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WSP Canada Group Ltd.

## **2021 Alley Renewal Package (21-RL-03)**

**Prepared for:**

Richard Hawkins, C.E.T.  
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111-93 Lombard Avenue  
Winnipeg, Mb  
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**Project Number:**

1000 043 12

**Date:**

November 2, 2020  
Final Report



Quality Engineering | Valued Relationships

November 2, 2020

Our File No. 1000 043 12

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

**RE: Sub-Surface Investigation Report for  
2021 Alley Renewal Package (21-RL-03)**

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TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 2021 Alley Renewal Package (21-RL-03).

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 "Nelson John Ferreira".

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

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

## Revision History

Revision No.	Author	Issue Date	Description
0	JSB	November 2, 2020	Final Report

## Authorization Signatures

Prepared By:



Jashandeep Singh Bhullar E.I.T.  
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Reviewed By:



Angela Fidler-Kliwer, C. Tech  
Manager of Laboratory and Field  
Services

Senior 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 2021 Alley Renewal Package (21-RL-03). The test holes were located along the back alley between Dufferin Street & Jarvis Avenue, Dominion Street & Garfield Street, Craig Street & Stiles Street, Westminster Avenue & Dundurn Place and between Banning Street & Lipton Street. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure. The investigation was carried out in accordance with the City of Winnipeg public works street project requirements (Bid Opp:156-2020).

## 2.0 Road Investigation and Laboratory Program

The investigation included coring of pavement and drilling test holes at 5 different street back alleys. Test hole locations are shown on Figures 01 to 05 (attached) and table below summarizes the investigation program per street back alley.

**Table 1 – Test Hole Location Summary**

<b>Back Alley</b>	<b># of Test Holes</b>	<b>Test Hole Description</b>
<b>Dufferin Street &amp; Jarvis Street Back Alley</b> bounded by Salter St. and Powers St.	3	TH20- 01, 02, 03
<b>Dominion Street &amp; Garfield Street North Back Alley</b> bounded by Sargent Ave and Wellington Ave	3	TH20- 04, 10, 11
<b>Craig Street &amp; Stiles Street Back Alley</b> bounded by Wolseley Ave and Portage Ave	3	TH20- 05, 06, 07
<b>Westminster Avenue &amp; Dundurn Place Back Alley</b> bounded by Walnut St. and Maryland St.	2	TH20- 08, 09
<b>Banning Street &amp; Lipton Street Back Alley</b> bounded by Wellington Ave and Yarwood Ave	2	TH20- 12, 13

The road investigation was conducted between September 22, 2020 and October 8, 2020. The pavement (asphalt and/or concrete) was cored by Jashandeep Singh Bhullar of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. Five test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The remaining eight test holes were drilled to a depth of 2 m using a hand auger (50 mm diameter) combined with a gas-powered post auger equipped with 100 mm solid stem auger. The sub-surface conditions were observed during drilling and soils were visually classified by Jashandeep Singh Bhullar of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples and bulk samples retrieved during the sub-surface

investigation were transported to TREK’s material testing laboratory for further testing. Core samples were also retrieved and logged at TREK’s material testing laboratory.

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.

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 0.3 and 0.7 m below pavement as well as Standard Proctor and CBR (California Bearing Ratio) testing. The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores.

Ten CBRs were completed on bulk samples of the soil units present below the pavement. Only clay and silt layers were encountered within the prescribed sample depth for CBR testing and the results are shown in the table below.

**Table 2 - CBR Testing Summary**

Back Alley	Sample Descr.	Test Hole	Depth (m)	SPMDD (kg/m <sup>3</sup> )	Opt. Moisture (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Dufferin Street and Jarvis Street	Silt & Clay	TH20 - 01	0.2 – 1.5	1761	16.5	94.8	20.2	4.3	3.8
	Silt & Clay	TH20 - 03	0.2 – 1.5	1657	20.6	94.1	23.3	4.0	3.1
Dominion Street and Garfield Street	Silt & Clay	TH20 -04	0.2 – 1.2	1468	26.7	94.6	29.8	7.2	5.4
	Silt & Clay	TH20 - 10, 11	0.2 – 1.2	1625	20.3	95.1	22.4	9.0	6.6
Craig Street and Stiles Street	Silt & Clay	TH20 - 05	0.2 – 1.5	1477	26.8	95.3	29.0	6.2	4.7
	Silt & Clay	TH20- 06, 07	0.2 – 1.5	1591	21.1	94.8	24.1	4.5	3.7
Westminster Avenue and Dundurn Place	Silt & Clay	TH20 - 08	0.4 – 1.5	1513	25.3	95.7	28.7	6.1	4.7
	Silt & Clay	TH20 - 09	0.3 – 1.5	1580	21.6	95.1	25.9	5.7	4.5
Banning Street and Lipton Street	Silt & Clay	TH20 – 12	0.2 – 1.5	1569	23.2	94.6	24.3	4.1	3.4
	Silt & Clay	TH20 - 13	0.2 – 1.2	1501	24.7	95.4	26.4	4.1	3.5

\* Testing completed on bulk grab samples from the top 1.5 m of each test hole.

The test hole logs include a description of the soil units encountered during drilling and other pertinent information such as groundwater conditions and a summary of the laboratory testing results. The soils were classified in general accordance with the Unified Soil Classification System (USCS) and the AASHTO soil classification system (American Association of state highway and transportation officials). The AASHTO system classifies soils based on laboratory testing results from Atterberg Limits and grain size testing methods (hydrometer and mechanical sieve method). Where laboratory testing was not conducted, the AASHTO classification of the soils were interpreted based on a visual assessment as indicated with a (I) on the test hole logs and attached tables. For cohesive soils, the AASHTO system uses a combination of testing results to determine the Group Index of the soils and thus, were only determined where sufficient laboratory test data was available.

### **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 Ltd. (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

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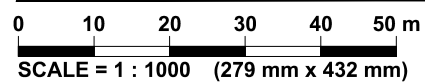



ANSI full bleed B (11.00 x 17.00 inches)

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**KEY PLAN**  
NTS



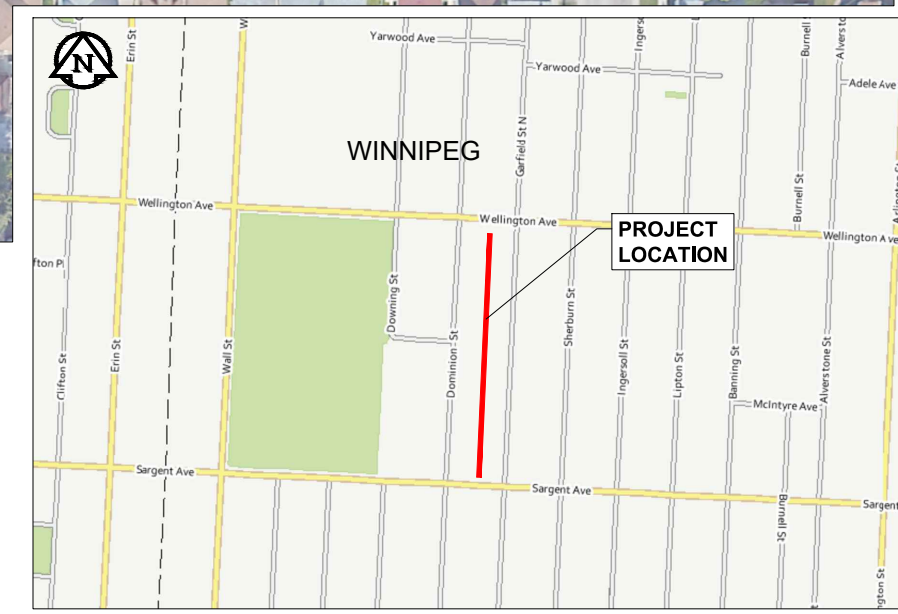
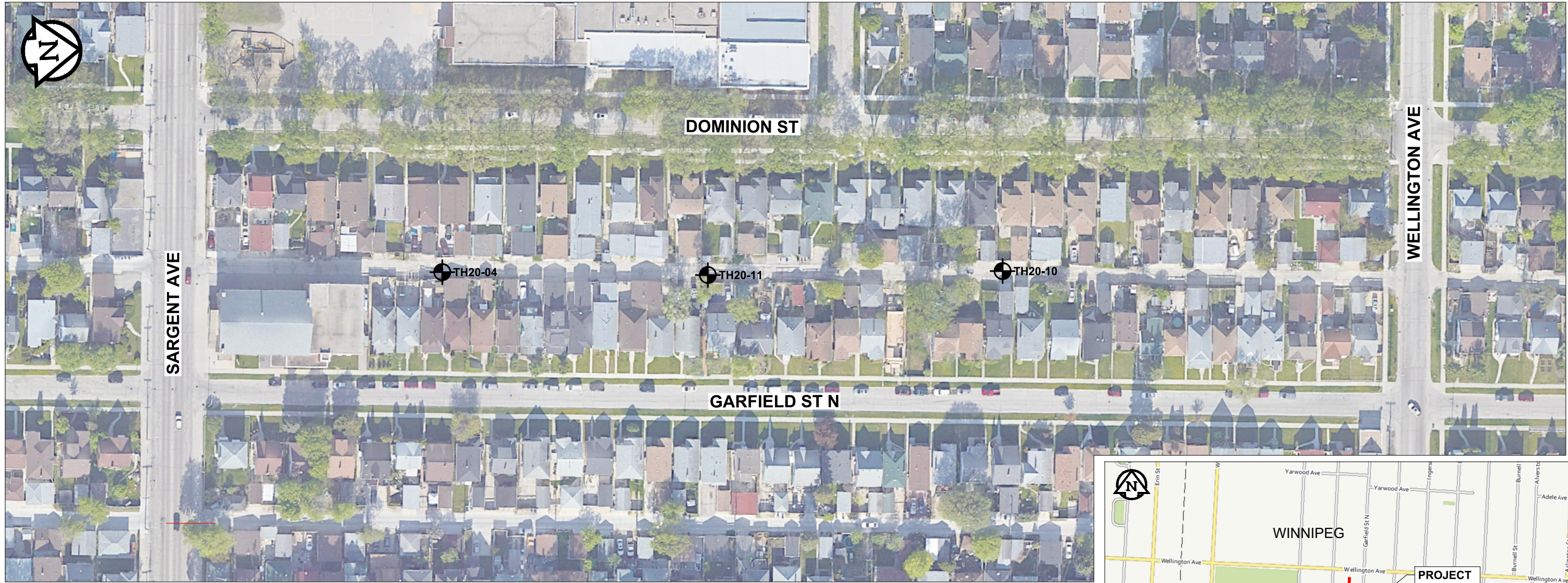
**LEGEND:**  TEST HOLE (TREK, 2020)

**NOTES:**

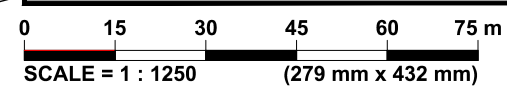
1. AERIAL PHOTO FROM GOOGLE EARTH (2020)
2. TEST HOLE LOCATIONS OBTAINED USING HANDHELD GPS UNIT AND BY MEASURING DISTANCES OFF NEAREST ADDRESS

**Figure 01**  
Test Hole Location Plan

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**KEY PLAN**  
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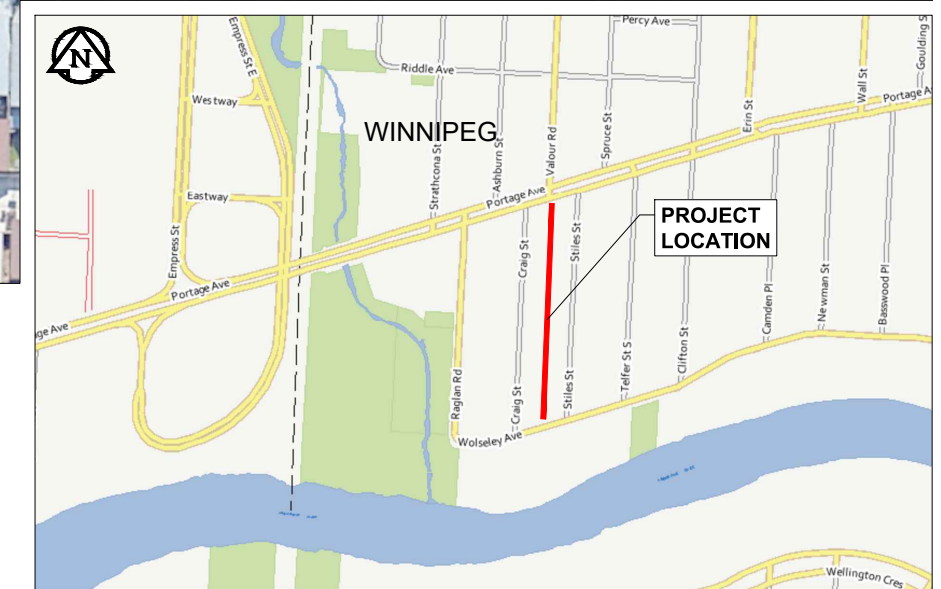
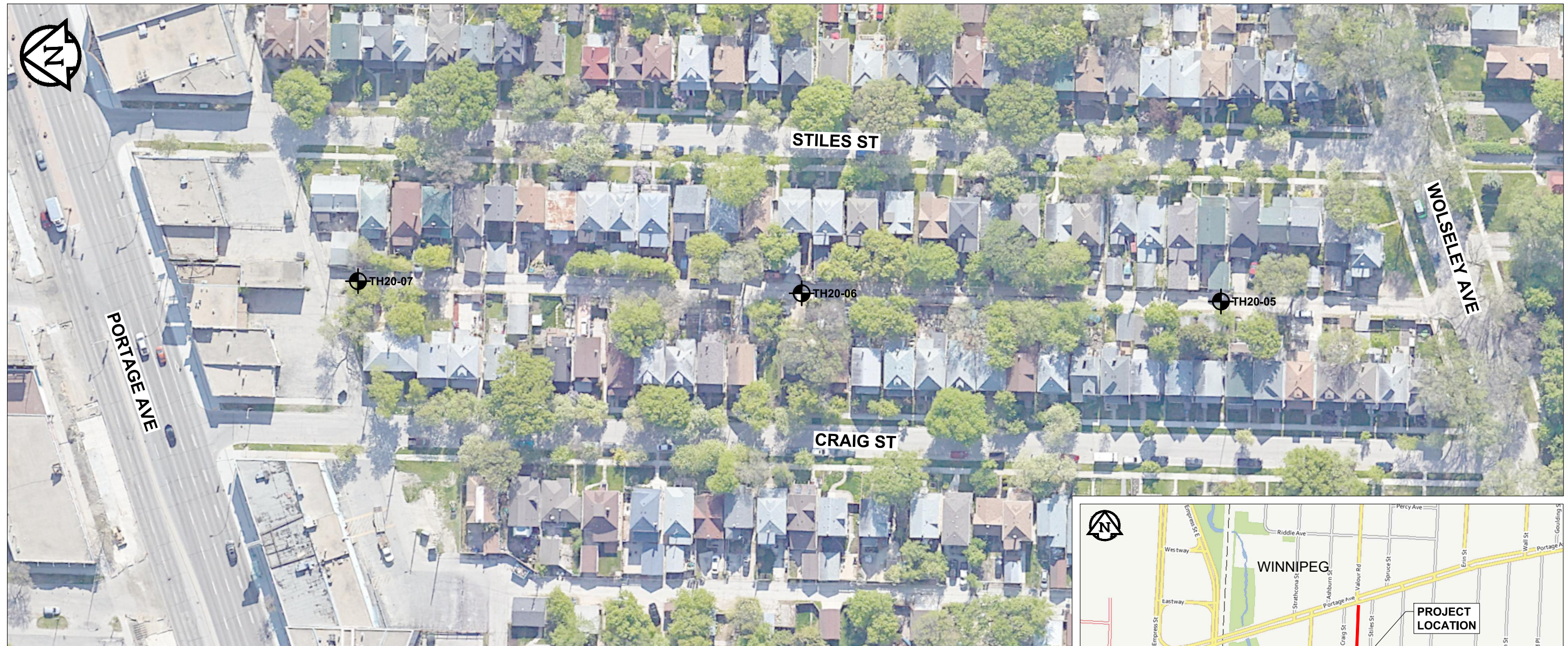
**NOTES:**

1. AERIAL PHOTO FROM GOOGLE EARTH (2020)
2. TEST HOLE LOCATIONS OBTAINED USING HANDHELD GPS UNIT AND BY MEASURING DISTANCES OFF NEAREST ADDRESS

**Figure 02**  
Test Hole Location Plan

ANSI full bleed B (11.00 x 17.00 inches)

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**KEY PLAN**  
NTS

0 10 20 30 40 50 m  
SCALE = 1 : 1000 (279 mm x 432 mm)

