	t:	Morrison Her	rshfield			Project Number:	٠.	0035	-057-0	00						
Proje	ct Name	e: Local Streets	s 18-R-05 - Culross B	ay		Location:	_	Тор	of Pave	emer	nt					
Contr	ractor:	Maple Leaf D	Drilling Ltd.			Ground Elevation	n:									
Metho	od:	125mm Solid Ste	em Auger, B40 Mobile Trud	ck Mount		Date Drilled:	_	2017	Decei	mber	r 22					
	Sample	Type:	Grab (G)		Shelby Tube (T)	Split Spoon	(S	S)	Sn	olit Ba	arrel (SI	3)	Core (C)		
		Size Legend:	Fines	Clay	Silt	Sand			Gra		\ \{\rangle}				ulders	
-				7// 0.29	ШШ э	[····a		<u></u>	<u>.</u>		□Bulk	Unit Wt			ined Sh	
Depth (m)	Soil Symbol			AL DESCRIF	PTION		Sample Type	Sample Number	Tem		Particle Particle Particle PL M 20 40	Size (%) 60 80 C LL		Strer	ngth (kP est Type orvane ∠ ket Pen I Qu ⊠ eld Vane	na) ∆ a. Ф
	P 4 4	CONCRETE - 13	39 mm thick													
-		CLAY (Fill) - san and soft when th gravel	ndy, some silt, some g nawed, intermediate p	ravel (<20 n lasticity, pod	nm diameter), b orly graded, sub	rown, frozen, moist -agular to angular	4	G92	-		•					
		CLAY - silty, trac	ce sand			J										
-0.5-			0.6 m, moist and soft	when thawe	d			G93	1							
		- high plasti	icity				4		_							
								G94			•					
1.0-		- stiff below 1.0 r	m													
		- Suil Delow 1.01	111				7	G95							٠	
							4	030								
							7	G96						△0	.	
-1.5-		- firm to stiff belo	ow 1.5 m				4									
- -							1	G97			•			-		
									1							
2 0																
-							4	G98			•	•		△		
; ;							П									
2.5																
<u> </u>																
<u>.</u>								G99				•		٥		
									1							
3.0-		END OF TEST F	HOLE AT 3.0 m DEP1	TH IN CLAY												
-1.0- -1.5- -1.5- -2.0- -2.5- -3.0-	:	Notes: 1) No seepage c			ite chips, sand a	and cold patch										
:			ated at house #90, 1.0) m Southwe	est from Northea	st curb.										
		Dawn Sellick		Davisonad	I By: Nelson F	erreira			Projec	t En	aineer:	Nelsor	Ferreir	<u> </u>		

