

APPENDIX 'A'

GEOTECHNICAL REPORT



Quality Engineering | Valued Relationships

WSP Canada Group Ltd
2018 Local Improvement Package 18-LI-02

Prepared for:

WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B
Attention: Marcus Wong

Project Number:

0395 005 00

Date:

July 6, 2018
Final Report



Quality Engineering | Valued Relationships

July 6, 2018

Our File No. 0395 005 00

Mr. Richard Hawkins, C.E.T.
WSP Canada Group Ltd.
111-93 Lombard Avenue
Winnipeg, Manitoba, R3B 3B1

**RE: Sub-Surface Investigation Report for
2018 Local Improvement Package 18-LI-02**

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 2018 Local Improvement Package 18-LI-02.

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

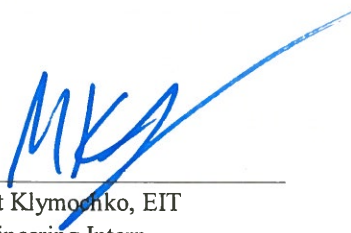
cc: Angela Fidler-Kliwer C.Tech. (TREK Geotechnical)

Revision History

Revision No.	Author	Issue Date	Description
0	MK	July 6, 2018	Final Report

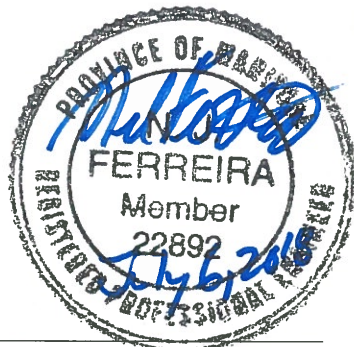
Authorization Signatures

Prepared By:



Matt Klymochko, EIT
Engineering Intern

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 road investigation completed for the 2018 Local Street Package 18-LI-02 project. The test holes were located within the alleys of Claremont Avenue, Monck Avenue, Ferndale Avenue, Birchdale Avenue, Lawndale Avenue, Linden Avenue, Greene Avenue, Crawford Avenue, Chandos Avenue, Dumoulin Street and Provencher Boulevard. The information collected describes the sand and gravel structure of the existing road as well as the soil stratigraphy beneath the pavement structure at select locations. The road structure along the alleys consists of sand and gravel with no surface pavements (asphalt or concrete) except for two test locations which consisted of about 50 mm of asphalt.

2.0 Road Investigation and Laboratory Program

The investigation consisted of drilling 28 test holes along back alleys that are to be upgraded as part of the *Thin Bituminous Overlay Program and Asphalt Alley Local Improvements Project*. WSP selected the investigation locations as shown on Figure 01 to Figure 06 (attached). Table 01 below summarizes the investigation program for each street.

Table 01: Road Investigation Program

Local Alley	# of Locations	Investigation
Claremont Avenue / Monck Avenue – Coniston Street to Lyndale Drive	6	Test Holes
Ferndale Avenue / Claremont Avenue – Coniston Street to Lyndale Drive	7	Test Holes
Birchdale Avenue / Lawndale Avenue – Walmer Street to Kirkdale Street	5	Test Holes
Kildonan Drive – Greene Avenue to Lyndale Drive	3	Test Holes
Crawford Avenue / Chandos Avenue – Highfield Street to Coniston Street	4	Test Holes
Dumoulin Street / Provencher Boulevard – Fleche Street to Nadeau Street	3	Test Holes

The road investigation was conducted between June 8th, 2018 and June 20th, 2018. The road structure (compacted sand and gravel) and underlying soil were drilled by TREK Geotechnical Inc (TREK) staff using a 50 mm diameter hand auger. At test holes (TH18-03 and TH18-22), the pavement structure (asphalt) 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 TREK staff. 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 at pre-determined depths of 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m and 1.6 m were transported to TREK's material testing laboratory for further testing.

The laboratory testing program consisted of moisture content determination on all samples, as well as 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 to F). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results. Photos of asphalt cores collected are provided in Appendix G.

Core and test hole locations noted on the summary tables and test hole logs are based on UTM coordinates obtained using a hand-held GPS and 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 WSP Canada Group Inc. (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 2018-06-29 Local Improve Pack 18-LI-02.0 A SL 0395 005 00 2018.dwg, 7/5/2018 4:09:50 PM



KEYPLAN
SCALE N.T.S.

0 25 50 75 100 m
SCALE = 1 : 2 000 (216 mm x 279 mm)

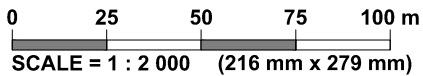
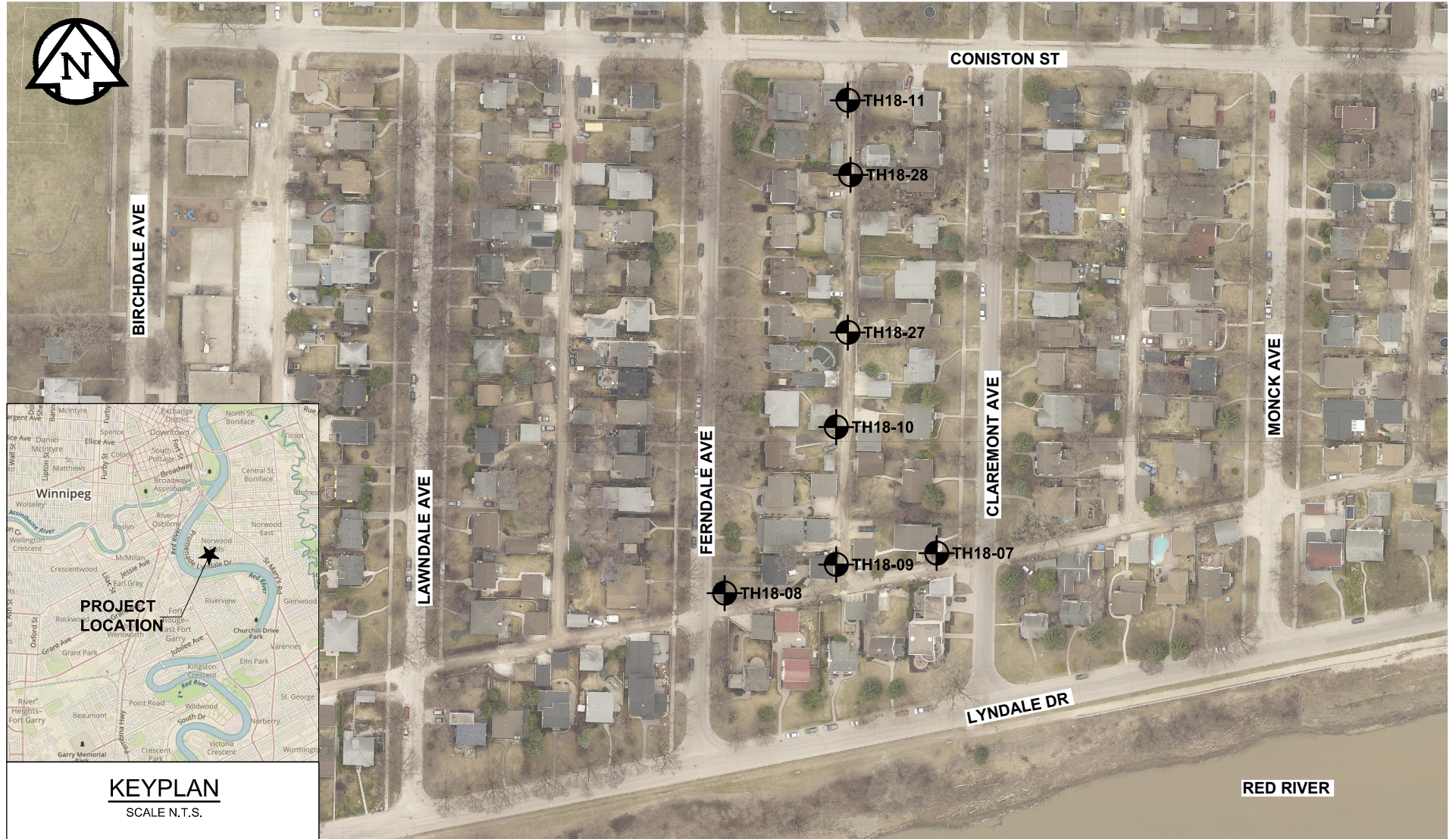
LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM CITY OF WINNIPEG, 2016

Figure 01
Test Hole Location Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-06-29 Local Improve Pack 18-LI-02.0 - A - SI_0395 005 00 2018.dwg, 7/5/2018 4:10:30 PM



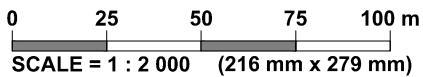
LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM CITY OF WINNIPEG, 2016

Figure 02
Test Hole Location Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-06-29 Local Improve Pack 18-LI-02.0 A SL 0395 005 00 2018.dwg 7/5/2018 4:11:08 PM



LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM CITY OF WINNIPEG, 2016

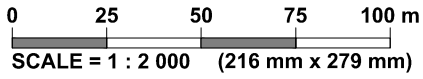
Figure 03
Test Hole Location Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-06-29 Local Improve Pack 18-LI-02 0 A SL 0395 005 00 2018.dwg, 7/5/2018 4:11:46 PM



KEYPLAN
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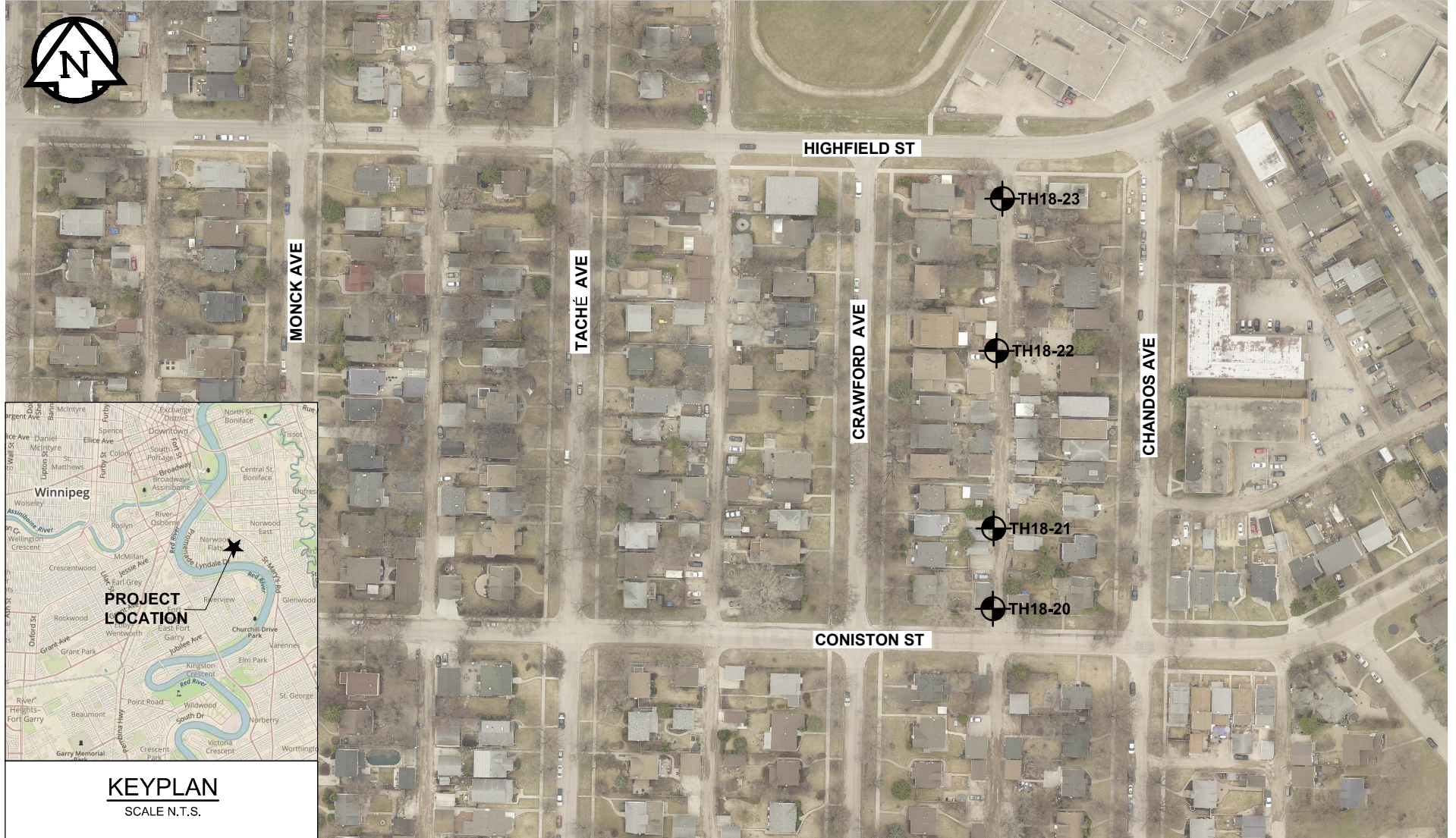
LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM CITY OF WINNIPEG, 2016

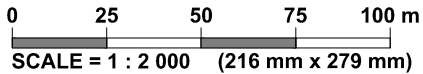
Figure 04
Test Hole Location Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-06-29 Local Improve Pack 18-LI-02.0 A_S1_0395 005 00 2018.dwg, 7/5/2018 4:12:33 PM



KEYPLAN
SCALE N.T.S.



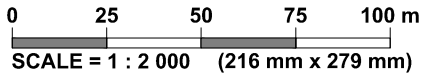
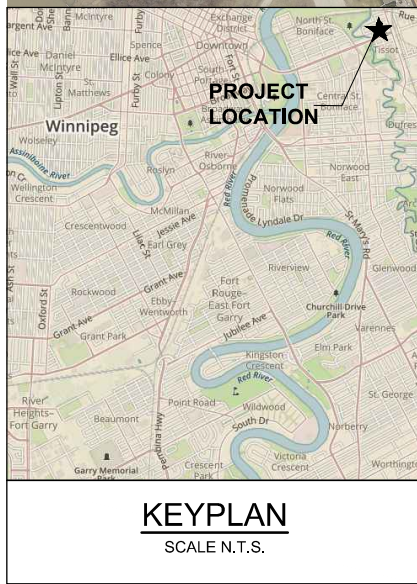
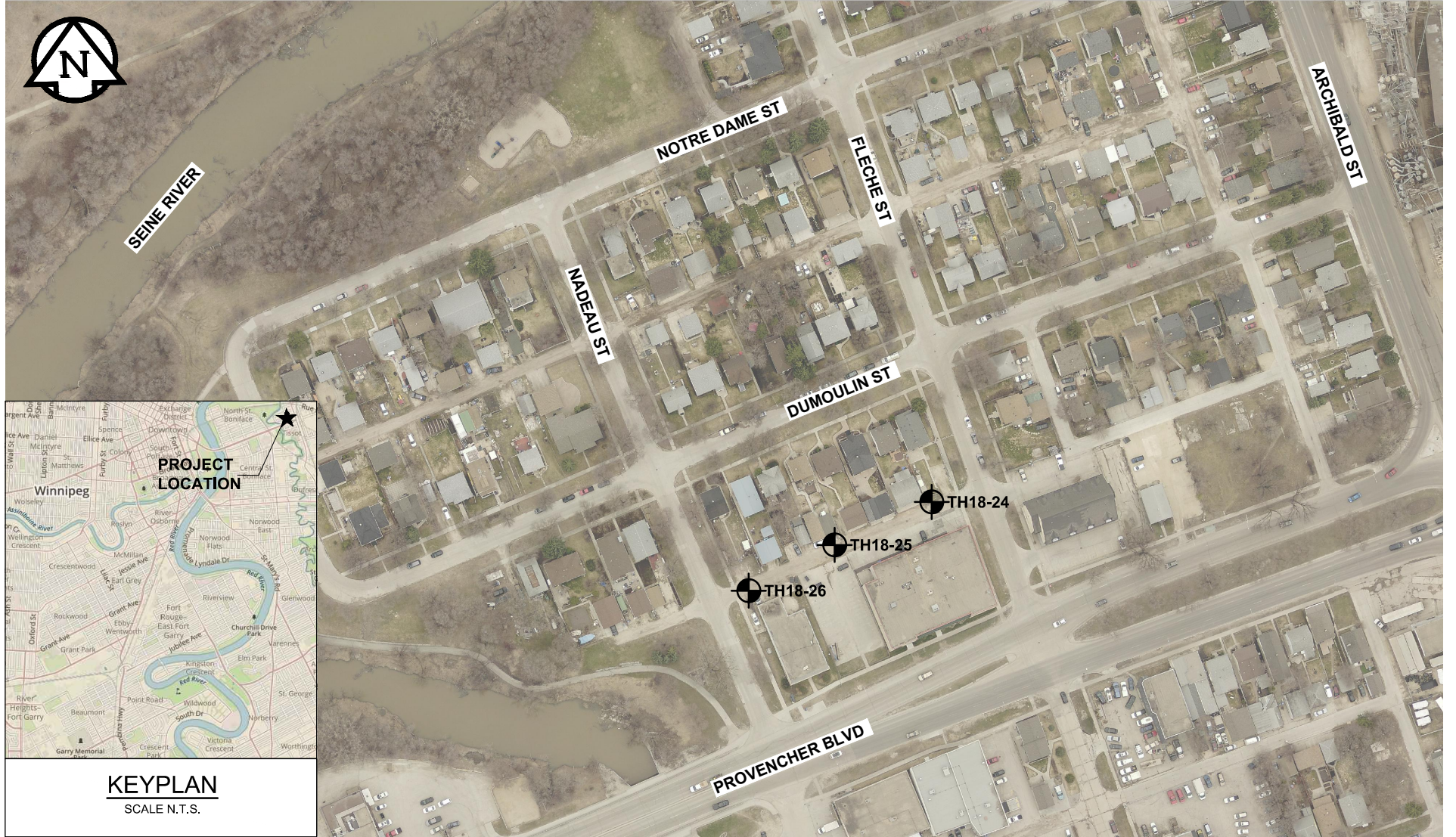
LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM CITY OF WINNIPEG, 2016

Figure 05
Test Hole Location Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-06-29 Local Improve Pack 18-LI-02 0_A_S1_0395 005 00 2018.dwg 7/5/2018 4:13:10 PM



LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM CITY OF WINNIPEG, 2016

Figure 06
Test Hole Location Plan

Appendix A

Claremont Avenue / Monck Avenue

Test Hole Logs, Summary Table, Lab Data

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 Incliner	

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 TH18-01

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Claremont / Monck) Location: UTM N-5526113, E-634651
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"		G01													
0.2 - 0.9		SILT and CLAY (Topsoil) - trace rootlets, trace oxidation - black - moist, very stiff - high plasticity		G02													
0.9 - 1.0		- some silt inclusions (< 20 mm diam.) below 0.9 m		G03													
1.0 - 1.5		SILT - clayey, trace organics - light brown - moist, firm - intermediate plasticity		G04													
1.5 - 2.0		CLAY - silty, trace silt inclusions (< 10 mm diam.) - grey - moist, very stiff - high plasticity		G05													
2.0 - 2.4				G06													
2.4 - 2.4				G07													

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located 5 m east of east curb on Claremont Avenue along eastbound lane behind 485 Lyndale Drive.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS 2018-06-12 LOCAL IMPROVEMENT MONCK_B_MK_0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/17/18



Sub-Surface Log

Test Hole TH18-02

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Claremont / Monck) Location: UTM N-5526128, E-634723
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"	▲	G08								
0.2 - 0.4		SILT and CLAY (Topsoil) - some rootlets, trace gravel - black - moist, stiff - high plasticity	▲	G09								
0.4 - 0.9		CLAY - silty, trace silt inclusions - dark grey - moist, stiff - high plasticity - some silt inclusions (< 5 mm diam.) below 0.9 m	▲	G10								
0.9 - 1.3		- very stiff below 1.3 m	▲	G11								
1.3 - 1.9		SILT - clayey, trace organics - light brown - moist, firm - intermediate plasticity - moist to wet below 1.9 m	▲	G12								
1.9 - 2.4		CLAY - silty, trace silt inclusions (< 15 mm diam.) - grey - moist, stiff to very stiff - high plasticity	▲	G13								
2.4 - 2.4			▲	G14								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located 8.6 m west of west curb on Monck Avenue along eastbound lane behind 503 Lyndale Drive.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT MONCK_B_MK_0395 005 00.GPJ TREK GEOTECHNICAL GDT 5/17/18



Sub-Surface Log

Test Hole TH18-03

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Claremont / Monck) Location: UTM N-5526135, E-634694
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0		ASPHALT - 40 mm thick										
0.0		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"		G15								
0.2		SILT and CLAY (Topsoil) - some rootlets, trace sand - black - moist, firm to stiff - high plasticity		G16								
0.8		SILT - clayey, trace organics - light brown - moist, firm - intermediate plasticity		G17								
1.0		SILT - clayey, trace organics - light brown - moist, firm - intermediate plasticity		G18								
1.2		- soft to firm below 1.2 m		G19								
1.5		- soft to firm below 1.2 m		G20								
2.0		CLAY - silty, trace to some silt inclusions (< 25 mm diam.) - grey - moist, stiff - high plasticity		G21								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located in northbound lane behind 39 Monck Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT MONCK_B_MK_0395 005 00.GPJ TREK GEOTECHNICAL GDT 5/7/18



Sub-Surface Log

Test Hole TH18-04

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Claremont / Monck) Location: UTM N-5526180, E-634693
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"		G22								
0.2 - 0.8		SILT and CLAY (Topsoil) - some rootlets, trace fine sand, trace oxidation - black - moist, stiff - high plasticity		G23								
0.8 - 1.0		CLAY - silty, trace fine sand - grey - moist, stiff - high plasticity - trace silt inclusions (< 5 mm diam.) below 1.0 m		G24								
1.0 - 1.4		SILT - clayey, trace organics - light brown - moist, firm - intermediate plasticity - frozen below 1.4 m, moist and firm when thawed		G25								
1.4 - 1.8				G26								
1.8 - 2.0				G27								

END OF TEST HOLE AT 1.8 m DEPTH IN SILT

Notes:

1. Hand auger refusal at 1.8 m depth.
2. No seepage or sloughing observed.
3. Test hole open to 1.8 m after drilling.
4. Test hole backfilled with auger cuttings, sand and gravel at surface.
5. Test hole located in northbound lane behind 47 Monck Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT MONCK_B_MK 0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/17/18



Sub-Surface Log

Test Hole TH18-05

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Claremont / Monck) Location: UTM N-5526228, E-634698
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"	▲	G28													
0.2 - 0.4		SILT and CLAY (Topsoil) - sandy, some rootlets, trace gravel - black - moist, firm to stiff - high plasticity	▲	G29													
0.4 - 0.7		CLAY - silty - grey - moist, stiff - high plasticity	▲	G30								▲					
0.7 - 1.0		SILT - clayey - light brown - moist, firm - intermediate plasticity	▲	G31													
1.0 - 1.5		- soft and wet below 1.2 m CLAY - silty - grey - moist, stiff to very stiff - high plasticity	▲	G32													
1.5 - 2.1			▲	G33								▲					
2.1 - 2.4		- trace silt inclusions (< 25 mm diam.) below 2.1 m	▲	G34								▲					

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

- Notes:
1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4. Test hole located in northbound lane behind 59 and 63 Monck Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT MONCK_B_MK_0395 005 00.GPJ TREK GEOTECHNICAL GDT 5/17/18



Sub-Surface Log

Test Hole TH18-06

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Claremont / Monck) Location: UTM N-5526273, E-634697
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"		G35													
0.2 - 0.5		CLAY - silty, trace organics - dark grey - moist, stiff - high plasticity		G36													
0.5 - 0.8		SILT - some clay - light brown - moist, firm - intermediate plasticity - moist to wet and soft below 0.8 m		G37													
0.8 - 1.3		CLAY - silty - grey - moist, very stiff - high plasticity		G38													
1.3 - 1.6		- some silt inclusions (< 20 mm diam.) below 1.3 m		G39													
1.6 - 2.2		- very stiff to hard below 1.6 m		G40													
2.2 - 2.4		- firm to stiff below 2.2 m		G41													

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located 6 m south of south curb on Coniston Street along northbound lane behind 71 Monck Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT MONCK_B_MK_0395 005 00.GPJ TREK GEOTECHNICAL GDT 5/7/18



Local Improvement Package 18-LI-02
Sub-Surface Investigation
Claremont Avenue / Monck Avenue

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH18-01	UTM: 5526113 N, 634651 E Located 5 m east of east curb on Claremont Avenue along eastbound lane behind 485 Lyndale Drive	N/A	N/A	N/A	N/A	Sand and Gravel (Fill)	0.1	0.2	8							
						Silt and Clay (Topsoil)	0.4	0.5	31							
						Silt and Clay (Topsoil)	0.7	0.9	30							
						Silt	1.0	1.2	20	43	55	2		15	51	36
						Silt	1.3	1.5	15							
						Clay	1.6	1.8	36							
						Clay	2.2	2.4	42							
TH18-02	UTM: 5526128 N, 634723 E Located 8.6 m west of west curb on Monck Avenue along eastbound lane behind 503 Lyndale Drive	N/A	N/A	N/A	N/A	Sand and Gravel (Fill)	0.1	0.2	5		9	54	37			
						Silt and Clay (Topsoil)	0.4	0.5	29							
						Clay	0.7	0.9	35							
						Clay	1.0	1.2	32							
						Clay	1.3	1.5	30							
						Silt	1.6	1.8	28							
						Clay	2.2	2.4	40							
TH18-03	UTM: 5526135 N, 634694 E Located in northbound lane behind 39 Monck Avenue	Asphalt	40	N/A	N/A	Sand and Gravel (Fill)	0.1	0.2	9							
						Silt and Clay (Topsoil)	0.4	0.5	32							
						Silt and Clay (Topsoil)	0.7	0.9	31	51	46	3		20	62	42
						Silt	1.0	1.2	28							
						Silt	1.3	1.5	22							
						Silt	1.6	1.8	24							
						Clay	2.2	2.4	41							



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Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Claremont / monck

Sample Date 8-Jun-18
Test Date 14-Jun-18
Technician NM

Test Pit	TH8-01	TH18-01	TH18-01	TH18-01	TH18-01	TH18-01
Depth (m)	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	P30	N23	H77	D8	AB08	P06
Mass of tare	8.4	8.6	8.4	8.4	6.8	8.6
Mass wet + tare	279.0	211.8	249.6	182.6	270.8	203.6
Mass dry + tare	260.0	164.0	193.8	153.2	236.4	152.4
Mass water	19.0	47.8	55.8	29.4	34.4	51.2
Mass dry soil	251.6	155.4	185.4	144.8	229.6	143.8
Moisture %	7.6%	30.8%	30.1%	20.3%	15.0%	35.6%

Test Pit	TH18-01	TH18-02	TH18-02	TH18-02	TH18-02	TH18-02
Depth (m)	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	Z54	W09	F3	AC31	N08	Z11
Mass of tare	8.4	8.8	8.4	6.6	8.4	8.4
Mass wet + tare	225.8	304.2	189.6	253	277	150.4
Mass dry + tare	161.6	290.4	149.2	189.6	211.8	118.0
Mass water	64.2	13.8	40.4	63.4	65.2	32.4
Mass dry soil	153.2	281.6	140.8	183.0	203.4	109.6
Moisture %	41.9%	4.9%	28.7%	34.6%	32.1%	29.6%

Test Pit	TH18-02	TH18-02	TH18-03	TH18-03	TH18-03	TH18-03
Depth (m)	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G13	G14	G15	G16	G17	G18
Tare ID	AC20	AB82	AB11	F9	E62	F18
Mass of tare	7.0	6.6	6.6	9.0	8.4	8.4
Mass wet + tare	226.4	236.0	291.8	174.8	216.6	237.0
Mass dry + tare	178.0	170.4	268.4	134.4	168.0	187.2
Mass water	48.4	65.6	23.4	40.4	48.6	49.8
Mass dry soil	171.0	163.8	261.8	125.4	159.6	178.8
Moisture %	28.3%	40.0%	8.9%	32.2%	30.5%	27.9%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Claremont / monck