**LEGEND:**  TEST HOLE (TREK, 2020)

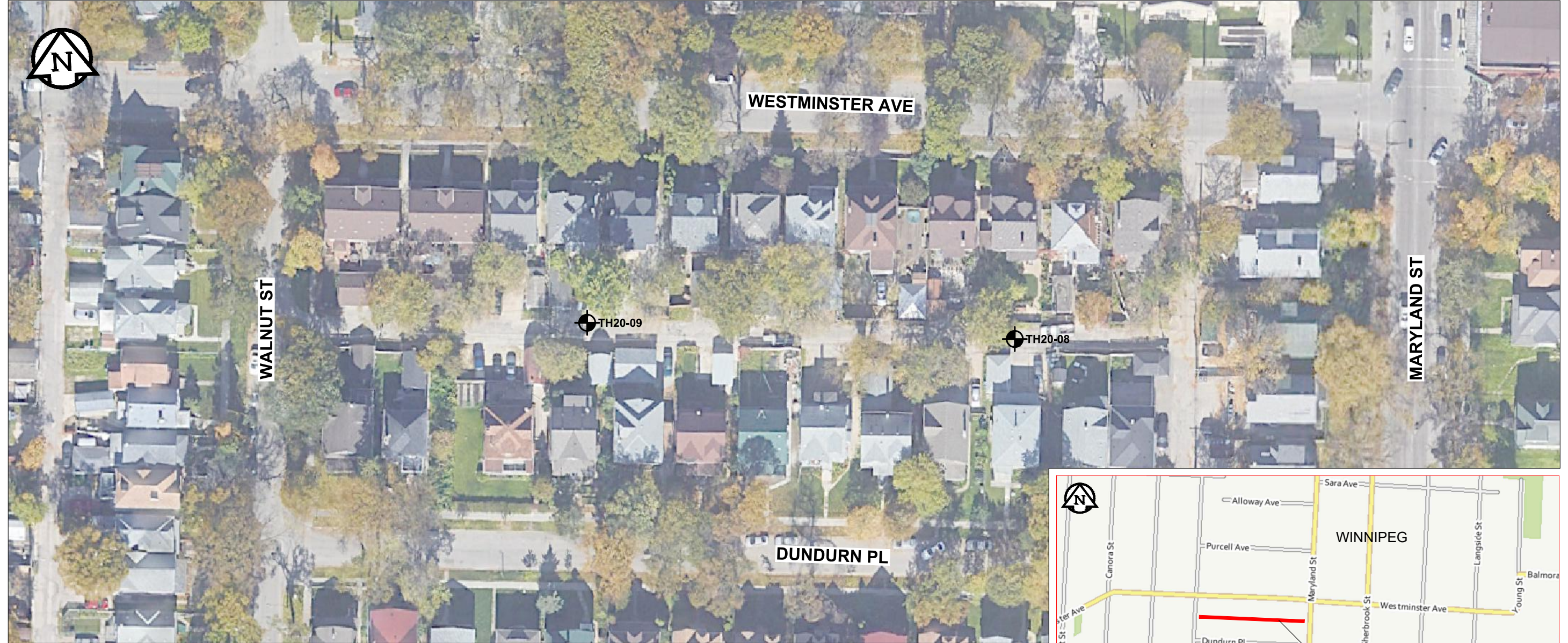
**NOTES:**

1. AERIAL PHOTO FROM GOOGLE EARTH (2020)
2. TEST HOLE LOCATIONS OBTAINED USING HANDHELD GPS UNIT AND BY MEASURING DISTANCES OFF NEAREST ADDRESS

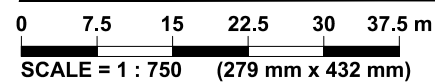
**Figure 03**  
Test Hole Location Plan

ANSI full bleed B (11.00 x 17.00 inches)

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**KEY PLAN**  
NTS



**LEGEND:** TEST HOLE (TREK, 2020)

**NOTES:**

1. AERIAL PHOTO FROM GOOGLE EARTH (2020)
2. TEST HOLE LOCATIONS OBTAINED USING HANDHELD GPS UNIT AND BY MEASURING DISTANCES OFF NEAREST ADDRESS

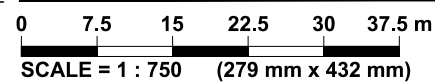
**Figure 04**  
Test Hole Location Plan

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ANSI full bleed B (11.00 x 17.00 Inches)



**KEY PLAN**  
NTS



**LEGEND:** TEST HOLE (TREK, 2020)

- NOTES:**
1. AERIAL PHOTO FROM GOOGLE EARTH (2020)
  2. TEST HOLE LOCATIONS OBTAINED USING HANDHELD GPS UNIT AND BY MEASURING DISTANCES OFF NEAREST ADDRESS

**Figure 05**  
Test Hole Location Plan

## **Appendix A**

### **Dufferin Street & Jarvis Street Back Alley**

#### **Test Hole Logs, Summary Table, Lab Testing Results and Pavement Core Photos**

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## 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	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	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				Plasticity Chart Plasticity chart for silt fraction with particles smaller than 0.425 mm	ASTM Sieve Sizes	> 12 in. 3 in. to 12 in. 3/4 in. to 3 in. #4 to 3/4 in.
						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		Von Post Classification Limit	Strong colour or odour, and often fibrous texture	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											

\* 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 TH20-01

1 of 1

**Client:** WSP **Project Number:** 1000-043-12  
**Project Name:** 2021 Alley Renewal Package (21-RL-03) **Location:** UTM 14U 5530492 m N, 633130 m E  
**Contractor:** Maple Leaf Drilling Ltd. **Ground Elevation:** Top of Pavement  
**Method:** 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** October 6, 2020

**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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	25	50	75	100/125
											△ Torvane △ ⊕ Pocket Pen. ⊕ ⊠ Qu ⊠ ○ Field Vane ○				
0.0 - 0.1		CONCRETE - 145 mm thick													
0.1 - 1.2		SILT AND CLAY - sandy, gravelly (diam. < 25 mm) - black - moist, very stiff - high plasticity - AASHTO A-7-6 (49)  - no gravel, trace sand below 0.8 m.		G01											
1.2 - 1.5		SILT - clayey, trace sand - light brown - moist, firm - low to intermediate plasticity - AASHTO: A-4 (I)		G03											
1.5 - 2.4		CLAY - silty, trace silt inclusions (<30 mm diam.) - brown - moist, stiff - high plasticity - AASHTO: A-7-6 (I)  - firm below 2.4 m.		G05											
2.4 - 3.0				G07											

END OF TEST HOLE AT 3.0 m IN CLAY

- Seepage not observed.
- Sloughing observed below 1.2 m.
- Test hole open to 1.2 m immediately after drilling.
- Test hole backfilled with granular fill and cold patch asphalt.
- Test hole located in back alley of property # 454 Dufferin St., 1.0 m South of North edge of alley.

**Logged By:** Jashandeep Singh Bhullar **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG - LOGS DUFFERIN ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0. C. JSB 1000-043-12.GPJ TREK GEOTECHNICAL.GDT 11/2/20



# Sub-Surface Log

Test Hole TH20-02

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5530470 m N, 633179 m E  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 6, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	25	50	75	100	125
0.0 - 0.1		CONCRETE - 155 mm thick														
0.1 - 0.6		SILT AND CLAY - trace sand, trace gravel (diam. < 25 mm) - black - moist, very stiff - high plasticity - AASHTO: A-7-6 (I)		G08												
0.6 - 1.0		SILT - clayey - light brown - moist, firm - low to intermediate plasticity - AASHTO: A-4 (I)		G09												
1.0 - 1.5		- trace clay, soft below 1.2 m.		G10												
1.5 - 1.6				G11												
1.6 - 1.7				G12												
1.7 - 2.0		CLAY - silty, trace silt inclusions (<30 mm diam.) - dark brown - moist, firm to stiff - high plasticity - AASHTO: A-7-6 (I)		G13												
2.0 - 2.2				G14												
2.2 - 2.4				G15												
2.4 - 2.6																
2.6 - 2.8																
2.8 - 3.0																

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) Seepage or sloughing not observed.
- 2) Test hole squeezed in and open to 2.9 m immediately after drilling.
- 3) Test hole backfilled with granular fill and cold patch asphalt.
- 4) Test hole located in back alley of property # 436 Dufferin St., 1.0 m South of North edge of alley.

Logged By: Jashandeep Singh Bhullar Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS DUFFERIN ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0. C. JSB 1000-043-12.GPJ TREK GEOTECHNICAL.GDT 11/2/20



# Sub-Surface Log

Test Hole TH20-03

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5530439 m N, 633242 m E  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 6, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	25	50	75	100/125
0.0 - 0.1		CONCRETE - 140 mm thick													
0.1 - 0.6		SILT AND CLAY - trace sand, trace gravel (diam. < 25 mm) - black - moist, stiff to very stiff - high plasticity - AASHTO: A-7-6 (I)	<input checked="" type="checkbox"/>	G16											
0.6 - 1.0		SILT - some clay - light brown - moist, firm - low plasticity - AASHTO: A-2-6 (2)	<input checked="" type="checkbox"/>	G17											
1.0 - 1.5			<input checked="" type="checkbox"/>	G18											
1.5 - 1.8			<input checked="" type="checkbox"/>	G19											
1.8 - 2.0		CLAY - silty, trace silt inclusions (<30 mm diam.) - dark brown, moist, firm to stiff - high plasticity, AASHTO: A-7-6 (I)	<input checked="" type="checkbox"/>	G20											
2.0 - 2.5		SILT - clayey - light brown - moist, firm - low to intermediate plasticity - AASHTO: A-4 (I)	<input checked="" type="checkbox"/>	G21											
2.5 - 3.0		CLAY - silty, trace silt inclusions (<30 mm diam.) - dark brown - moist, firm to stiff - high plasticity - AASHTO: A-7-6 (I)	<input checked="" type="checkbox"/>	G22											

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) Seepage not observed.
- 2) Sloughing observed below 1.5 m.
- 3) Test hole open to 1.5 m below ground immediately after drilling.
- 4) Test hole backfilled with granular fill and cold patch asphalt.
- 5) Test hole located in back alley of property # 412 Dufferin St., 1.0 m South of North edge of alley.

Logged By: Jashandeep Singh Bhullar Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS DUFFERIN ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0. C. JSB 1000-043-12.GPJ TREK GEOTECHNICAL.GDT 11/2/20



**2021 Alley Renewal Package (21-RL-03)**  
**Sub-Surface Investigation**  
**Dufferin Street & Jarvis Avenue Alley: bounded by Power Street and Salter Street**

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	
TH20-01	UTM: 14U 5530492 m N, 633130 m E Located in back alley of property # 454 Dufferin St., 1.0 m South of North edge of alley.	-	-	Concrete	145	Silt and Clay: AASHTO: A-7-6 (49)	0.2	0.3	18								
						Silt And Clay: AASHTO: A-7-6 (49)	0.8	0.9	34	48	45	7	0	20	67	47	
						Silt: AASHTO: A-4 (I)	1.0	1.2	19								
						Silt: AASHTO: A-4 (I)	1.3	1.5	25								
						Clay: AASHTO: A-7-6 (I)	1.8	1.9	32								
						Clay: AASHTO: A-7-6 (I)	2.1	2.3	38								
						Clay: AASHTO: A-7-6 (I)	2.6	2.7	47								
TH20-02	UTM: 14U 5530470 m N, 633179 m E Located in back alley of property # 436 Dufferin St., 1.0 m South of North edge of alley.	-	-	Concrete	155	Silt and Clay: AASHTO: A-7-6 (I)	0.2	0.3	35								
						Silt and Clay: AASHTO: A-7-6 (I)	0.7	0.8	24								
						Silt: AASHTO: A-4 (I)	0.8	0.9	17								
						Silt: AASHTO: A-4 (I)	1.0	1.2	25								
						Silt: AASHTO: A-4 (I)	1.3	1.5	23								
						Clay: AASHTO: A-7-6 (I)	1.8	1.9	38								
						Clay: AASHTO: A-7-6 (I)	2.1	2.3	49								
				Clay: AASHTO: A-7-6 (I)	2.6	2.7	53										
TH20-03	UTM: 14U 5530439 m N, 633242 m E Located in back alley of property # 412 Dufferin St., 1.0 m South of North edge of alley.	-	-	Concrete	140	Silt and Clay: AASHTO: A-7-6 (I)	0.2	0.3	28								
						Silt: AASHTO: A-4 (2)	0.8	0.9	21	16	78	6	0	18	22	4	
						Silt: AASHTO: A-4 (2)	1.0	1.2	22								
						Silt: AASHTO: A-4 (2)	1.3	1.5	23								
						Clay: AASHTO: A-7-6 (I)	1.7	1.8	33								
						Silt: AASHTO: A-4 (I)	2.1	2.3	23								
						Clay: AASHTO: A-7-6 (I)	2.6	2.7	42								

(I) - AASHTO classification was interpreted based on visual classification.



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave

**Sample Date** 6-Oct-20  
**Test Date** 7-Oct-20  
**Technician** NM

Test Hole	TH20-01	TH20-01	TH20-01	TH20-01	TH20-01	TH20-01
Depth (m)	0.2 - 0.3	0.8 - 0.9	1.0 - 1.2	1.3 - 1.5	1.8 - 1.9	2.1 - 2.3
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	N37	F97	N31	Z140	Z61	K23
Mass of tare	8.5	8.4	8.5	8.8	8.7	8.7
Mass wet + tare	467.9	171.6	167.3	181.8	173.4	172.8
Mass dry + tare	399.2	129.8	141.6	147.6	133.2	128.0
Mass water	68.7	41.8	25.7	34.2	40.2	44.8
Mass dry soil	390.7	121.4	133.1	138.8	124.5	119.3
Moisture %	17.6%	34.4%	19.3%	24.6%	32.3%	37.6%

Test Hole	TH20-01	TH20-02	TH20-02	TH20-02	TH20-02	TH20-02
Depth (m)	2.6 - 2.7	0.2 - 0.3	0.7 - 0.8	0.8 - 0.9	1.0 - 1.2	1.3 - 1.5
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	AB35	F35	AC40	N110	C14	F148
Mass of tare	6.9	8.5	6.6	8.5	8.5	8.3
Mass wet + tare	171.1	178.2	206.7	178.5	204.1	169.1
Mass dry + tare	119.0	134.6	168.4	154.4	164.8	139.2
Mass water	52.1	43.6	38.3	24.1	39.3	29.9
Mass dry soil	112.1	126.1	161.8	145.9	156.3	130.9
Moisture %	46.5%	34.6%	23.7%	16.5%	25.1%	22.8%

Test Hole	TH20-02	TH20-02	TH20-02	TH20-03	TH20-03	TH20-03
Depth (m)	1.8 - 1.9	2.1 - 2.3	2.6 - 2.7	0.2 - 0.3	0.8 - 0.9	1.0 - 1.2
Sample #	G13	G14	G15	G16	G17	G18
Tare ID	F91	AC14	N59	E47	A101	Z18
Mass of tare	8.8	6.8	8.5	8.7	8.7	8.7
Mass wet + tare	191.4	176.9	199.5	188.6	512.8	220.8
Mass dry + tare	141.4	121.2	133.0	149.6	426.4	182.8
Mass water	50.0	55.7	66.5	39.0	86.4	38.0
Mass dry soil	132.6	114.4	124.5	140.9	417.7	174.1
Moisture %	37.7%	48.7%	53.4%	27.7%	20.7%	21.8%



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave

**Sample Date** 6-Oct-20  
**Test Date** 7-Oct-20  
**Technician** NM

Test Hole	TH20-03	TH20-03	TH20-03	TH20-03		
Depth (m)	1.3 - 1.5	1.7 - 1.8	2.1 - 2.3	2.6 - 2.7		
Sample #	G19	G20	G21	G22		
Tare ID	N42	Z36	K32	AB05		
Mass of tare	8.6	8.5	8.5	6.8		
Mass wet + tare	184.3	183.0	222.2	188.7		
Mass dry + tare	151.8	139.4	183.0	134.6		
Mass water	32.5	43.6	39.2	54.1		
Mass dry soil	143.2	130.9	174.5	127.8		
Moisture %	22.7%	33.3%	22.5%	42.3%		



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin St./Jarvis St.

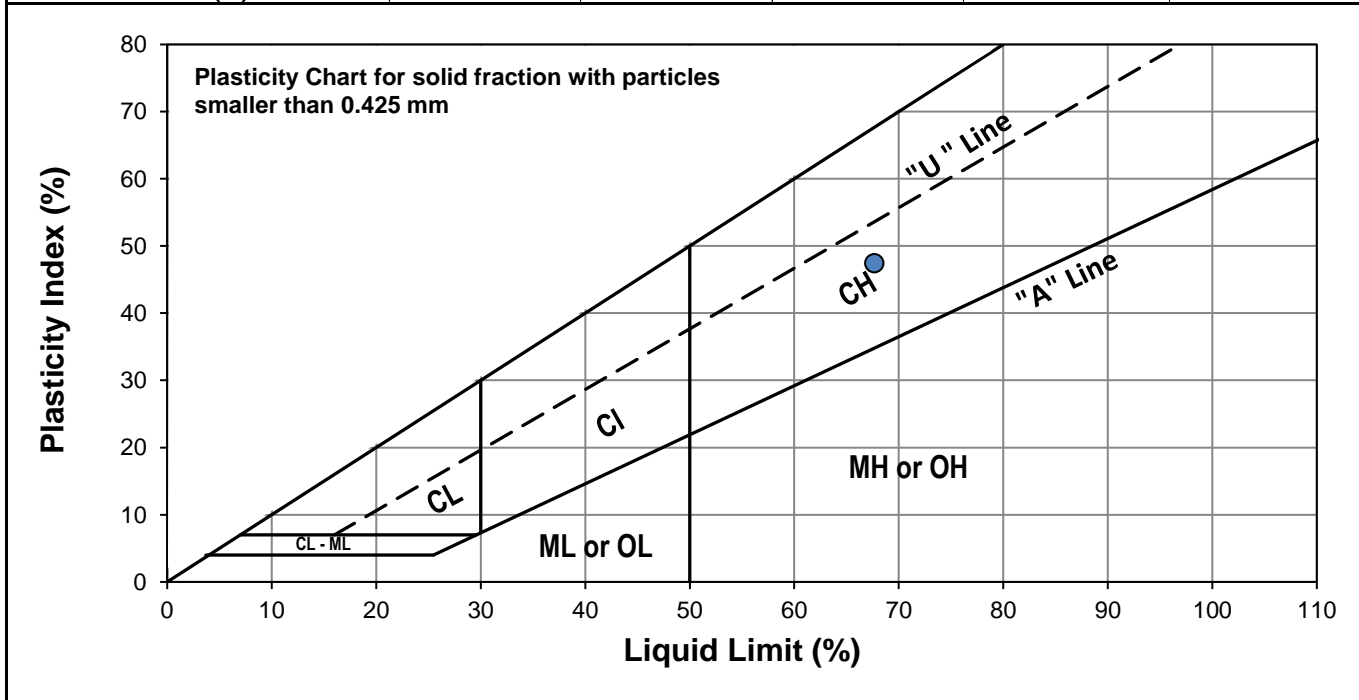


**Test Hole** TH20-01  
**Sample #** G02  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 06-Oct-20  
**Test Date** 23-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	68
<b>Plastic Limit</b>	20
<b>Plasticity Index</b>	47