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Client		Morrison He					F	Project Number	r: 0035-057-00 Top of Pavement								
Proje	ct Name	: Local Street	s 18-R-05	5 - Culross Bay	/		L	ocation:		Top	of Pave	emen	ıt				
Contr	actor:	Maple Leaf I	Orilling Ltd	d.			0	Fround Elevation	on:								
Metho	od:	125mm Solid S	tem Auger, I	B40 Mobile Truck	Mount			Date Drilled:		2017	Decer	nber	22				
	Sample	Туре:		Grab (G)		Shelby Tub	e (T)	Split Spoor	n (S	S)	Sp	lit Ba	rrel (SB)	Co	ore (C)		
	Particle	Size Legend:	F	ines	Clay		Silt	Sand			Grav	/el	F7 0	obbles		Boulde	ers
	_								a)	er	o l		□ Bulk Uni (kN/m³ 7 18 19	t Wt)		drained trength	
ا د	Soil Symbol								Sample Type	Sample Number	Temperature (°C)	16 1				Test Ty	. ,
Depth (m)	Syr			MATERIAL	DESCRI	PTION			ble.	S S		0 2	Particle Size	3 (%) 0 80 100	- Z	∆ Torvar Pocket F	ne ∆ Pen. Φ
	Soil								am	ldm	e.		PL MC	LL	1	☐ Qu Field Va	\boxtimes
									0)	Sa		0 2	0 40 60	80 100			50 200
	<i>P</i>	ASPHALT - 38 i							/								
[]		CONCRETE - 1 CLAY (Fill) - sar			wol (<20 r	om diamete	or) brown	frozon moiet	\perp		-						
		and soft when the	nawed, int	termediate pla	sticity, pod	orly graded	, sub-agu	ılar to angular		G100			•			_	
		gravel							Г		1						
		CLAY - silty, tra	t	trans around (a	10 mm die	matar)			1		-						
-0.5-		- brown	ce sand, t	race graver (<	10 mm dia	irrieter)				G101			•				
. :		moist, sofhigh plast									1						
			-						L		1						
		stiff below 0.8	m							G102			•			△	
											1						
- 1.0−									L								
. :		trace sulphate	s below 1.	.1 m						G103			•		/	△	
<u> </u>											1						
. :																	
. :										G104						<u> </u>	
-1.5-											1					+	
<u> </u>										G105						<u> </u>	
									4	0.00	-					_ •	
. :																	
-2.0-		firm to stiff belo	ow 2.0 m							G106					<		
<u> </u>									4	0100	4					r	
<u> </u>																	
-2.5-																_	
<u> </u>																	
_																	
<u> </u>																	
-3.0-									\mathbf{V}	G107			•				
		END OF HOLE Notes:	AT 3.0 m	DEPTH IN CI	AY		<u> </u>							<u> </u>			
		1) No seepage	or sloughi	ing.													
		2) Test hole bac 3) Test hole loca	kfilled wit ated betw	th auger cuttin een house #1	gs and be 05 and #1	ntonite. 07. 1.8 m N	Vortheast	from									
		Southwest curb				,											
-1.5- -2.0- -3.0-	- d D:::	Davis 0:10:1			David	UD N		:			Dus'-	4 ===	.!	lalaa:: =			
Logge	ea By:	Dawn Sellick			Keviewed	I By: Nels	son Ferre	en a		_	Projec	ι⊏ng	jineer: <u>N</u>	ieison Fe	rreira		

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Clien	ıt:	Morrison Hershfield		Project Number:	r: <u>0035-057-00</u>							
Proje	ect Nam	: Local Streets 18-R-05	5 - Culross Bay		Location:	_	Тор о	f Paveme	ent			
Cont	ractor:	Maple Leaf Drilling Lt	d.		Ground Elevation	n: _						
Meth	od:	125mm Solid Stem Auger,	B40 Mobile Truck Mount		Date Drilled:		2017	Decembe	er 22			
	Sample	Type:	Grab (G)	Shelby Tube (T)	Split Spoon	(SS	5)	Split E	Barrel (SB)	Co	ore (C)	
	Particle	Size Legend:	Fines CI	ay III Silt	Sand			Gravel	62	Cobbles	В	oulders
Depth (m)	So	CONCRETE - 153 mm th	MATERIAL DES	CRIPTION		Sample Type	Sample Number	Temperatu (°C)	Bulk U (kN/m 17 18 Particle Si 20 40 PL MC 20 40	3) 19 20 21 Ze (%) 60 80 100	Stre	ained Shear ength (kPa) est Type Torvane △ ocket Pen. • ☑ Qu ☒ leid Vane ○
-0.5-	2 4 4	CLAY (Fill) -trace silt, sorting and street frozen, moist and street entertaint and street frozen frozen frozen frozen to 0.6 m, miles	m sand, trace grave soft when thawed city				G108 G109		•			
GEOTECHNICAL.GDT 18-2-1		- high plasticity	ost and soft when a	iawod			G110 G111		•			
1.5- - 1.5- - 2.0 0-2-02-00-2-00-2-00-2-00-2-00-2-00		firm to stiff below 1.7 m					G112 G113				△ •	
SUB-SUKFACE LOG LOGS ZUR-0-25 LOCALS I REE IS 18-K-05 CULKOSS 1035-057-00 0 B NM.GFU I REK GEOTIECHNICAL GUT 18-K-10 10 10 10 10 10 10 10 10 10 10 10 10 1							9117					
ACE LOG LOGS 2018-01-		END OF HOLE AT 3.0 m Notes: I) No seepage or slough 2) Test hole backfilled wi b) Test hole located at ho	ing. ith auger cuttings an	d bentonite. outhwest from Northe	ast curb.		G115		•		20	
P COC	ed By	Dawn Sellick	Revi	ewed By: Nelson Fe	erreira			Project F	ngineer:	Nelson Fe	rreira	
ភ լ 099	ou by.	Dawn Ocilior		INCIDUIT FE	JII OII O			اعا ۱۰۰۱	.aee	14013011 FB	попа	