Sample Date 8-Jun-18
Test Date 14-Jun-18
Technician NM

Test Pit	TH18-03	TH18-03	TH18-03	TH18-04	TH18-04	TH18-04
Depth (m)	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9
Sample #	G19	G20	G21	G22	G23	G24
Tare ID	F110	F5	AC07	H52	H56	EA2
Mass of tare	8.4	8.8	6.8	8.8	8.6	8.4
Mass wet + tare	246.6	209.0	237.2	268.8	181.4	225.2
Mass dry + tare	204.2	170.4	170.4	261.2	138.6	169.0
Mass water	42.4	38.6	66.8	7.6	42.8	56.2
Mass dry soil	195.8	161.6	163.6	252.4	130.0	160.6
Moisture %	21.7%	23.9%	40.8%	3.0%	32.9%	35.0%

Test Pit	TH18-04	TH18-04	TH18-04	TH18-05	TH18-05	TH18-05
Depth (m)	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9
Sample #	G25	G26	G27	G28	G29	G30
Tare ID	Z82	K13	F81	N93	D42	F151
Mass of tare	8.2	8.6	8.6	8.6	8.6	8.6
Mass wet + tare	192.6	215.0	212.2	246.8	230.4	203.0
Mass dry + tare	142.6	163.4	171.6	235.4	179.6	150.0
Mass water	50.0	51.6	40.6	11.4	50.8	53.0
Mass dry soil	134.4	154.8	163.0	226.8	171.0	141.4
Moisture %	37.2%	33.3%	24.9%	5.0%	29.7%	37.5%

Test Pit	TH18-05	TH18-05	TH18-05	TH18-05	TH18-06	TH18-06
Depth (m)	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5
Sample #	G31	G32	G33	G34	G35	G36
Tare ID	D45	E68	E108	H4	Z34	W104
Mass of tare	8.6	8.4	8.4	8.6	8.8	8.6
Mass wet + tare	216.6	168.2	229.0	251.4	228.8	251.6
Mass dry + tare	166.6	131.0	170.0	178.4	221.0	194.0
Mass water	50.0	37.2	59.0	73.0	7.8	57.6
Mass dry soil	158.0	122.6	161.6	169.8	212.2	185.4
Moisture %	31.6%	30.3%	36.5%	43.0%	3.7%	31.1%



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Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Claremont / monck

Sample Date 8-Jun-18
Test Date 14-Jun-18
Technician NM

Test Pit	TH18-06	TH18-06	TH18-06	TH18-06	TH18-06	
Depth (m)	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	
Sample #	G37	G38	G39	G40	G41	
Tare ID	N76	C25	K15	E33	F131	
Mass of tare	8.6	8.4	8.6	8.6	8.4	
Mass wet + tare	323.4	204.0	247.4	253.2	220.0	
Mass dry + tare	257.6	154.8	182.0	191.2	153.4	
Mass water	65.8	49.2	65.4	62.0	66.6	
Mass dry soil	249.0	146.4	173.4	182.6	145.0	
Moisture %	26.4%	33.6%	37.7%	34.0%	45.9%	



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Atterberg Limits
ASTM D4318-10e1

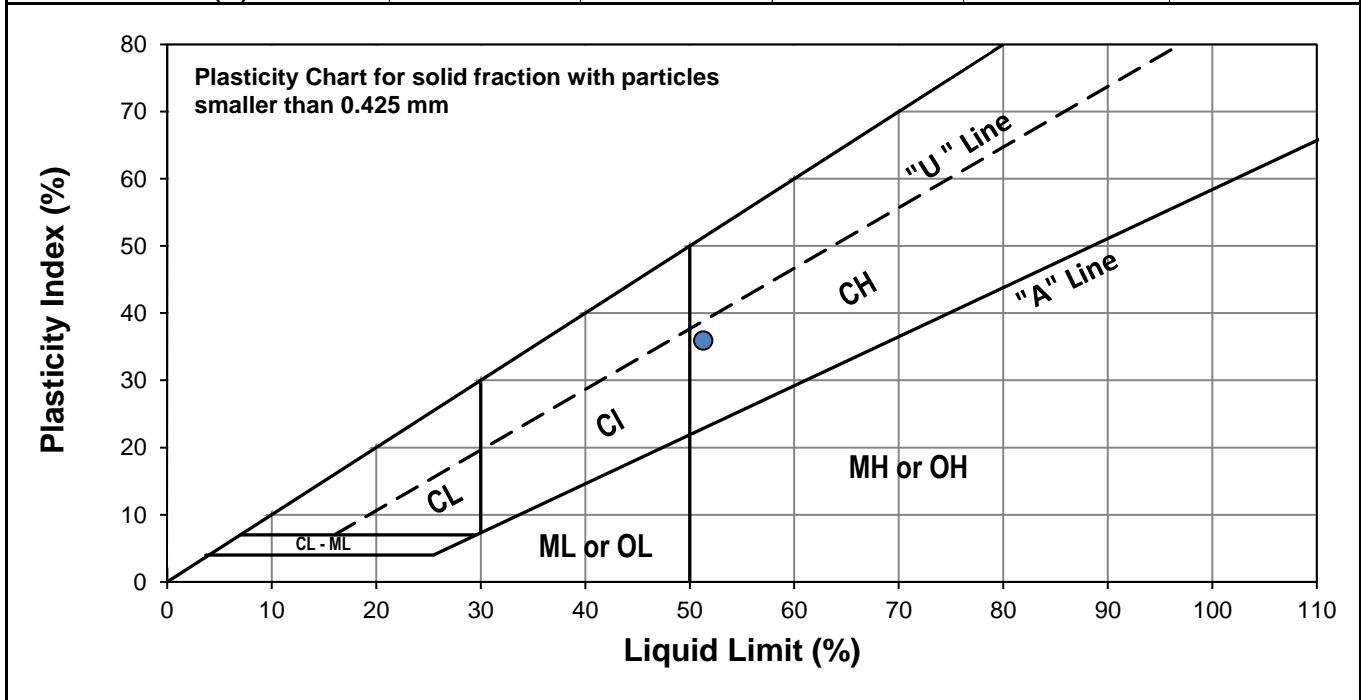
Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Monck

Test Hole TH18-01
Sample # G04
Depth (m) 1.0 - 1.2
Sample Date 8-Jun-18
Test Date 3-Jul-18
Technician NM

Liquid Limit	51
Plastic Limit	15
Plasticity Index	36

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	19	29	34		
Mass Wet Soil + Tare (g)	27.439	27.905	25.700		
Mass Dry Soil + Tare (g)	22.830	23.338	21.962		
Mass Tare (g)	14.181	14.276	14.312		
Mass Water (g)	4.609	4.567	3.738		
Mass Dry Soil (g)	8.649	9.062	7.650		
Moisture Content (%)	53.289	50.397	48.863		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.694	20.162			
Mass Wet Soil + Tare (g)	19.841	19.373			
Mass Dry Soil + Tare (g)	14.209	14.321			
Mass Water (g)	0.853	0.789			
Mass Dry Soil (g)	5.632	5.052			
Moisture Content (%)	15.146	15.618			



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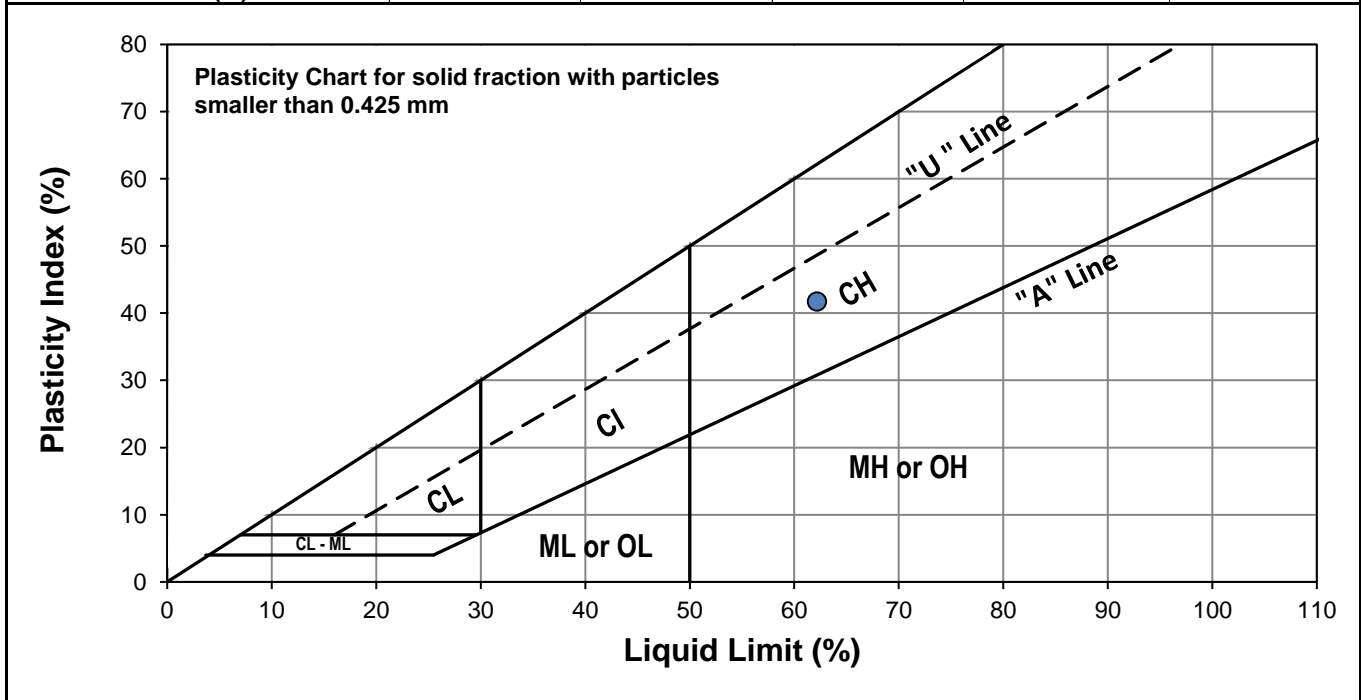
Project No. 0395-005-00
Client wsp Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Monck

Test Hole TH18-03
Sample # G17
Depth (m) 0.7 - 0.9
Sample Date 8-Jun-18
Test Date 22-Jun-18
Technician NM

Liquid Limit	62
Plastic Limit	20
Plasticity Index	42

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	27	34		
Mass Wet Soil + Tare (g)	33.337	30.209	36.168		
Mass Dry Soil + Tare (g)	25.770	24.135	27.977		
Mass Tare (g)	14.155	14.263	14.170		
Mass Water (g)	7.567	6.074	8.191		
Mass Dry Soil (g)	11.615	9.872	13.807		
Moisture Content (%)	65.149	61.528	59.325		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.024	20.460			
Mass Wet Soil + Tare (g)	19.021	19.402			
Mass Dry Soil + Tare (g)	14.193	14.152			
Mass Water (g)	1.003	1.058			
Mass Dry Soil (g)	4.828	5.250			
Moisture Content (%)	20.775	20.152			



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Atterberg Limits
ASTM D4318-10e1

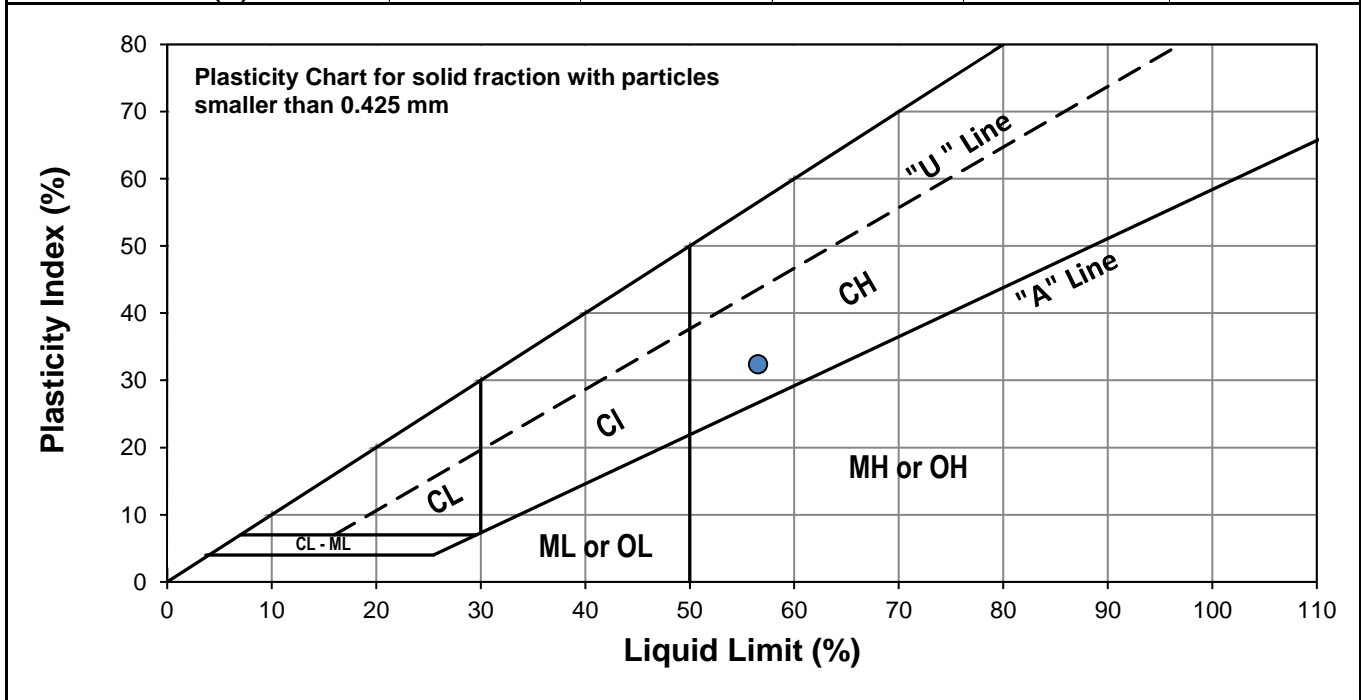
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 Claremont / Monck

Test Hole TH18-05
Sample # G29
Depth (m) 0.4 - 0.5
Sample Date 8-Jun-18
Test Date 28-Jun-18
Technician NM

Liquid Limit	57
Plastic Limit	24
Plasticity Index	32

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	23	34		
Mass Wet Soil + Tare (g)	33.262	29.501	27.716		
Mass Dry Soil + Tare (g)	26.024	23.943	22.977		
Mass Tare (g)	13.936	14.208	14.148		
Mass Water (g)	7.238	5.558	4.739		
Mass Dry Soil (g)	12.088	9.735	8.829		
Moisture Content (%)	59.878	57.093	53.675		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.006	20.761			
Mass Wet Soil + Tare (g)	19.654	19.473			
Mass Dry Soil + Tare (g)	14.031	14.179			
Mass Water (g)	1.352	1.288			
Mass Dry Soil (g)	5.623	5.294			
Moisture Content (%)	24.044	24.329			



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Grain Size Analysis (Sieve Method)

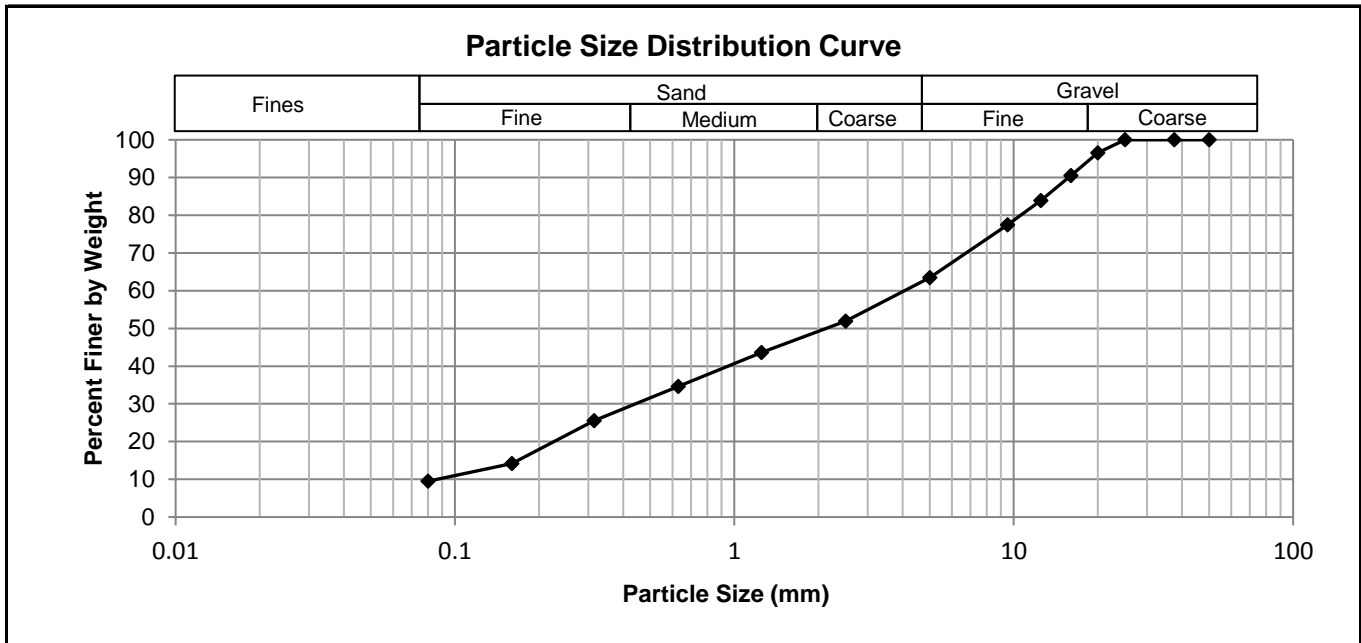
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Monck

Sample # G08
Source In situ
Soil Desc. Sand and Gravel
Date Sampled 15-Jun-18
Date Tested 20-Jun-18
Technician NM

Total Weight (kg)	24.71
Cobbles %	0.0
Gravel %	36.5
Sand %	54.0
Fines %	9.5



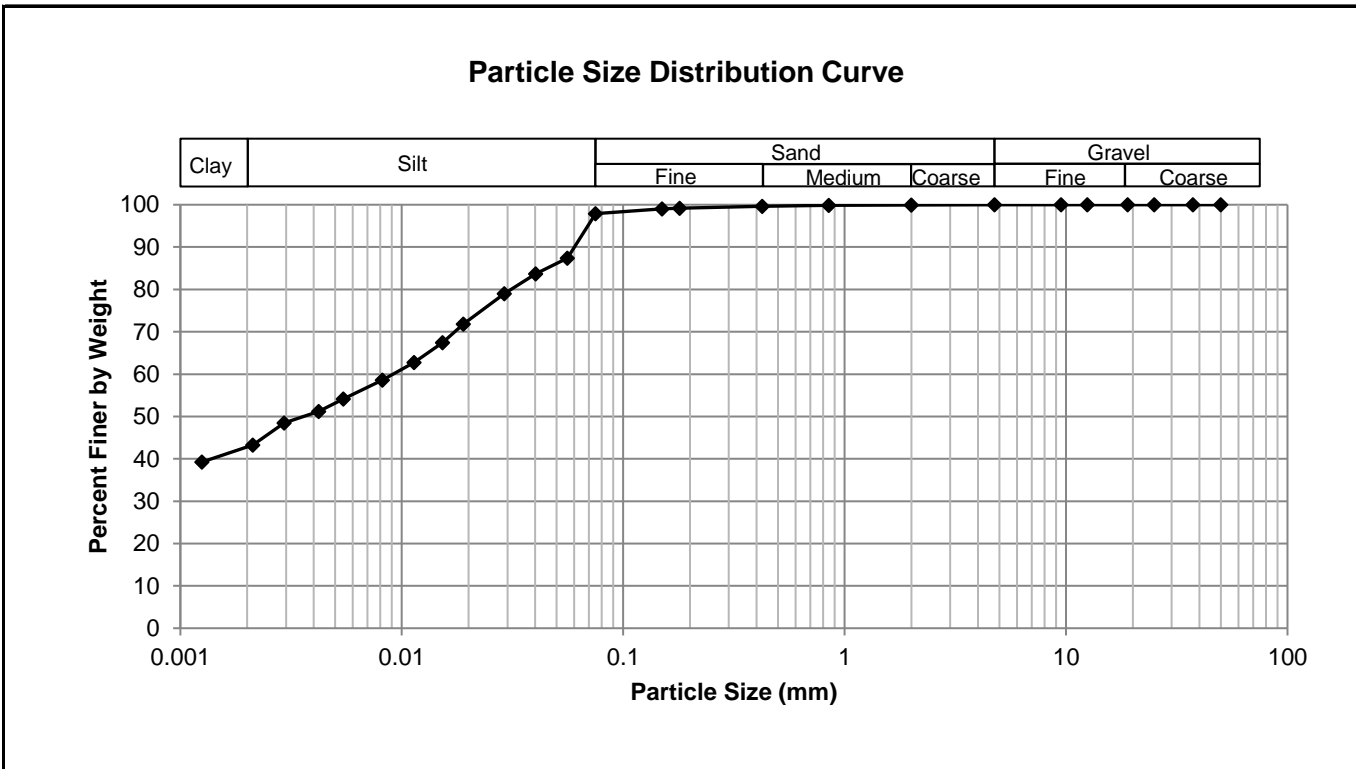
Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
25.0	100	-
20.0	97	-
12.5	84	-
9.5	77	-
5.00	63	-
2.50	52	-
1.25	44	-
0.630	35	-
0.315	26	-
0.160	14	-
0.080	9.5	-



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 Claremont / Monck

Test Hole TH18-01
Sample # G04
Depth (m) 1.0 - 1.1
Sample Date 8-Jun-18
Test Date 2-Jul-18
Technician NM

Gravel	0.0%
Sand	2.1%
Silt	55.2%
Clay	42.7%



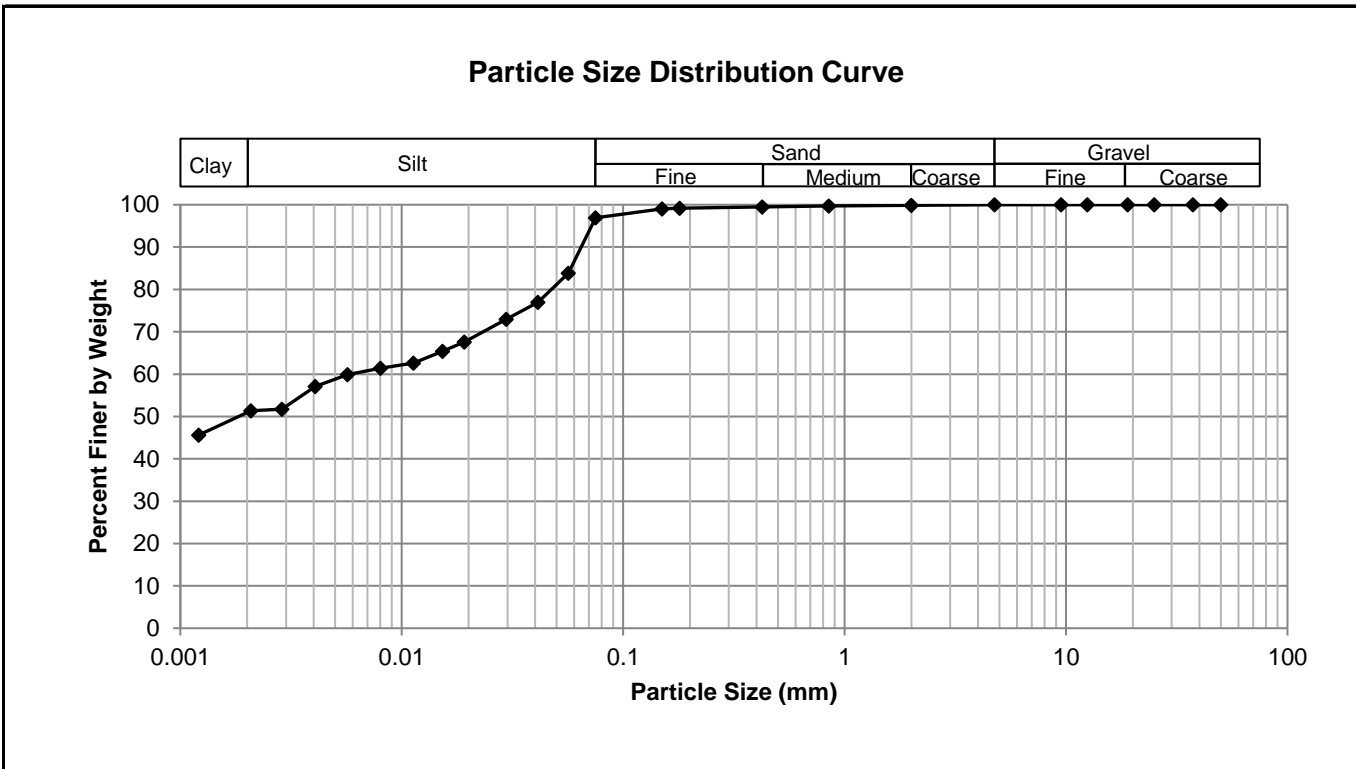
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.86
37.5	100.00	2.00	99.96	0.0560	87.42
25.0	100.00	0.850	99.87	0.0403	83.67
19.0	100.00	0.425	99.67	0.0291	78.98
12.5	100.00	0.180	99.15	0.0190	71.79
9.50	100.00	0.150	99.04	0.0153	67.41
4.75	100.00	0.075	97.86	0.0114	62.73
				0.0082	58.61
				0.0054	54.18
				0.0042	51.20
				0.0029	48.50
				0.0021	43.27
				0.0013	39.25



Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Monck

Test Hole TH18-03
Sample # G17
Depth (m) 0.7 - 0.9
Sample Date 8-Jun-18
Test Date 3-Jul-18
Technician NM

Gravel	0.0%
Sand	3.1%
Silt	46.1%
Clay	50.8%



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	96.93
37.5	100.00	2.00	99.86	0.0566	83.85
25.0	100.00	0.850	99.70	0.0412	76.98
19.0	100.00	0.425	99.46	0.0297	72.92
12.5	100.00	0.180	99.15	0.0192	67.62
9.50	100.00	0.150	99.03	0.0153	65.43
4.75	100.00	0.075	96.93	0.0113	62.62
				0.0080	61.43
				0.0057	59.92
				0.0041	57.06
				0.0029	51.75
				0.0021	51.38
				0.0012	45.63



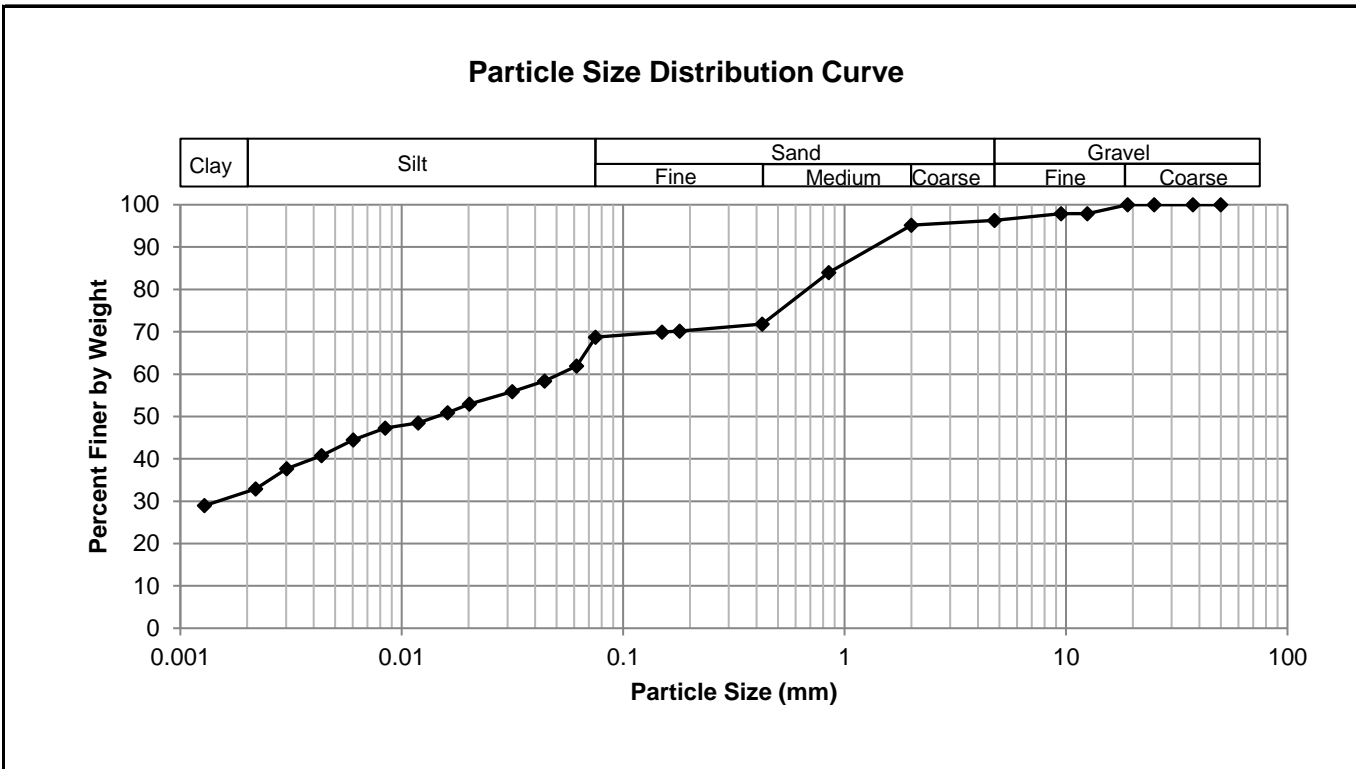
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Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Monck