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	19	24	34
<b>Mass Wet Soil + Tare (g)</b>	26.115	23.341	25.255
<b>Mass Dry Soil + Tare (g)</b>	21.246	19.568	20.827
<b>Mass Tare (g)</b>	14.277	13.986	14.076
<b>Mass Water (g)</b>	4.869	3.773	4.428
<b>Mass Dry Soil (g)</b>	6.969	5.582	6.751
<b>Moisture Content (%)</b>	69.867	67.592	65.590



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	13.913	14.197			
<b>Mass Wet Soil + Tare (g)</b>	20.101	20.271			
<b>Mass Dry Soil + Tare (g)</b>	19.053	19.255			
<b>Mass Water (g)</b>	1.048	1.016			
<b>Mass Dry Soil (g)</b>	5.140	5.058			
<b>Moisture Content (%)</b>	20.389	20.087			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave

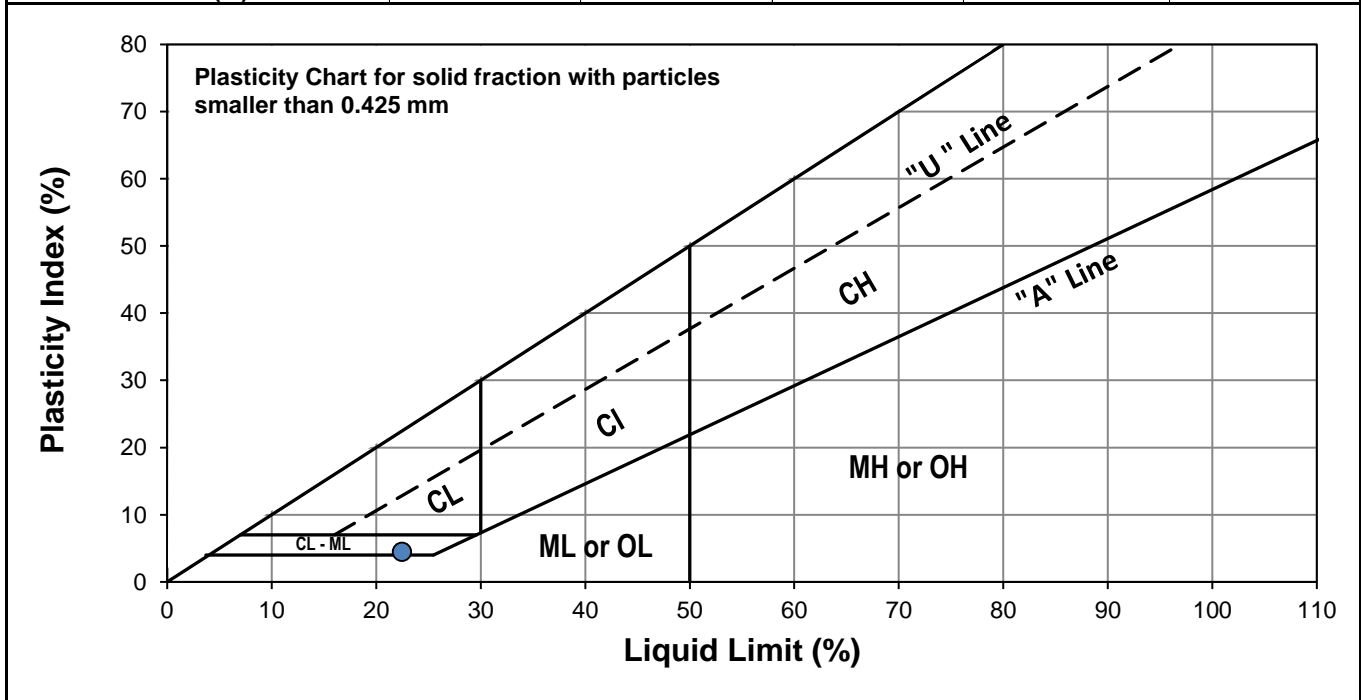


**Test Hole** TH20-03  
**Sample #** G17  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 13-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	22
<b>Plastic Limit</b>	18
<b>Plasticity Index</b>	4

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	19	27	35
<b>Mass Wet Soil + Tare (g)</b>	28.577	28.370	26.998
<b>Mass Dry Soil + Tare (g)</b>	25.792	25.838	24.681
<b>Mass Tare (g)</b>	14.000	14.409	13.684
<b>Mass Water (g)</b>	2.785	2.532	2.317
<b>Mass Dry Soil (g)</b>	11.792	11.429	10.997
<b>Moisture Content (%)</b>	23.618	22.154	21.069



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.173	14.136			
<b>Mass Wet Soil + Tare (g)</b>	20.938	21.936			
<b>Mass Dry Soil + Tare (g)</b>	19.904	20.745			
<b>Mass Water (g)</b>	1.034	1.191			
<b>Mass Dry Soil (g)</b>	5.731	6.609			
<b>Moisture Content (%)</b>	18.042	18.021			





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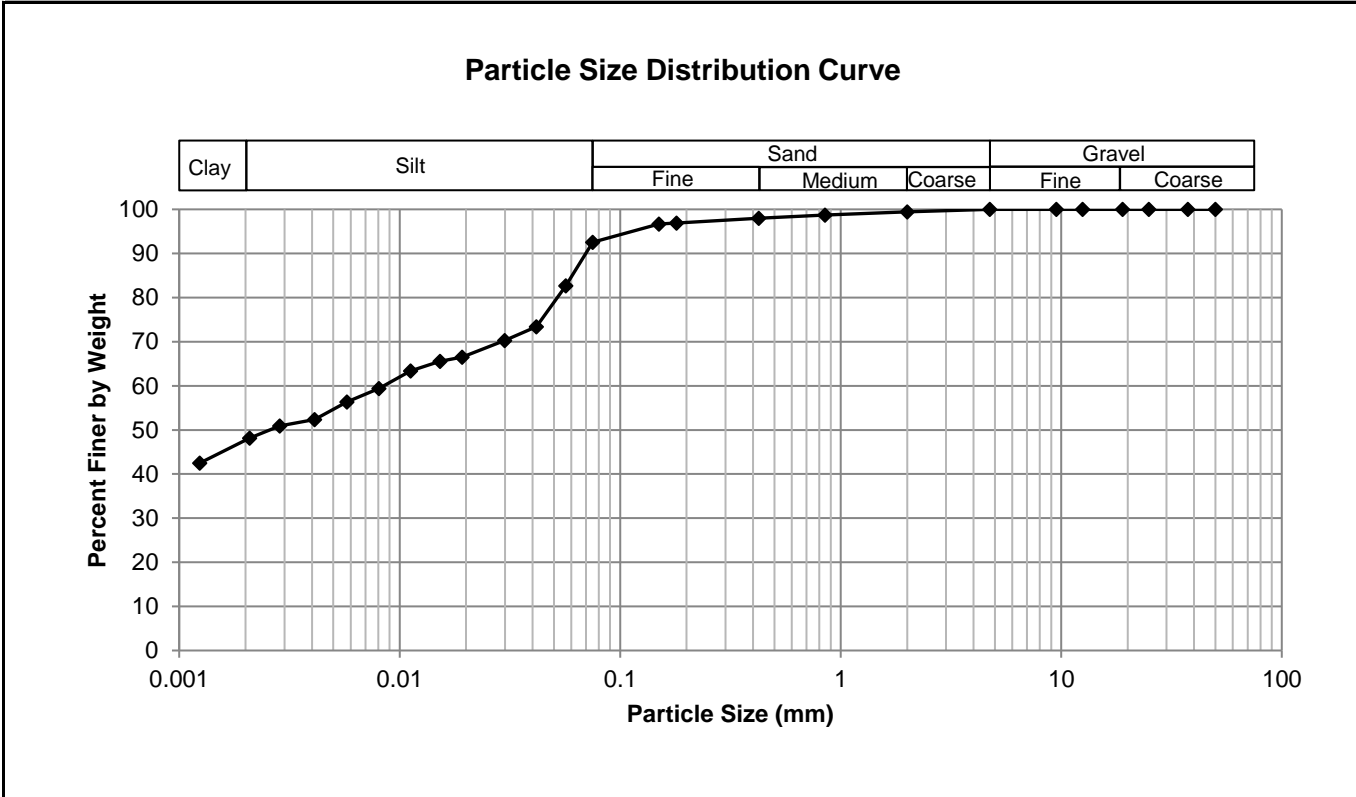
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave



**Test Hole** TH20-01  
**Sample #** G02  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 22-Oct-20  
**Technician** AD/JSB

<b>Gravel</b>	0.0%
<b>Sand</b>	7.5%
<b>Silt</b>	45.0%
<b>Clay</b>	47.6%



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	92.54
37.5	100.00	2.00	99.47	0.0566	82.70
25.0	100.00	0.850	98.72	0.0417	73.37
19.0	100.00	0.425	98.02	0.0299	70.26
12.5	100.00	0.180	96.93	0.0192	66.53
9.50	100.00	0.150	96.67	0.0152	65.60
4.75	100.00	0.075	92.54	0.0112	63.42
				0.0081	59.38
				0.0058	56.32
				0.0041	52.39
				0.0029	50.94
				0.0021	48.14
				0.0012	42.47



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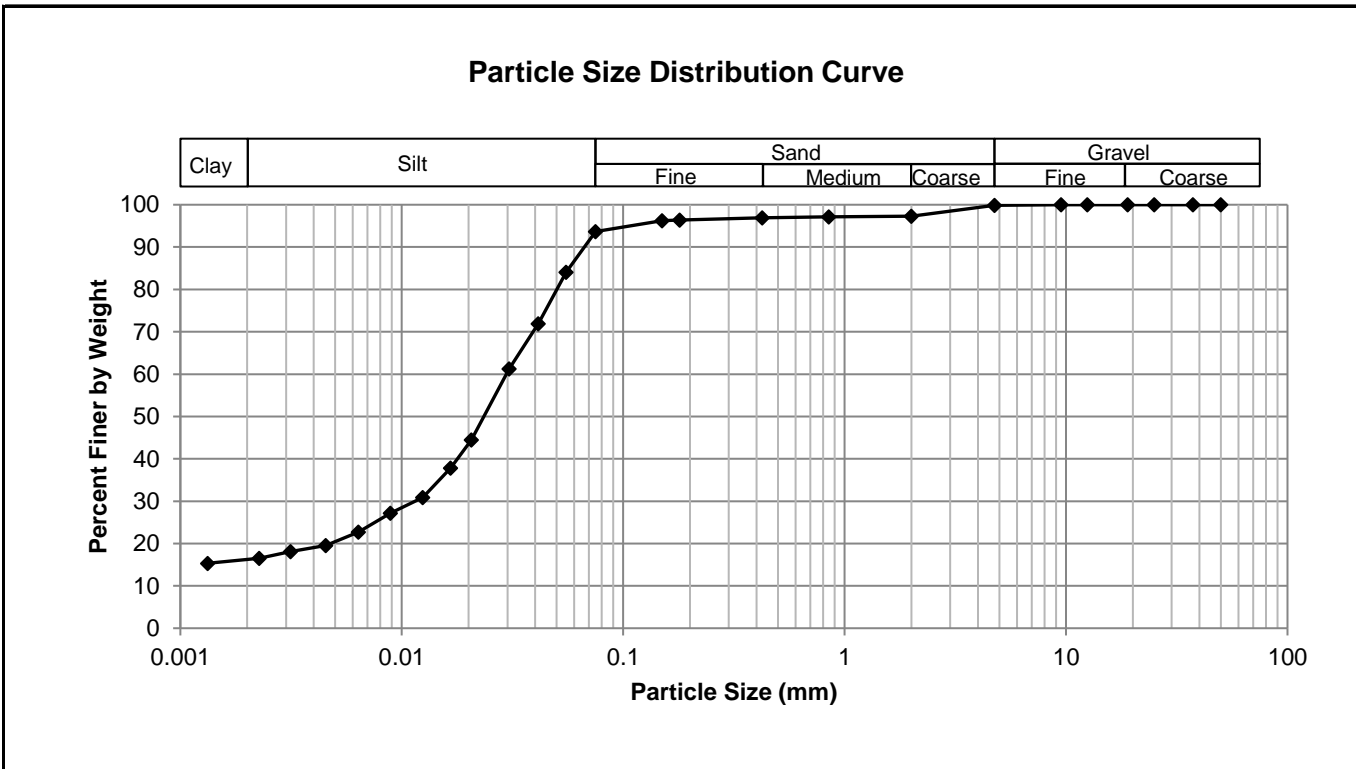
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave



**Test Hole** TH20-03  
**Sample #** G17  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 11-Oct-20  
**Technician** AD/JSB

<b>Gravel</b>	0.1%
<b>Sand</b>	6.2%
<b>Silt</b>	77.5%
<b>Clay</b>	16.2%



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	99.86	0.0750	93.66
37.5	100.00	2.00	97.26	0.0553	84.06
25.0	100.00	0.850	97.12	0.0414	71.90
19.0	100.00	0.425	96.90	0.0306	61.26
12.5	100.00	0.180	96.37	0.0206	44.46
9.50	100.00	0.150	96.21	0.0166	37.84
4.75	99.86	0.075	93.66	0.0124	30.85
				0.0089	27.20
				0.0064	22.71
				0.0045	19.51
				0.0031	18.13
				0.0023	16.52
				0.0013	15.34



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# Standard Proctor Compaction Test

ASTM D698-12e2

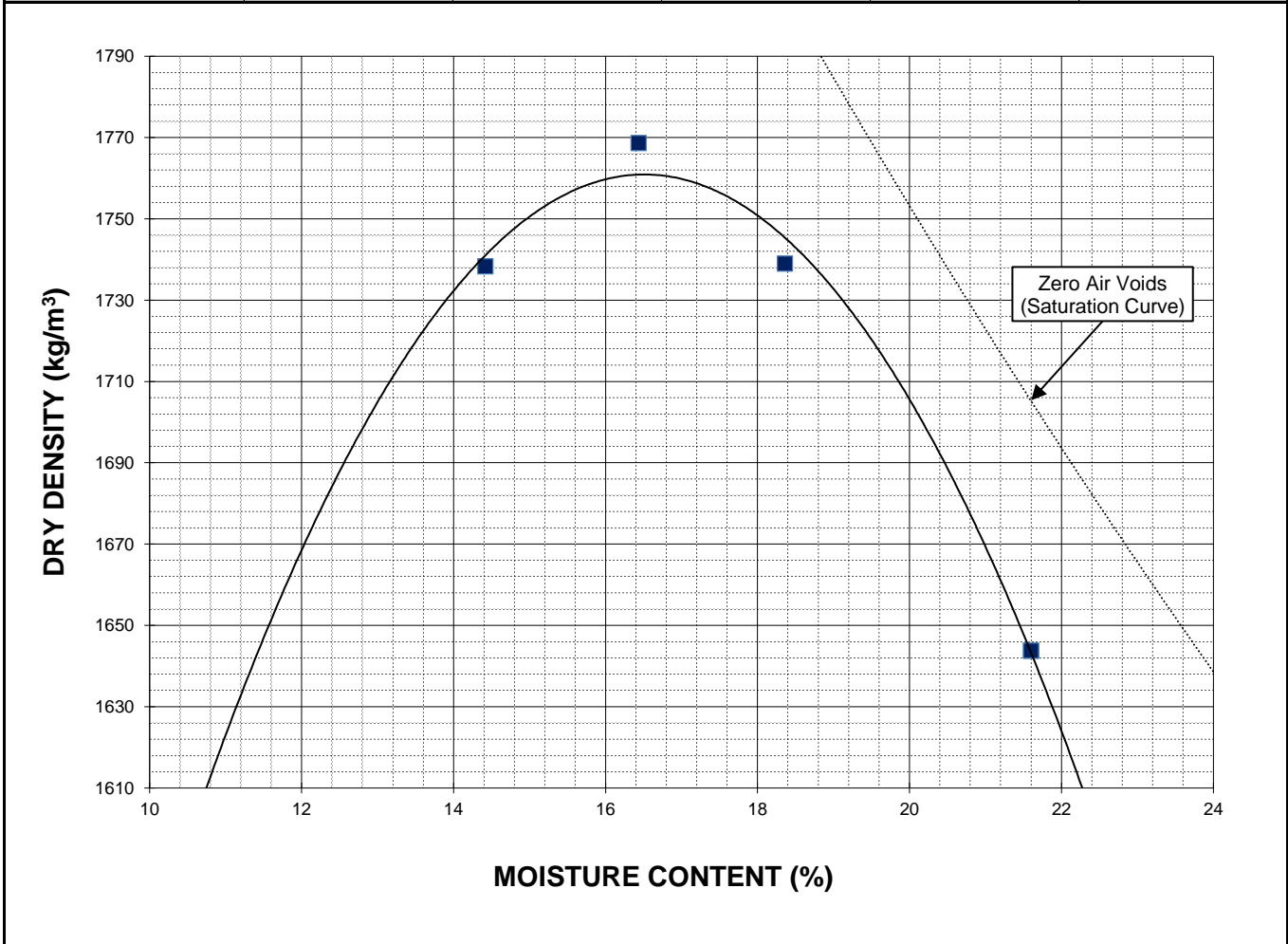
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave



**Sample #** TH20-01 (0.2 - 1.5 m)  
**Source** Back Alley between Dufferin Ave/Jarvis Ave  
**Material** Silt and Clay  
**Sample Date** 6-Oct-20  
**Test Date** 10-Oct-20  
**Technician** AD

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1761
<b>Optimum Moisture (%)</b>	16.5