1 of 1

GENTECHNICOL

Project Na Contractor	me: Local Streets	s 18-R-05 - Culross Bay			er: <u>0035-057-00</u>						
Contractor		o to tree cances bay		_ Location:	Top	of Pavement					
1		-		_ Ground Elevation							
Method:	125mm Solid St	tem Auger, B40 Mobile Truck	Mount	_ Date Drilled:	201	7 December 2	2				
Sam	ole Type:	Grab (G)	Shelby Tube (T) Split Spoon	(SS)	Split Barr	el (SB) 🔲 Co	ore (C)			
Parti	cle Size Legend:	Fines	Clay Silt	Sand	2		Cobbles	Boulders			
Depth (m) Soil Symbol		MATERIAL	DESCRIPTION		Sample Type Sample Number	<u>9</u> 16 17	Bulk Unit Wt (kN/m³) 20 21 21 21 21 21 21 21 21 21 21 21 21 21	Undrained Shear Strength (kPa) Test Type △ Torvane △ Pocket Pen. •			
	CONCRETE - 1	53 mm thick									
	- brown - frozen, mo - intermedia	me clay, some silt, trace oist and soft when thaw ate plasticity	ed	ter)	G110	6					
-0.5-	- brown	ce sand, trace gravel (< 0.6 m, moist and soft whicity	•		G11	7	•				
-1.0-	- stiff below 1.1	m			G118	8					
	- Sun Delow 1.1	""			G119		•	Δ •			
-1.5-					O IZ						
	- firm to stiff belo	ow 1.7 m			G12	1		40			
					G122	2	•				
-2.5											
-1.0- -1.5- -1.5- -2.0- -2.5- -3.0-					G12	3		•			
	Notes: 1) No seepage (2) Test hole bac	ckfilled with auger cutting ated between house #13	gs and bentonite.	theast from			-				
Logged By	r: Dawn Sellick		Reviewed By: Nelson	Ferreira		Project Engir	neer: Nelson Fe	rreira			



Local Streets Package 18-R-05 Sub-Surface Investigation Culross Bay

T411-1-	Test Hole	Paveme	ent Surface	Pavement Str	ucture Material		Sample Depth (m)		n) Moisture	Grain Size Analysis			Atterberg Limits			
No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Subgrade Description	Top (m)	Bottom (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic	Liquid	Plasticity Index
		Asphalt	N/A	Concrete	140											
						SAND (FILL)	0.2	0.3	15							
	UTM: 5530439 N,					CLAY	0.5	0.6	31							
	642393 E					CLAY	0.8	0.9	32	0	2	28	70	23	74	51
TH17-09	Located at House #28 &					CLAY	1.1	1.2	33							
	1.7 m Northest from					CLAY	1.4	1.5	38							
	Southwest curb					CLAY	1.7	1.8	44							
						CLAY	2.0	2.1	42							
						CLAY	2.7	2.9	42							
		Asphalt	76	Concrete	127											
						SAND (FILL)	0.2	0.3	27							
	UTM: 5530457 N,					CLAY	0.5	0.6	35							
	642460 E					CLAY	0.8	0.9	33							
TH17-10	Located at House #19, &					CLAY	1.1	1.2	34							
	1.6 m Southwest from					CLAY	1.4	1.5	44							
	Northeast curb					CLAY	1.7	1.8	47							
						CLAY	2.0	2.1	50							
						CLAY	2.9	3.0	51							
		Asphalt	N/A	Concrete	139											
						SAND (FILL)	0.2	0.3	24							
	UTM: 5530466 N,					CLAY	0.5	0.6	34							
	642520 E					CLAY	0.8	0.9	34	1	4	19	76	25	84	58
TH17-11	Located at House #55, &					CLAY	1.1	1.2	35							
	1.4 m Northeast from					CLAY	1.4	1.5	22							
	Southwest curb					CLAY	1.7	1.8	32							
						CLAY	2.0	2.1	42							
						CLAY	2.9	3.0	45							
		Asphalt	N/A	Concrete	139											
						SAND (FILL)	0.2	0.3	29						1	
	UTM: 5530504 N,					CLAY	0.5	0.6	40						1	
	642546 E					CLAY	0.8	0.9	36							
TH17-12	Located at House #90, &					CLAY	1.1	1.2	38							
	1.0 m Southwest from					CLAY	1.4	1.5	40							
	Northeast curb.					CLAY	1.7	1.8	42							
						CLAY	2.0	2.1	47							
			1			CLAY	2.7	2.9	48							