Test Hole TH18-05
Sample # G29
Depth (m) 0.4 - 0.5
Sample Date 8-Jun-18
Test Date 2-Jul-18
Technician NM

Gravel	3.7%
Sand	27.6%
Silt	36.7%
Clay	32.1%



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	96.34	0.0750	68.76
37.5	100.00	2.00	95.19	0.0617	61.94
25.0	100.00	0.850	84.02	0.0443	58.37
19.0	100.00	0.425	71.82	0.0316	55.92
12.5	97.88	0.180	70.16	0.0202	52.94
9.50	97.88	0.150	69.94	0.0161	50.86
4.75	96.34	0.075	68.76	0.0119	48.48
				0.0084	47.29
				0.0060	44.47
				0.0043	40.75
				0.0030	37.69
				0.0022	32.88
				0.0013	28.96

Appendix B

Ferndale Avenue / Claremont Avenue

Test Hole Logs, Summary Table, Lab Data

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	Material Sand Coarse Medium Fine Silt or Clay			
			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		Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19
						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		Material Boulders Cobbles Gravel Coarse Fine						
	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								
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 Incliner	

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 TH18-07

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526111, E-634628
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	Test Type
							16	17	18	19		
0.0 - 0.4		SAND and GRAVEL (Fill) - trace clay, trace to some silt - brown, dry, compact - well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"	▲	G42								
0.4 - 0.6		SAND (Fill) - trace clay, trace gravel - brown - dry to moist, loose to compact - well graded fine sand to fine gravel	▲	G43								
0.6 - 0.8			▲	G44								
0.8 - 1.0			▲	G45								
1.0 - 1.2			▲	G46								
1.2 - 1.5		SILT - some sand, some clay - light brown - moist, soft to firm - low to intermediate plasticity	▲	G47								
1.5 - 2.0		CLAY - silty, trace to some silt inclusions (< 20 mm diam.) - grey - moist, stiff - high plasticity	▲	G48								△

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

- No seepage observed.
- Caving from sand layer observed from 0.6 to 1.5 m.
- Test hole open to 2.4 m after drilling.
- Test hole backfilled with auger cuttings, sand and gravel at surface.
- Test hole located 8 m west of west curb on Claremont Avenue along westbound lane behind 475 Lyndale Drive.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E_B_MK 0395 005 00 GPJ_TREK GEOTECHNICAL_GDT_5/7/18



Sub-Surface Log

Test Hole TH18-08

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526097, E-634554
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace to some silt - brown, dry, compact - well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"		G49													
0.2 - 0.9		CLAY - silty, trace sand - dark grey - moist, stiff to very stiff - high plasticity		G50													
0.9 - 1.1		- trace to some silt inclusions (< 10 mm diam.) below 0.9 m		G51													
1.1 - 1.4		- trace organics below 1.1 m		G52													
1.4 - 2.0		SILT - some clay - light brownish grey - moist, firm - low to intermediate plasticity - moist to wet and soft below 1.4 m		G53													
2.0 - 2.4		CLAY - silty, trace silt inclusions (< 25 mm diam.) - greyish brown - moist, very stiff - high plasticity		G54													
2.4 - 2.4				G55													

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4. Test hole located 6 m east of east curb on Ferndale Avenue along eastbound lane behind 457 Lyndale Drive.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E.B. MK 0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-09

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526107, E-634593
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)	Particle Size (%)		Undrained Shear Strength (kPa)	Test Type
								0 20 40 60 80 100	0 20 40 60 80 100		
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace to some silt - brown, dry, compact - well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"		G56							
0.2 - 0.4		SILT and CLAY (Topsoil) - trace sand - black - moist, very stiff - high plasticity		G57							△
0.4 - 0.9		CLAY - silty - dark grey - moist, stiff - high plasticity - trace silt inclusions (< 20 mm diam.) below 0.9 m		G58							△
0.9 - 1.4		SILT - some clay - light brownish grey - moist, firm - low to intermediate plasticity		G60							△
1.4 - 1.6		- soft below 1.6 m		G61							△
1.6 - 2.0		CLAY - silty - dark grey - moist, stiff - high plasticity		G62							△

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located in northbound lane behind 27 Claremont Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E.B. MK 0395.005.00.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-10

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526155, E-634593
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.3		SILT and CLAY (Fill) - trace sand, trace gravel (< 25 mm diam.) - dark grey to black - moist, firm - high plasticity		G63								
0.3 - 0.5		- silt inclusions (< 25 mm diam.) below 0.3 m		G64								
0.5 - 1.6		CLAY - silty, some organics - dark grey - moist, stiff - high plasticity		G65								
1.6 - 2.1		- stiff to very stiff below 1.1 m		G66								
2.1 - 2.4		- stiff and some silt inclusions (< 25 mm diam.) below 1.6 m		G67								
2.4 - 2.5		SILT - some clay - light brown - moist, firm - low to intermediate plasticity - wet, very soft below 2.1 m		G68								
2.5 - 2.6				G69								

END OF TEST HOLE AT 2.4 m DEPTH IN SILT

- Notes:
- Seepage below 2.1 m in silt layer.
 - No sloughing observed.
 - Water level at 2.1 m after drilling.
 - Test hole open to 2.4 m after drilling.
 - Test hole backfilled with auger cuttings to surface.
 - Test hole located in southbound lane behind 40 and 44 Ferndale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E_B_MK 0395 005 00 GPJ_TREK GEOTECHNICAL_GDT_5/7/18



Sub-Surface Log

Test Hole TH18-11

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526269, E-634597
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	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 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace to some silt - brown, dry, compact - well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"	▲	G70		16			0	20	40	60	80	100					
0.2 - 0.6		CLAY - silty, some organics, some fine gravel - dark grey - moist, stiff to very stiff - high plasticity	▲	G71															
0.6 - 1.0		- trace silt inclusions (< 20 mm diam.), no gravel, no organics below 0.6 m	▲	G72															
1.0 - 1.4		- some silt inclusions (< 40 mm diam.) below 0.9 m	▲	G73															
1.4 - 1.8			▲	G74															
1.8 - 2.2		- no silt inclusions below 1.8 m	▲	G75															
2.2 - 2.4		- stiff below 2.3 m	▲	G76															

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located 7 m south of south curb on Coniston Street along center of backlane behind 72 Ferndale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E.B. MK 0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-27

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526188, E-634597
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 20 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)						
							16	17	18	19	20		21					
							Particle Size (%)					Test Type						
							0	20	40	60	80	100	<input checked="" type="checkbox"/> Torvane <input type="checkbox"/> <input checked="" type="checkbox"/> Pocket Pen. <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Qu <input checked="" type="checkbox"/> <input type="checkbox"/> Field Vane <input type="checkbox"/>					
							0	20	40	60	80	100	0	50	100	150	200	250
		SAND and GRAVEL (Fill) - trace clay, trace to some silt, trace organics - dark brown, dry, compact - well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"		G182														
0.5		SILT and CLAY (Topsoil) - silty, trace sand, trace gravel - black - moist, very stiff - high plasticity		G183														
		CLAY - silty - grey - moist, stiff - high plasticity		G184														
1.0		SILT - sandy, some clay - light brown - moist, soft - low to intermediate plasticity		G185														
1.5		CLAY - silty - grey - moist, very stiff - high plasticity		G186														
2.0		- stiff below 1.6 m		G187														
				G188														

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

- Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4. Test hole located in center of backlane behind 47 Claremont Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E_B.MK 0395.005.00.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-28

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Ferndale / Claremont) Location: UTM N-5526243, E-634598
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 20 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m³)					Undrained Shear Strength (kPa)				
							Particle Size (%)					Test Type				
							16	17	18	19	20	21	0	50	100	150
0.0		SAND and GRAVEL (Fill) - trace clay, trace organics, dark brown - dry to moist, compact, well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub-angular, "pit run"		G189												
0.1		SILT and CLAY (Topsoil) - trace sand, trace gravel - black, moist, very stiff, high plasticity														
0.3		CLAY - silty - grey - moist, stiff - high plasticity		G190												
0.4				G191												
0.9		SILT - sandy, some clay - light brown - moist, soft - low to intermediate plasticity		G192												
1.4		CLAY - silty - grey - moist, stiff - high plasticity		G193												
1.7				G194												
2.2				G195												

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. Seepage observed below 1.2 m.
 2. No sloughing observed.
 3. Test hole open to 2.4 m after drilling.
 4. Test hole backfilled with auger cuttings, sand and gravel at surface.
 5. Test hole located in center of backlane behind 63 and 67 Claremont Avenue.

SUB-SURFACE LOG - LOGS 2018-06-12 LOCAL IMPROVEMENT FERNDAL E.B. MK 0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/7/18

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira



Local Improvement Package 18-LI-02
Sub-Surface Investigation
Claremont Avenue / Ferndale Avenue

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH18-11	UTM: 5526269 N, 634597 E Located 7 m south of south curb on Coniston Street along center of backlane behind 72 Ferndale Avenue	N/A	N/A	N/A	N/A	Sand and Gravel (Fill)	0.1	0.2	3							
						Clay	0.4	0.5	27							
						Clay	0.7	0.9	28							
						Clay	1.0	1.2	33							
						Clay	1.3	1.5	34							
						Clay	1.6	1.8	32							
						Clay	2.2	2.4	42							
TH18-27	UTM: 5526188 N, 634597 E Located in center of backlane behind 47 Claremont Avenue	N/A	N/A	N/A	N/A	Sand and Gravel (Fill)	0.1	0.2	6							
						Silt and Clay (Topsoil)	0.4	0.5	30							
						Clay	0.7	0.9	31							
						Silt	1.0	1.2	21	21	47	27	5	17	37	20
						Clay	1.3	1.5	32							
						Clay	1.6	1.8	40							
						Clay	2.2	2.4	45							
TH18-28	UTM: 5526243 N, 634598 E Located in center of backlane behind 63 and 67 Claremont Avenue	N/A	N/A	N/A	N/A	Sand and Gravel (Fill) 0-0.1 m										
						Silt and Clay (Topsoil)	0.1	0.2	30							
						Clay	0.4	0.5	37							
						Clay	0.6	0.8	35							
						Silt	1.0	1.2	28							
						Clay	1.3	1.5	38							
						Clay	1.6	1.8	39							
				Clay	2.2	2.4	46									



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 Tel: 204.975.9433 Fax: 204.975.9435

Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Ferndale

Sample Date 11-Jun-18
Test Date 25-Jun-18
Technician NM

Test Pit	TH18-07	TH18-07	TH18-07	TH18-07	TH18-07	TH18-07
Depth (m)	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8
Sample #	G42	G43	G44	G45	G46	G47
Tare ID	Z98	C15	Z105	F63	E1	A8
Mass of tare	8.6	8.6	8.4	8.5	8.4	8.0
Mass wet + tare	237.3	160.7	514.6	174.5	189.1	158.6
Mass dry + tare	232.9	154.6	500.4	170.0	184.6	140.7
Mass water	4.4	6.1	14.2	4.5	4.5	17.9
Mass dry soil	224.3	146.0	492.0	161.5	176.2	132.7
Moisture %	2.0%	4.2%	2.9%	2.8%	2.6%	13.5%

Test Pit	TH18-07	TH18-08	TH18-08	TH18-08	TH18-08	TH18-08
Depth (m)	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G48	G49	G50	G51	G52	G53
Tare ID	A4	Z13	E41	Z57	AA10	AB90
Mass of tare	8.4	8.8	8.5	8.6	7.0	6.7
Mass wet + tare	138	110.1	135.1	446.5	168.5	138.3
Mass dry + tare	99.0	105.1	102.8	342.9	129.9	112.7
Mass water	39.0	5.0	32.3	103.6	38.6	25.6
Mass dry soil	90.6	96.3	94.3	334.3	122.9	106.0
Moisture %	43.0%	5.2%	34.3%	31.0%	31.4%	24.2%

Test Pit	TH18-08	TH18-08	TH18-09	TH18-09	TH18-09	TH18-09
Depth (m)	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G54	G55	G56	G57	G58	G59
Tare ID	F1	AB65	A13	AA14	D3	N34
Mass of tare	8.6	6.6	8.4	7.0	8.5	8.4
Mass wet + tare	135.1	131.3	158.6	188.6	183.6	197.7
Mass dry + tare	112.0	100.6	153.9	147.6	138.5	150.3
Mass water	23.1	30.7	4.7	41.0	45.1	47.4
Mass dry soil	103.4	94.0	145.5	140.6	130.0	141.9
Moisture %	22.3%	32.7%	3.2%	29.2%	34.7%	33.4%



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Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Ferndale

Sample Date 11-Jun-18
Test Date 25-Jun-18
Technician NM

Test Pit	TH18-09	TH18-09	TH18-09	TH18-10	TH18-10	TH18-10
Depth (m)	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9
Sample #	G60	G61	G62	G63	G64	G65
Tare ID	AA03	N04	F75	E106	K34	AB68
Mass of tare	7.0	8.8	8.6	8.6	8.5	6.6
Mass wet + tare	195.5	203.6	157.4	150.7	395.6	187.9
Mass dry + tare	154.5	165.1	111.9	131.6	298.1	143.2
Mass water	41.0	38.5	45.5	19.1	97.5	44.7
Mass dry soil	147.5	156.3	103.3	123.0	289.6	136.6
Moisture %	27.8%	24.6%	44.0%	15.5%	33.7%	32.7%

Test Pit	TH18-10	TH18-10	TH18-10	TH18-10	TH18-11	TH8-11
Depth (m)	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5
Sample #	G66	G67	G68	G69	G70	G71
Tare ID	E135	N115	Z39	AC16	D49	D47
Mass of tare	8.4	8.7	8.4	6.7	8.5	8.8
Mass wet + tare	198.5	192.8	153.6	223.7	212.9	247.5
Mass dry + tare	153.3	147.6	118.1	178.4	207.3	197.3
Mass water	45.2	45.2	35.5	45.3	5.6	50.2
Mass dry soil	144.9	138.9	109.7	171.7	198.8	188.5
Moisture %	31.2%	32.5%	32.4%	26.4%	2.8%	26.6%

Test Pit	TH18-11	TH18-11	TH18-11	TH18-11	TH18-11	TH18-27
Depth (m)	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2
Sample #	G72	G73	G74	G75	G76	G182
Tare ID	AB04	A15	Z116	AA23	W03	F87
Mass of tare	6.6	8.5	8.4	6.5	8.4	8.4
Mass wet + tare	143.4	194.2	158.4	154.6	154.9	153.8
Mass dry + tare	113.6	148.2	120.6	118.8	111.3	145.4
Mass water	29.8	46.0	37.8	35.8	43.6	8.4
Mass dry soil	107.0	139.7	112.2	112.3	102.9	137.0
Moisture %	27.9%	32.9%	33.7%	31.9%	42.4%	6.1%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Ferndale

Sample Date 11-Jun-18
Test Date 25-Jun-18
Technician NM

Test Pit	TH18-27	TH18-27	TH18-27	TH18-27	TH18-27	TH18-27
Depth (m)	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4
Sample #	G183	G184	G185	G186	G187	G188
Tare ID	E104	AB52	AB46	AC34	AB85	Z118
Mass of tare	8.6	6.6	6.8	6.5	6.7	8.4
Mass wet + tare	143.2	210.3	506.5	186.7	169.5	160.1
Mass dry + tare	112.5	161.6	420.5	143.3	122.9	113.4
Mass water	30.7	48.7	86.0	43.4	46.6	46.7
Mass dry soil	103.9	155.0	413.7	136.8	116.2	105.0
Moisture %	29.5%	31.4%	20.8%	31.7%	40.1%	44.5%

Test Pit	TH18-28	TH18-28	TH18-28	TH18-28	TH18-28	TH18-28
Depth (m)	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8
Sample #	G189	G190	G191	G192	G193	G194
Tare ID	W05	N38	F97	AB23	W57	AA21
Mass of tare	8.6	8.5	8.4	6.6	8.5	6.9
Mass wet + tare	184.0	128.4	143.7	224.4	198.4	128.4
Mass dry + tare	143.1	95.9	108.9	176.8	146.6	94.3
Mass water	40.9	32.5	34.8	47.6	51.8	34.1
Mass dry soil	134.5	87.4	100.5	170.2	138.1	87.4
Moisture %	30.4%	37.2%	34.6%	28.0%	37.5%	39.0%

Test Pit	TH18-28					
Depth (m)	2.2 - 2.4					
Sample #	G195					
Tare ID	E92					
Mass of tare	8.5					
Mass wet + tare	152.2					
Mass dry + tare	106.9					
Mass water	45.3					
Mass dry soil	98.4					
Moisture %	46.0%					



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Atterberg Limits
ASTM D4318-10e1

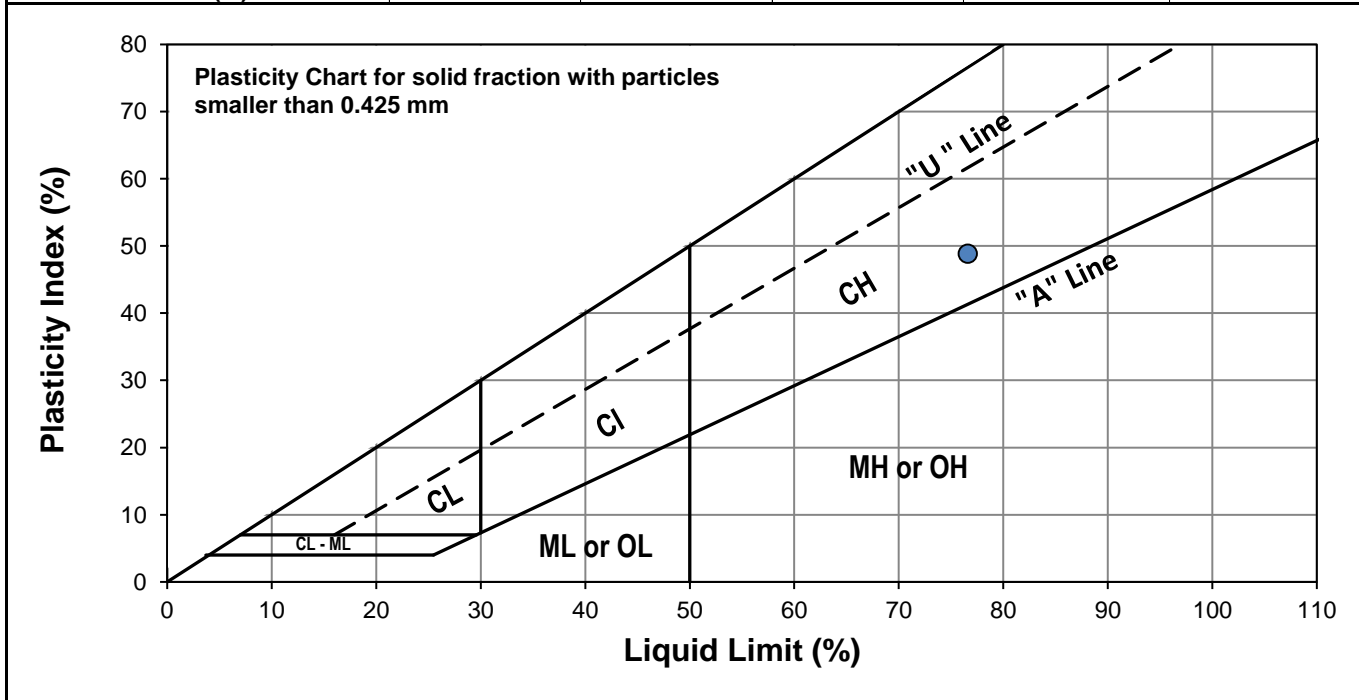
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Ferndale

Test Hole TH18-08
Sample # G51
Depth (m) 0.7 - 0.9
Sample Date 8-Jun-18
Test Date 25-Jun-18
Technician HS

Liquid Limit	77
Plastic Limit	28
Plasticity Index	49

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	22	29		
Mass Wet Soil + Tare (g)	28.403	26.441	29.083		
Mass Dry Soil + Tare (g)	22.057	21.194	22.610		
Mass Tare (g)	14.188	14.447	14.007		
Mass Water (g)	6.346	5.247	6.473		
Mass Dry Soil (g)	7.869	6.747	8.603		
Moisture Content (%)	80.646	77.768	75.241		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.724	20.371			
Mass Wet Soil + Tare (g)	19.288	19.006			
Mass Dry Soil + Tare (g)	14.178	14.028			
Mass Water (g)	1.436	1.365			
Mass Dry Soil (g)	5.110	4.978			
Moisture Content (%)	28.102	27.421			



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Atterberg Limits
ASTM D4318-10e1

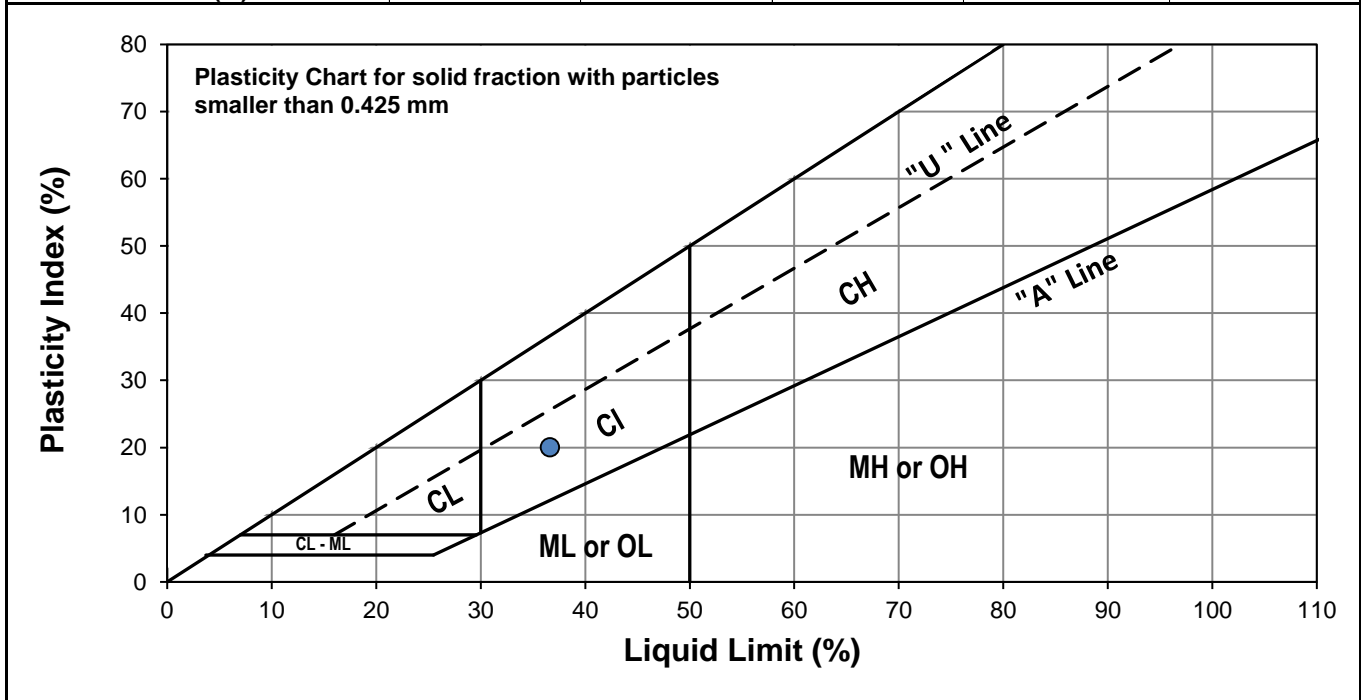
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Ferndale

Test Hole TH18-10
Sample # G185
Depth (m) 1.0 - 1.2
Sample Date 21-Jun-18
Test Date 25-Jun-18
Technician HS

Liquid Limit	37
Plastic Limit	17
Plasticity Index	20

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	25	34		
Mass Wet Soil + Tare (g)	28.056	25.896	27.942		
Mass Dry Soil + Tare (g)	24.304	22.656	24.236		
Mass Tare (g)	14.403	13.782	13.921		
Mass Water (g)	3.752	3.240	3.706		
Mass Dry Soil (g)	9.901	8.874	10.315		
Moisture Content (%)	37.895	36.511	35.928		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.742	20.745			
Mass Wet Soil + Tare (g)	19.814	19.822			
Mass Dry Soil + Tare (g)	14.203	14.283			
Mass Water (g)	0.928	0.923			
Mass Dry Soil (g)	5.611	5.539			
Moisture Content (%)	16.539	16.664			



Grain Size Analysis (Sieve Method)

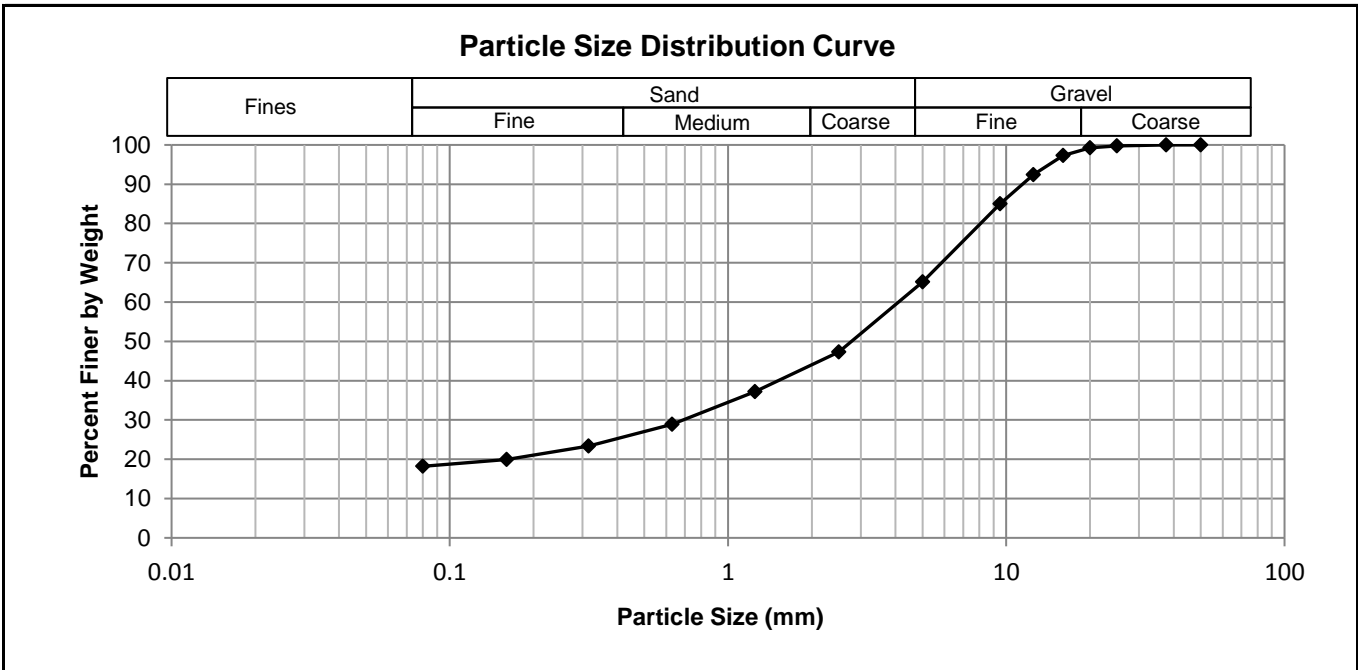
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Ferndale

Test Hole TH18-07
Sample # G42
Depth 0.3-0.8
Date Sampled 15-Jun-18
Date Tested 20-Jun-18
Technician NM

Gravel %	34.9
Sand %	46.9
Fines %	18.2



Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
25.0	100	-
20.0	99	-
12.5	92	-
9.5	85	-
5.00	65	-
2.50	47	-
1.25	37	-
0.630	29	-
0.315	23	-
0.160	20	-
0.080	18	-