Trial Number	1	2	3	4	
Wet Density (kg/m <sup>3</sup> )	1989	2059	2058	1999	
Dry Density (kg/m <sup>3</sup> )	1738	1769	1739	1644	
Moisture Content (%)	14.4	16.4	18.4	21.6	





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# Standard Proctor Compaction Test

ASTM D698-12e2

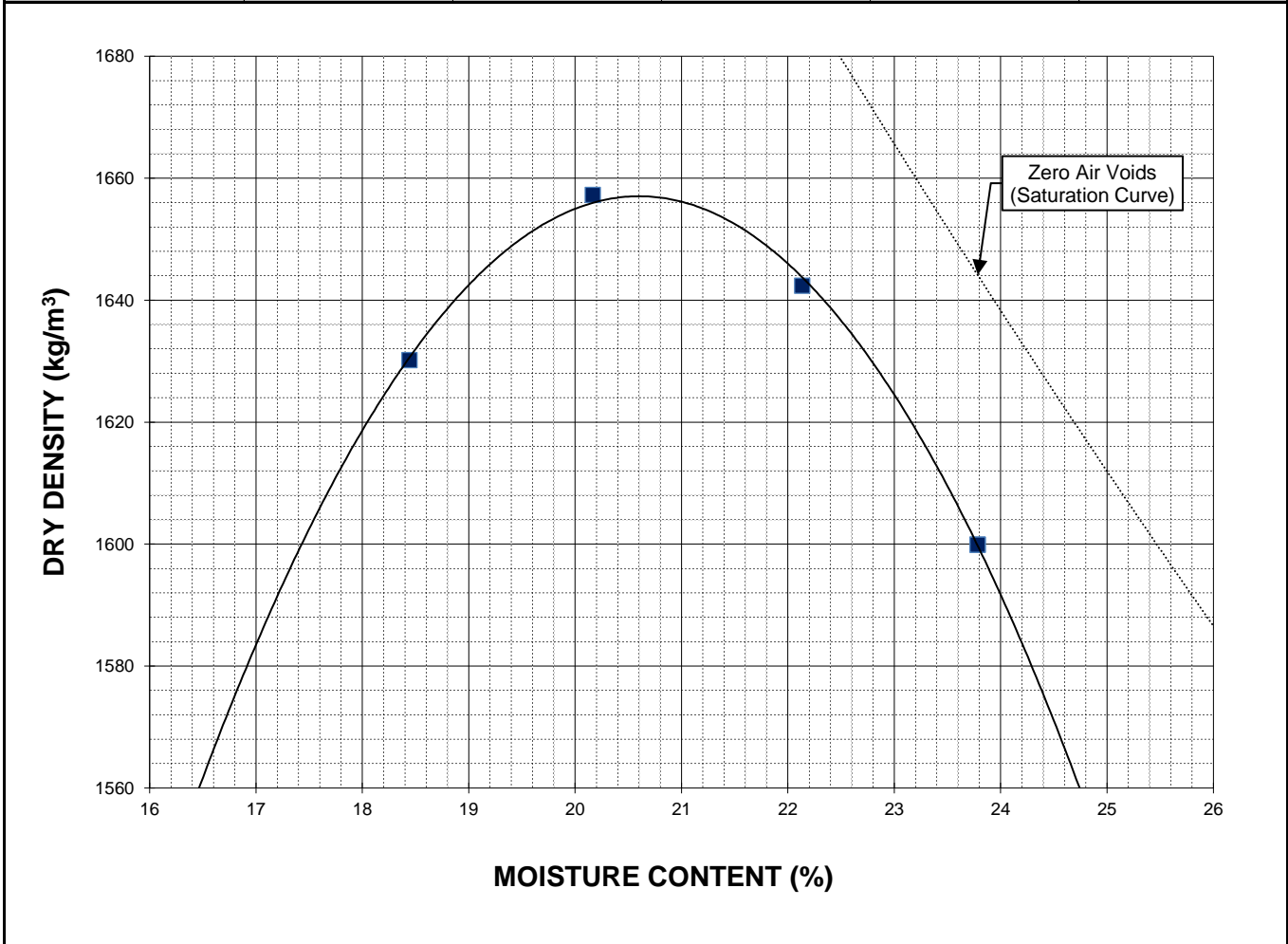
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dufferin Ave/Jarvis Ave



**Sample #** TH20-03 (0.2 - 1.5 m)  
**Source** Back Alley between Dufferin Ave/Jarvis Ave  
**Material** Silt and Clay  
**Sample Date** 6-Oct-20  
**Test Date** 10-Oct-20  
**Technician** BMH

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1657
<b>Optimum Moisture (%)</b>	20.6

Trial Number	1	2	3	4	
Wet Density (kg/m <sup>3</sup> )	1931	1992	2006	1980	
Dry Density (kg/m <sup>3</sup> )	1630	1657	1642	1600	
Moisture Content (%)	18.4	20.2	22.1	23.8	





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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley between Dufferin Ave/Jarvis Ave
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	10/6/2020
<b>Sample #</b>	TH20-01 (0.2 - 1.5 m)	<b>Test Date</b>	10/13/2020
		<b>Technician</b>	NM

**Proctor Results (ASTM D698)**

Maximum Dry Density            1761 kg/m<sup>3</sup>  
 Optimum Moisture Content        16.5 %  
 Material Retained on 19 mm Sieve    0.0 %

**CBR Sample Compaction**

Dry Density                            1669 kg/m<sup>3</sup>  
 Initial Moisture Content            20.2 %  
 Relative Density                    94.8 % SPMD

**Soaking Results**

Surcharge                            4.54 kg  
 Swell                                    0.1 %  
 Moisture Content in top 25 mm    20.7 %  
 Immersion Period                    95 h

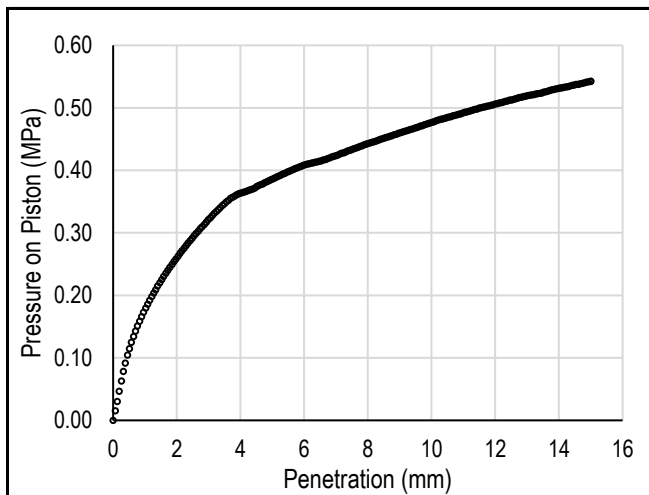
**CBR Results**

CBR at 2.54 mm                    4.3 %  
 CBR at 5.08 mm                    3.8 %  
 Zero Correction                    0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.13	0.13
1.27	0.20	0.20
1.91	0.25	0.25
2.54	0.30	0.30
3.18	0.33	0.33
3.81	0.36	0.36
4.45	0.37	0.37
5.08	0.39	0.39
7.62	0.44	0.44
10.16	0.48	0.48
12.70	0.52	0.52

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley between Dufferin Ave/Jarvis Ave
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	10/6/2020
<b>Sample #</b>	TH20-03 (0.2 - 1.5 m)	<b>Test Date</b>	10/14/2020
		<b>Technician</b>	NM

**Proctor Results (ASTM D698)**

Maximum Dry Density 1657 kg/m<sup>3</sup>  
 Optimum Moisture Content 20.6 %  
 Material Retained on 19 mm Sieve 0.0 %

**CBR Sample Compaction**

Dry Density 1559 kg/m<sup>3</sup>  
 Initial Moisture Content 23.3 %  
 Relative Density 94.1 % SPMDD

**Soaking Results**

Surcharge 4.54 kg  
 Swell 0.4 %  
 Moisture Content in top 25 mm 29.4 %  
 Immersion Period 94 h

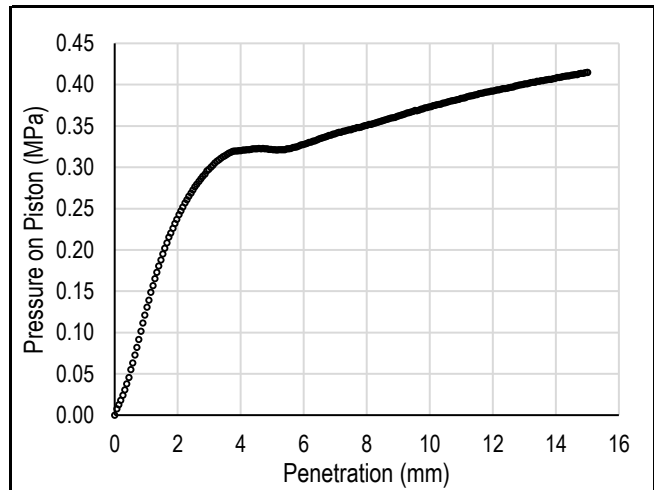
**CBR Results**

CBR at 2.54 mm 4.0 %  
 CBR at 5.08 mm 3.1 %  
 Zero Correction 0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.07	0.07
1.27	0.17	0.17
1.91	0.23	0.23
2.54	0.28	0.28
3.18	0.31	0.31
3.81	0.32	0.32
4.45	0.32	0.32
5.08	0.32	0.32
7.62	0.35	0.35
10.16	0.38	0.38
12.70	0.40	0.40

**Load/Penetration Curve**



**Comments:**



Photo 1: Pavement Core Sample at Test Hole TH20-01



Photo 2: Pavement Core Sample at Test Hole TH20-02



Photo 3: Pavement Core Sample at Test Hole TH20-03



## **Appendix B**

### **Dominion Street & Garfield Street North Back Alley**

#### **Test Hole Logs, Summary Table, Lab Testing Results and Pavement Core Photos**

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## GENERAL NOTES

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

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

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

## Other Symbol Types

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

## LEGEND OF ABBREVIATIONS AND SYMBOLS

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

## FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

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

## TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



# Sub-Surface Log

Test Hole TH20-04

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5528865 m N, 630946 m E  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 6, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	25	50	75	100/125
0.0 - 0.1		CONCRETE - 140 mm thick													
0.1 - 0.8		SILT AND CLAY - sandy, trace gravel (diam. < 30 mm) - black - moist, very stiff - high plasticity - AASHTO: A-7-6 (39)  - some sand below 0.8 m.		G23											
0.8 - 1.0				G24											
1.0 - 1.5		SILT - clayey - light brown - moist, soft to firm, intermediate to high plasticity, AASHTO: A-5 (I)		G25											
1.5 - 2.0		CLAY - silty, trace silt inclusions (diam. <20 mm), trace gravel (diam. <15 mm) - dark brown - moist, stiff - high plasticity - AASHTO: A-7-6 (I) - trace sulphate precipitate (diam. < 15 mm) at 1.7 m.		G26											
2.0 - 2.2				G27											
2.2 - 2.5				G28											
2.5 - 3.0				G29											

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) Seepage or sloughing not observed.
- 2) Test hole squeezed in and open to 2.9 m immediately after drilling.
- 3) Test hole backfilled with granular fill and cold patch asphalt.
- 4) Test hole located in back alley of House # 1067 Dominion St., 1.0 m West of East edge of alley.

Logged By: Jashandeep Singh Bhullar Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS DOMINION ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_D\_JSB 1000-043-12 GPJ TREK GEOTECHNICAL.GDT 11/2/20



# Sub-Surface Log

Test Hole TH20-10

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5529038 m N, 630948 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	25	50	75	100	125
0.0 - 0.1		CONCRETE - 130 mm thick														
0.1 - 0.8		SILT AND CLAY - trace sand, trace organics - black - moist, stiff - high plasticity - AASHTO: A-7-6 (48)		G65												
0.8 - 1.0		- no organics, brownish grey below 0.8 m		G66												
1.0 - 1.5				G67												
1.5 - 1.7		SILT - trace clay - light brown - moist, soft - intermediate plasticity - AASHTO: A-5 (I) - wet below 1.5 m.		G68												
1.7 - 2.0				G69												
2.0 - 2.1		CLAY - silty - grey, moist, very stiff, high plasticity, AASHTO: A-7-6 (I)		G70												
2.1 - 2.2				G71												

END OF TEST HOLE AT 2.0 m IN CLAY  
 1) Seepage or sloughing not observed.  
 2) Test hole is open to 2.0 m immediately after drilling.  
 3) Test hole backfilled with granular fill and cold patch asphalt.  
 4) Test hole located in back alley of house # 1029 Dominion St., 1.0 m West of East edge of alley.

SUB-SURFACE LOG LOGS DOMINION ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_D\_JSB 1000-043-12.GPJ TREK GEOTECHNICAL.GDT 11/2/20



# Sub-Surface Log

Test Hole TH20-11

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5528947 m N, 630948 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	25	50	75	100	125				
0.0 - 0.1		CONCRETE - 155 mm thick												
0.1 - 0.5		SILT AND CLAY - trace sand, trace gravel (diam. < 20 mm), trace organics - black - moist, stiff - high plasticity - AASHTO: A-7-6 (41)	<input checked="" type="checkbox"/>	G72										
0.5 - 0.8		- no organics, grey below 0.8 m.	<input checked="" type="checkbox"/>	G73										
0.8 - 1.0			<input checked="" type="checkbox"/>	G74										
1.0 - 1.5		SILT - trace clay - light brown - moist, soft - no to low plasticity, AASHTO: A-4 (I)	<input checked="" type="checkbox"/>	G75										
1.5 - 2.0		CLAY - silty - grey - moist, stiff - high plasticity - AASHTO: A-7-6 (I)	<input checked="" type="checkbox"/>	G76										
			<input checked="" type="checkbox"/>	G77										

END OF TEST HOLE AT 2.0 m IN CLAY  
 1) Seepage or sloughing not observed.  
 2) Test hole is open to 2.0 m immediately after drilling.  
 3) Test hole backfilled with granular fill and cold patch asphalt.  
 4) Test hole located in back alley of house # 1087 Dominion St., 1.0 m West of East edge of alley.

SUB-SURFACE LOG LOGS DOMINION ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_D\_JSB 1000-043-12.GPJ TREK GEOTECHNICAL.GDT 11/2/20



**2021 Alley Renewal Package (21-RL-03)**  
**Sub-Surface Investigation**  
**Dominion Street & Garfield Street N Alley: bounded by Sargent Avenue and Wellington 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	
TH20-04	UTM: 14U 5528865 m N, 630946 m E Located in back alley of House # 1067 Dominion St., 1.0 m West of East edge of alley.	-	-	Concrete	140	Silt and Clay: AASHTO: A-7-6 (39)	0.2	0.3	32								
						Silt And Clay: AASHTO: A-7-6 (39)	0.8	0.9	40	39	47	14	0	22	64	42	
						Silt And Clay: AASHTO: A-7-6 (39)	1.0	1.2	31								
						Silt: AASHTO: A-5 (I)	1.3	1.5	30								
						Clay: AASHTO: A-7-6 (I)	1.8	1.9	30								
						Clay: AASHTO: A-7-6 (I)	2.1	2.3	45								
						Clay: AASHTO: A-7-6 (I)	2.6	2.7	48								
TH20-10	UTM: 14U 5529038 m N, 630948 m E Located in back alley of House # 1029 Dominion St., 0.5 m West of East edge of alley.	-	-	Concrete	130	Clay: AASHTO: A-7-6 (I)	0.2	0.3	31								
						Clay: AASHTO: A-7-6 (I)	0.5	0.6	31								
						Silt And Clay: AASHTO: A-7-6 (48)	0.8	0.9	31	62	32	6	0	18	63	46	
						Silt And Clay: AASHTO: A-7-6 (48)	1.1	1.2	26								
						Silt: AASHTO: A-5 (I)	1.2	1.4	22								
						Silt: AASHTO: A-5 (I)	1.5	1.7	21								
						Clay: AASHTO: A-7-6 (I)	1.8	2.0	36								
TH20-11	UTM: 14U 5528947 m N, 630948 m E Located in back alley of House # 1087 Dominion St., 0.5 m West of East edge of alley.	-	-	Concrete	155	Clay: AASHTO: A-7-6 (I)	0.2	0.3	18								
						Clay: AASHTO: A-7-6 (I)	0.5	0.6	35	52	38	10	0	24	65	41	
						Clay: AASHTO: A-7-6 (I)	0.8	0.9	26								
						Silt: AASHTO: A-4 (I)	1.1	1.2	21								
						Clay: AASHTO: A-7-6 (I)	1.4	1.5	35								
						Clay: AASHTO: A-7-6 (I)	1.7	2.0	36								

(I) - AASHTO classification was interpreted based on visual classification.