Local Streets Package 18-R-05 Sub-Surface Investigation Culross Bay

T411-1-		Paveme	ent Surface	Pavement Str	ucture Material		Sample	Depth (m)	Moisture		Grain Siz	e Analysis	5	At	terberg L	imits
Test Hole No.	Test Hole Location	Туре	Thickness (mm)	Туре	Thickness (mm)	Subgrade Description	Top (m)	Bottom (m)	Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic	Liquid	Plasticity Index
		Asphalt	38	Concrete	115											
						SAND (FILL)	0.2	0.3	29							
	UTM: 5530548 N,					CLAY	0.5	0.6	41							
	642519 E					CLAY	0.8	0.9	37							
TH17-13	Located between House #105 and#107, & 1.8 m					CLAY	1.1	1.2	36							
	Northeast from					CLAY	1.4	1.5	38							
	Southwest curb					CLAY	1.7	1.8	42							
						CLAY	2.0	2.1	48							
						CLAY	2.9	3.0	49							
		Asphalt	N/A	Concrete	153											
						CLAY (FILL)	0.2	0.3	41							
	UTM: 5530538 N,					CLAY	0.5	0.6	37							
	642440 E					CLAY	0.8	0.9	35							
TH17-14						CLAY	1.1	1.2	37							
	& 1.9 m Southwest from					CLAY	1.4	1.5	34							
	Northeast curb					CLAY	1.7	1.8	42							
						CLAY	2.0	2.1	45							
						CLAY	2.9	3.0	52							
		Asphalt	N/A	Concrete	153							%Fines				
						SAND (FILL)	0.2	0.3	26	3	63	34				
	UTM: 5530509 N,					CLAY	0.5	0.6	38							
	642367 E					CLAY	0.8	0.9	29							
TH17-15	Located between House #137 and #141, & 1.1 m					CLAY	1.1	1.2	35							
	Northeast from					CLAY	1.3	1.5	41							
	Southwest curb					CLAY	1.7	1.8	43							
						CLAY	2.0	2.1	49							
						CLAY	2.9	3.0	50							
1																



Project Local Streets 18-R-05 Culross Bay

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%



Project Local Streets 18-R-05 Culross Bay

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 Local Streets 18-R-05 Culross Bay