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Grain Size Analysis (Sieve Method)

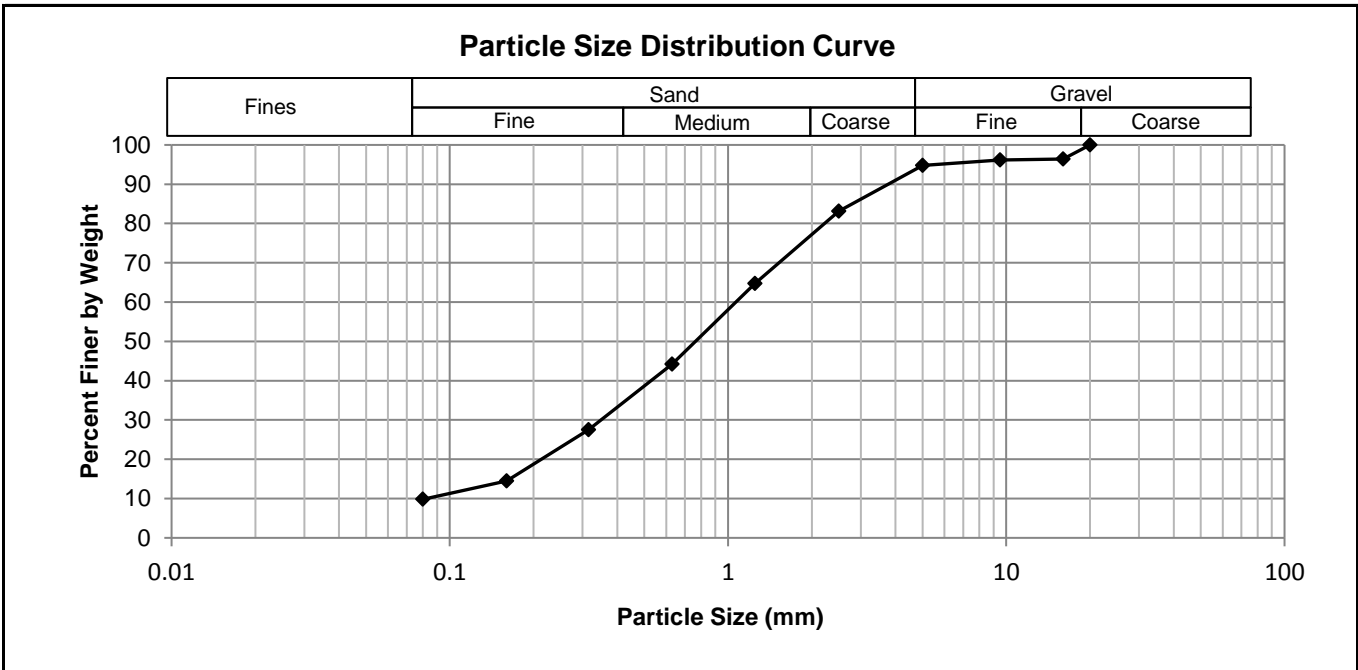
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Claremont / Ferndale

Test Hole TH18-07
Sample # G44
Depth 2.3-2.8
Date Sampled 11-Jun-18
Date Tested 26-Jun-18
Technician NM

Gravel %	5.2
Sand %	85.0
Fines %	9.8



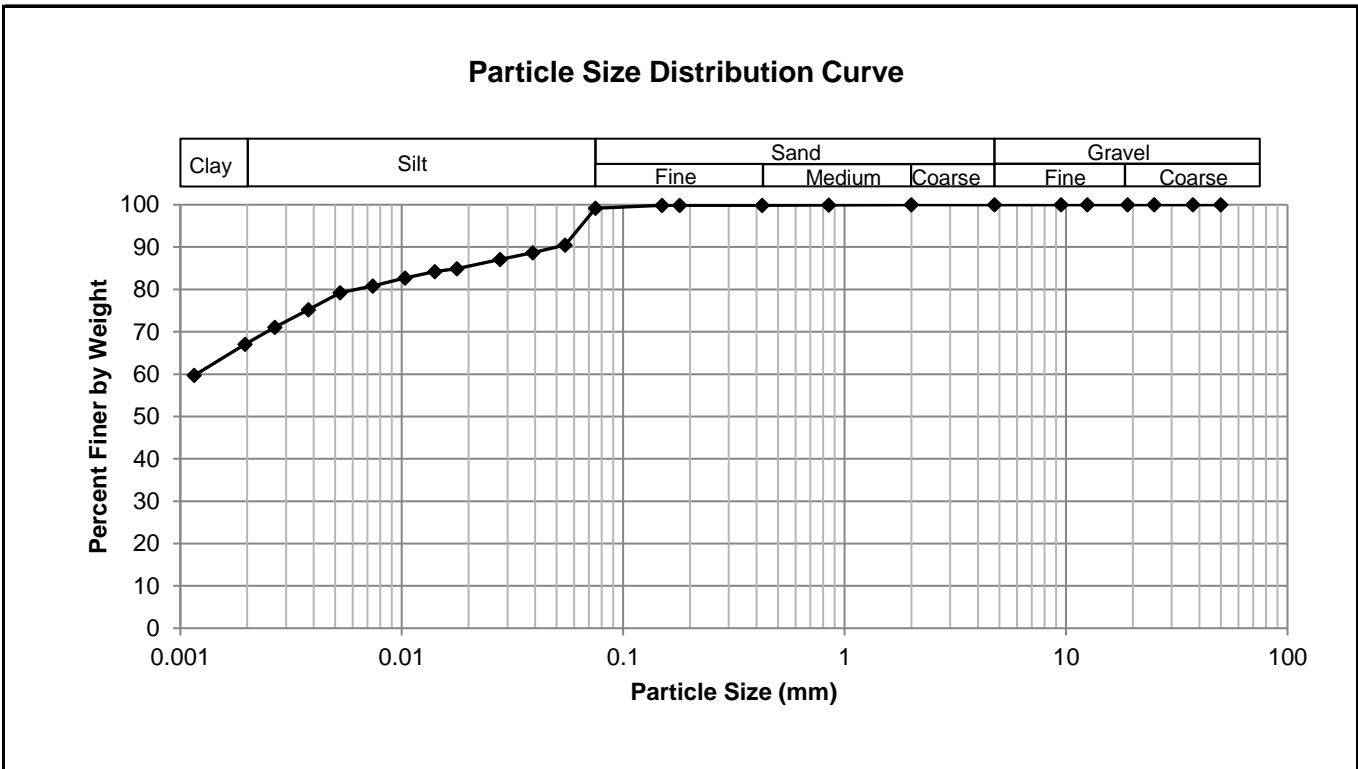
Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
20.0	100	-
16.0	96	-
9.5	96	-
5.00	95	-
2.50	83	-
1.25	65	-
0.630	44	-
0.315	27	-
0.160	14	-
0.080	10	-



Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Ferndale

Test Hole TH18-08
Sample # G51
Depth (m) 0.7 - 0.9
Sample Date 11-Jun-18
Test Date 4-Jul-18
Technician NM

Gravel	0.0%
Sand	0.8%
Silt	31.9%
Clay	67.3%



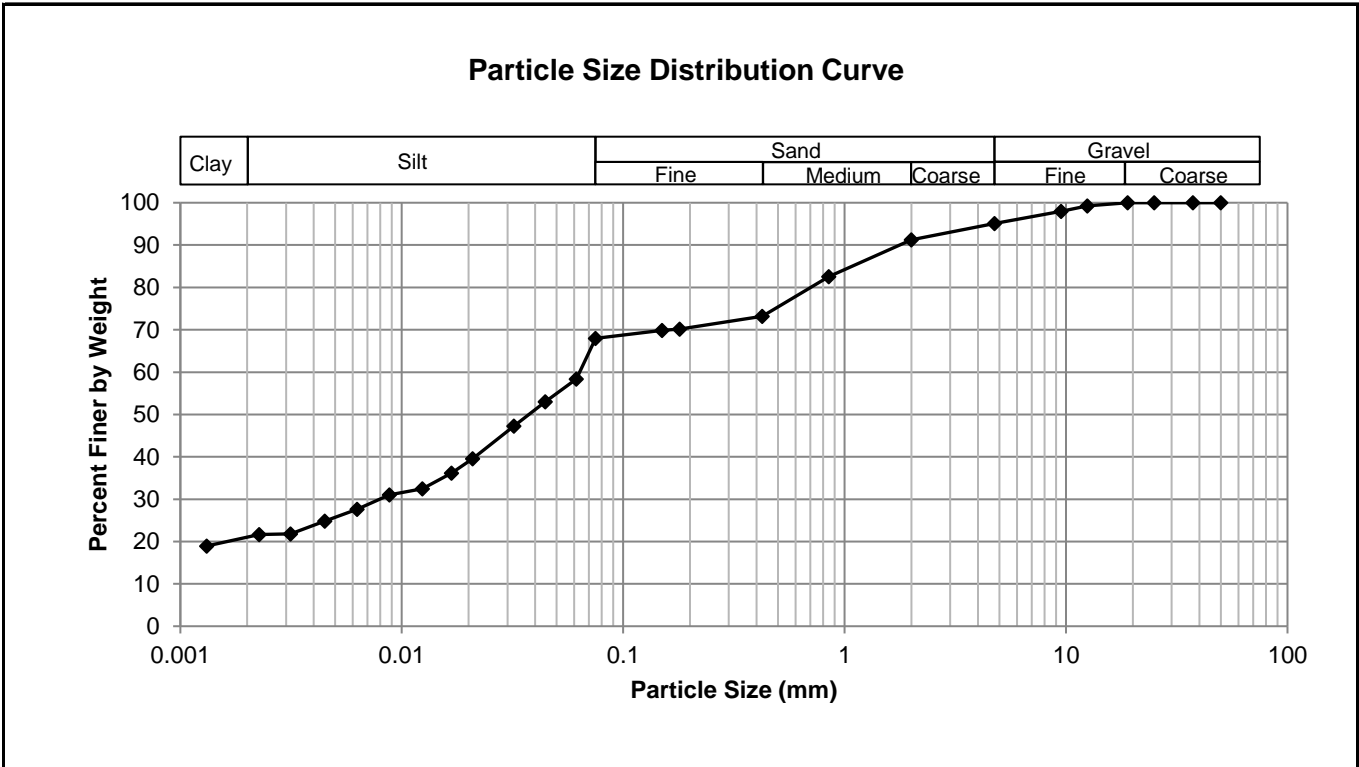
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	99.18
37.5	100.00	2.00	99.98	0.0548	90.52
25.0	100.00	0.850	99.93	0.0391	88.64
19.0	100.00	0.425	99.88	0.0278	87.08
12.5	100.00	0.180	99.85	0.0178	84.89
9.50	100.00	0.150	99.83	0.0141	84.19
4.75	100.00	0.075	99.18	0.0104	82.70
				0.0074	80.82
				0.0053	79.26
				0.0038	75.20
				0.0027	71.06
				0.0020	67.07
				0.0012	59.70



Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Claremont / Ferndale

Test Hole TH18-27
Sample # G185
Depth (m) 1.0 - 1.2
Sample Date 13-Jun-18
Test Date 3-Jul-18
Technician NM

Gravel	4.9%
Sand	27.1%
Silt	47.1%
Clay	20.9%



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	95.08	0.0750	67.94
37.5	100.00	2.00	91.22	0.0615	58.40
25.0	100.00	0.850	82.53	0.0445	52.98
19.0	100.00	0.425	73.17	0.0322	47.27
12.5	99.28	0.180	70.16	0.0209	39.57
9.50	97.96	0.150	69.88	0.0168	36.15
4.75	95.08	0.075	67.94	0.0124	32.44
				0.0088	31.02
				0.0063	27.64
				0.0045	24.79
				0.0032	21.84
				0.0023	21.65
				0.0013	18.95

Appendix C

Birchdale Avenue / Lawndale Avenue

Test Hole Logs, Summary Table, Lab Data

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	Material		
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	mm	Sand		
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW			ASTM Sieve Sizes	
		Sands (More than half of coarse fraction is smaller than 4.75 mm)	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	mm	Coarse Medium Fine
			GC		Clayey gravels, gravel-sand-silt 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)	Sands with fines (Appreciable amount of 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	Sand	
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW			
		Silts and Clays (Liquid limit less than 50)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Plasticity Chart 	mm	Coarse Medium Fine
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7			
			ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity				
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
Silts and Clays (Liquid limit greater than 50)	OL	Organic silts and organic silty clays of low plasticity							
	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							
Highly Organic Soils	Pt	Peat and other highly organic soils	Von Post Classification Limit	Strong colour or odour, and often fibrous texture	mm	Boulders Cobbles Gravel Coarse 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

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 Incliner	

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 TH18-12

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Birchdale / Lawndale) Location: UTM N-5526824, E-634412
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.1		SAND and GRAVEL (Fill) - trace clay, trace silt, brown - dry to moist, compact, well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"	▲	G77								
0.1 - 0.6		CLAY - silty, some organics, some fine gravel - dark grey - moist, very stiff - high plasticity	▲	G78								
0.6 - 1.0		- some silt inclusions (< 25 mm diam.), no organics, no gravel below 0.6 m	▲	G79								
1.0 - 1.5		- hard, some silt inclusions (< 50 mm diam.) below 0.9 m	▲	G80								
1.5 - 2.1		- trace organics below 1.5 m	▲	G81								
2.1 - 2.4		- very stiff below 2.1 m	▲	G82								
2.4 - 2.4			▲	G83								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4. Test hole located 10 m south of south curb on Walmer Street along center of backlane behind 213 Lawndale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT BIRCHDALE_B_MK 0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-13

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Birchdale / Lawndale) Location: UTM N-5526787, E-634411
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)								
							16	17	18	19	20	21	0	50	100	150	200	250		
0.0		SAND and GRAVEL (Fill) - trace clay, trace silt, brown, moist - compact, well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"		G84																
0.1		SILT and CLAY (Topsoil) - silty, some sand, trace gravel - black - moist, very stiff - high plasticity		G85																
0.6		CLAY - silty - dark grey - moist, very stiff - high plasticity		G86																
1.1		- some silt inclusions (< 50 mm diam.) below 1.1 m		G87																
1.4		- firm below 1.7 m		G88																
1.7				G89																
2.1		- stiff below 2.1 m		G90																

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. 0.2 m of water in bottom of test hole from surface runoff.
3. Test hole open to 2.4 m after drilling.
4. Test hole backfilled with auger cuttings, sand and gravel at surface.
5. Test hole located in southbound lane behind 205 Lawndale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT BIRCHDALE_B_MK 0395 005 00.GPJ TREK GEOTECHNICAL GDT 5/17/18



Sub-Surface Log

Test Hole TH18-14

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Birchdale / Lawndale) Location: UTM N-5526749, E-634408
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt, brown, moist - compact, well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"		G91								
0.2 - 0.4		SILT and CLAY (Topsoil) - silty, some sand, trace gravel, some organics - black - moist, very stiff - high plasticity		G92								
0.4 - 1.1		CLAY - silty - dark grey - moist, very stiff - high plasticity		G93								
1.1 - 1.5		- some silt inclusions (< 20 mm diam.) below 1.1 m		G94								
1.5 - 2.0		- some silt inclusions (< 50 mm diam.) below 1.5 m		G95								
2.0 - 2.4				G96								
2.4 - 2.8				G97								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located in northbound lane behind 194 and 198 Birchdale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT BIRCHDALE_B_MK 0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/17/18



Sub-Surface Log

Test Hole TH18-15

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Birchdale / Lawndale) Location: UTM N-5526698, E-634407
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	Test Type					
							Particle Size (%)											
							0	20	40	60	80	100						
							PL MC LL											
							0	20	40	60	80	100	0	50	100	150	200	250
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt, brown, moist - compact, well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"		G98														
0.2 - 0.5		SILT and CLAY (Topsoil) - silty, some sand, trace gravel, some organics - black - moist, very stiff - high plasticity		G99														
0.5 - 1.1		CLAY - silty - dark grey - moist, stiff to very stiff - high plasticity		G100														
1.1 - 1.4		- trace silt inclusions (< 20 mm diam.) below 1.1 m		G101														
1.4 - 1.6		- some silt inclusions (< 50 mm diam.) below 1.4 m		G102														
1.6 - 1.8				G103														
1.8 - 2.0				G104														

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located in northbound lane behind 179 Lawndale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT BIRCHDALE_B_MK_0395 005 00.GPJ TREK GEOTECHNICAL.GDT 5/17/18



Sub-Surface Log

Test Hole TH18-16

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Birchdale / Lawndale) Location: UTM N-5526662, E-634406
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 8 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (< 20 mm diam.) - rounded to sub-angular, "pit run"	▲	G105													
0.2 - 0.4		SILT and CLAY (Topsoil) - silty, some sand, trace gravel, some organics - black - moist, very stiff - high plasticity	▲	G106													
0.4 - 0.8		CLAY - silty, trace organics, trace oxidation - dark grey - moist, stiff - high plasticity - no oxidation, some silt inclusions (< 10 mm diam.) below 0.8 m - very stiff, some silt inclusions (< 30 mm diam.) below 0.9 m	▲	G107													
0.8 - 1.0			▲	G108													
1.0 - 1.4			▲	G109													
1.4 - 1.8			▲	G110													
1.8 - 2.0		- trace oxidation below 2.0 m															
2.0 - 2.3		- stiff below 2.3 m	▲	G111													

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
4. Test hole located 8 m north of north curb on Kirkdale Street along southbound lane behind 172 Birchdale Avenue.

Logged By: Matt Klymochko Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT BIRCHDALE_B_MK 0395 005 00.GPJ TREK GEOTECHNICAL GDT 5/17/18



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Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Birchdale / Lawndale

Sample Date 11-Jun-18
Test Date 14-Jun-18
Technician NM

Test Pit	TH18-12	TH18-12	TH18-12	TH18-12	TH18-12	TH18-12
Depth (m)	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8
Sample #	G77	G78	G79	G80	G81	G82
Tare ID	Z07	Z49	E23	P36	E93	AA02
Mass of tare	8.6	8.2	8.6	8.6	8.6	6.6
Mass wet + tare	234.2	202.4	175.4	210.8	201.2	233.0
Mass dry + tare	225.2	160.2	142.4	170.8	161.0	186.4
Mass water	9.0	42.2	33.0	40.0	40.2	46.6
Mass dry soil	216.6	152.0	133.8	162.2	152.4	179.8
Moisture %	4.2%	27.8%	24.7%	24.7%	26.4%	25.9%

Test Pit	TH18-12	TH18-13	TH18-13	TH18-13	TH18-13	TH18-13
Depth (m)	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G83	G84	G85	G86	G87	G88
Tare ID	D40	E107	Z97	E102	Z15	Z66
Mass of tare	8.2	8.4	8.6	8.6	8.4	8.4
Mass wet + tare	201	170.2	218.6	214.4	224.4	246.6
Mass dry + tare	162.0	137.6	170.6	166.2	171.8	190.4
Mass water	39.0	32.6	48.0	48.2	52.6	56.2
Mass dry soil	153.8	129.2	162.0	157.6	163.4	182.0
Moisture %	25.4%	25.2%	29.6%	30.6%	32.2%	30.9%

Test Pit	TH18-13	TH18-13	TH18-14	TH18-14	TH18-14	TH18-14
Depth (m)	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G89	G90	G91	G92	G93	G94
Tare ID	AC29	F46	F8	E121	AB66	AC01
Mass of tare	6.6	8.6	8.6	8.4	6.6	6.6
Mass wet + tare	211.8	244.2	168.0	226.8	206.6	232.6
Mass dry + tare	154.8	185.4	140.4	172.0	157.8	179.4
Mass water	57.0	58.8	27.6	54.8	48.8	53.2
Mass dry soil	148.2	176.8	131.8	163.6	151.2	172.8
Moisture %	38.5%	33.3%	20.9%	33.5%	32.3%	30.8%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Birchdale / Lawndale

Sample Date 11-Jun-18
Test Date 14-Jun-18
Technician NM

Test Pit	TH18-14	TH18-14	TH18-14	TH18-15	TH18-15	TH18-15
Depth (m)	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9
Sample #	G95	G96	G97	G98	G99	G100
Tare ID	F135	E40	P14	P24	AB13	AB18
Mass of tare	8.4	8.6	8.6	8.4	6.6	6.6
Mass wet + tare	206.2	204.0	192.8	228.4	171.2	193.4
Mass dry + tare	155.0	158.4	153.4	178.8	128.6	144.6
Mass water	51.2	45.6	39.4	49.6	42.6	48.8
Mass dry soil	146.6	149.8	144.8	170.4	122.0	138.0
Moisture %	34.9%	30.4%	27.2%	29.1%	34.9%	35.4%

Test Pit	TH18-15	TH18-15	TH18-15	TH18-15	TH18-16	TH18-16
Depth (m)	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5
Sample #	G101	G102	G103	G104	G105	G106
Tare ID	Z123	Q01	F40	AA09	AB80	F93
Mass of tare	8.4	8.4	8.4	6.8	6.6	8.2
Mass wet + tare	203.6	178.2	204.6	194.2	232.8	205.4
Mass dry + tare	152.6	137.6	155.6	148.2	213.2	154.2
Mass water	51.0	40.6	49.0	46.0	19.6	51.2
Mass dry soil	144.2	129.2	147.2	141.4	206.6	146.0
Moisture %	35.4%	31.4%	33.3%	32.5%	9.5%	35.1%

Test Pit	TH18-16	TH18-16	TH18-16	TH18-16	TH18-16	
Depth (m)	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	
Sample #	G107	G108	G109	G110	G111	
Tare ID	F105	C21	N69	D25	N60	
Mass of tare	8.4	8.4	8.8	8.8	8.4	
Mass wet + tare	189.0	196.2	231.8	218.4	170.0	
Mass dry + tare	141.0	150.2	179.4	171.2	131.0	
Mass water	48.0	46.0	52.4	47.2	39.0	
Mass dry soil	132.6	141.8	170.6	162.4	122.6	
Moisture %	36.2%	32.4%	30.7%	29.1%	31.8%	



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Atterberg Limits
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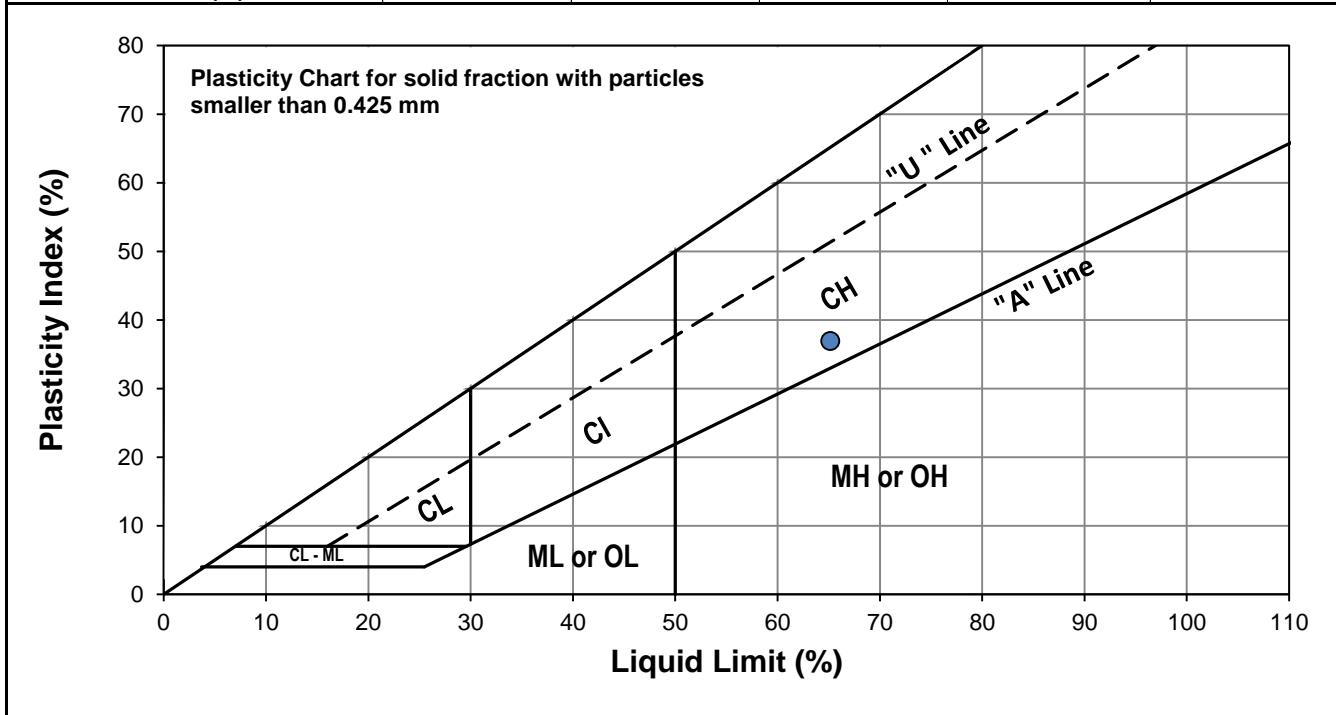
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Birchdale / Lawndale

Test Hole TH18-14
Sample # G92
Depth (m) 0.4 - 0.5
Sample Date 11-Jun-18
Test Date 15-Jun-18
Technician NM

Liquid Limit	65
Plastic Limit	28
Plasticity Index	37

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	23	35
Mass Wet Soil + Tare (g)	31.027	33.127	25.544
Mass Dry Soil + Tare (g)	24.221	25.595	21.194
Mass Tare (g)	14.233	14.167	14.233
Mass Water (g)	6.806	7.532	4.350
Mass Dry Soil (g)	9.988	11.428	6.961
Moisture Content (%)	68.142	65.908	62.491



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.214	20.119			
Mass Wet Soil + Tare (g)	19.667	18.782			
Mass Dry Soil + Tare (g)	14.174	14.069			
Mass Water (g)	1.547	1.337			
Mass Dry Soil (g)	5.493	4.713			
Moisture Content (%)	28.163	28.368			



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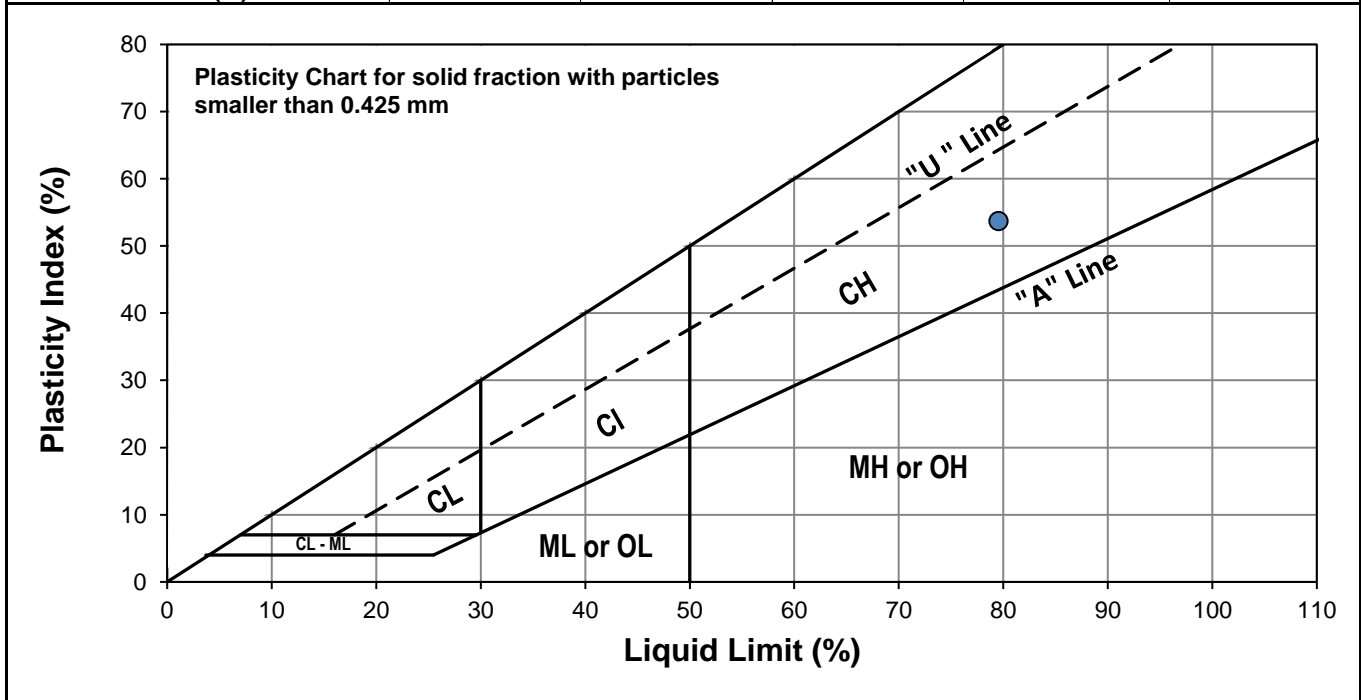
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 Birchdale / Lawndale