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St

**Sample Date** 6-Oct-20  
**Test Date** 7-Oct-20  
**Technician** AD/BMH

Test Hole	TH20-04	TH20-04	TH20-04	TH20-04	TH20-04	TH20-04
Depth (m)	0.2 - 0.3	0.8 - 0.9	1.0 - 1.2	1.3 - 1.5	1.8 - 1.9	2.1 - 2.3
Sample #	G23	G24	G25	G26	G27	G28
Tare ID	E12	E72	AB14	W22	AA01	H53
Mass of tare	8.9	8.5	6.7	8.5	6.7	8.5
Mass wet + tare	394.9	303.0	199.2	256.6	203.5	250.2
Mass dry + tare	300.8	218.4	153.2	199.4	158.0	174.8
Mass water	94.1	84.6	46.0	57.2	45.5	75.4
Mass dry soil	291.9	209.9	146.5	190.9	151.3	166.3
Moisture %	32.2%	40.3%	31.4%	30.0%	30.1%	45.3%

Test Hole	TH20-04	TH20-10	TH20-10	TH20-10	TH20-10	TH20-10
Depth (m)	2.6 - 2.7	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.2 - 1.4
Sample #	G29	G65	G66	G67	G68	G69
Tare ID	F53	W35	AB98	W92	A103	A20
Mass of tare	6.9	8.5	6.8	8.4	8.6	8.8
Mass wet + tare	211.5	249.0	316.2	460.6	321.6	320.2
Mass dry + tare	145.6	192.4	243.3	354.2	257.3	265.2
Mass water	65.9	56.6	72.9	106.4	64.3	55.0
Mass dry soil	138.7	183.9	236.5	345.8	248.7	256.4
Moisture %	47.5%	30.8%	30.8%	30.8%	25.9%	21.5%

Test Hole	TH20-10	TH20-10	TH20-11	TH20-11	TH20-11	TH20-11
Depth (m)	1.5 - 1.7	1.8 - 2.0	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G70	G71	G72	G73	G74	G75
Tare ID	Z19	W55	C22	K34	N107	AC01
Mass of tare	8.8	8.6	8.6	8.6	8.6	6.6
Mass wet + tare	317.2	328.4	288.0	423.4	251.4	281.2
Mass dry + tare	263.5	244.7	245.1	316.0	201.6	233.2
Mass water	53.7	83.7	42.9	107.4	49.8	48.0
Mass dry soil	254.7	236.1	236.5	307.4	193.0	226.6
Moisture %	21.1%	35.5%	18.1%	34.9%	25.8%	21.2%





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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St

**Sample Date** 6-Oct-20  
**Test Date** 7-Oct-20  
**Technician** AD/BMH

<b>Test Hole</b>	TH20-11	TH20-11				
<b>Depth (m)</b>	1.4 - 1.5	1.7 - 2.0				
<b>Sample #</b>	G76	G77				
<b>Tare ID</b>	AA19	F10				
<b>Mass of tare</b>	6.6	8.8				
<b>Mass wet + tare</b>	277.2	347.4				
<b>Mass dry + tare</b>	207.3	257.6				
<b>Mass water</b>	69.9	89.8				
<b>Mass dry soil</b>	200.7	248.8				
<b>Moisture %</b>	34.8%	36.1%				



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## Atterberg Limits ASTM D4318-10e1

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St./Garfield St.

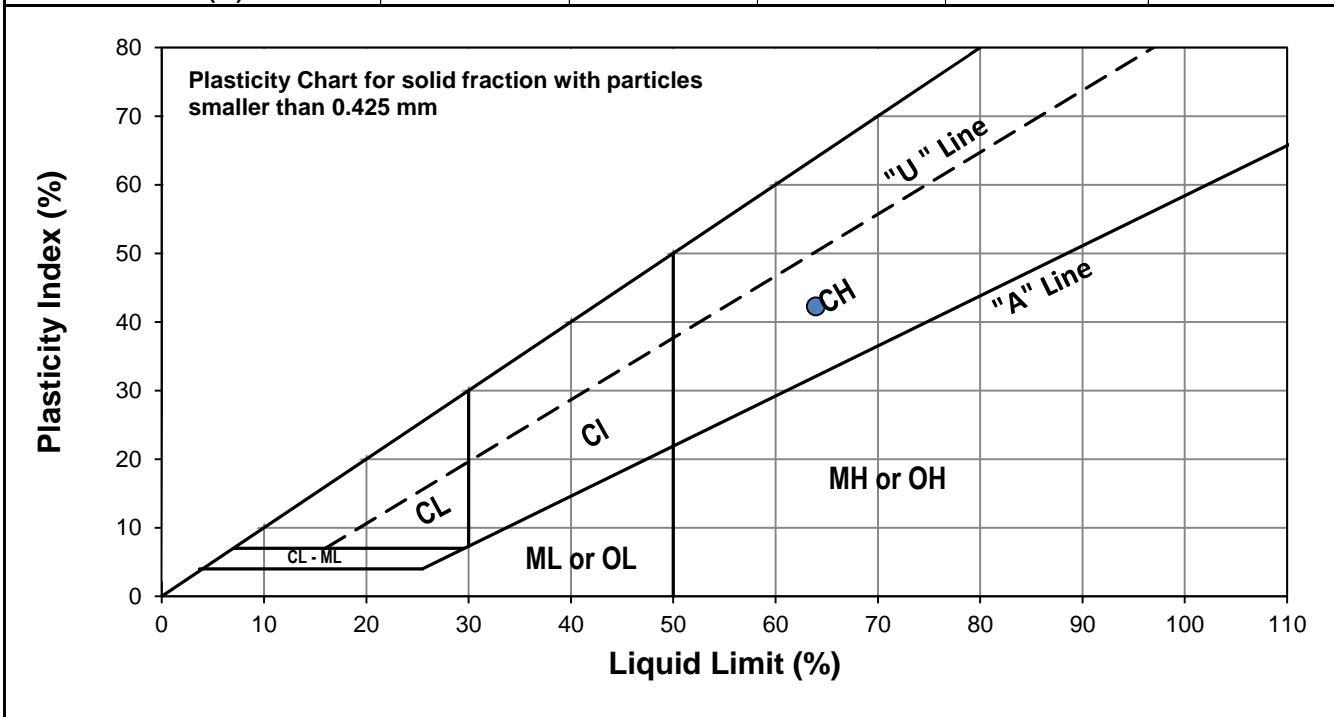


**Test Hole** TH20-04  
**Sample #** G24  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 06-Oct-20  
**Test Date** 23-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	64
<b>Plastic Limit</b>	22
<b>Plasticity Index</b>	42

### Liquid Limit

Trial #	1	2	3
<b>Number of Blows (N)</b>	21	26	32
<b>Mass Wet Soil + Tare (g)</b>	25.066	25.653	26.686
<b>Mass Dry Soil + Tare (g)</b>	20.774	21.186	21.903
<b>Mass Tare (g)</b>	14.160	14.169	14.277
<b>Mass Water (g)</b>	4.292	4.467	4.783
<b>Mass Dry Soil (g)</b>	6.614	7.017	7.626
<b>Moisture Content (%)</b>	64.893	63.660	62.720



### Plastic Limit

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.217	14.010			
<b>Mass Wet Soil + Tare (g)</b>	20.657	20.648			
<b>Mass Dry Soil + Tare (g)</b>	19.507	19.464			
<b>Mass Water (g)</b>	1.150	1.184			
<b>Mass Dry Soil (g)</b>	5.290	5.454			
<b>Moisture Content (%)</b>	21.739	21.709			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St

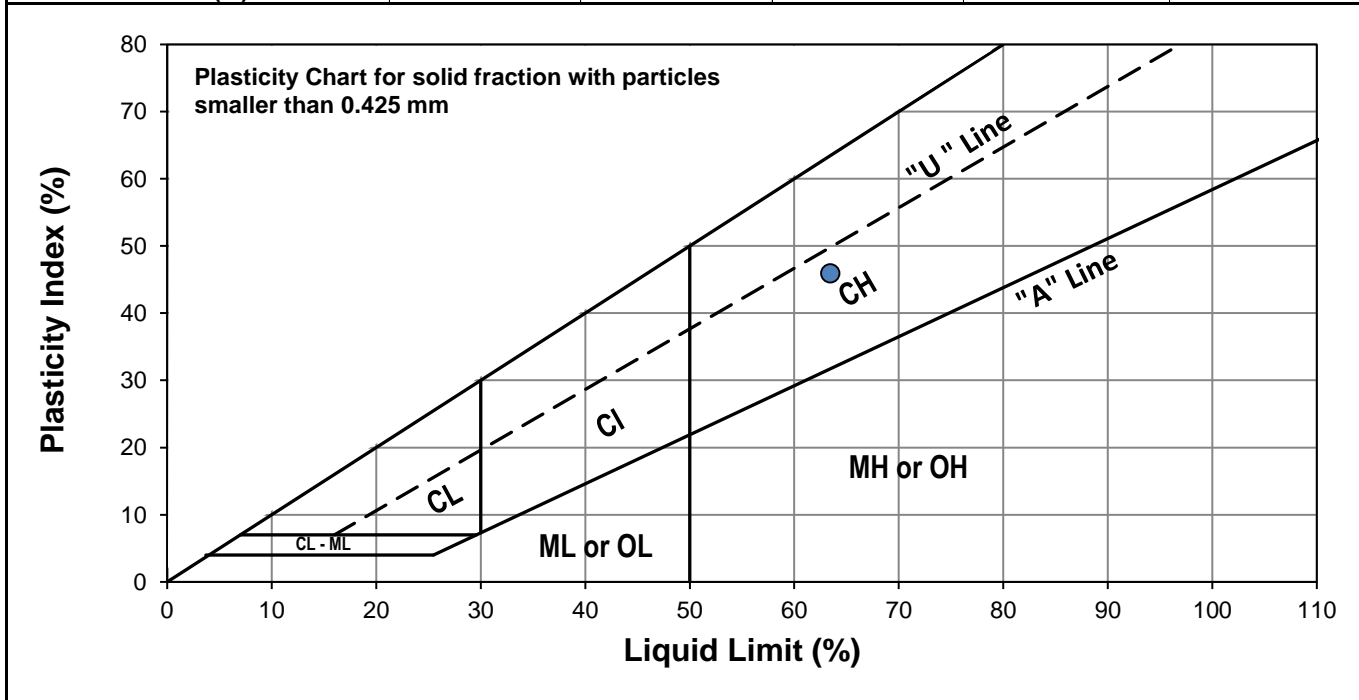


**Test Hole** TH20-10  
**Sample #** G67  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 8-Oct-20  
**Test Date** 14-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	63
<b>Plastic Limit</b>	18
<b>Plasticity Index</b>	46

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	15	29	33
<b>Mass Wet Soil + Tare (g)</b>	27.074	25.002	26.439
<b>Mass Dry Soil + Tare (g)</b>	21.924	20.838	21.663
<b>Mass Tare (g)</b>	14.129	14.159	14.000
<b>Mass Water (g)</b>	5.150	4.164	4.776
<b>Mass Dry Soil (g)</b>	7.795	6.679	7.663
<b>Moisture Content (%)</b>	66.068	62.345	62.325



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.051	13.961			
<b>Mass Wet Soil + Tare (g)</b>	20.192	20.066			
<b>Mass Dry Soil + Tare (g)</b>	19.272	19.160			
<b>Mass Water (g)</b>	0.920	0.906			
<b>Mass Dry Soil (g)</b>	5.221	5.199			
<b>Moisture Content (%)</b>	17.621	17.426			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St

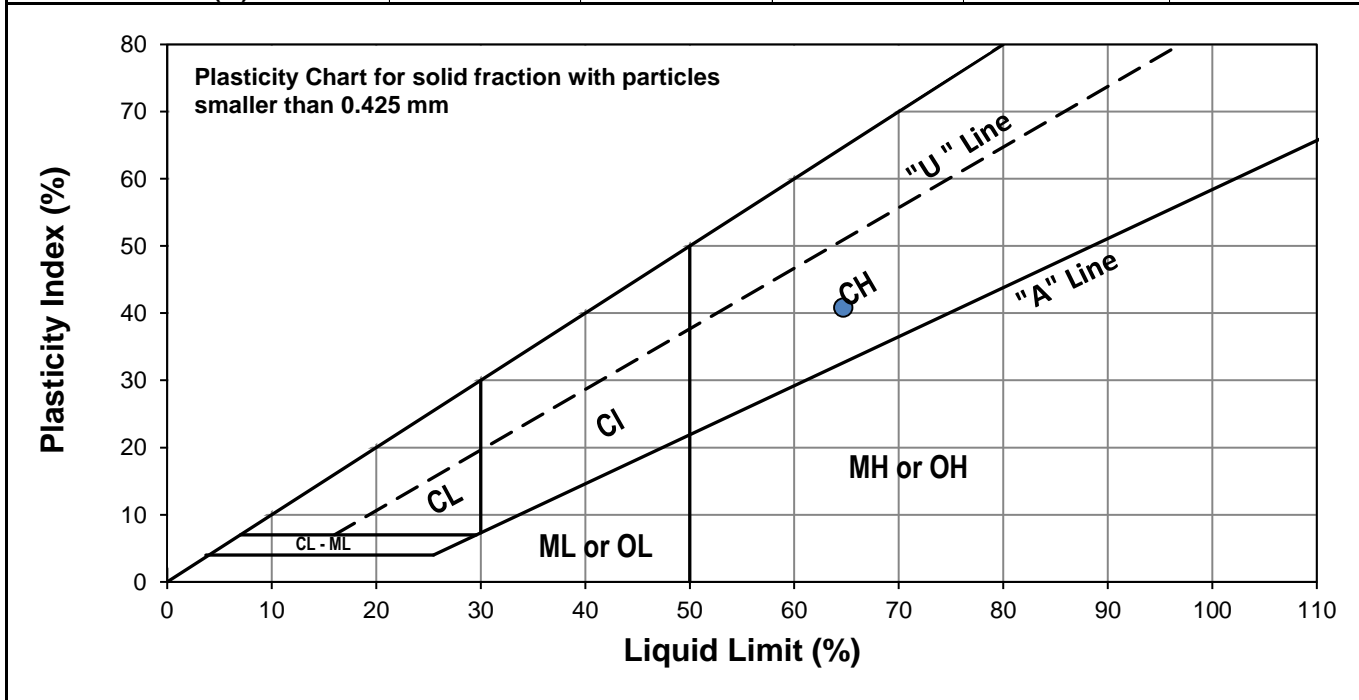


**Test Hole** TH20-11  
**Sample #** G73  
**Depth (m)** 0.5 - 0.6  
**Sample Date** 8-Oct-20  
**Test Date** 13-Oct-20  
**Technician** AD

**Liquid Limit** 65  
**Plastic Limit** 24  
**Plasticity Index** 41

**Liquid Limit**

Trial #	1	2	3
Number of Blows (N)	16	26	33
Mass Wet Soil + Tare (g)	27.055	24.651	25.941
Mass Dry Soil + Tare (g)	21.754	20.497	21.321
Mass Tare (g)	13.955	14.041	13.948
Mass Water (g)	5.301	4.154	4.620
Mass Dry Soil (g)	7.799	6.456	7.373
Moisture Content (%)	67.970	64.343	62.661



**Plastic Limit**

Trial #	1	2	3	4	5
Mass Tare (g)	14.037	13.900			
Mass Wet Soil + Tare (g)	23.933	22.184			
Mass Dry Soil + Tare (g)	21.998	20.612			
Mass Water (g)	1.935	1.572			
Mass Dry Soil (g)	7.961	6.712			
Moisture Content (%)	24.306	23.421			



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**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

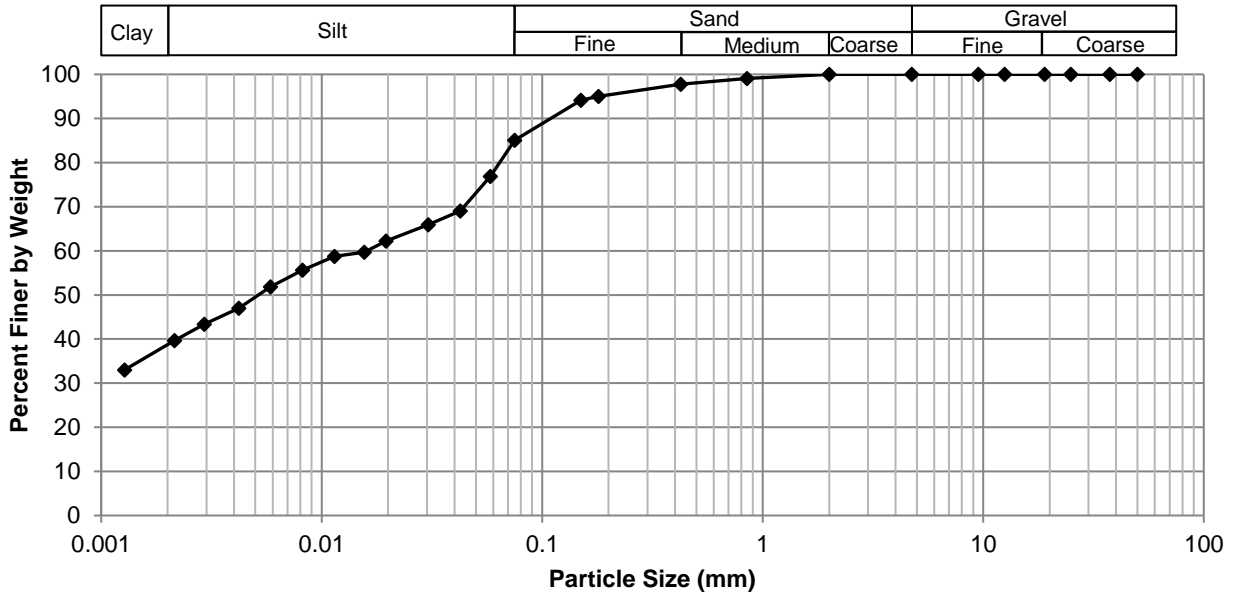
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St./Garfield St.