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%



Project No. 0035-057-00

Client Morrison Hershfield

Project Local Streets 18-R-05 Culross Bay

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%		



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

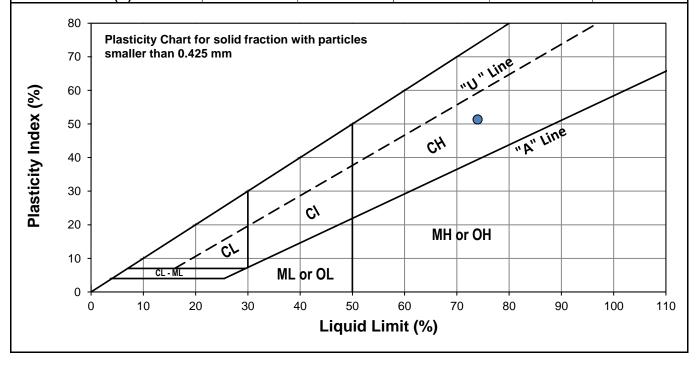
 Test Date
 7-Jan-18

 Technician
 DS

Liquid Limit 74
Plastic Limit 23
Plasticity Index 51

Liquid Limit

Liquid Littit				
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			

Project No. 0035-057-00

Client Morrision 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

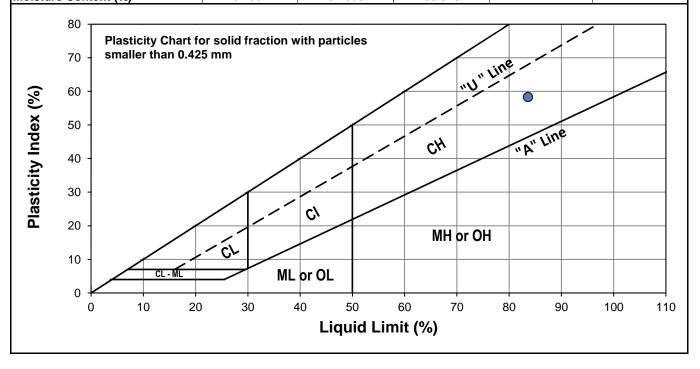
 Test Date
 7-Jan-18

 Technician
 JB

Liquid Limit	84
Plastic Limit	25
Plasticity Index	58

Liquid Limit

<u> Liquia Liiriit</u>				
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 Local Streets 18-R-03 Culross Bay

 Test Hole
 TH17-09

 Sample #
 G70

 Depth (m)
 0.8 - 0.9

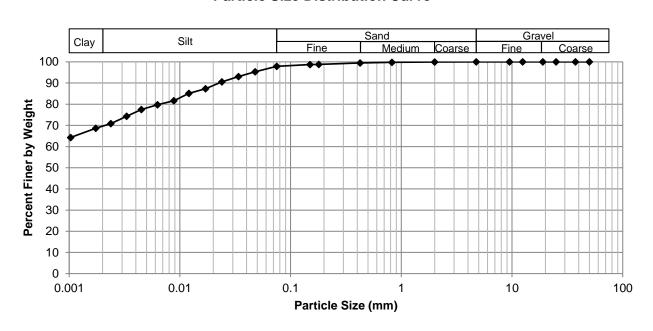
 Sample Date
 21-Dec-17

 Test Date
 5-Jan-18

 Technician
 LI/DS

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

Particle Size Distribution Curve



Gravel		Sa	and	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 Local Streets 18-R-03 Culross Bay

 Test Hole
 TH17-11

 Sample #
 G86

 Depth (m)
 0.8 - 0.9

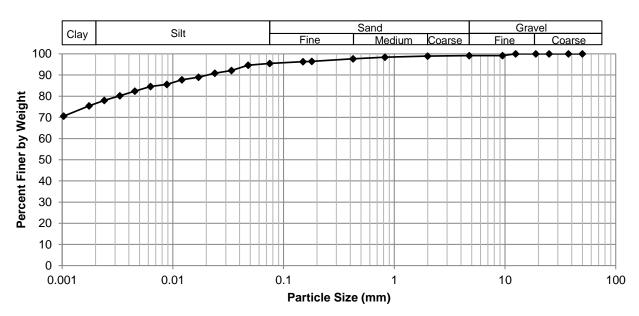
 Sample Date
 22-Dec-17

 Test Date
 5-Jan-18

 Technician
 LI/DS

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

Particle Size Distribution Curve



Gravel		Sa	ınd	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



Project Local Streets 18-R-03 Culross Bay

 Test Hole
 TH17-15

 Sample #
 G116

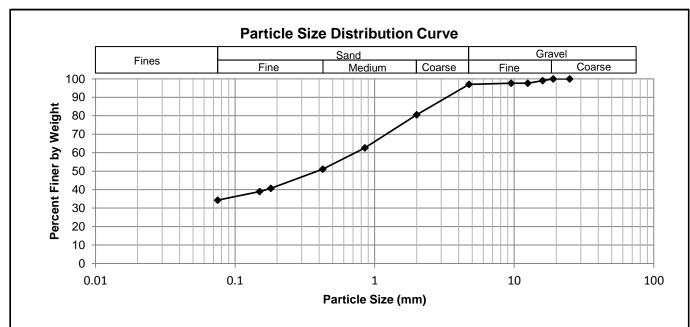
 Depth (m)
 0.5 - 1.0

 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