Test Hole TH18-16
Sample # G106
Depth (m) 0.4 - 0.5
Sample Date 11-Jun-18
Test Date 28-Jun-18
Technician NM

Liquid Limit	80
Plastic Limit	26
Plasticity Index	54

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	24	31		
Mass Wet Soil + Tare (g)	26.610	26.809	28.861		
Mass Dry Soil + Tare (g)	20.935	21.234	22.248		
Mass Tare (g)	14.006	14.271	13.747		
Mass Water (g)	5.675	5.575	6.613		
Mass Dry Soil (g)	6.929	6.963	8.501		
Moisture Content (%)	81.902	80.066	77.791		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.382	20.490			
Mass Wet Soil + Tare (g)	19.897	19.230			
Mass Dry Soil + Tare (g)	14.163	14.341			
Mass Water (g)	1.485	1.260			
Mass Dry Soil (g)	5.734	4.889			
Moisture Content (%)	25.898	25.772			



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Grain Size Analysis (Sieve Method)

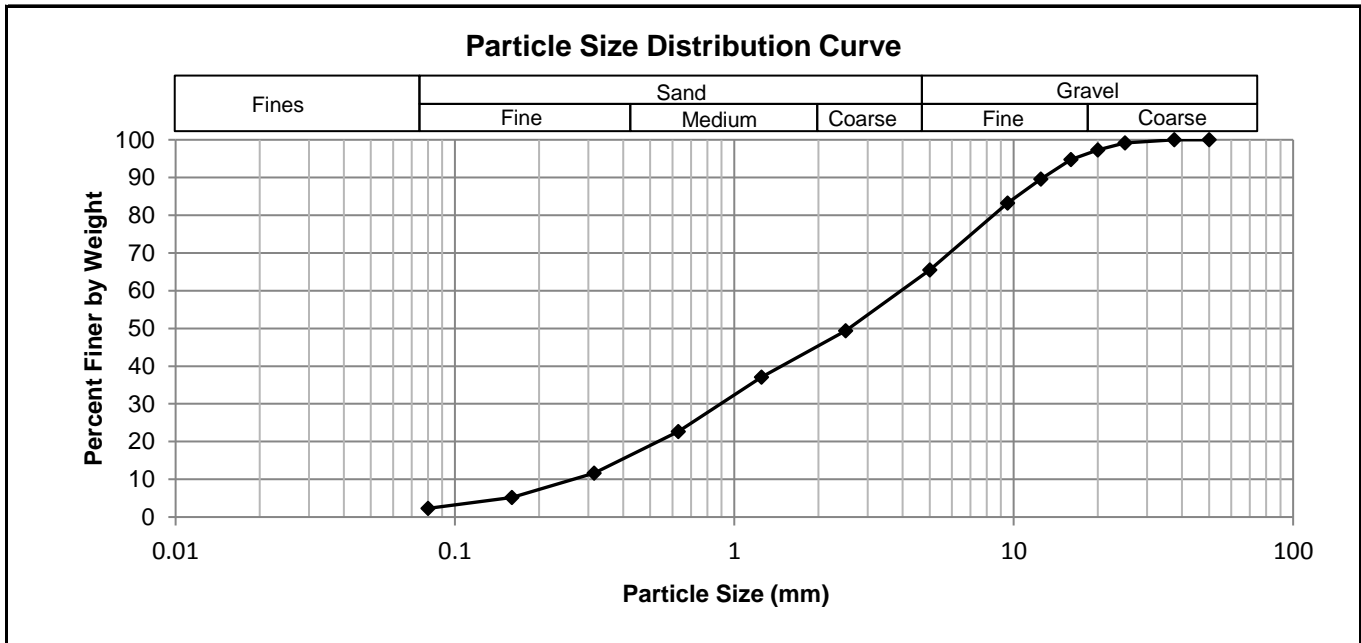
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Birchdale / Lawndale

Sample # G77
Source In situ
Soil Desc. Sand and Gravel
Date Sampled 11-Jun-18
Date Tested 18-Jun-18
Technician NM

Total Weight (kg)	20.71
Cobbles %	0.0
Gravel %	34.5
Sand %	63.2
Fines %	2.3



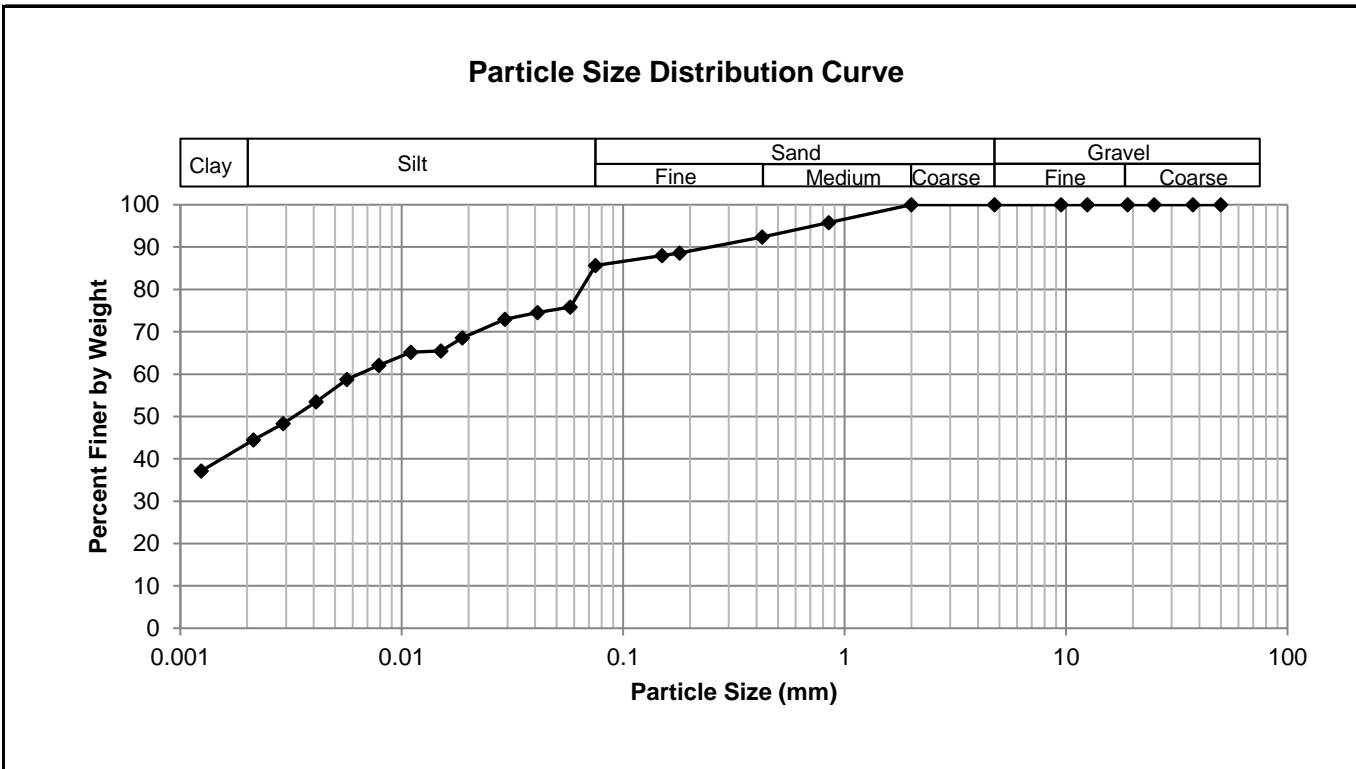
Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
37.5	100	-
25.0	99	-
20.0	97	-
12.5	90	-
9.5	83	-
5.00	66	-
2.50	49	-
1.25	37	-
0.630	23	-
0.315	12	-
0.160	5.2	-
0.080	2.3	-



Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Birchdale / Lawndale

Test Hole TH18-14
Sample # G92
Depth (m) 0.4 - 0.5
Sample Date 11-Jun-18
Test Date 19-Jun-18
Technician NM

Gravel	0.0%
Sand	14.4%
Silt	42.3%
Clay	43.4%



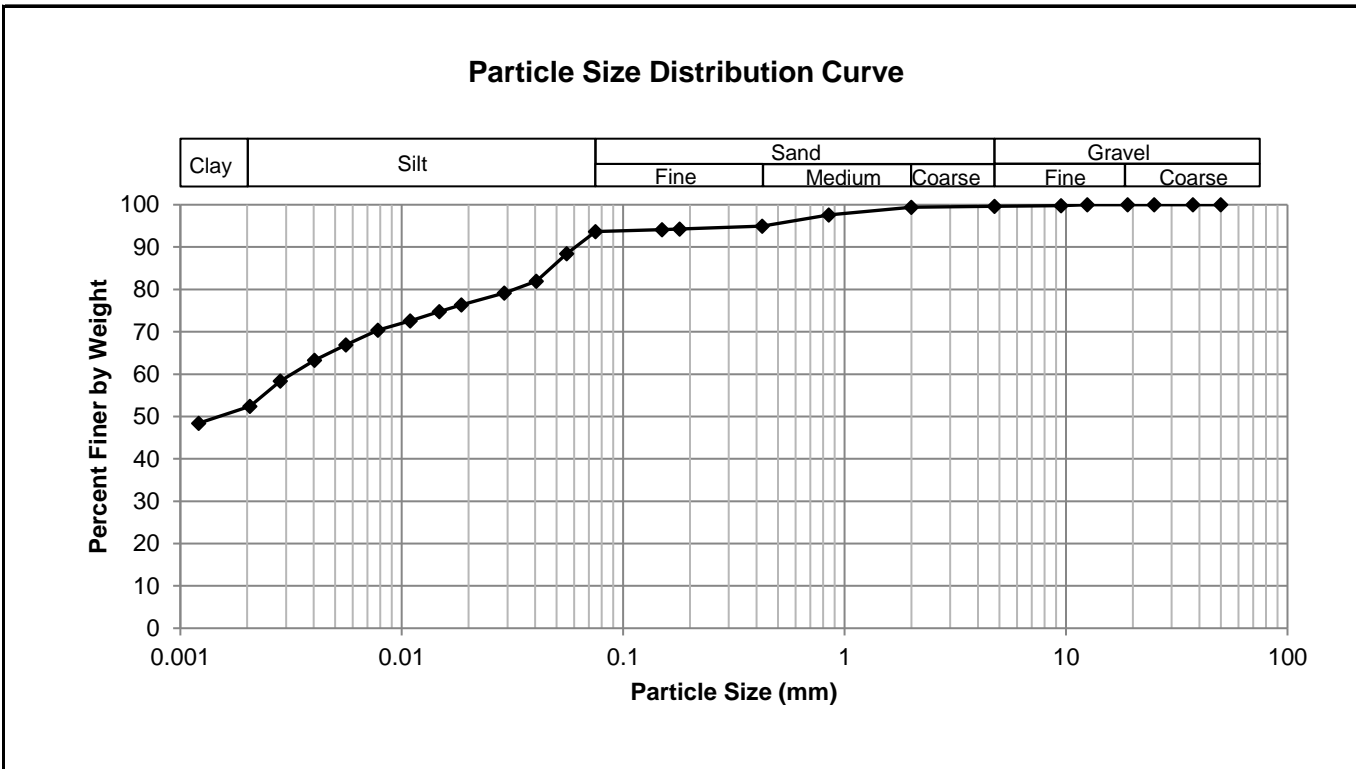
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	85.63
37.5	100.00	2.00	99.99	0.0577	75.80
25.0	100.00	0.850	95.76	0.0410	74.55
19.0	100.00	0.425	92.35	0.0292	72.99
12.5	100.00	0.180	88.64	0.0188	68.61
9.50	100.00	0.150	87.96	0.0151	65.49
4.75	100.00	0.075	85.63	0.0110	65.17
				0.0079	62.05
				0.0057	58.79
				0.0041	53.46
				0.0029	48.32
				0.0021	44.50
				0.0012	37.16



Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Birchdale / Lawndale

Test Hole TH18-16
Sample # G106
Depth (m) 0.4 - 0.5
Sample Date 11-Jun-18
Test Date 2-Jul-18
Technician NM

Gravel	0.4%
Sand	5.9%
Silt	41.6%
Clay	52.1%



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	99.60	0.0750	93.69
37.5	100.00	2.00	99.44	0.0557	88.45
25.0	100.00	0.850	97.56	0.0406	81.93
19.0	100.00	0.425	94.95	0.0291	79.13
12.5	100.00	0.180	94.25	0.0186	76.33
9.50	99.79	0.150	94.09	0.0148	74.77
4.75	99.60	0.075	93.69	0.0109	72.60
				0.0078	70.37
				0.0056	66.89
				0.0040	63.31
				0.0028	58.35
				0.0021	52.37
				0.0012	48.42

Appendix D

Kildonan Drive

Test Hole Logs, Summary Table, Lab Data

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	Material					
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	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting all gradation requirements for GW 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	mm	Sand					
		GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines								
		GM		Silty gravels, gravel-sand-silt mixtures								
		GC		Clayey gravels, gravel-sand-silt mixtures								
	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 Not meeting all gradation requirements for SW 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	mm	Coarse Medium Fine				
			SP		Poorly-graded sands, gravelly sands, little or no fines							
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures							
			SC		Clayey sands, sand-clay mixtures							
			Silts 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	Plasticity Chart 	mm	Boulders Cobbles Gravel Coarse Fine
				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										
Silts 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									
Highly Organic Soils	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 TH18-17

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 - Kildonan Drive Location: UTM N-5532970, E-635770
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 12 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0		SAND and GRAVEL (Fill) - trace clay, trace silt, brown - moist, compact, well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G112													
0.2		SILT and CLAY (Topsoil) - silty, trace sand, trace debris (wood), trace organics - black - moist, stiff - high plasticity	▲	G113								△ ⊕					
0.8		SILT and CLAY - trace organics, trace oxidation - dark grey - moist, very stiff - high plasticity	▲	G114								⊕ ⊕					
1.2		- trace silt inclusions (< 5 mm diam.) below 1.2 m	▲	G115								⊕ △					
1.4			▲	G116								⊕ △					
1.6			▲	G117													
2.0			▲	G118								△ ⊕					

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel to surface.
 4) Test hole located west of 11 Linden Ave, 2.0 m east of west edge of southbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT HS 0395 005 00 - KILDONAN DR.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-18

1 of 1

Client: WSP Canada Group Ltd. **Project Number:** 0395 005 00
Project Name: 2018 Local Improvement Package 18-LI-02 - Kildonan Drive **Location:** UTM N-5532990, E-635770
Contractor: TREK Geotechnical Inc. **Ground Elevation:** Street Level
Method: Hand Auger **Date Drilled:** 12 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.5		SAND and GRAVEL (Fill) - trace clay, trace to some silt - brown - moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"		G119								
0.5 - 1.0		SAND (Fill) - silty, clayey, trace silt inclusions (< 5 mm diam.), trace organics - black - moist, stiff to very stiff - intermediate plasticity		G120								
1.0 - 1.5		SILT and CLAY - trace organics, trace oxidation - brown - moist, stiff to very stiff to 2.0 m - high plasticity		G121								
1.5 - 1.7		- trace oxidation below 1.5 m		G122								
1.7 - 2.0		- trace silt inclusions (< 5 mm diam.) below 1.7 m		G123								
2.0 - 2.4		- stiff below 1.8 m		G124								
				G125								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4) Test hole located behind 859 Kildonan Drive, 2.0 east of west edge of southbound lane.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT HS 0395 005 00 - KILDONAN DR. GPJ_TREK GEOTECHNICAL_GDT_5/7/18



Sub-Surface Log

Test Hole TH18-19

1 of 1

Client: WSP Canada Group Ltd. **Project Number:** 0395 005 00
Project Name: 2018 Local Improvement Package 18-LI-02 - Kildonan Drive **Location:** UTM N-5533009, E-635775
Contractor: TREK Geotechnical Inc. **Ground Elevation:** Street Level
Method: Hand Auger **Date Drilled:** 12 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Undrained Shear Strength (kPa)									
							16	17	18	19	20	21	Test Type	Strength				
							Particle Size (%)		Test Type									
							0	20	40	60	80	100	0	50	100	150	200	250
							PL	MC	LL			□	△	+	⊗	⊠	○	
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt, brown - dry to moist, compact, well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G126														
0.2 - 0.5		SILT and CLAY (Topsoil) - silty, trace sand, trace gravel, trace organics - black - moist, stiff - high plasticity	▲	G127														
0.5 - 1.0		SILT and CLAY - trace organics to 1.7 m, trace silt inclusions (< 5 mm diam.) - brown - moist, stiff - high plasticity	▲	G128														
1.0 - 1.5		SILT and CLAY - trace organics to 1.7 m, trace silt inclusions (< 5 mm diam.) - brown - moist, stiff - high plasticity	▲	G129														
1.5 - 2.0		- stiff to very stiff below below 1.2 m	▲	G130														
2.0 - 2.4			▲	G131														
			▲	G132														

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4) Test hole located behind 863 Kildonan Drive, 0.3 m west of east edge of northbound lane.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-12 LOCAL IMPROVEMENT HS 0395 005 00 - KILDONAN DR.GPJ TREK GEOTECHNICAL.GDT 5/7/18



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Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02-Kildonan (Greene/Linden)

Sample Date 12-Jun-18
Test Date 19-Jun-18
Technician KM

Test Pit	TH18-17	TH18-17	TH18-17	TH18-17	TH18-17	TH18-17
Depth (m)	0.0 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	2.2 - 1.8
Sample #	G112	G113	G114	G115	G116	G117
Tare ID	N113	K3	H9	A109	Z52	H74
Mass of tare	9.0	8.6	8.8	8.4	8.6	8.6
Mass wet + tare	293.2	242.6	233.0	201.4	245.4	222.6
Mass dry + tare	266.0	193.2	190.6	164.8	195.6	180.0
Mass water	27.2	49.4	42.4	36.6	49.8	42.6
Mass dry soil	257.0	184.6	181.8	156.4	187.0	171.4
Moisture %	10.6%	26.8%	23.3%	23.4%	26.6%	24.9%

Test Pit	TH18-17	TH18-18	TH18-18	TH18-18	TH18-18	TH18-18
Depth (m)	1.6 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G118	G119	G120	G121	G122	G123
Tare ID	P20	W14	AC06	A3	N06	AA15
Mass of tare	8.6	8.6	7.0	8.4	8.4	6.8
Mass wet + tare	232.2	290	297	380.8	251.2	277
Mass dry + tare	188.4	265.2	269.4	308.6	198.8	219.0
Mass water	43.8	24.8	27.6	72.2	52.4	58.0
Mass dry soil	179.8	256.6	262.4	300.2	190.4	212.2
Moisture %	24.4%	9.7%	10.5%	24.1%	27.5%	27.3%

Test Pit	TH18-18	TH18-18	TH18-19	TH18-19	TH18-19	TH18-19
Depth (m)	1.6 - 1.8	2.2 - 2.4	0.0 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G124	G125	G126	G127	G128	G129
Tare ID	F50	W110	Z59	N64	F15	Z58
Mass of tare	8.6	8.2	8.6	8.4	9.0	8.6
Mass wet + tare	284.0	282.6	344.2	210.6	214.0	204.8
Mass dry + tare	230.0	221.0	326.6	163.4	177.4	168.0
Mass water	54.0	61.6	17.6	47.2	36.6	36.8
Mass dry soil	221.4	212.8	318.0	155.0	168.4	159.4
Moisture %	24.4%	28.9%	5.5%	30.5%	21.7%	23.1%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02-Kildonan (Greene/Linden)

Sample Date 12-Jun-18
Test Date 19-Jun-18
Technician KM

Test Pit	TH18-19	TH18-19	TH18-19			
Depth (m)	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4			
Sample #	G130	G131	G132			
Tare ID	W94	N37	Z28			
Mass of tare	8.6	8.4	8.4			
Mass wet + tare	205.0	215.8	205.6			
Mass dry + tare	170.0	177.6	168.8			
Mass water	35.0	38.2	36.8			
Mass dry soil	161.4	169.2	160.4			
Moisture %	21.7%	22.6%	22.9%			

Test Pit						
Depth (m)						
Sample #						
Tare ID						
Mass of tare						
Mass wet + tare						
Mass dry + tare						
Mass water						
Mass dry soil						
Moisture %						

Test Pit						
Depth (m)						
Sample #						
Tare ID						
Mass of tare						
Mass wet + tare						
Mass dry + tare						
Mass water						
Mass dry soil						
Moisture %						



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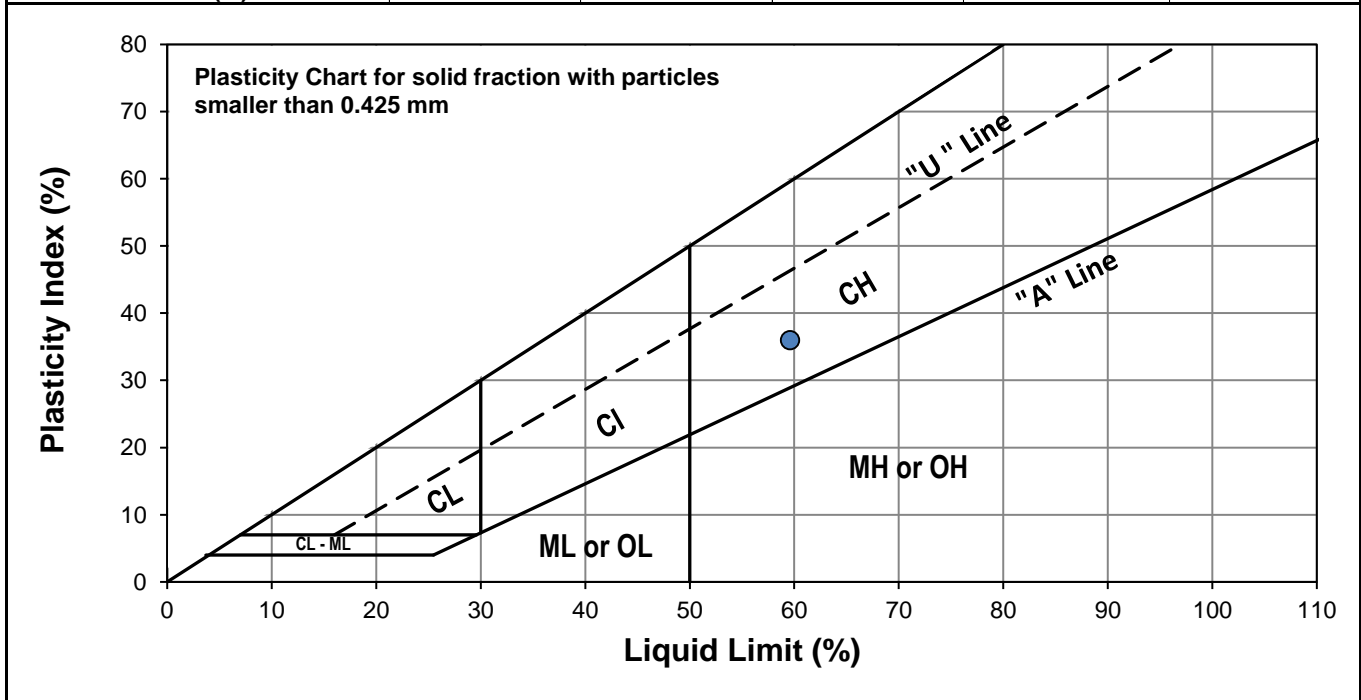
Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Kildonan (Greene/Linden)

Test Hole TH18-17
Sample # G114
Depth (m) 0.7 - 0.9
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician KM

Liquid Limit	60
Plastic Limit	24
Plasticity Index	36

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	29	35		
Mass Wet Soil + Tare (g)	19.601	18.857	17.902		
Mass Dry Soil + Tare (g)	17.534	17.131	16.503		
Mass Tare (g)	14.225	14.208	14.050		
Mass Water (g)	2.067	1.726	1.399		
Mass Dry Soil (g)	3.309	2.923	2.453		
Moisture Content (%)	62.466	59.049	57.032		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.119	20.917			
Mass Wet Soil + Tare (g)	19.788	19.608			
Mass Dry Soil + Tare (g)	14.130	14.100			
Mass Water (g)	1.331	1.309			
Mass Dry Soil (g)	5.658	5.508			
Moisture Content (%)	23.525	23.765			



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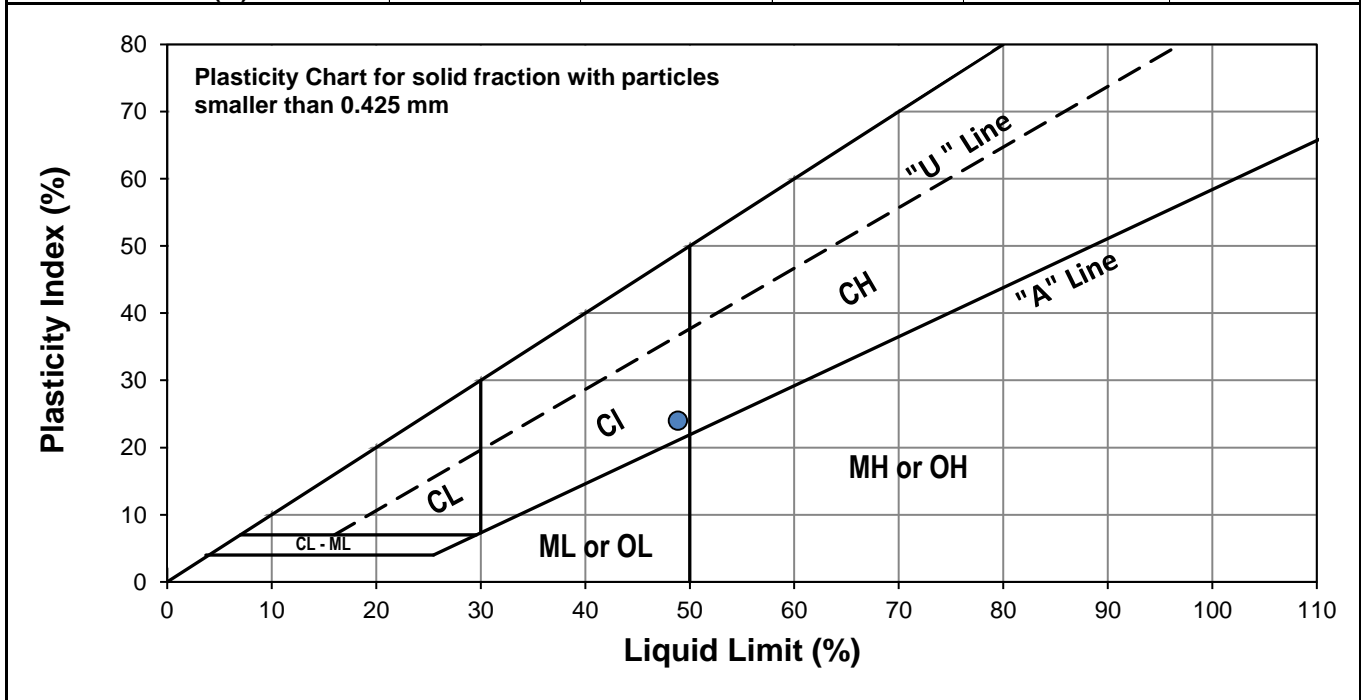
Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Kildonan (Greene/Linden)

Test Hole TH18-18
Sample # G121
Depth (m) 0.7 - 0.9
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician KM

Liquid Limit	49
Plastic Limit	25
Plasticity Index	24

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	21	27	33		
Mass Wet Soil + Tare (g)	19.656	20.206	20.512		
Mass Dry Soil + Tare (g)	17.695	18.150	18.507		
Mass Tare (g)	13.760	13.904	14.273		
Mass Water (g)	1.961	2.056	2.005		
Mass Dry Soil (g)	3.935	4.246	4.234		
Moisture Content (%)	49.835	48.422	47.355		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.236	21.460			
Mass Wet Soil + Tare (g)	19.844	20.005			
Mass Dry Soil + Tare (g)	14.235	14.168			
Mass Water (g)	1.392	1.455			
Mass Dry Soil (g)	5.609	5.837			
Moisture Content (%)	24.817	24.927			