**Test Hole** TH20-04  
**Sample #** G24  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 22-Oct-20  
**Technician** AD/JSB

<b>Gravel</b>	0.0%
<b>Sand</b>	14.9%
<b>Silt</b>	46.6%
<b>Clay</b>	38.5%

**Particle Size Distribution Curve**



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	85.08
37.5	100.00	2.00	100.00	0.0582	76.89
25.0	100.00	0.850	99.08	0.0425	69.07
19.0	100.00	0.425	97.74	0.0305	65.95
12.5	100.00	0.180	95.04	0.0196	62.20
9.50	100.00	0.150	94.16	0.0156	59.69
4.75	100.00	0.075	85.08	0.0114	58.76
				0.0082	55.63
				0.0059	51.88
				0.0042	46.99
				0.0029	43.40
				0.0021	39.65
				0.0013	33.01



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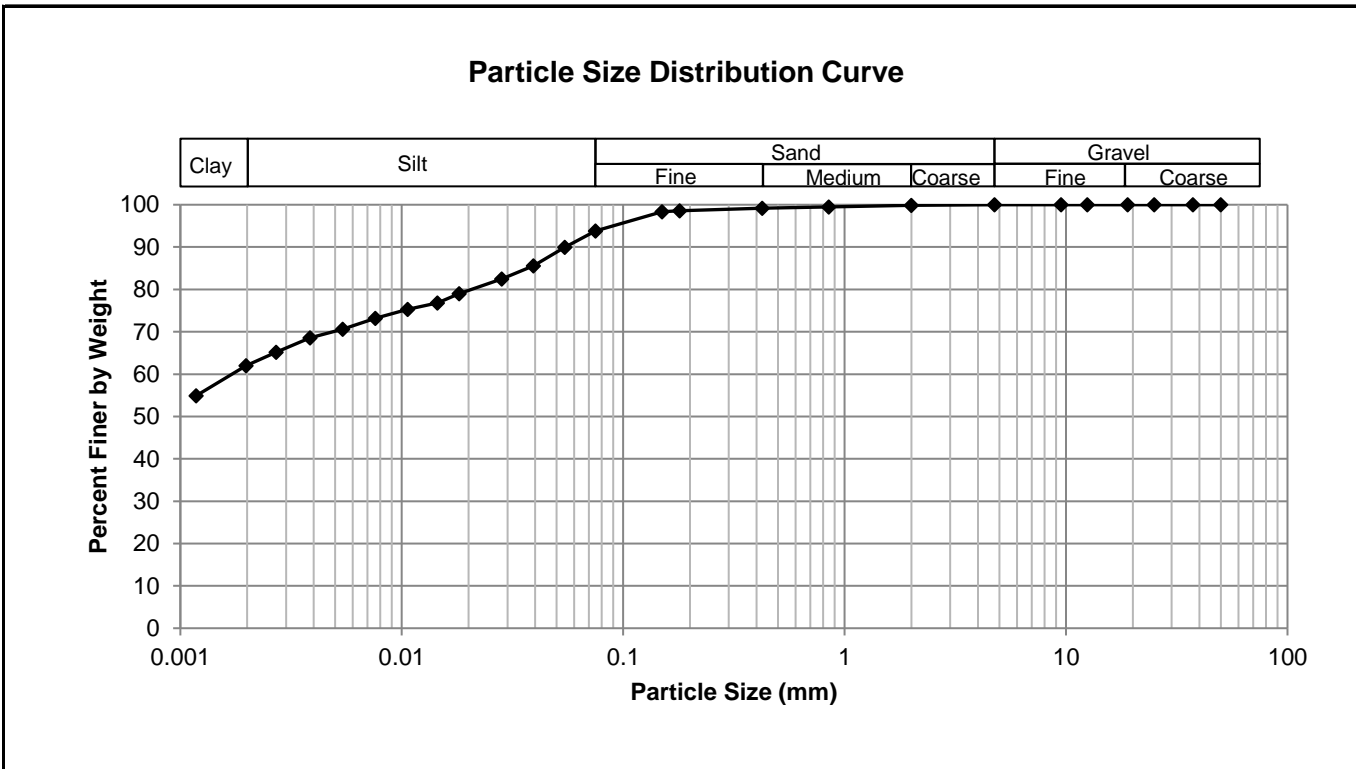
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St



**Test Hole** TH20-10  
**Sample #** G67  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 13-Oct-20  
**Technician** JSB

<b>Gravel</b>	0.0%
<b>Sand</b>	6.2%
<b>Silt</b>	31.7%
<b>Clay</b>	62.1%



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	100.00	0.0750	93.78
37.5	100.00	2.00	99.89	0.0546	89.95
25.0	100.00	0.850	99.47	0.0394	85.58
19.0	100.00	0.425	99.15	0.0283	82.45
12.5	100.00	0.180	98.55	0.0182	79.02
9.50	100.00	0.150	98.32	0.0145	76.83
4.75	100.00	0.075	93.78	0.0107	75.27
				0.0076	73.15
				0.0054	70.65
				0.0039	68.60
				0.0027	65.16
				0.0020	62.04
				0.0012	54.91



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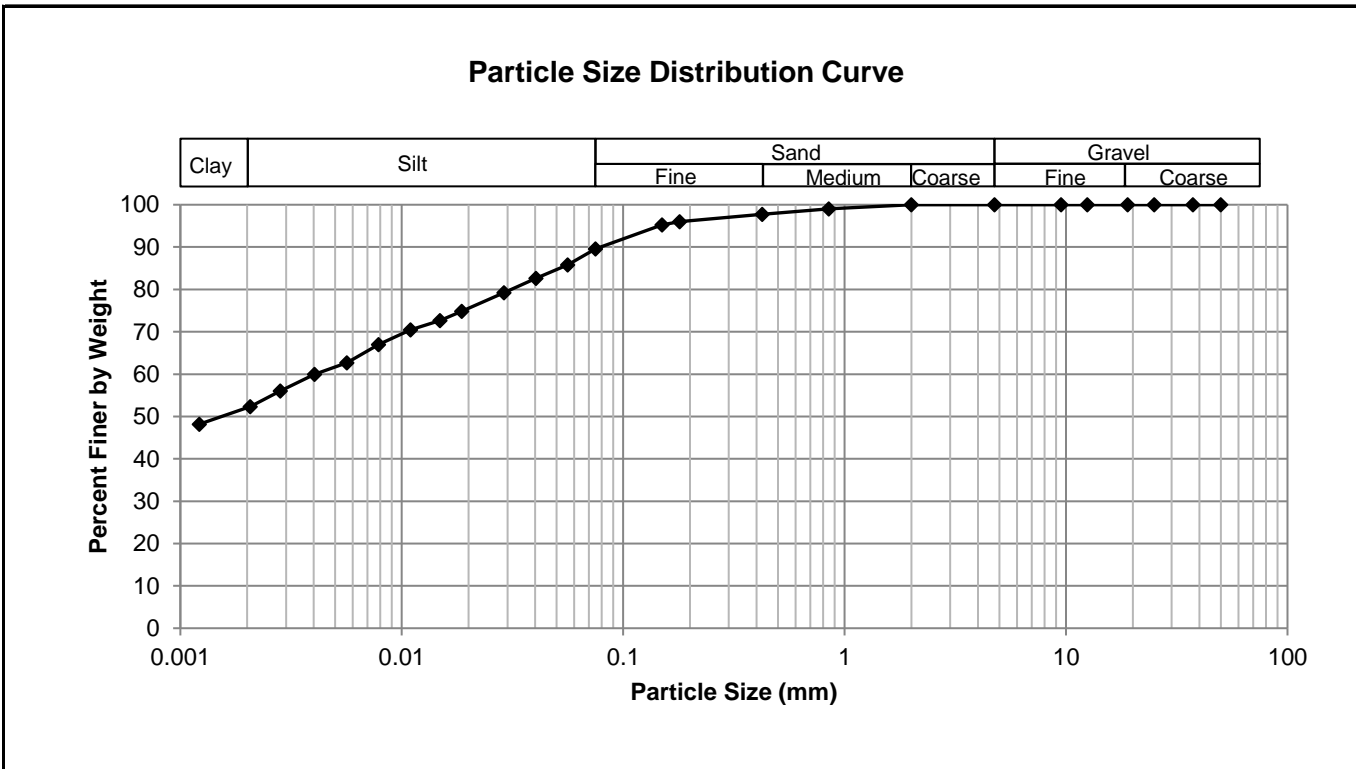
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St



**Test Hole** TH20-11  
**Sample #** G73  
**Depth (m)** 0.5 - 0.6  
**Sample Date** 16-Oct-20  
**Test Date** 19-Oct-20  
**Technician** AD

<b>Gravel</b>	0.0%
<b>Sand</b>	10.4%
<b>Silt</b>	37.6%
<b>Clay</b>	52.0%



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	89.59
37.5	100.00	2.00	100.00	0.0562	85.78
25.0	100.00	0.850	99.02	0.0403	82.65
19.0	100.00	0.425	97.78	0.0290	79.21
12.5	100.00	0.180	96.01	0.0187	74.83
9.50	100.00	0.150	95.25	0.0149	72.65
4.75	100.00	0.075	89.59	0.0110	70.46
				0.0079	67.02
				0.0057	62.71
				0.0040	59.96
				0.0028	56.02
				0.0021	52.34
				0.0012	48.19



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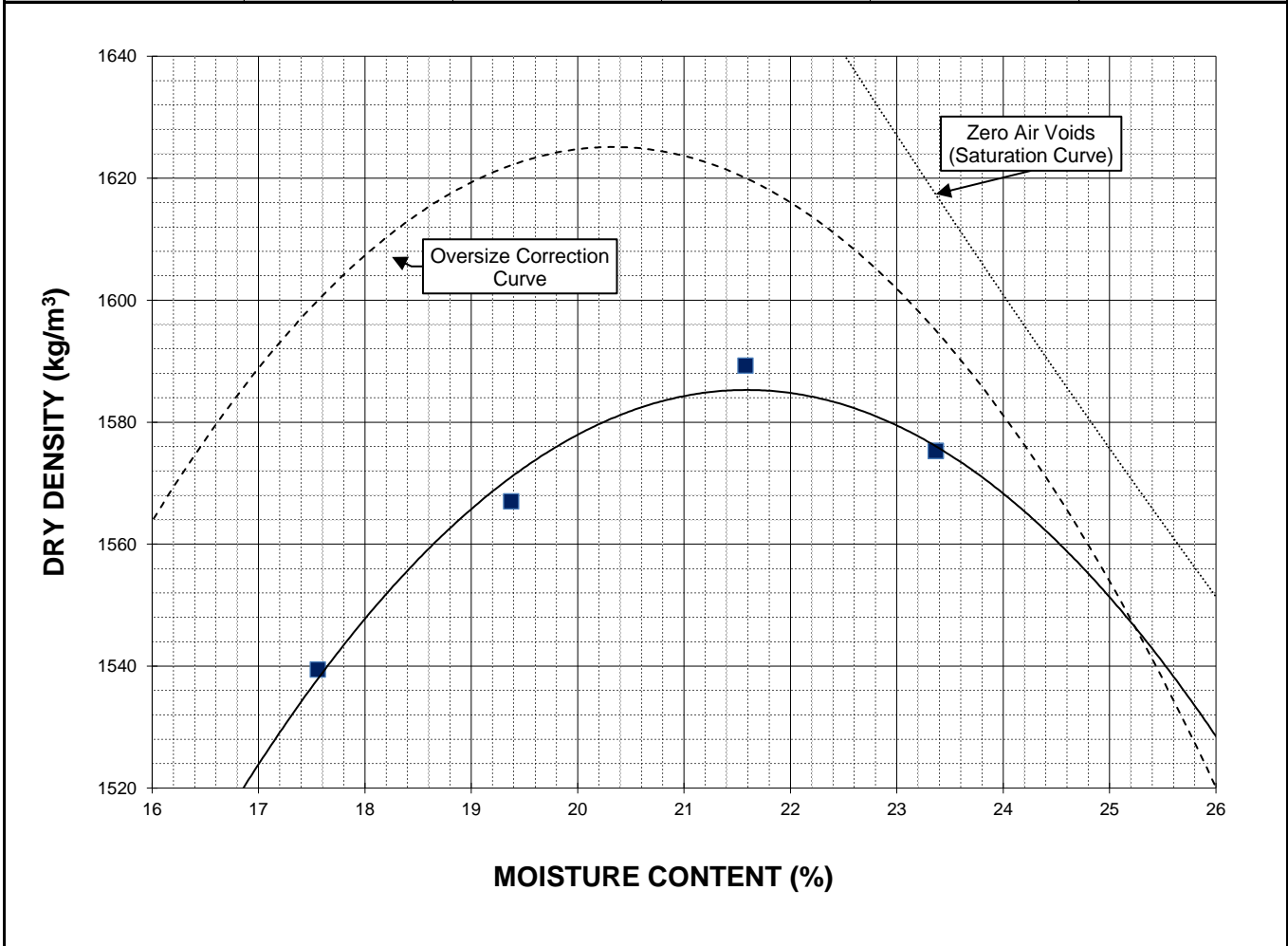
## Standard Proctor Compaction Test ASTM D698-12e2

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St



<b>Sample #</b>	TH20-10 and TH20-11 (0.2 - 1.2 m)		
<b>Source</b>	Back Alley btw Dominion St/Garfield St	<b>Corrected Max. Dry Density (kg/m<sup>3</sup>)</b>	1625
<b>Material</b>	Silt and Clay	<b>Corrected Optimum Moisture (%)</b>	20.3
<b>Sample Date</b>	8-Oct-20	<b>OverSize Material (%)</b>	6
<b>Test Date</b>	16-Oct-20	<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1585
<b>Technician</b>	MT	<b>Optimum Moisture (%)</b>	21.6

Trial Number	1	2	3	4	
<b>Wet Density (kg/m<sup>3</sup>)</b>	1810	1871	1932	1943	
<b>Dry Density (kg/m<sup>3</sup>)</b>	1539	1567	1589	1575	
<b>Moisture Content (%)</b>	17.6	19.4	21.6	23.4	







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# Standard Proctor Compaction Test

ASTM D698-12e2

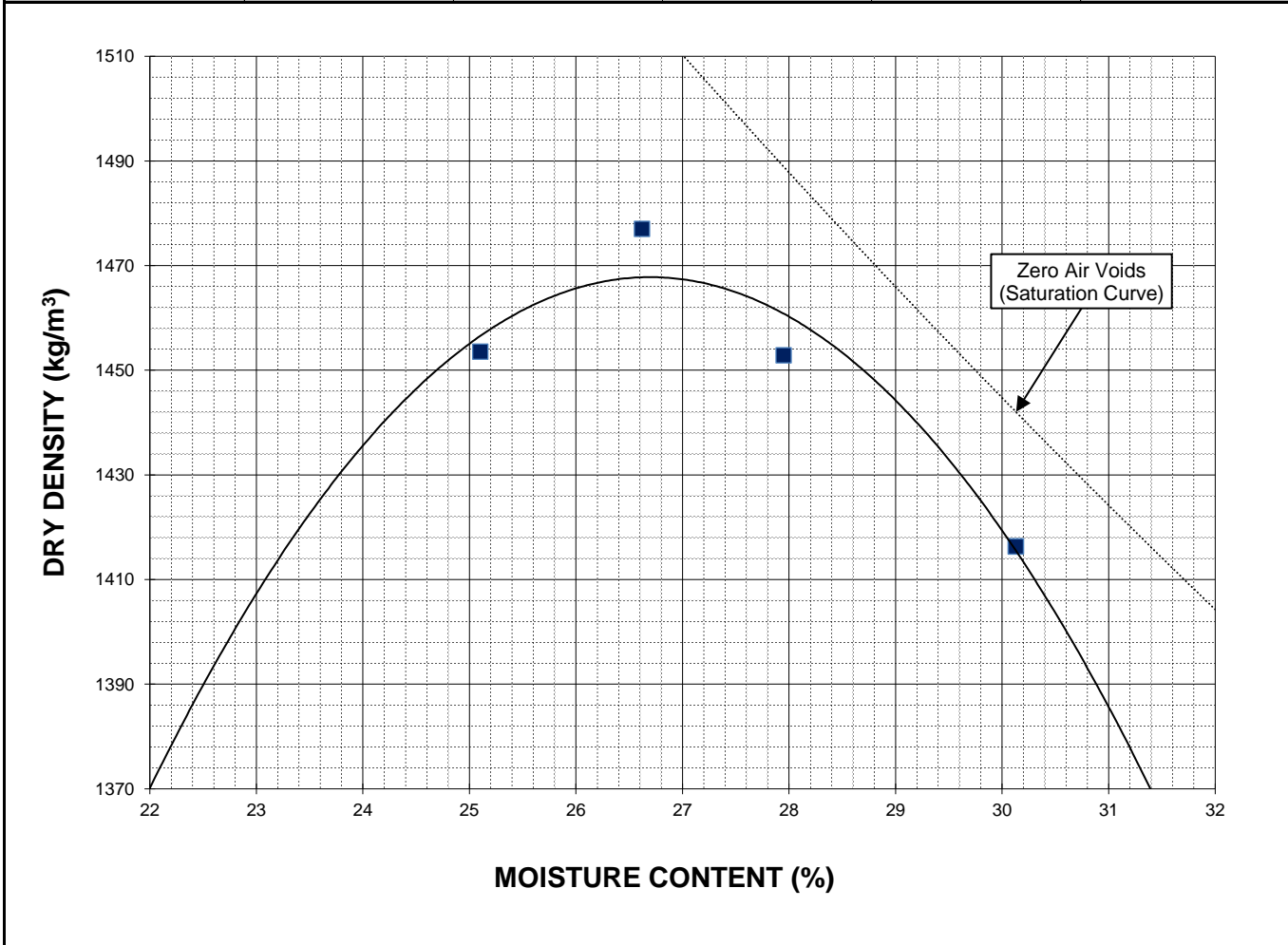
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Dominion St/Garfield St



**Sample #** TH20-04 (0.2 - 1.5 m)  
**Source** Back Alley between Dominion St/Garfield St  
**Material** Silt and Clay  
**Sample Date** 06-Oct-20  
**Test Date** 10-Oct-20  
**Technician** BMH

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1468
<b>Optimum Moisture (%)</b>	26.7

Trial Number	1	2	3	4	
Wet Density (kg/m <sup>3</sup> )	1818	1870	1859	1843	
Dry Density (kg/m <sup>3</sup> )	1454	1477	1453	1416	
Moisture Content (%)	25.1	26.6	27.9	30.1	





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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley btw Dominion St/Garfield St
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-06
<b>Sample #</b>	TH20-04 (0.2 - 1.5 m)	<b>Test Date</b>	2020-10-17
		<b>Technician</b>	NM

**Proctor Results (ASTM D698)**

Maximum Dry Density                    1468 kg/m3  
 Optimum Moisture Content            26.7 %  
 Material Retained on 19 mm Sieve   0.0 %