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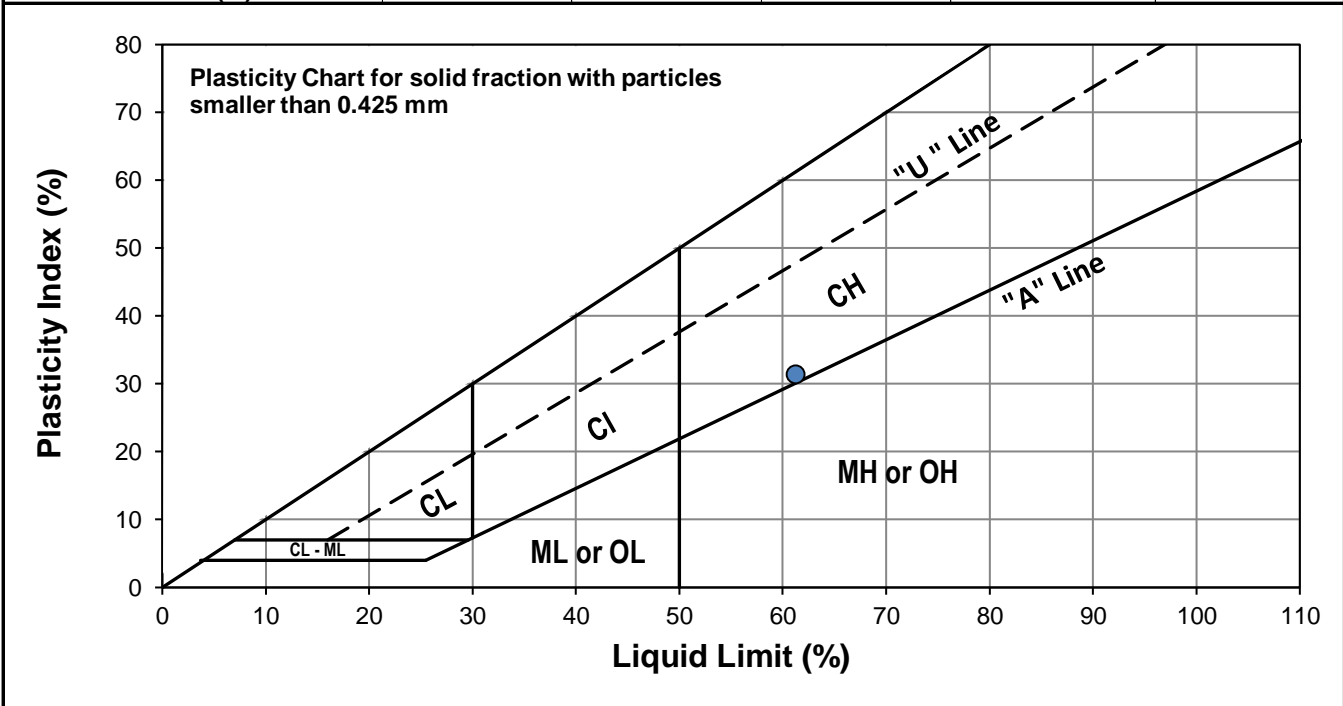
Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 Kildonan (Greene/Linden)

Test Hole TH18-19
Sample # G127
Depth (m) 0.4 - 0.7
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician KM

Liquid Limit	61
Plastic Limit	30
Plasticity Index	31

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	18	24	33
Mass Wet Soil + Tare (g)	20.266	20.365	19.674
Mass Dry Soil + Tare (g)	17.925	17.995	17.586
Mass Tare (g)	14.213	14.170	14.071
Mass Water (g)	2.341	2.370	2.088
Mass Dry Soil (g)	3.712	3.825	3.515
Moisture Content (%)	63.066	61.961	59.403



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.239	21.585			
Mass Wet Soil + Tare (g)	19.647	19.845			
Mass Dry Soil + Tare (g)	14.301	14.067			
Mass Water (g)	1.592	1.740			
Mass Dry Soil (g)	5.346	5.778			
Moisture Content (%)	29.779	30.114			



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Grain Size Analysis (Sieve Method)

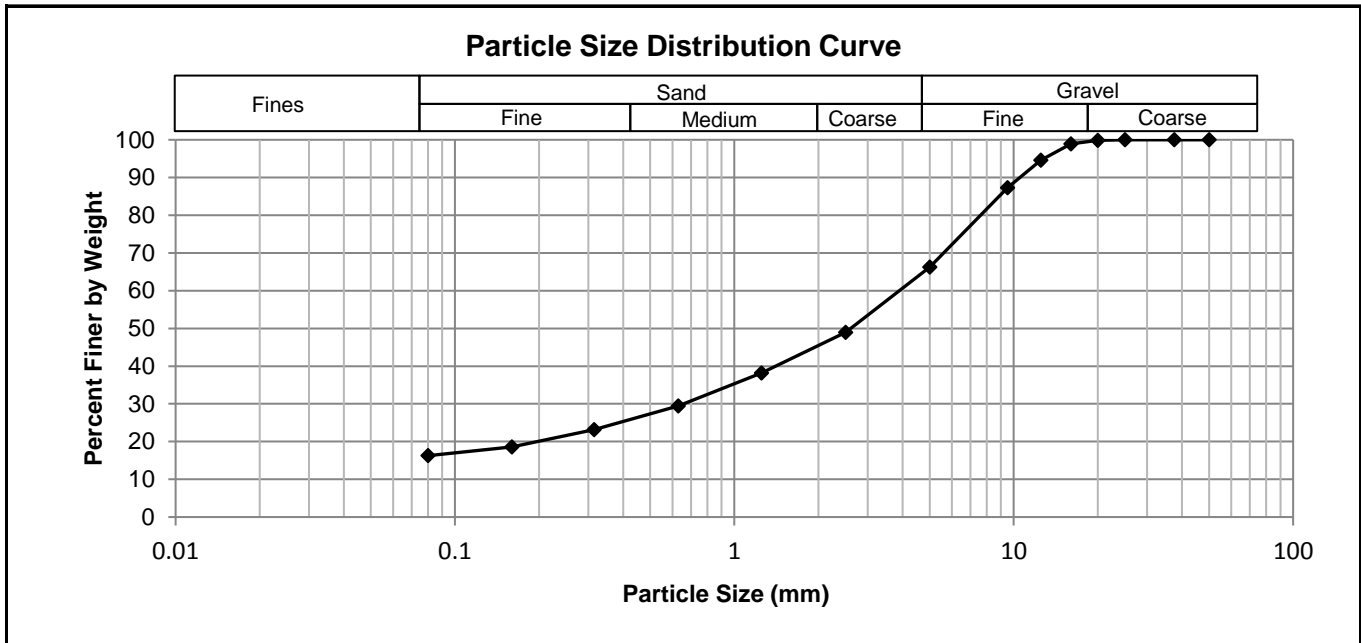
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Test Hole TH18-18
Sample # G119
Depth 03-0.8
Date Sampled 13-Jun-18
Date Tested 22-Jun-18
Technician KM

Gravel %	33.7
Sand %	50.0
Fines %	16.3



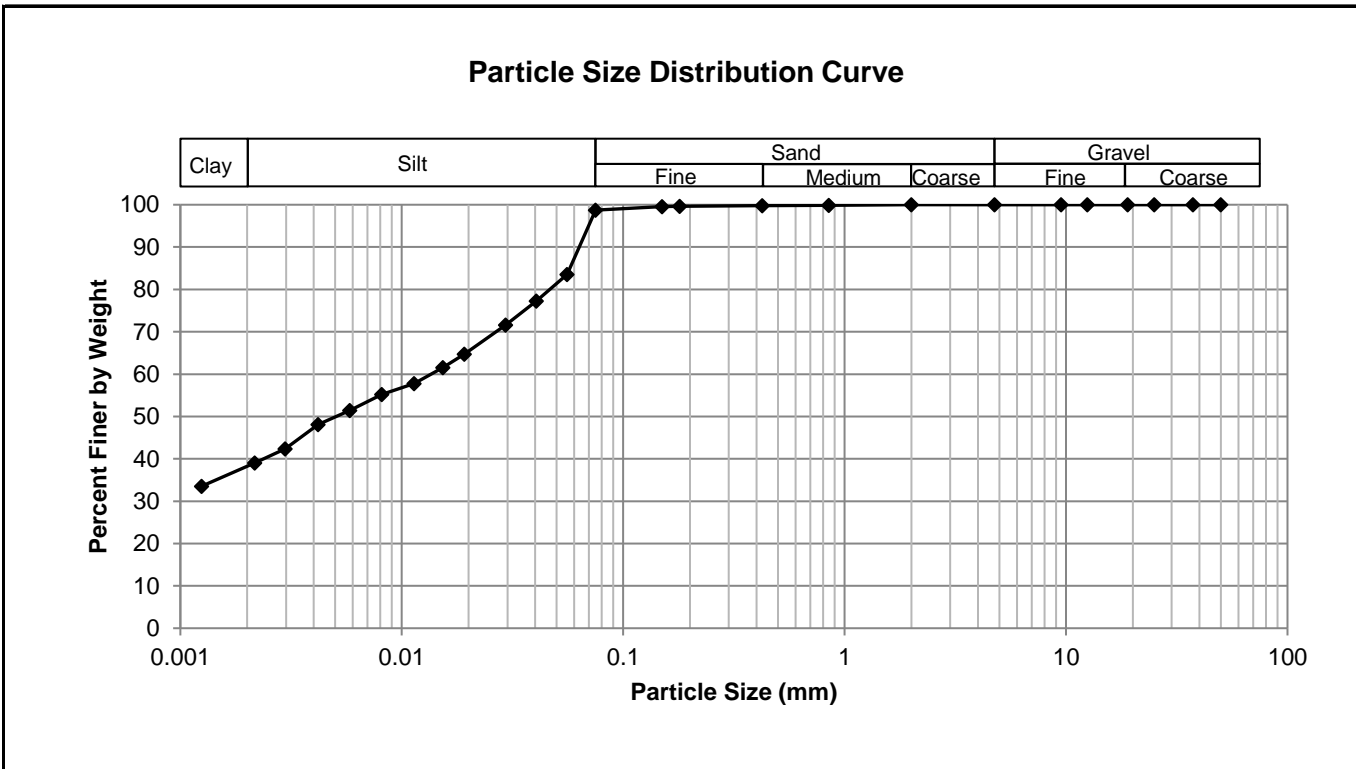
Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
25.0	100	-
20.0	100	-
16.0	99	-
12.5	95	-
9.5	87	-
5.00	66	-
2.50	49	-
1.25	38	-
0.630	29	-
0.315	23	-
0.160	19	-
0.080	16	-



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Kildonan

Test Hole TH18-17
Sample # G114
Depth (m) 0.7 - 0.9
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician KM

Gravel	0.0%
Sand	1.3%
Silt	60.6%
Clay	38.0%



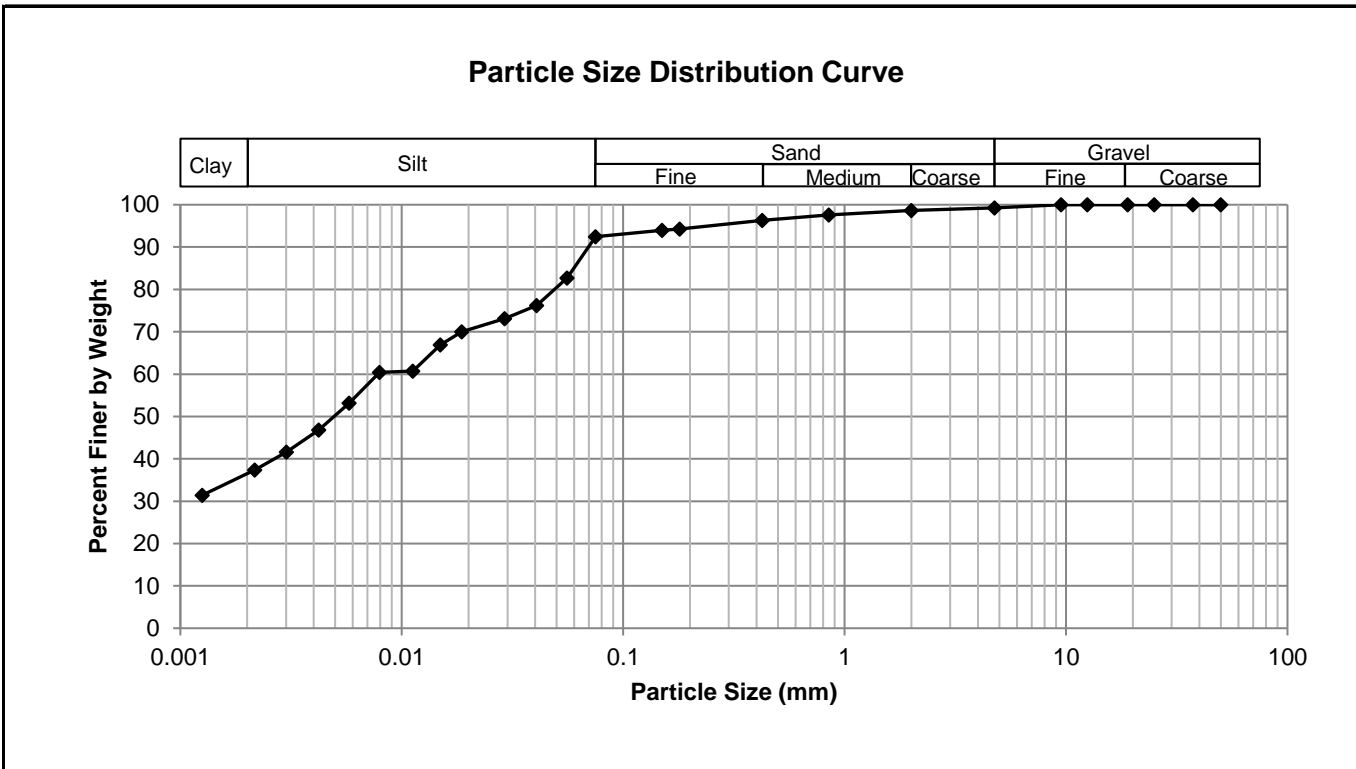
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	98.69
37.5	100.00	2.00	99.98	0.0558	83.53
25.0	100.00	0.850	99.87	0.0406	77.28
19.0	100.00	0.425	99.78	0.0294	71.59
12.5	100.00	0.180	99.63	0.0191	64.71
9.50	100.00	0.150	99.56	0.0153	61.52
4.75	100.00	0.075	98.69	0.0114	57.77
				0.0081	55.20
				0.0058	51.39
				0.0042	48.07
				0.0030	42.36
				0.0022	39.06
				0.0012	33.54



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Kildonan

Test Hole TH18-19
Sample # G127
Depth (m) 0.4 - 0.5
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician KM

Gravel	0.8%
Sand	6.8%
Silt	59.4%
Clay	33.0%



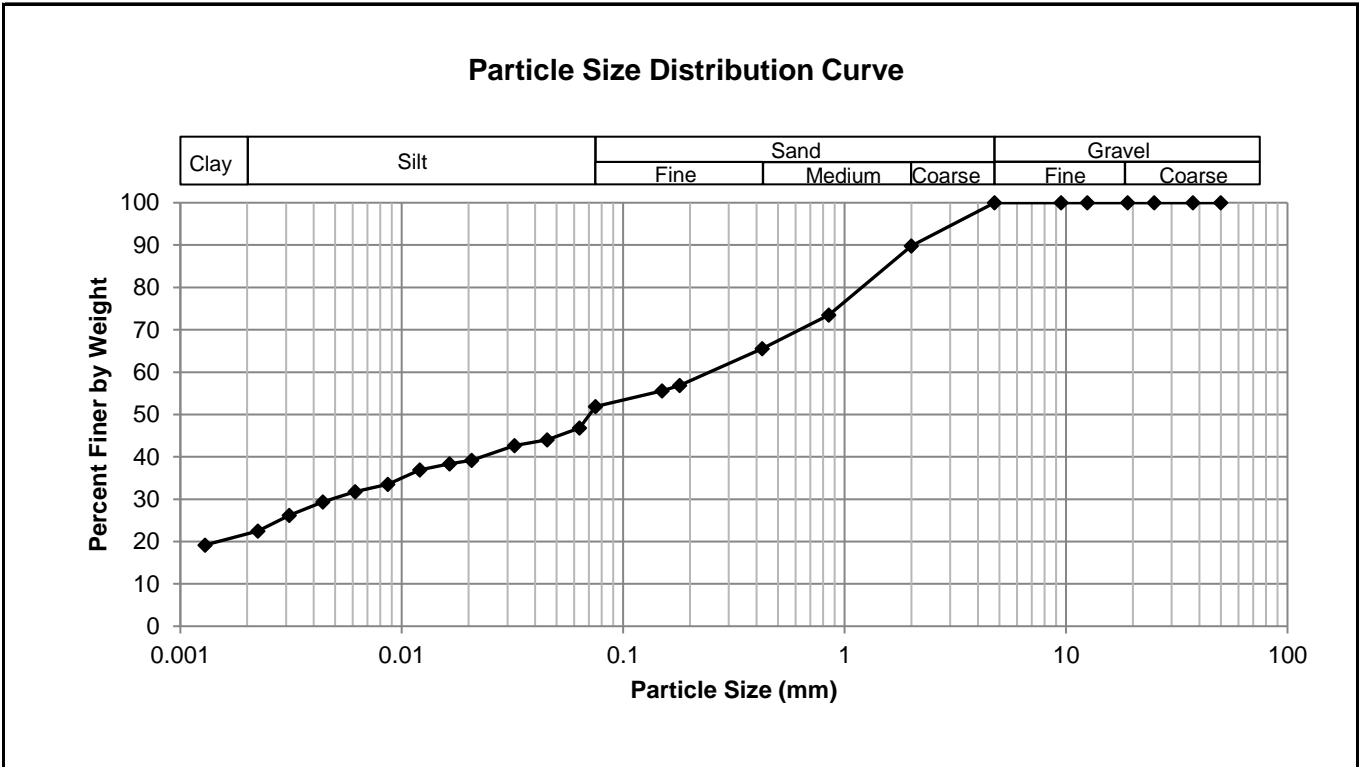
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	99.23	0.0750	92.44
37.5	100.00	2.00	98.66	0.0559	82.67
25.0	100.00	0.850	97.58	0.0407	76.19
19.0	100.00	0.425	96.34	0.0291	73.11
12.5	100.00	0.180	94.29	0.0187	70.03
9.50	100.00	0.150	93.93	0.0150	66.94
4.75	99.23	0.075	92.44	0.0112	60.71
				0.0079	60.40
				0.0058	53.18
				0.0042	46.80
				0.0030	41.60
				0.0022	37.36
				0.0013	31.42



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Kildonan

Test Hole TH18-17
Sample # G121
Depth (m) 0.7 - 0.9
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician KM

Gravel	0.0%
Sand	48.2%
Silt	30.3%
Clay	21.6%



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	51.84
37.5	100.00	2.00	89.83	0.0635	46.85
25.0	100.00	0.850	73.45	0.0454	44.04
19.0	100.00	0.425	65.59	0.0323	42.64
12.5	100.00	0.180	56.87	0.0207	39.21
9.50	100.00	0.150	55.60	0.0164	38.37
4.75	100.00	0.075	51.84	0.0121	36.91
				0.0086	33.54
				0.0062	31.79
				0.0044	29.37
				0.0031	26.21
				0.0022	22.46
				0.0013	19.18

Appendix E

Crawford Avenue / Chandos Avenue

Test Hole Logs, Summary Table, Lab Data

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	Material			
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	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting all gradation requirements for GW	mm #10 to #4 #40 to #10 #200 to #40 < #200	Sand Coarse Medium Fine Silt or Clay			
		GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines						
		GM		Silty gravels, gravel-sand-silt mixtures						
		GC		Clayey gravels, gravel-sand-silt mixtures						
	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 Not meeting all gradation requirements for SW	mm 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075	Sand Coarse Medium Fine Silt or Clay		
			SP		Poorly-graded sands, gravelly sands, little or no fines					
		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 Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
					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..... GM, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*					
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts 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	Plasticity Chart 	mm > 300 75 to 300 19 to 75 4.75 to 19	Boulders Cobbles Gravel Coarse Fine			
		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						
	Silts 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						
	Highly Organic Soils	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 Incliner	

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 TH18-20

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Crawford / Chandos) Location: UTM N-5526289, E-634995
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 12 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt, brown - dry to moist, compact, well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G133		●						
0.2 - 0.5		SILT and CLAY (Topsoil) - trace sand - black - moist, very stiff - high plasticity	▲	G134								
0.5 - 1.0		SILT - clayey - brown - moist, soft - low plasticity	▲	G135								
1.0 - 1.5		SILT - clayey - brown - moist, soft - low plasticity	▲	G136								
1.5 - 2.0		CLAY - silty, trace silt inclusions (< 20 mm diam.) - brown - moist, stiff to very stiff - high plasticity	▲	G137								
2.0 - 2.4		CLAY - silty, trace silt inclusions (< 20 mm diam.) - brown - moist, stiff to very stiff - high plasticity - stiff below 2.1 m	▲	G138								
2.4 - 2.4		CLAY - silty, trace silt inclusions (< 20 mm diam.) - brown - moist, stiff to very stiff - high plasticity - stiff below 2.1 m	▲	G139								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
- 4) Test hole located behind 80 Crawford Ave, 1.4 m west of east edge of northbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - CRAWFORD AVE.GPJ TREK GEOTECHNICAL.GDT 5/7/18



Sub-Surface Log

Test Hole TH18-21

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Crawford / Chandos) Location: UTM N-5526317, E-634995
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 13 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.3		SAND and GRAVEL (Fill) - trace to some silt, trace clay - brown - dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G140													
0.3 - 0.8		SILT and CLAY (Topsoil) - trace sand - black - moist, stiff - high plasticity	▲	G141													
0.8 - 1.1		SILT - clayey - brown - moist, soft - low plasticity	▲	G142													
1.1 - 1.5		CLAY - silty, trace silt inclusions (< 10 mm diam.) - brown - moist, very stiff to hard - low plasticity - stiff, intermediate plasticity below 1.5 m	▲	G143													
1.5 - 2.0			▲	G144													
2.0 - 2.1			▲	G145													
2.1 - 2.4		- trace silt inclusions (<15 mm diam.) below 2.0 m - high plasticity below 2.1 m	▲	G146													

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
- 4) Test hole located behind 86 Crawford Ave, 0.4 m west of east edge of northbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - CRAWFORD AVE GPJ_TREK GEOTECHNICAL_GDT_5/7/18



Sub-Surface Log

Test Hole TH18-22

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Crawford / Chandos) Location: UTM N-5526379, E-634996
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 13 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)											
							16	17	18	19	20	21	0	20	40	60	80	100	0	50	100	150
0.00 - 0.05		ASPHALT - 55 mm thick																				
0.05 - 0.25		SAND and GRAVEL (Fill) - trace clay, trace silt, brown - dry to moist, compact, well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"		G147																		
0.25 - 0.45		SILT and CLAY (Topsoil) - some sand, trace gravel, trace organics - black - moist, stiff - high plasticity		G148																		
0.45 - 0.65		CLAY - silty, trace sand to 2.0 m, trace silt inclusions (< 5 mm diam.) - grey - moist, stiff - high plasticity		G149																		
0.65 - 0.85				G150																		
0.85 - 1.05				G151																		
1.05 - 1.25				G152																		
1.25 - 2.00																						
2.00 - 2.40		- brown, trace silt and silt inclusions (< 25 mm diam.) below 2.0 m		G153																		

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
- 4) Test hole located behind 100 Crawford Ave, 1.6 m west of east edge of northbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - CRAWFORD AVE GPJ TREK GEOTECHNICAL GDT 5/7/18



Sub-Surface Log

Test Hole TH18-23

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Crawford / Chandos) Location: UTM N-5526432, E-634998
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 13 June 2018

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	SPT (N)	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 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt, brown - dry to moist, compact, well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G154		●			0	20	40	60	80	100					
0.2 - 0.5		SILT and CLAY (Topsoil) - trace sand - black - moist, stiff - high plasticity							0	20	40	60	80	100					
0.5 - 0.8			▲	G155					0	20	40	60	80	100					
0.8 - 1.0			▲	G156					0	20	40	60	80	100					
1.0 - 1.5		SILT - clayey - brown - moist, soft - low plasticity	▲	G157					0	20	40	60	80	100					
1.5 - 1.8			▲	G158					0	20	40	60	80	100					
1.8 - 2.0		CLAY - silty, trace silt inclusions < 20 mm diam.) - brown - moist, hard - high plasticity	▲	G159					0	20	40	60	80	100					
2.0 - 2.4		- stiff, trace silt inclusions (< 5 m diam.) below 2.0 m	▲	G160					0	20	40	60	80	100					

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY

Notes:

1. No seepage or sloughing observed.
2. Test hole open to 2.4 m after drilling.
3. Test hole backfilled with auger cuttings, sand and gravel at surface.
- 4) Test hole located behind 116 Crawford Ave, 0.4 m west of east edge of northbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - CRAWFORD AVE GPJ TREK GEOTECHNICAL_GDT 5/7/18



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement 18-LI-02 -Crawford

Sample Date 12-Jun-18
Test Date 15-Jun-18
Technician SC

Test Pit	TH18-20	TH18-20	TH18-20	TH18-20	TH18-20	TH18-20
Depth (m)	0.0 - 0.1	0.4 - 0.5	0.8 - 0.9	1.0 - 1.2	1.4 - 1.5	1.6 - 1.8
Sample #	G133	G134	G135	G136	G137	G138
Tare ID	E3	H8	E79	E103	P17	W45
Mass of tare	8.8	8.4	9.2	8.2	8.6	8.4
Mass wet + tare	281.2	329.0	408.6	306.2	392.6	270.0
Mass dry + tare	267.8	241.6	313.6	247.0	322.8	207.4
Mass water	13.4	87.4	95.0	59.2	69.8	62.6
Mass dry soil	259.0	233.2	304.4	238.8	314.2	199.0
Moisture %	5.2%	37.5%	31.2%	24.8%	22.2%	31.5%

Test Pit	TH18-20	TH18-21	TH18-21	TH18-21	TH18-21	TH18-21
Depth (m)	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G139	G140	G141	G142	G143	G144
Tare ID	P11	Z37	A20	C3	N33	Z93
Mass of tare	8.6	8.4	9.2	8.4	8.4	8.8
Mass wet + tare	340.4	319.6	280	476.2	361.6	304.6
Mass dry + tare	238.4	303.6	214.6	349.6	287.8	231.4
Mass water	102.0	16.0	65.4	126.6	73.8	73.2
Mass dry soil	229.8	295.2	205.4	341.2	279.4	222.6
Moisture %	44.4%	5.4%	31.8%	37.1%	26.4%	32.9%

Test Pit	TH18-21	TH18-21	TH18-22	TH18-22	TH18-22	TH18-22
Depth (m)	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G145	G146	G147	G148	G149	G150
Tare ID	E48	AA06	AB07	N32	A39	C19
Mass of tare	8.6	6.6	6.6	8.6	8.6	9.0
Mass wet + tare	287.8	303.2	306.4	393.2	367.2	314.2
Mass dry + tare	208.6	210.4	292.8	298.0	295.8	238.4
Mass water	79.2	92.8	13.6	95.2	71.4	75.8
Mass dry soil	200.0	203.8	286.2	289.4	287.2	229.4
Moisture %	39.6%	45.5%	4.8%	32.9%	24.9%	33.0%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement 18-LI-02 -Crawford

Sample Date 12-Jun-18
Test Date 15-Jun-18
Technician SC

Test Pit	TH18-22	TH18-22	TH18-22	TH18-23	TH18-23	TH18-23
Depth (m)	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4	0.0 - 0.1	0.4 - 0.5	0.7 - 0.9
Sample #	G151	G152	G153	G154	G155	G156
Tare ID	Z75	AB64	AB01	AB100	P23	D2
Mass of tare	8.4	6.8	6.6	6.8	8.4	8.2
Mass wet + tare	313.8	302.4	329.6	270.2	331.8	380.2
Mass dry + tare	236.0	226.8	229.4	255.0	242.8	282.2
Mass water	77.8	75.6	100.2	15.2	89.0	98.0
Mass dry soil	227.6	220.0	222.8	248.2	234.4	274.0
Moisture %	34.2%	34.4%	45.0%	6.1%	38.0%	35.8%

Test Pit	TH18-23	TH18-23	TH18-23	TH18-23		
Depth (m)	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4		
Sample #	G157	G158	G159	G160		
Tare ID	Z12	K20	E8	K28		
Mass of tare	8.6	8.4	8.6	8.6		
Mass wet + tare	517.6	341.0	318.2	317.4		
Mass dry + tare	420.4	277.2	239.8	222.6		
Mass water	97.2	63.8	78.4	94.8		
Mass dry soil	411.8	268.8	231.2	214.0		
Moisture %	23.6%	23.7%	33.9%	44.3%		



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Atterberg Limits
ASTM D4318-10e1

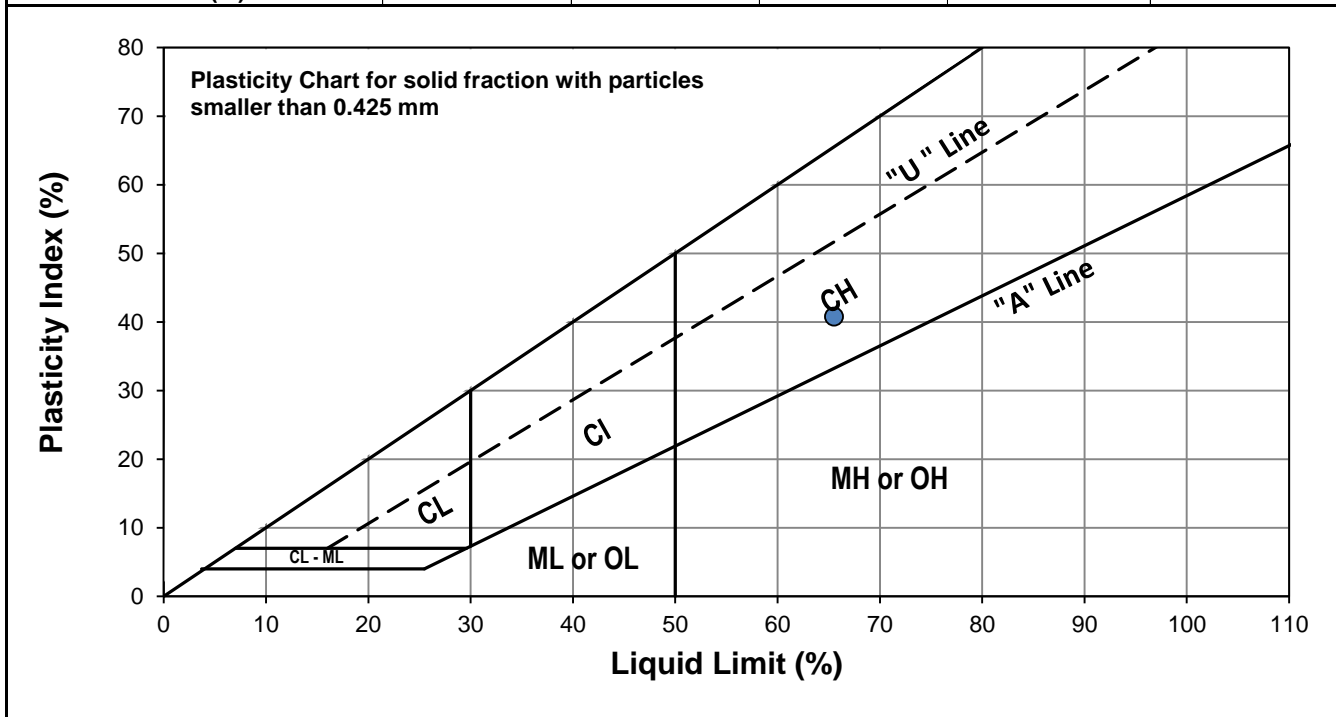
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Crawford

Test Hole TH18-20
Sample # G135
Depth (m) 0.8 - 0.9
Sample Date 12-Jun-18
Test Date 18-Jun-18
Technician SC

Liquid Limit	66
Plastic Limit	25
Plasticity Index	41

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	26	35
Mass Wet Soil + Tare (g)	27.738	28.541	28.879
Mass Dry Soil + Tare (g)	22.361	22.856	23.079
Mass Tare (g)	14.326	14.125	14.093
Mass Water (g)	5.377	5.685	5.800
Mass Dry Soil (g)	8.035	8.731	8.986
Moisture Content (%)	66.920	65.113	64.545



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.570	20.826			
Mass Wet Soil + Tare (g)	19.328	19.526			
Mass Dry Soil + Tare (g)	14.326	14.253			
Mass Water (g)	1.242	1.300			
Mass Dry Soil (g)	5.002	5.273			
Moisture Content (%)	24.830	24.654			



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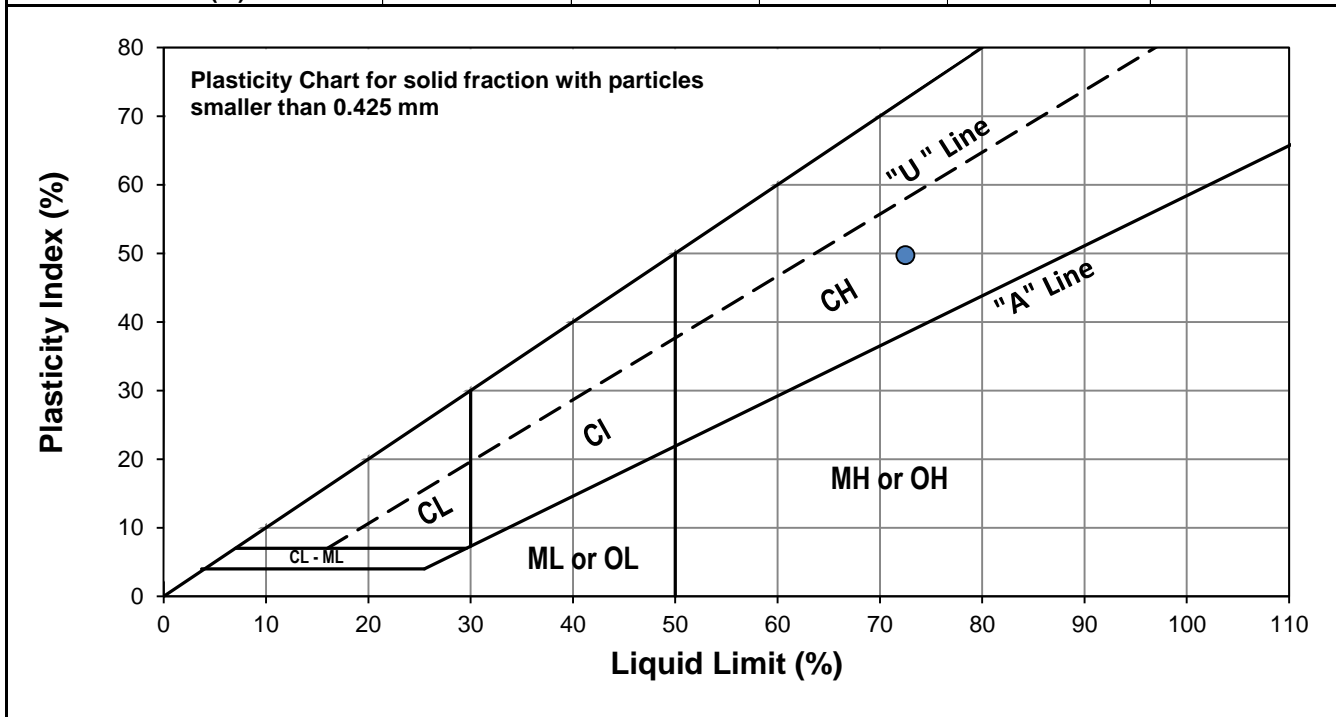
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Crawford

Test Hole TH18-21
Sample # G142
Depth (m) 0.7 - 0.9
Sample Date 12-Jun-18
Test Date 21-Jun-18
Technician SC

Liquid Limit	73
Plastic Limit	23
Plasticity Index	50

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	18	23	34
Mass Wet Soil + Tare (g)	18.388	18.780	17.501
Mass Dry Soil + Tare (g)	16.484	16.757	16.260
Mass Tare (g)	14.110	14.089	14.326
Mass Water (g)	1.904	2.023	1.241
Mass Dry Soil (g)	2.374	2.668	1.934
Moisture Content (%)	80.202	75.825	64.168



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.208	20.620			
Mass Wet Soil + Tare (g)	19.069	19.434			
Mass Dry Soil + Tare (g)	14.028	14.282			
Mass Water (g)	1.139	1.186			
Mass Dry Soil (g)	5.041	5.152			
Moisture Content (%)	22.595	23.020			



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Atterberg Limits
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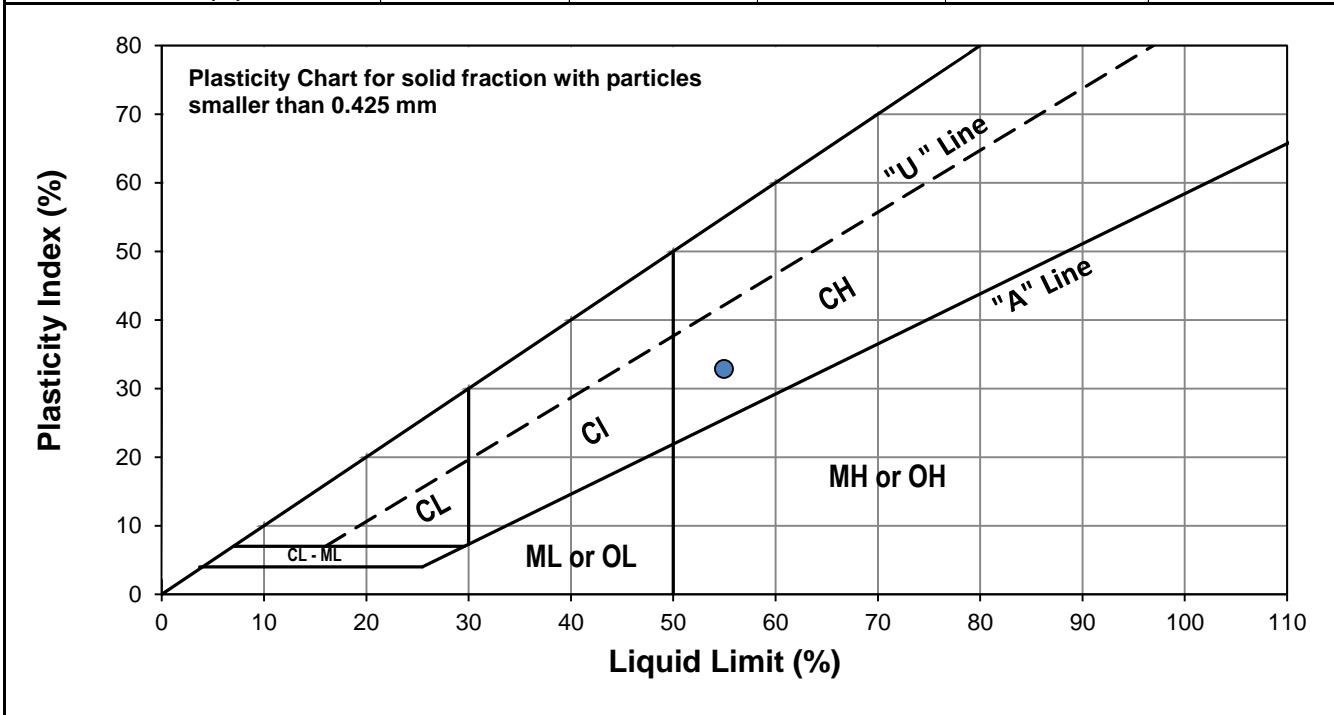
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Crawford

Test Hole TH18-22
Sample # G148
Depth (m) 0.4 - 0.5
Sample Date 12-Jun-18
Test Date 22-Jun-18
Technician SC

Liquid Limit	55
Plastic Limit	22
Plasticity Index	33

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	25	34
Mass Wet Soil + Tare (g)	17.549	17.382	17.448
Mass Dry Soil + Tare (g)	16.319	16.156	16.309
Mass Tare (g)	14.109	13.920	14.221
Mass Water (g)	1.230	1.226	1.139
Mass Dry Soil (g)	2.210	2.236	2.088
Moisture Content (%)	55.656	54.830	54.550



Plastic Limit

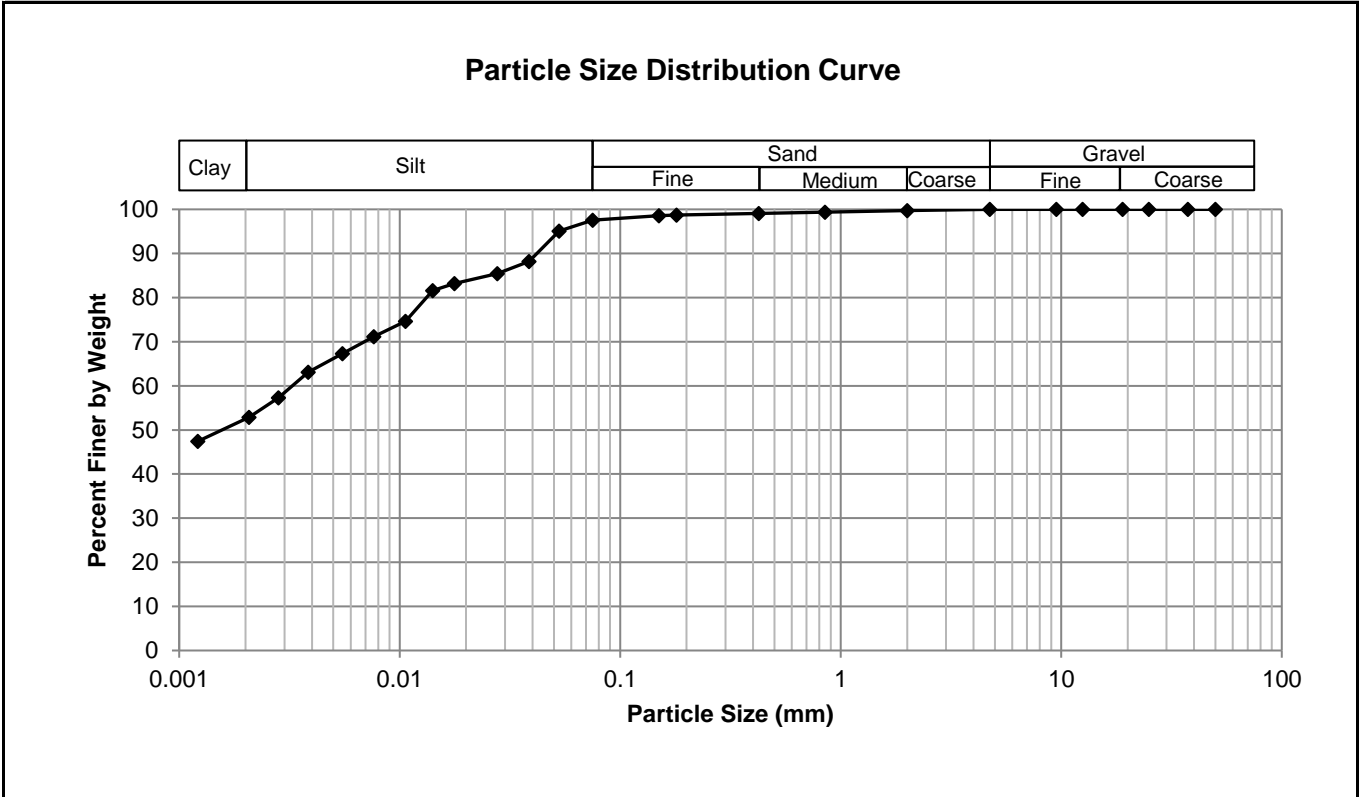
Trial #	1	2	3	4	5
Mass Tare (g)	20.310	20.873			
Mass Wet Soil + Tare (g)	19.186	19.668			
Mass Dry Soil + Tare (g)	14.087	14.254			
Mass Water (g)	1.124	1.205			
Mass Dry Soil (g)	5.099	5.414			
Moisture Content (%)	22.044	22.257			



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 -Crawford

Test Hole TH18-20
Sample # G135
Depth (m) 0.8 - 0.9
Sample Date 12-Jun-18
Test Date 20-Jun-18
Technician SC

Gravel	0.0%
Sand	2.5%
Silt	45.1%
Clay	52.4%



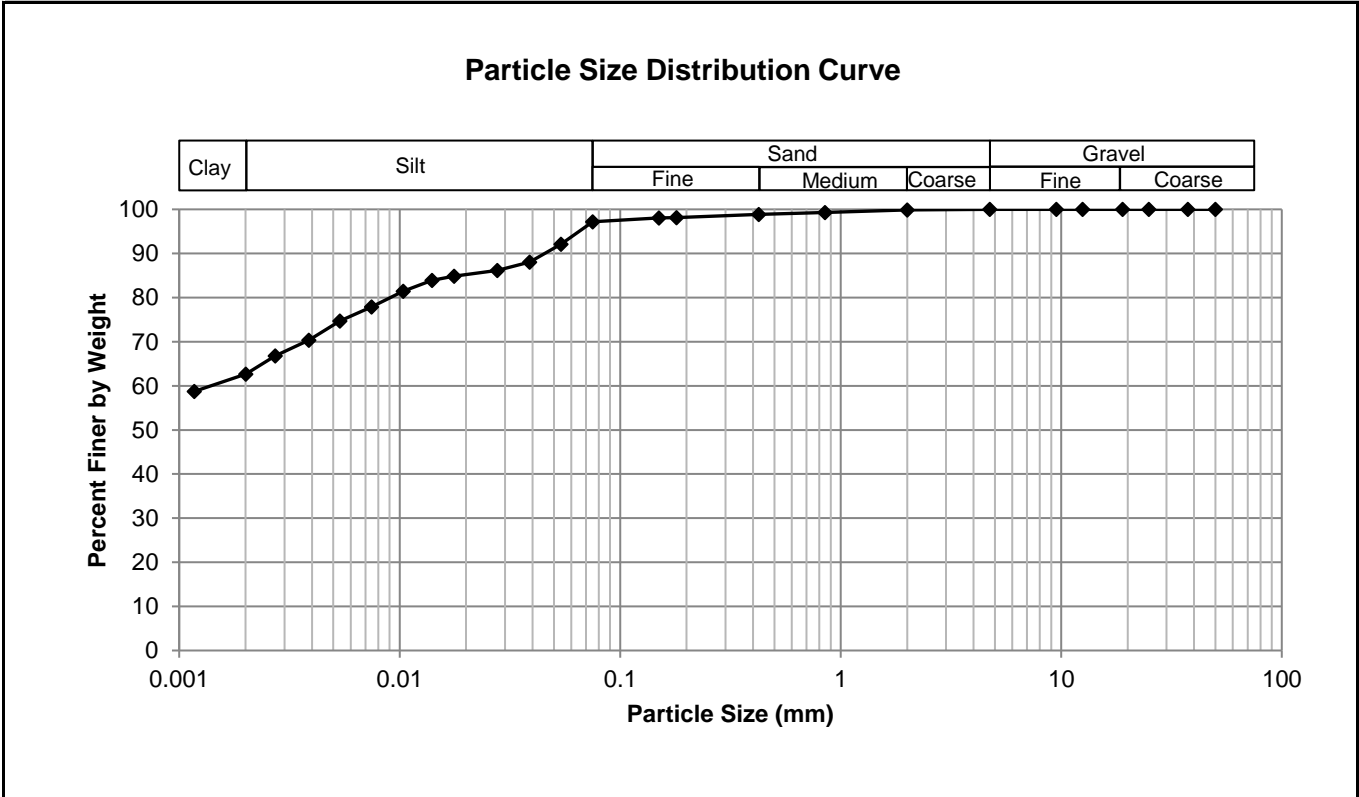
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.53
37.5	100.00	2.00	99.73	0.0528	95.08
25.0	100.00	0.850	99.33	0.0386	88.22
19.0	100.00	0.425	99.11	0.0277	85.41
12.5	100.00	0.180	98.71	0.0177	83.16
9.50	100.00	0.150	98.60	0.0141	81.60
4.75	100.00	0.075	97.53	0.0106	74.66
				0.0076	71.16
				0.0055	67.27
				0.0038	63.08
				0.0028	57.32
				0.0021	52.88
				0.0012	47.40



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 -Crawford

Test Hole TH18-21
Sample # G142
Depth (m) 0.8 - 0.9
Sample Date 12-Jun-18
Test Date 20-Jun-18
Technician SC

Gravel	0.0%
Sand	2.8%
Silt	34.6%
Clay	62.6%



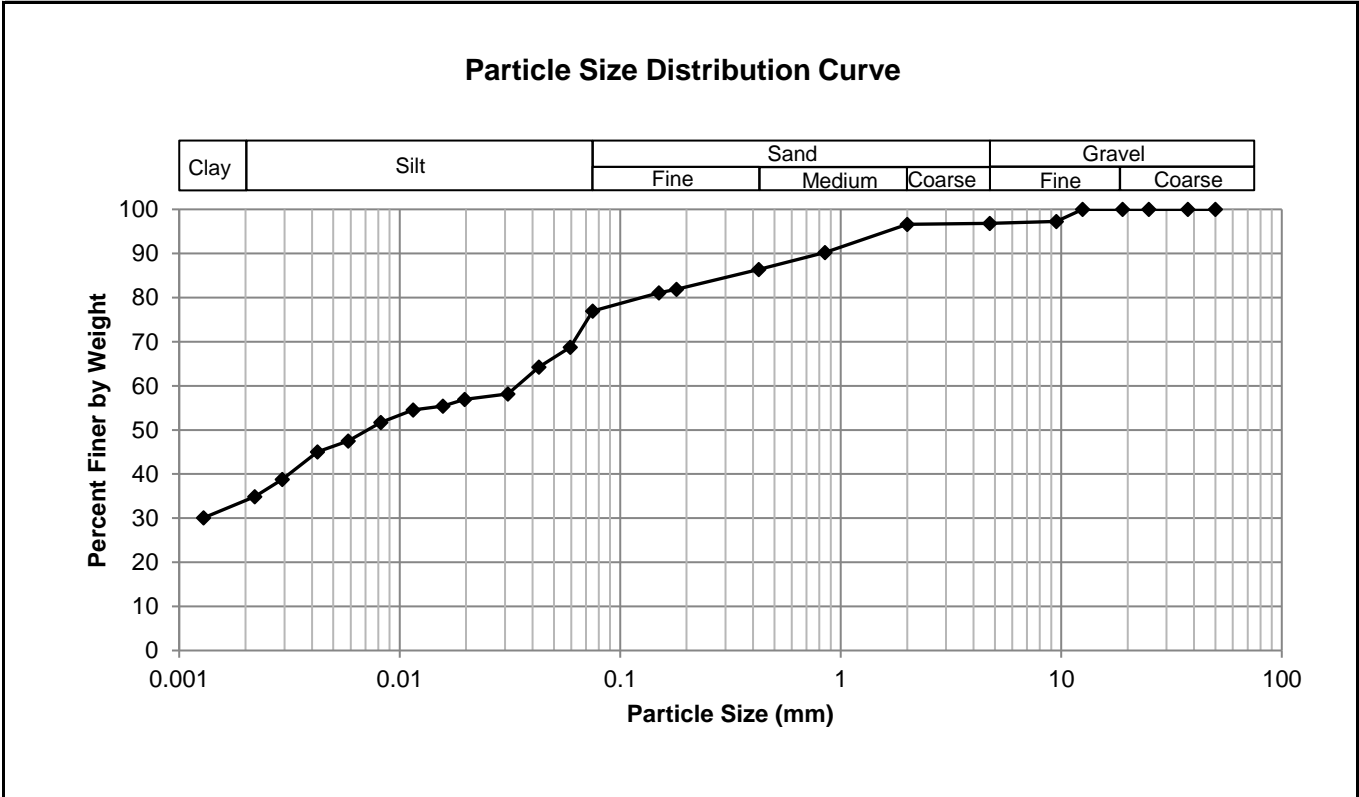
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.20
37.5	100.00	2.00	99.88	0.0539	92.12
25.0	100.00	0.850	99.29	0.0389	88.06
19.0	100.00	0.425	98.86	0.0277	86.18
12.5	100.00	0.180	98.16	0.0177	84.86
9.50	100.00	0.150	98.03	0.0140	83.92
4.75	100.00	0.075	97.20	0.0104	81.43
				0.0075	77.92
				0.0054	74.72
				0.0039	70.36
				0.0027	66.78
				0.0020	62.65
				0.0012	58.73



Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 -Crawford

Test Hole TH18-21
Sample # G148
Depth (m) 0.4 - 0.5
Sample Date 12-Jun-18
Test Date 20-Jun-18
Technician SC

Gravel	3.2%
Sand	19.8%
Silt	43.1%
Clay	33.8%



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	96.81	0.0750	76.97
37.5	100.00	2.00	96.58	0.0594	68.77
25.0	100.00	0.850	90.21	0.0428	64.24
19.0	100.00	0.425	86.38	0.0310	58.20
12.5	100.00	0.180	81.89	0.0197	56.92
9.50	97.28	0.150	81.07	0.0157	55.41
4.75	96.81	0.075	76.97	0.0115	54.50
				0.0082	51.71
				0.0058	47.50
				0.0042	45.01
				0.0029	38.83
				0.0022	34.91
				0.0013	30.07



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Grain Size Analysis (Sieve Method)

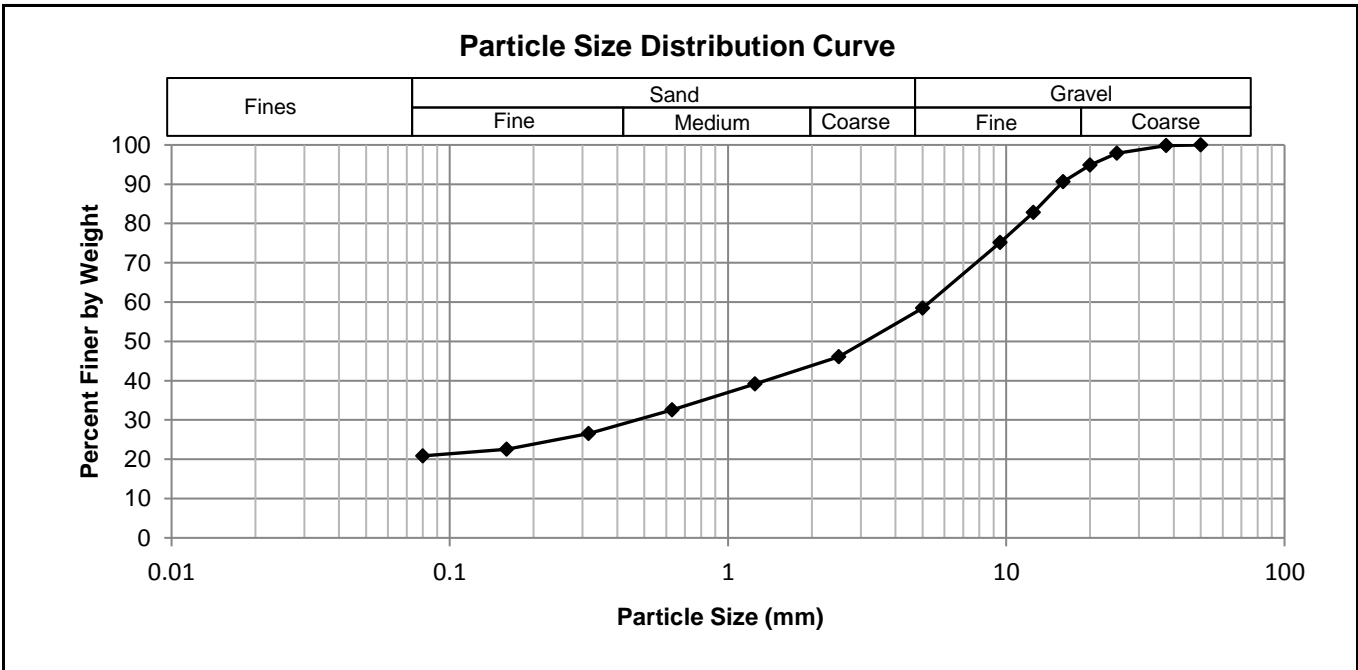
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Crawford

Test Hole TH18-21
Sample # G140
Depth 03-0.8
Date Sampled 13-Jun-18
Date Tested 20-Jun-18
Technician SC

Gravel %	41.5
Sand %	37.6
Fines %	20.9



Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
50.0	100	-
37.5	100	-
25.0	98	-
20.0	95	-
16.0	91	-
12.5	83	-
9.5	75	-
5.00	58	-
2.50	46	-
1.25	39	-
0.630	33	-
0.315	26	-
0.160	23	-
0.080	21	-