**CBR Sample Compaction**

Dry Density                                    1389 kg/m3  
 Initial Moisture Content                29.8 %  
 Relative Density                            94.6 % SPMD

**Soaking Results**

Surcharge                                    4.54 kg  
 Swell    0.3 %  
 Moisture Content in top 25 mm        33.2 %  
 Immersion Period                         97 h

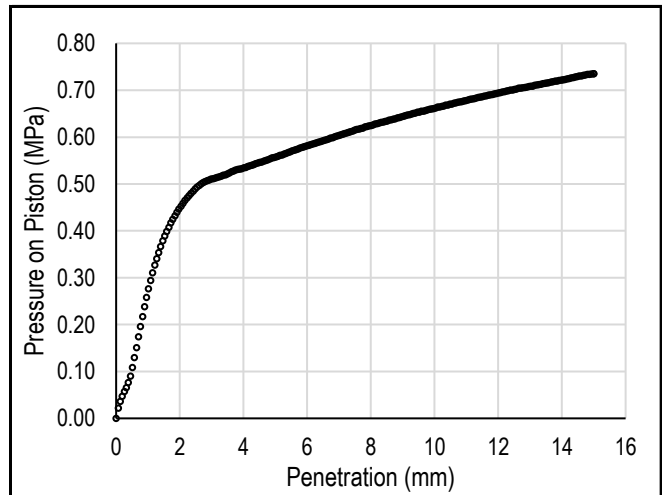
**CBR Results**

CBR at 2.54 mm                            7.2 %  
 CBR at 5.08 mm                            5.4 %  
 Zero Correction                             0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.15	0.15
1.27	0.34	0.34
1.91	0.44	0.44
2.54	0.49	0.49
3.18	0.51	0.51
3.81	0.53	0.53
4.45	0.54	0.54
5.08	0.56	0.56
7.62	0.62	0.62
10.16	0.66	0.66
12.70	0.70	0.70

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley btw Dominion St/Garfield St
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-06
<b>Sample #</b>	TH20-10/11 (0.2 - 1.5 m)	<b>Test Date</b>	2020-10-13
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1625 kg/m <sup>3</sup>
Optimum Moisture Content	20.3 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1546 kg/m <sup>3</sup>
Initial Moisture Content	22.4 %
Relative Density	95.1 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.3 %
Moisture Content in top 25 mm	25.7 %
Immersion Period	96 h

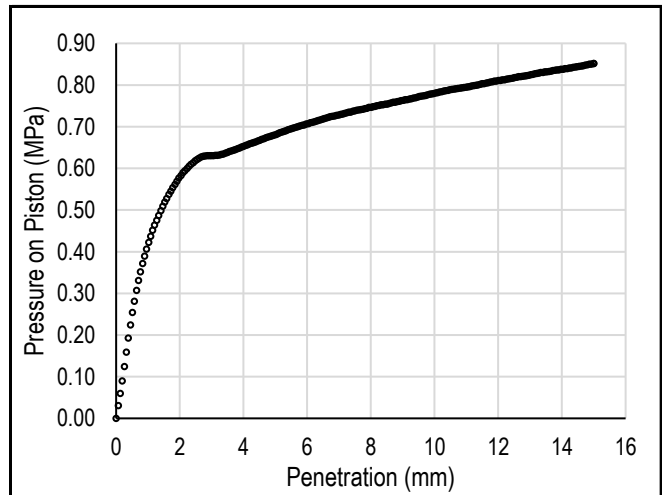
**CBR Results**

CBR at 2.54 mm	9.0 %
CBR at 5.08 mm	6.6 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.31	0.31
1.27	0.48	0.48
1.91	0.57	0.57
2.54	0.62	0.62
3.18	0.63	0.63
3.81	0.65	0.65
4.45	0.67	0.67
5.08	0.68	0.68
7.62	0.74	0.74
10.16	0.78	0.78
12.70	0.82	0.82

**Load/Penetration Curve**



**Comments:**



Photo 1: Pavement Core Sample at Test Hole TH20-04



Photo 2: Pavement Core Sample at Test Hole TH20-10



Photo 3: Pavement Core Sample at Test Hole TH20-11

## **Appendix C**

### **Craig Street & Stiles Street Back Alley**

#### **Test Hole Logs, Summary Table, Lab Testing Results and Pavement Core Photos**

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## 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		
<b>Coarse-Grained soils</b> (More than half the material is larger than No. 200 sieve size)	<b>Gravels</b> (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	ASTM Sieve sizes #10 to #4 #40 to #10 #200 to #40 < #200		
		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				
	<b>Sands</b> (More than half of coarse fraction is smaller than 4.75 mm)	<b>Clean sands</b> (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 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			
		<b>Sands with fines</b> (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures			
			SC		Clayey sands, sand-clay mixtures			
					<b>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:</b>  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*			
<b>Fine-Grained soils</b> (More than half the material is smaller than No. 200 sieve size)	<b>Silts and Clays</b> (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	<b>Plasticity Chart</b> 	<b>Material</b> 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				
	<b>Silts and Clays</b> (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				
	<b>Highly Organic Soils</b>	Pt		Peat and other highly organic soils			<b>Von Post Classification Limit</b>	<b>Strong colour or odour, and often fibrous texture</b>

\* 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 TH20-05

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5526867 m N, 630085 m E  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 6, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	25	50	75	100/125
0.0 - 0.1		CONCRETE - 230 mm thick													
0.1 - 0.9		SILT AND CLAY - sandy, trace gravel (diam. < 25 mm), trace organics - black - moist, firm - high plasticity - AASHTO: A-7-6 (56)  - very stiff below 0.6 m.  - trace sand below 0.9 m.		G30											
0.9 - 1.0				G31											
1.0 - 1.1				G32											
1.1 - 1.5		- no organics, brown below 1.1 m.		G33											
1.5 - 2.0				G34											
2.0 - 2.5				G35											
2.5 - 3.0				G36											

END OF TEST HOLE AT 3.0 m IN SILT AND CLAY  
 1) Seepage or sloughing not observed.  
 2) Test hole open to 3.0 m immediately after drilling.  
 3) Test hole backfilled with granular fill and cold patch asphalt.  
 4) Test hole located in back alley of house # 462 Stiles St., 1.0 m East of West edge of alley.

Logged By: Jashandeep Singh Bhullar Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS CRIAG ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_D\_JSB 1000-043-12 GPJ\_TREK GEOTECHNICAL.GDT 11/2/20



# Sub-Surface Log

Test Hole TH20-06

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5526971 m N, 630093 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)							
					16	17	18	19	20	21	0	25	50	75	100	125
0.0 - 0.1		CONCRETE - 210 mm thick														
0.1 - 0.8		SILT AND CLAY - trace sand, trace organics - black - moist, stiff - high plasticity - AASHTO: A-7-6 (48)  - no organics, light brown below 0.8 m.	G37													
0.8 - 1.0		SILT - trace clay - light brown - moist, very soft - low to no plasticity - AASHTO: A-2-5 (I)	G38													
1.0 - 1.2			G39													
1.2 - 1.4			G40													
1.4 - 1.6			G41													
1.6 - 1.8			G42													
1.8 - 2.1			G43													

END OF TEST HOLE AT 2.1 m IN SILT

- 1) Seepage or sloughing not observed.
- 2) Test hole open to 2.1 m immediately after drilling.
- 3) Test hole backfilled with granular fill and cold patch asphalt.
- 4) Test hole located in back alley of house # 500 Stiles St., 1.0 m East of West edge of alley.

Logged By: Bryan Hiebert Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS CRIAG ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_D\_JSB 1000-043-12 GPJ\_TREK GEOTECHNICAL.GDT 11/2/20



# Sub-Surface Log

Test Hole TH20-07

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5527081 m N, 630092 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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 25 50 75 100 125										
0.0 - 0.1		CONCRETE - 210 mm thick													
0.1 - 0.6		CLAY - silty, trace organics - black - moist, firm to stiff - high plasticity - AASHTO: A-7-6 (I)  - no organics, greyish brown, very stiff below 0.6 m.		G44											
				G45											
				G46											
0.6 - 1.0		SILT AND CLAY - light brown - moist, stiff - intermediate plasticity, AASHTO: A-7-5 (I)		G47											
1.0 - 1.5		SILT - trace clay - light brown - moist, soft - low to no plasticity - AASHTO: A-2-5 (I)		G48											
				G49											
				G50											

END OF TEST HOLE AT 2.0 m IN SILT  
 1) Seepage or sloughing not observed.  
 2) Test hole open to 2.0 m immediately after drilling.  
 3) Test hole backfilled with granular fill and cold patch asphalt.  
 4) Test hole located in back alley of house # 532 Stiles St., 1.0 m East of West edge of alley.

Logged By: Bryan Hiebert Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS CRIAG ST. 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_D\_JSB 1000-043-12 GPJ TREK GEOTECHNICAL.GDT 11/2/20



2021 Alley Renewal Package (21-RL-03)

Sub-Surface Investigation

Criag Street & Stiles Street Alley : bounded by Wolsley Avenue and Portage 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	
TH20-05	UTM: 14U 5526866 m N, 630087 m E Located in back alley of House # 462 Stiles St., 1.0 m East of West edge of alley.	-	-	Concrete	230	Silt And Clay: AASHTO: A-7-6 (56)	0.8	0.9	26								
						Silt And Clay: AASHTO: A-7-6 (56)	0.9	1.1	35	49	49	2	0	23	73	50	
						Silt And Clay: AASHTO: A-7-6 (56)	1.1	1.4	34								
						Silt And Clay: AASHTO: A-7-6 (56)	1.7	1.9	30								
						Silt And Clay: AASHTO: A-7-6 (56)	2.1	2.3	29								
						Silt And Clay: AASHTO: A-7-6 (56)	2.6	2.7	31								
TH20-06	UTM: 14U 5526969 m N, 630089 m E Located in back alley of House # 500 Stiles St., 1.0 m East of West edge of alley.	-	-	Concrete	210	Silt And Clay: AASHTO: A-7-6 (48)	0.3	0.5	37	48	48	2	2	23	67	44	
						Silt And Clay: AASHTO: A-7-6 (48)	0.6	0.8	35								
						Silt And Clay: AASHTO: A-7-6 (48)	0.8	0.9	27								
						Silt	0.9	1.1	20								
						Silt	1.2	1.4	21								
						Silt	1.5	1.7	19								
TH20-07	UTM: 14U 5527078 m N, 630092 m E Located in back alley of House # 532 Stiles St., 1.0 m East of West edge of alley.	-	-	Concrete	210	Clay: AASHTO: A-7-6 (I)	0.2	0.4	33								
						Clay: AASHTO: A-7-6 (I)	0.4	0.5	33								
						Clay: AASHTO: A-7-6 (I)	0.6	0.8	31								
						Silt And Clay: AASHTO: A-7-6 (I)	0.9	1.1	25								
						Silt	1.2	1.4	19								
						Silt	1.5	1.7	26								
				Silt	1.8	2.0	22										

(I) - AASHTO classification was interpreted based on visual classification.



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St/Stiles St

**Sample Date** 6-Oct-20  
**Test Date** 7-Oct-20  
**Technician** AD/BMH

Test Hole	TH20-05	TH20-05	TH20-05	TH20-05	TH20-05	TH20-05
Depth (m)	0.2 - 0.4	0.8 - 0.9	0.9 - 1.1	1.1 - 1.4	1.7 - 1.9	2.1 - 2.3
Sample #	G30	G31	G32	G33	G34	G35
Tare ID	W15	F90	W32	AB58	A27	A23
Mass of tare	8.4	8.6	8.4	6.7	8.7	8.6
Mass wet + tare	481.2	218.7	156.1	318.1	187.2	256.0
Mass dry + tare	384.8	164.0	118.4	246.4	146.8	198.0
Mass water	96.4	54.7	37.7	71.7	40.4	58.0
Mass dry soil	376.4	155.4	110.0	239.7	138.1	189.4
Moisture %	25.6%	35.2%	34.3%	29.9%	29.3%	30.6%

Test Hole	TH20-05	TH20-06	TH20-06	TH20-06	TH20-06	TH20-06
Depth (m)	2.6 - 2.7	0.3 - 0.5	0.6 - 0.8	0.8 - 0.9	0.9 - 1.1	1.2 - 1.4
Sample #	G36	G37	G38	G39	G40	G41
Tare ID	AC26	A107	E136	AB68	N114	Z75
Mass of tare	6.7	8.6	8.4	6.8	8.6	8.6
Mass wet + tare	224.0	431.8	175.0	172.3	185.4	179.9
Mass dry + tare	172.6	317.9	131.8	136.8	155.8	149.9
Mass water	51.4	113.9	43.2	35.5	29.6	30.0
Mass dry soil	165.9	309.3	123.4	130.0	147.2	141.3
Moisture %	31.0%	36.8%	35.0%	27.3%	20.1%	21.2%

Test Hole	TH20-06	TH20-06	TH20-07	TH20-07	TH20-07	TH20-07
Depth (m)	1.5 - 1.7	2.0 - 2.1	0.2 - 0.4	0.4 - 0.5	0.6 - 0.8	0.9 - 1.1
Sample #	G42	G43	G44	G45	G46	G47
Tare ID	F9	E42	E89	AB03	N21	F94
Mass of tare	8.8	8.6	8.7	6.8	8.6	8.4
Mass wet + tare	176.2	168.0	160.3	170.9	177.8	188.3
Mass dry + tare	149.1	142.2	123.1	130.0	137.6	152.8
Mass water	27.1	25.8	37.2	40.9	40.2	35.5
Mass dry soil	140.3	133.6	114.4	123.2	129.0	144.4
Moisture %	19.3%	19.3%	32.5%	33.2%	31.2%	24.6%



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St/Stiles St

**Sample Date** 6-Oct-20  
**Test Date** 7-Oct-20  
**Technician** AD/BMH

Test Hole	TH20-07	TH20-07	TH20-07			
Depth (m)	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0			
Sample #	G48	G49	G50			
Tare ID	Z14	Z43	AC28			
Mass of tare	8.8	8.5	6.8			
Mass wet + tare	180.4	183.6	172.0			
Mass dry + tare	153.0	147.2	141.8			
Mass water	27.4	36.4	30.2			
Mass dry soil	144.2	138.7	135.0			
Moisture %	19.0%	26.2%	22.4%			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St./Stiles St.

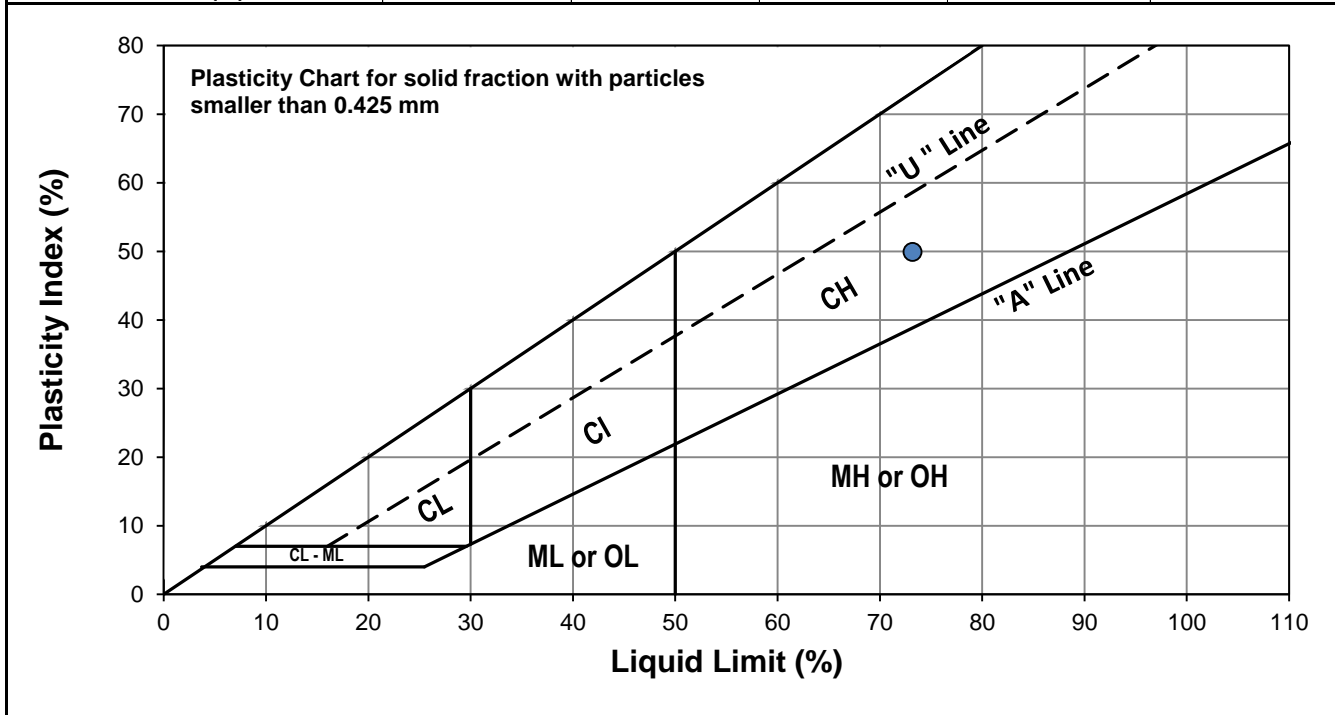


**Test Hole** TH20-05  
**Sample #** G31  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 06-Oct-20  
**Test Date** 23-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	73
<b>Plastic Limit</b>	23
<b>Plasticity Index</b>	50

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	17	24	31
<b>Mass Wet Soil + Tare (g)</b>	25.010	27.099	26.202
<b>Mass Dry Soil + Tare (g)</b>	20.250	21.664	21.162
<b>Mass Tare (g)</b>	13.971	14.253	14.147
<b>Mass Water (g)</b>	4.760	5.435	5.040
<b>Mass Dry Soil (g)</b>	6.279	7.411	7.015
<b>Moisture Content (%)</b>	75.808	73.337	71.846