Appendix F

Dumoulin Street / Provencher Boulevard

Test Hole Logs, Summary Table, Lab Data

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	Material			
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	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 Not meeting all gradation requirements for GW	ASTM Sieve sizes #10 to #4 #40 to #10 #200 to #40 < #200	Sand Coarse Medium Fine			
		GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines						
		GM		Silty gravels, gravel-sand-silt mixtures						
		GC		Clayey gravels, gravel-sand-silt mixtures						
	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 Not meeting all gradation requirements for SW	mm 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075	Sand Coarse Medium Fine		
			SP		Poorly-graded sands, gravelly sands, little or no fines					
		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 Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
					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*					
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts 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	Plasticity Chart 	Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19	Material Boulders Cobbles Gravel Coarse Fine			
		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						
	Silts 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						
	Highly Organic Soils	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 TH18-24

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Dumoulin / Provencher) Location: UTM N-5528811, E-635859
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 13 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown - dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G161		18			0	0		
0.2 - 0.5		CLAY - silty, trace silt inclusions (< 20 mm diam.) - dark grey - moist, firm to stiff - high plasticity	▲	G162		20			0	0	50	100
0.5 - 0.8		SILT - some clay, trace sand - brown - moist, soft - low plasticity	▲	G163		20			0	0		
0.8 - 1.2		SILT AND CLAY - trace sand - brown - moist, very stiff, low plasticity	▲	G164		20			0	0		
1.2 - 1.5		CLAY - silty, trace sand, trace silt inclusions (< 5 mm diam.), trace oxidation - brown - moist, stiff - high plasticity	▲	G165		20			0	0	50	100
1.5 - 2.0		CLAY - silty, trace sand, trace silt inclusions (< 5 mm diam.), trace oxidation - brown - moist, stiff - high plasticity	▲	G166		20			0	0	50	100
2.0 - 2.4		- firm below 2.1 m	▲	G167		20			0	0	50	100

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. Seepage observed at 1.2 m.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4) Test hole located behind 472 Dumoulin St, 3.0 m south of north edge of eastbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - DUMOULIN ST.GPJ TREK GEOTECHNICAL.GDT 57/18



Sub-Surface Log

Test Hole TH18-25

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Dumoulin / Provencher) Location: UTM N-5528796, E-635825
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 13 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							16	17	18	19	20	21
0.0 - 0.3		SAND and GRAVEL (Fill) - trace clay, trace silt - brown - dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"		G168		16						
0.3 - 1.0		CLAY - silty, trace gravel, trace silt inclusions (< 25 mm diam.), trace organics to 1.0 m - dark grey - moist, stiff - high plasticity		G169								
1.0 - 1.3		- very stiff below 1.0 m		G170								
1.3 - 1.8		- stiff below 1.3 m		G171								
1.8 - 2.0		SILT - some clay, trace sand - brown - moist, soft, intermediate plasticity		G172								
2.0 - 2.4		CLAY - silty - brown - moist, stiff - high plasticity		G173								
2.4 - 2.4		CLAY - silty - brown - moist, stiff - high plasticity		G174								

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. Seepage observed at 1.8 m.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4) Test hole located behind 458 Dumoulin St, 1.2 m north of south edge of eastbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - DUMOULIN ST.GPJ TREK GEOTECHNICAL GDT 57/18



Sub-Surface Log

Test Hole TH18-26

1 of 1

Client: WSP Canada Group Ltd. Project Number: 0395 005 00
 Project Name: 2018 Local Improvement Package 18-LI-02 (Dumoulin / Provencher) Location: UTM N-5528780, E-635795
 Contractor: TREK Geotechnical Inc. Ground Elevation: Street Level
 Method: Hand Auger Date Drilled: 13 June 2018

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	SPT (N)	Temperature (°C)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	20	40	60	80
0.0 - 0.2		SAND and GRAVEL (Fill) - trace clay, trace silt - brown, dry to moist, compact - well graded fine sand to fine gravel (<20 mm diam.) - rounded to sub angular, "pit run"	▲	G175													
0.2 - 0.5		CLAY - silty, trace sand, trace silt inclusions (< 25 mm diam.) - dark grey - moist, stiff - high plasticity	▲	G176								△					
0.5 - 1.0		CLAY - silty, trace sand, trace silt inclusions (< 25 mm diam.) - dark grey - moist, stiff - high plasticity	▲	G177								△					
1.0 - 1.5		SILT - some clay, trace sand - brown - moist, soft - intermediate plasticity	▲	G178								△					
1.5 - 2.0		SILT - some clay, trace sand - brown - moist, soft - intermediate plasticity	▲	G179													
2.0 - 2.4		CLAY - silty, trace silt inclusions (< 10 mm diam.), trace oxidation - brown - moist, stiff - high plasticity	▲	G180													
2.4 - 2.4		CLAY - silty, trace silt inclusions (< 10 mm diam.), trace oxidation - brown - moist, stiff - high plasticity	▲	G181								△					

END OF TEST HOLE AT 2.4 m DEPTH IN CLAY
 Notes:
 1. Seepage observed at 1.8 m.
 2. Test hole open to 2.4 m after drilling.
 3. Test hole backfilled with auger cuttings, sand and gravel at surface.
 4) Test hole located behind 452 Dumoulin St, 3 m south of north edge of westbound lane.

Logged By: Harsimran Singh Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-06-14 LOCAL IMPROVEMENT HS 0395 005 00 - DUMOULIN ST.GPJ TREK GEOTECHNICAL GDT 57/18



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Sample Date 13-Jun-18
Test Date 15-Jun-18
Technician EH

Test Pit	TH18-24	TH18-24	TH18-24	TH18-24	TH18-24	TH18-24
Depth (m)	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8
Sample #	G161	G162	G163	G164	G165	G166
Tare ID	N35	F99	AC16	AC24	AB06	N79
Mass of tare	8.6	8.6	6.8	6.7	6.7	8.6
Mass wet + tare	524.9	311.2	349.2	290.8	326.0	243.8
Mass dry + tare	510.5	231.6	285.0	233.1	247.6	172.6
Mass water	14.4	79.6	64.2	57.7	78.4	71.2
Mass dry soil	501.9	223.0	278.2	226.4	240.9	164.0
Moisture %	2.9%	35.7%	23.1%	25.5%	32.5%	43.4%

Test Pit	TH18-24	TH18-25	TH18-25	TH18-25	TH18-25	TH18-25
Depth (m)	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G167	G168	G169	G170	G171	G172
Tare ID	AC27	E125	F32	D18	N47	C11
Mass of tare	6.7	8.2	8.3	8.6	8.4	8.3
Mass wet + tare	295.9	549.6	277.2	258.3	292.3	228.1
Mass dry + tare	200.7	538.0	215.5	197.6	223.5	169.0
Mass water	95.2	11.6	61.7	60.7	68.8	59.1
Mass dry soil	194.0	529.8	207.2	189.0	215.1	160.7
Moisture %	49.0%	2.2%	29.8%	32.1%	32.0%	36.8%

Test Pit	TH18-25	TH18-25	TH18-26	TH18-26	TH18-26	TH18-26
Depth (m)	1.6 - 1.8	2.2 - 2.4	0.1 - 0.2	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G173	G174	G175	G176	G177	G178
Tare ID	K30	W83	P85	E49	E22	Z47
Mass of tare	8.6	8.5	8.6	8.7	8.6	8.6
Mass wet + tare	208.8	221.1	529.5	376.2	248.1	330.4
Mass dry + tare	153.4	156.9	519.2	288.2	189.5	254.2
Mass water	55.4	64.2	10.3	88.0	58.6	76.2
Mass dry soil	144.8	148.4	510.6	279.5	180.9	245.6
Moisture %	38.3%	43.3%	2.0%	31.5%	32.4%	31.0%



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Moisture Content Report ASTM D2216-10

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Sample Date 13-Jun-18
Test Date 15-Jun-18
Technician EH

Test Pit	TH18-26	TH18-26	TH18-26			
Depth (m)	1.3 - 1.5	1.6 - 1.8	2.2 - 2.4			
Sample #	G179	G180	G181			
Tare ID	E81	AA05	AB81			
Mass of tare	8.7	6.7	6.9			
Mass wet + tare	331.3	372.8	372.6			
Mass dry + tare	265.3	302.3	299.0			
Mass water	66.0	70.5	73.6			
Mass dry soil	256.6	295.6	292.1			
Moisture %	25.7%	23.8%	25.2%			



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Atterberg Limits
ASTM D4318-10e1

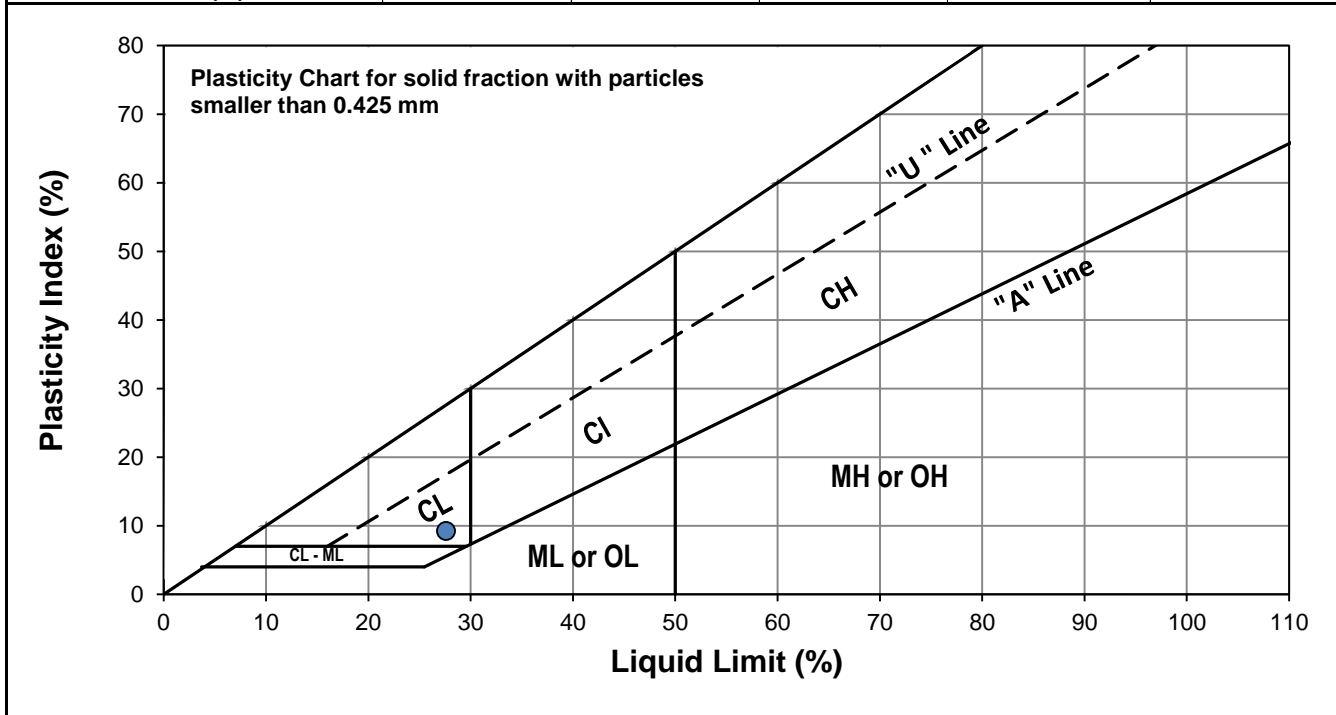
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Test Hole TH18-24
Sample # G163
Depth (m) 0.7 - 0.9
Sample Date 13-Jun-18
Test Date 22-Jun-18
Technician EH

Liquid Limit	28
Plastic Limit	18
Plasticity Index	9

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	15	25	30
Mass Wet Soil + Tare (g)	26.209	25.740	26.340
Mass Dry Soil + Tare (g)	23.566	23.250	23.729
Mass Tare (g)	14.207	14.235	14.177
Mass Water (g)	2.643	2.490	2.611
Mass Dry Soil (g)	9.359	9.015	9.552
Moisture Content (%)	28.240	27.621	27.335



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.255	20.459			
Mass Wet Soil + Tare (g)	19.310	19.496			
Mass Dry Soil + Tare (g)	14.227	14.200			
Mass Water (g)	0.945	0.963			
Mass Dry Soil (g)	5.083	5.296			
Moisture Content (%)	18.591	18.184			



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Atterberg Limits
ASTM D4318-10e1

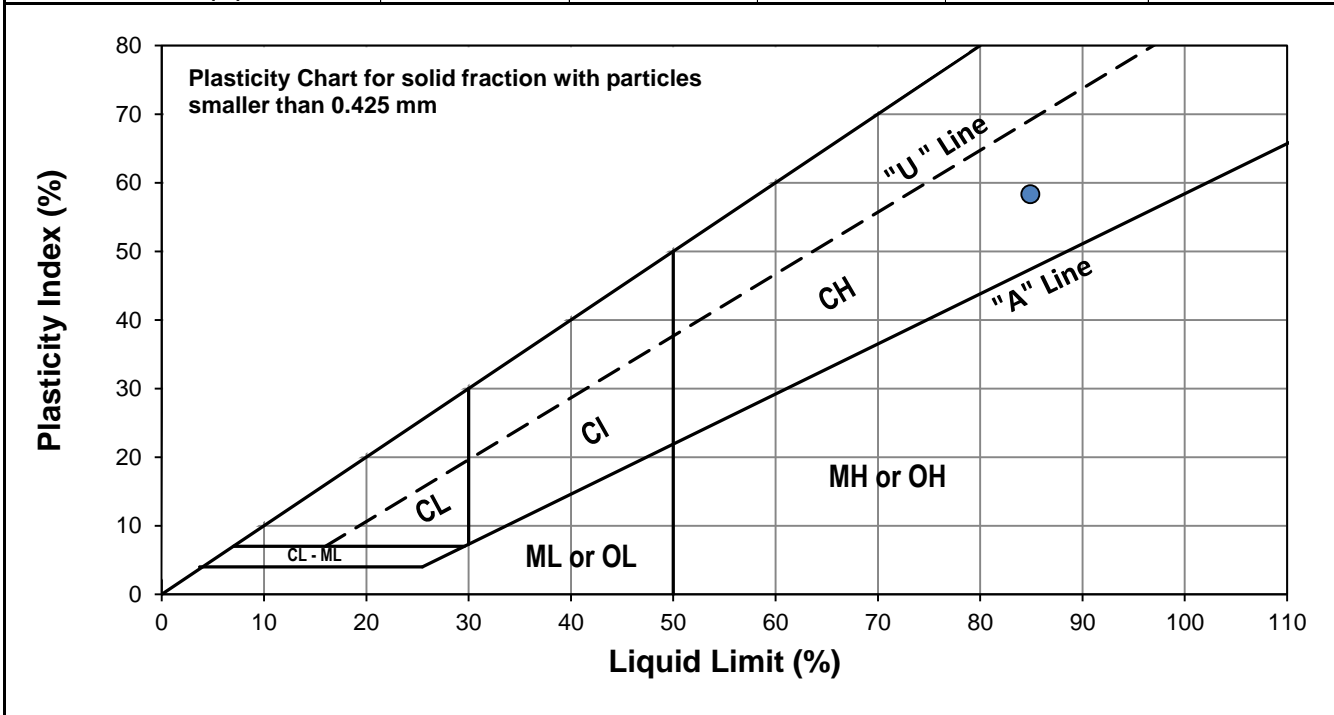
Project No. 0395-005-00
Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Test Hole TH18-26
Sample # G176
Depth (m) 0.4 - 0.5
Sample Date 13-Jun-18
Test Date 22-Jun-18
Technician EH

Liquid Limit	85
Plastic Limit	27
Plasticity Index	58

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	18	25	32
Mass Wet Soil + Tare (g)	23.823	23.173	24.263
Mass Dry Soil + Tare (g)	19.233	19.059	19.752
Mass Tare (g)	14.042	14.201	14.280
Mass Water (g)	4.590	4.114	4.511
Mass Dry Soil (g)	5.191	4.858	5.472
Moisture Content (%)	88.422	84.685	82.438



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.782	20.369			
Mass Wet Soil + Tare (g)	19.402	19.028			
Mass Dry Soil + Tare (g)	14.273	13.923			
Mass Water (g)	1.380	1.341			
Mass Dry Soil (g)	5.129	5.105			
Moisture Content (%)	26.906	26.268			



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Grain Size Analysis (Sieve Method)

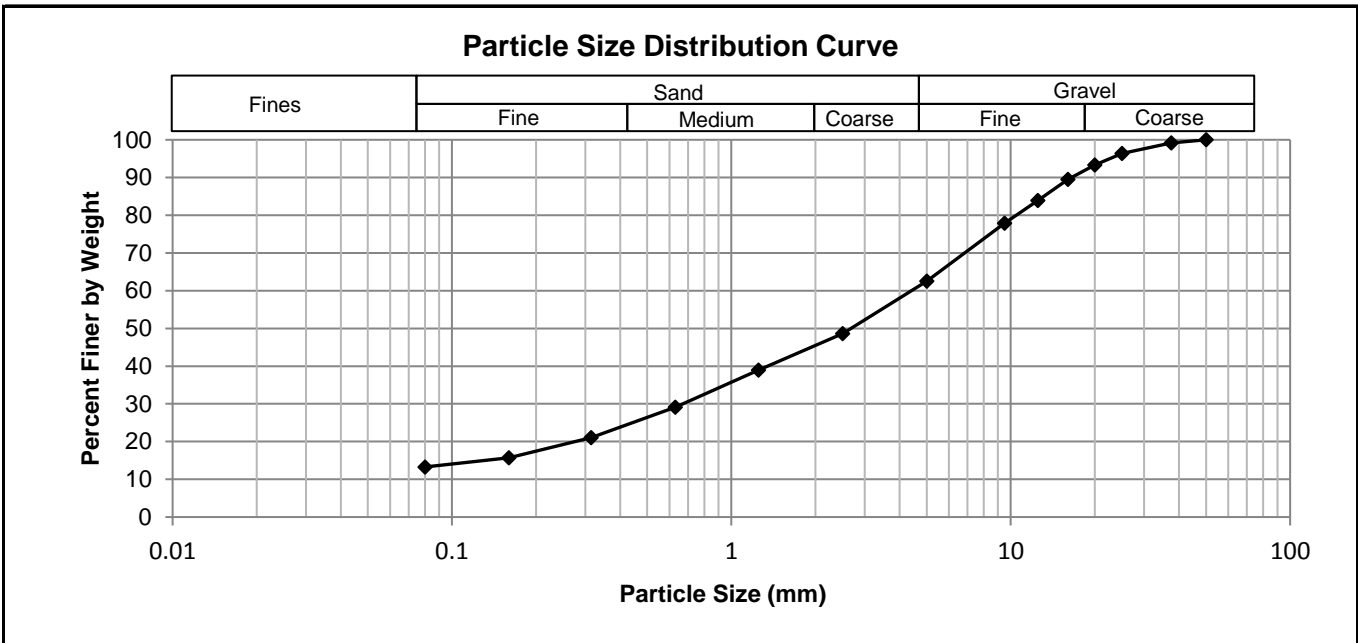
ASTM C136-14

ASTM C117-13

Project No. 0395-005-00
Client WSP Canada Group Ltd
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Sample # G175
Source In situ
Soil Desc. Sand and Gravel
Date Sampled 13-Jun-18
Date Tested 18-Jun-18
Technician EH

Total Weight (kg)	30.38
Cobbles %	0.0
Gravel %	37.5
Sand %	49.3
Fines %	13.3



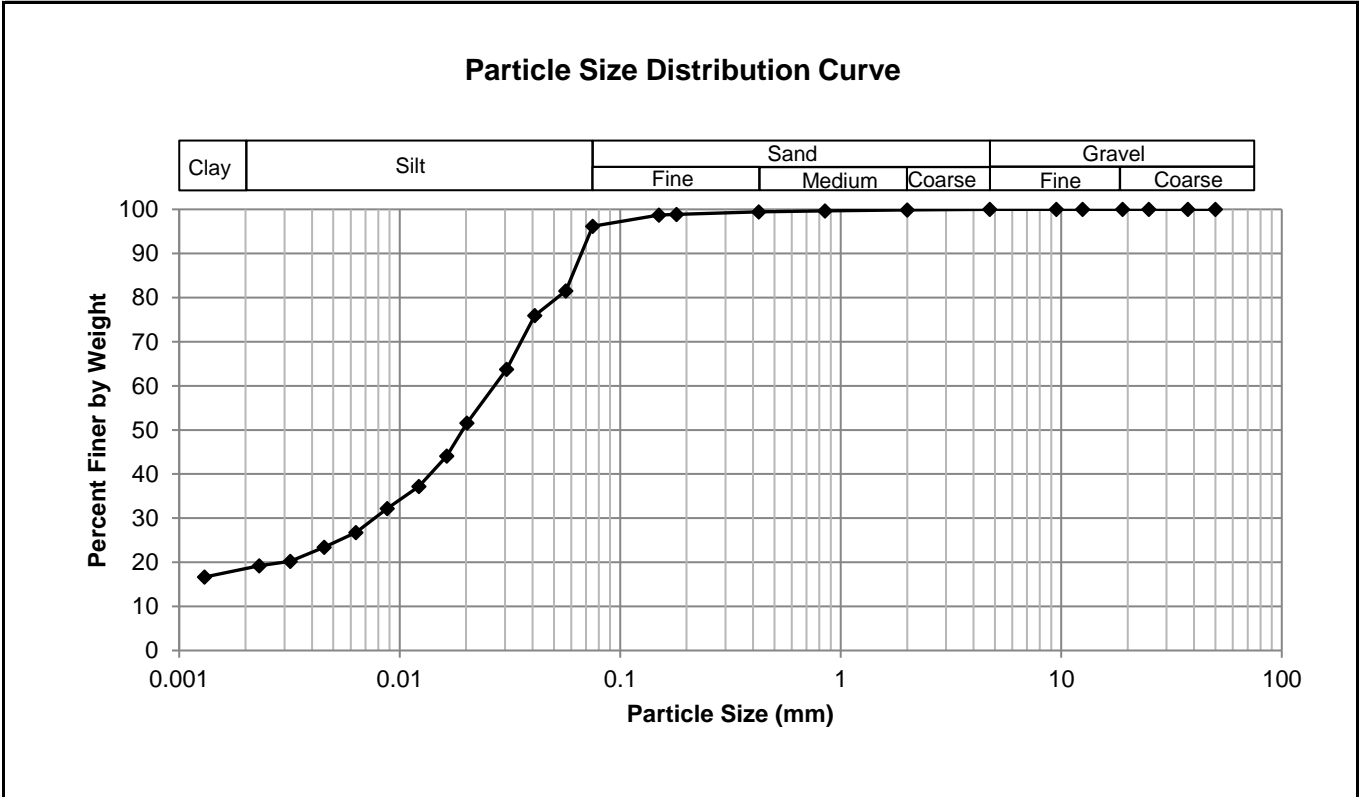
Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
50.0	100	-
37.5	99	-
25.0	96	-
20.0	93	-
12.5	84	-
9.5	78	-
5.00	63	-
2.50	49	-
1.25	39	-
0.630	29	-
0.315	21	-
0.160	16	-
0.080	13	-



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Client WSP Canada Group Ltd.
Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Test Hole TH18-24
Sample # G163
Depth (m) 0.7 - 0.9
Sample Date 13-Jun-18
Test Date 22-Jun-18
Technician EH

Gravel	0.0%
Sand	3.9%
Silt	77.7%
Clay	18.4%



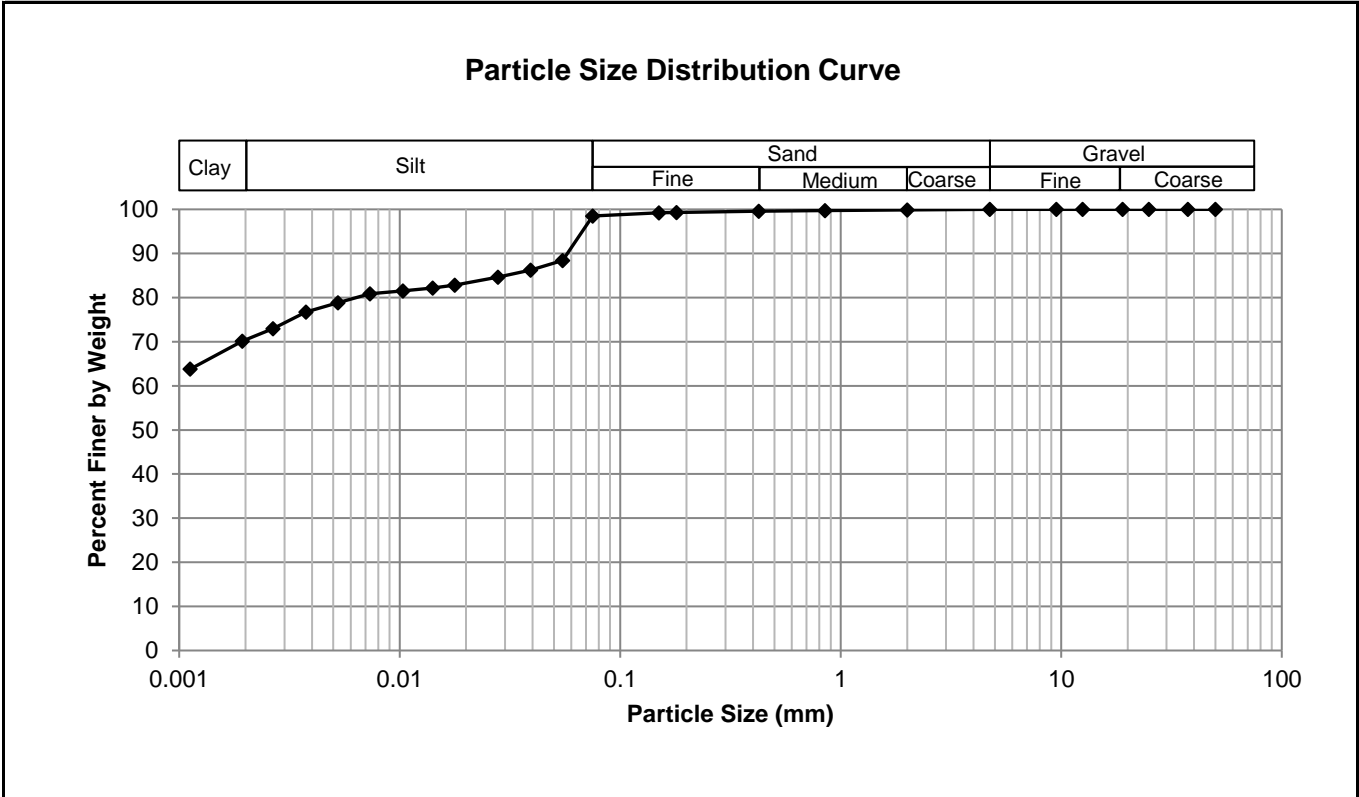
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	96.14
37.5	100.00	2.00	99.86	0.0566	81.54
25.0	100.00	0.850	99.67	0.0410	75.92
19.0	100.00	0.425	99.43	0.0305	63.74
12.5	100.00	0.180	98.87	0.0202	51.57
9.50	100.00	0.150	98.69	0.0164	44.08
4.75	100.00	0.075	96.14	0.0122	37.21
				0.0088	32.22
				0.0063	26.76
				0.0045	23.42
				0.0032	20.24
				0.0023	19.21
				0.0013	16.65



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Project 2018 Local Improvement Package 18-LI-02 - Dumoulin

Test Hole TH18-26
Sample # G176
Depth (m) 0.4 - 0.5
Sample Date 13-Jun-18
Test Date 22-Jun-18
Technician EH

Gravel	0.0%
Sand	1.5%
Silt	28.1%
Clay	70.4%



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	100.00	0.0750	98.49
37.5	100.00	2.00	99.88	0.0548	88.42
25.0	100.00	0.850	99.71	0.0392	86.23
19.0	100.00	0.425	99.56	0.0279	84.67
12.5	100.00	0.180	99.28	0.0178	82.80
9.50	100.00	0.150	99.24	0.0141	82.17
4.75	100.00	0.075	98.49	0.0103	81.55
				0.0073	80.85
				0.0052	78.83
				0.0038	76.73
				0.0027	72.93
				0.0019	70.10
				0.0011	63.80

Appendix G

TH18-03 and TH 18-22

Asphalt Core Photos



Photo 1: Pavement Core Sample at Test Hole TH18-03



Photo 1: Pavement Core Sample at Test Hole TH18-22