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.095	13.933			
<b>Mass Wet Soil + Tare (g)</b>	20.308	19.976			
<b>Mass Dry Soil + Tare (g)</b>	19.133	18.833			
<b>Mass Water (g)</b>	1.175	1.143			
<b>Mass Dry Soil (g)</b>	5.038	4.900			
<b>Moisture Content (%)</b>	23.323	23.327			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St/Stiles St

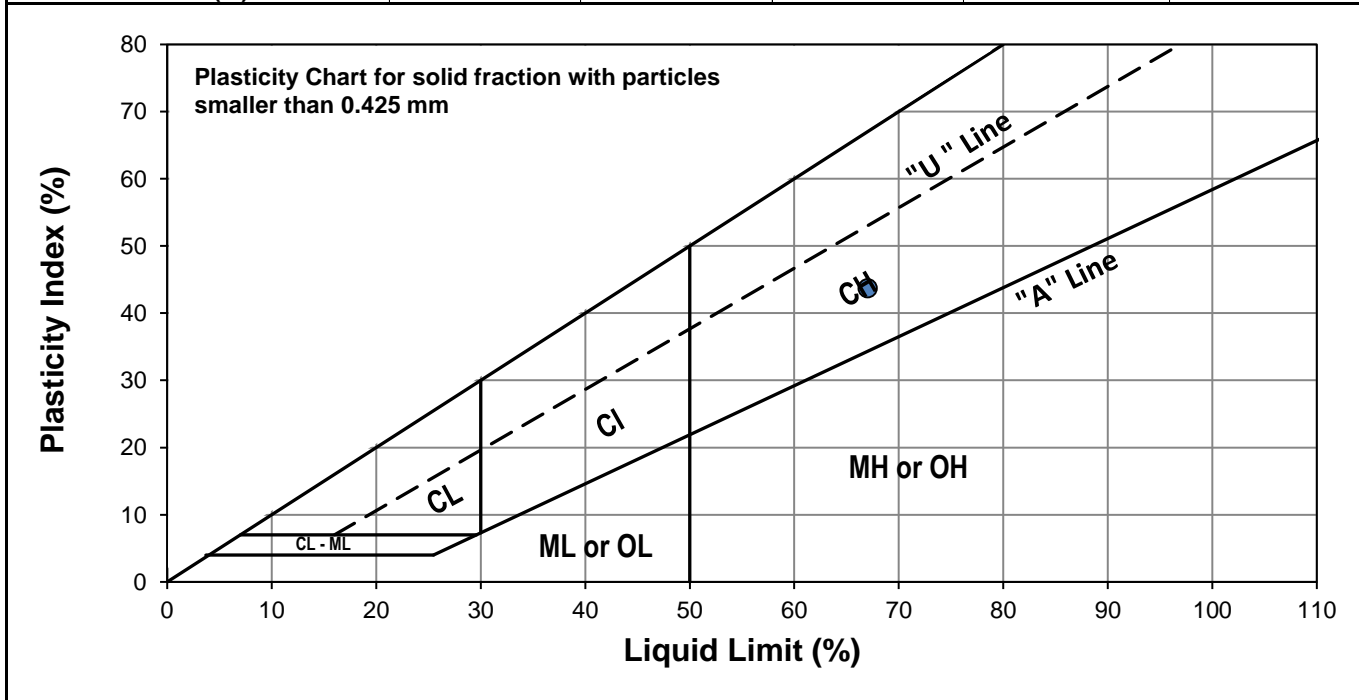


**Test Hole** TH20-06  
**Sample #** G37  
**Depth (m)** 0.3 - 0.5  
**Sample Date** 8-Oct-20  
**Test Date** 14-Oct-20  
**Technician** AD/MT

**Liquid Limit** 67  
**Plastic Limit** 23  
**Plasticity Index** 44

**Liquid Limit**

Trial #	1	2	3
Number of Blows (N)	16	22	30
Mass Wet Soil + Tare (g)	24.563	24.284	24.362
Mass Dry Soil + Tare (g)	20.280	20.154	20.331
Mass Tare (g)	14.098	14.052	14.232
Mass Water (g)	4.283	4.130	4.031
Mass Dry Soil (g)	6.182	6.102	6.099
Moisture Content (%)	69.282	67.683	66.093



**Plastic Limit**

Trial #	1	2	3	4	5
Mass Tare (g)	14.285	14.038			
Mass Wet Soil + Tare (g)	20.194	20.386			
Mass Dry Soil + Tare (g)	19.078	19.183			
Mass Water (g)	1.116	1.203			
Mass Dry Soil (g)	4.793	5.145			
Moisture Content (%)	23.284	23.382			





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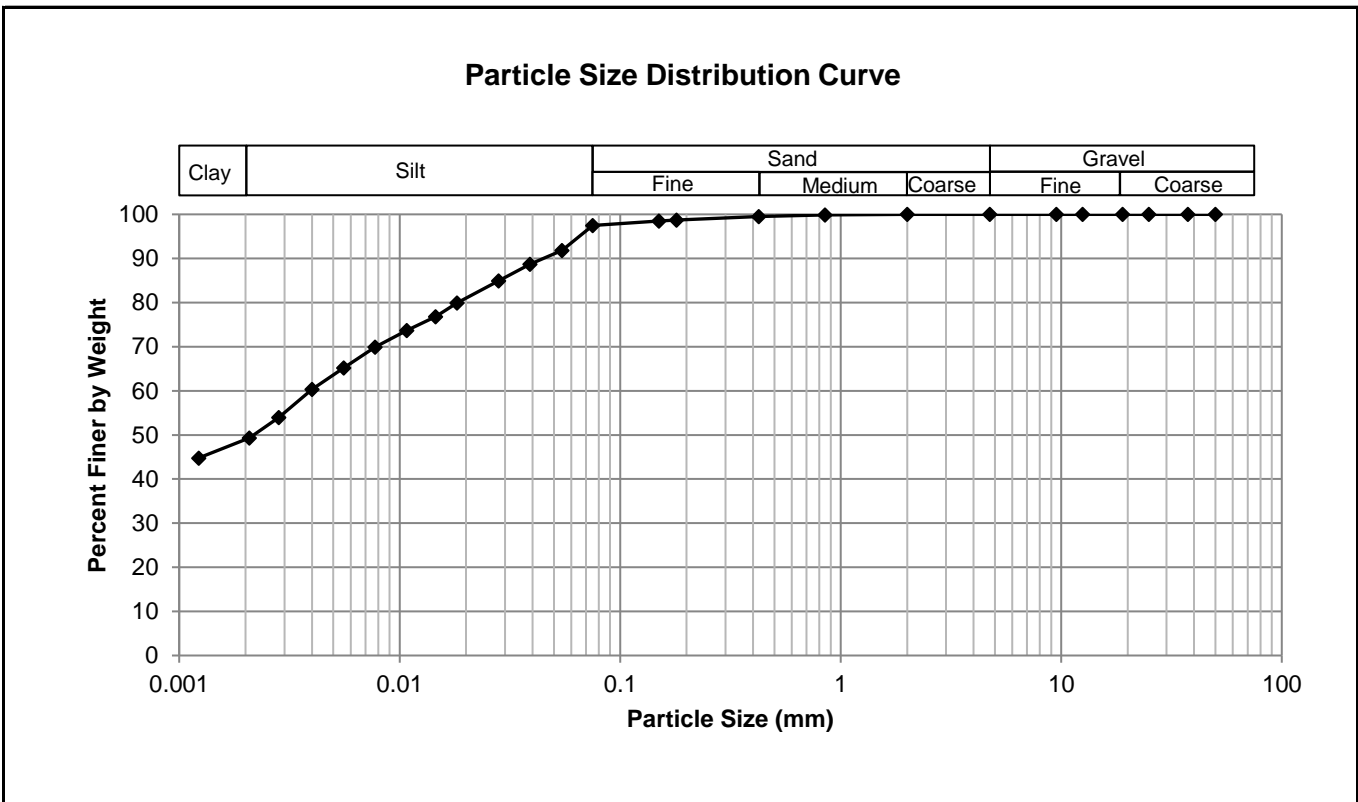
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St./Stiles St.



**Test Hole** TH20-05  
**Sample #** G31  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 22-Oct-20  
**Technician** JSB

<b>Gravel</b>	0.0%
<b>Sand</b>	2.5%
<b>Silt</b>	48.6%
<b>Clay</b>	48.9%



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	100.00	0.0750	97.46
37.5	100.00	2.00	100.00	0.0544	91.81
25.0	100.00	0.850	99.84	0.0390	88.68
19.0	100.00	0.425	99.49	0.0281	84.93
12.5	100.00	0.180	98.71	0.0182	79.93
9.50	100.00	0.150	98.50	0.0146	76.80
4.75	100.00	0.075	97.46	0.0108	73.67
				0.0077	69.92
				0.0056	65.23
				0.0040	60.36
				0.0028	53.99
				0.0021	49.30
				0.0012	44.78



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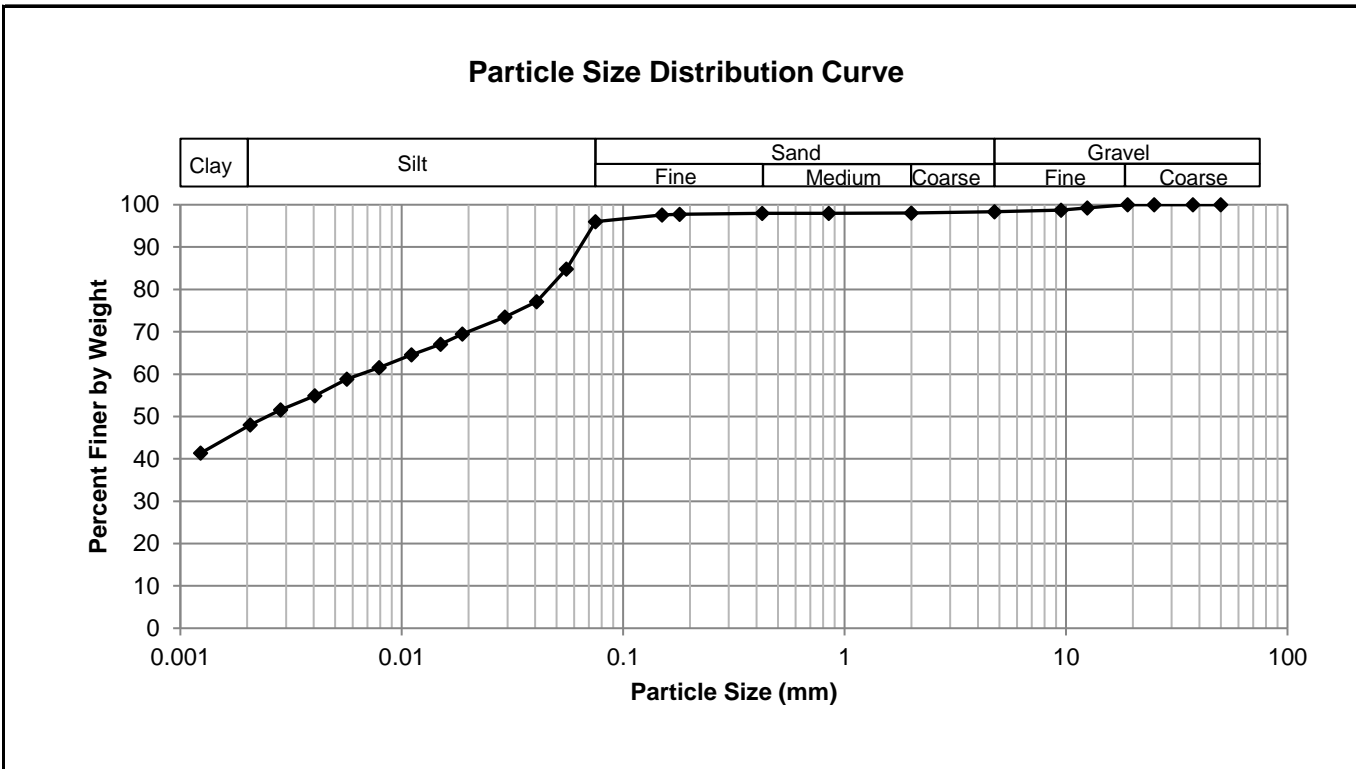
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St/Stiles St



**Test Hole** TH20-06  
**Sample #** G37  
**Depth (m)** 0.3 - 0.5  
**Sample Date** 8-Oct-20  
**Test Date** 14-Oct-20  
**Technician** JSB

<b>Gravel</b>	1.7%
<b>Sand</b>	2.3%
<b>Silt</b>	48.5%
<b>Clay</b>	47.5%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	98.32	0.0750	95.99
37.5	100.00	2.00	98.06	0.0555	84.82
25.0	100.00	0.850	97.94	0.0407	77.15
19.0	100.00	0.425	97.94	0.0292	73.47
12.5	99.22	0.180	97.71	0.0188	69.48
9.50	98.73	0.150	97.61	0.0150	67.03
4.75	98.32	0.075	95.99	0.0111	64.58
				0.0079	61.57
				0.0057	58.81
				0.0041	54.88
				0.0028	51.61
				0.0021	48.04
				0.0012	41.37



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## Standard Proctor Compaction Test ASTM D698-12e2

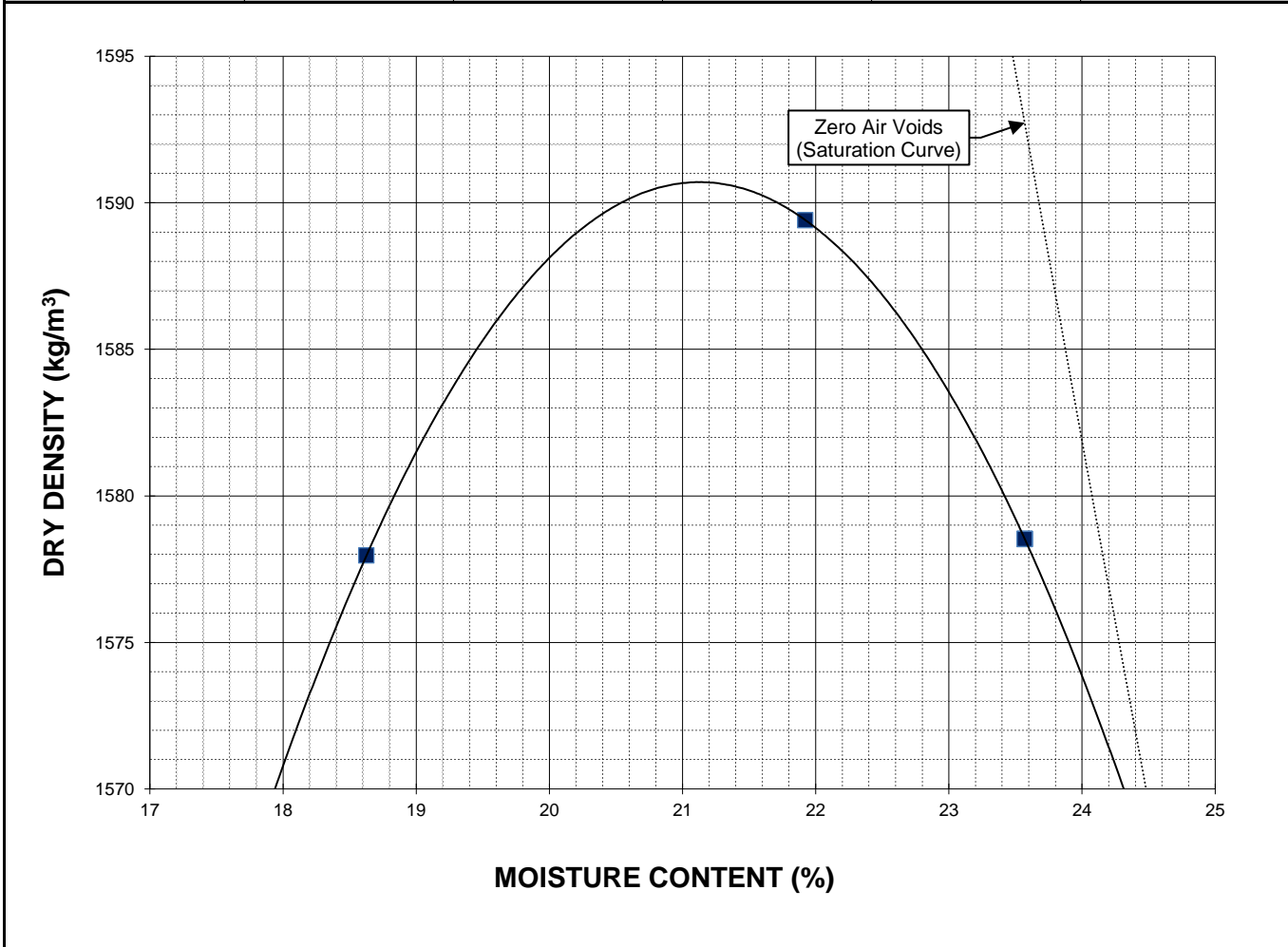
**Project No.** 1000-043-12  
**Client** WSP Canada  
**Project** 2021 Alley Renewal Package - Craig St/Stiles St



**Sample #** TH20-06 & TH20-07 (0.2 - 1.5 m)  
**Source** Back Alley between Craig St/Stiles St  
**Material** Silt and Clay  
**Sample Date** 08-Oct-20  
**Test Date** 16-Oct-20  
**Technician** BMH

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1591
<b>Optimum Moisture (%)</b>	21.1

Trial Number	1	2	3		
<b>Wet Density (kg/m<sup>3</sup>)</b>	1872	1938	1951		
<b>Dry Density (kg/m<sup>3</sup>)</b>	1578	1589	1579		
<b>Moisture Content (%)</b>	18.6	21.9	23.6		





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## Standard Proctor Compaction Test ASTM D698-12e2

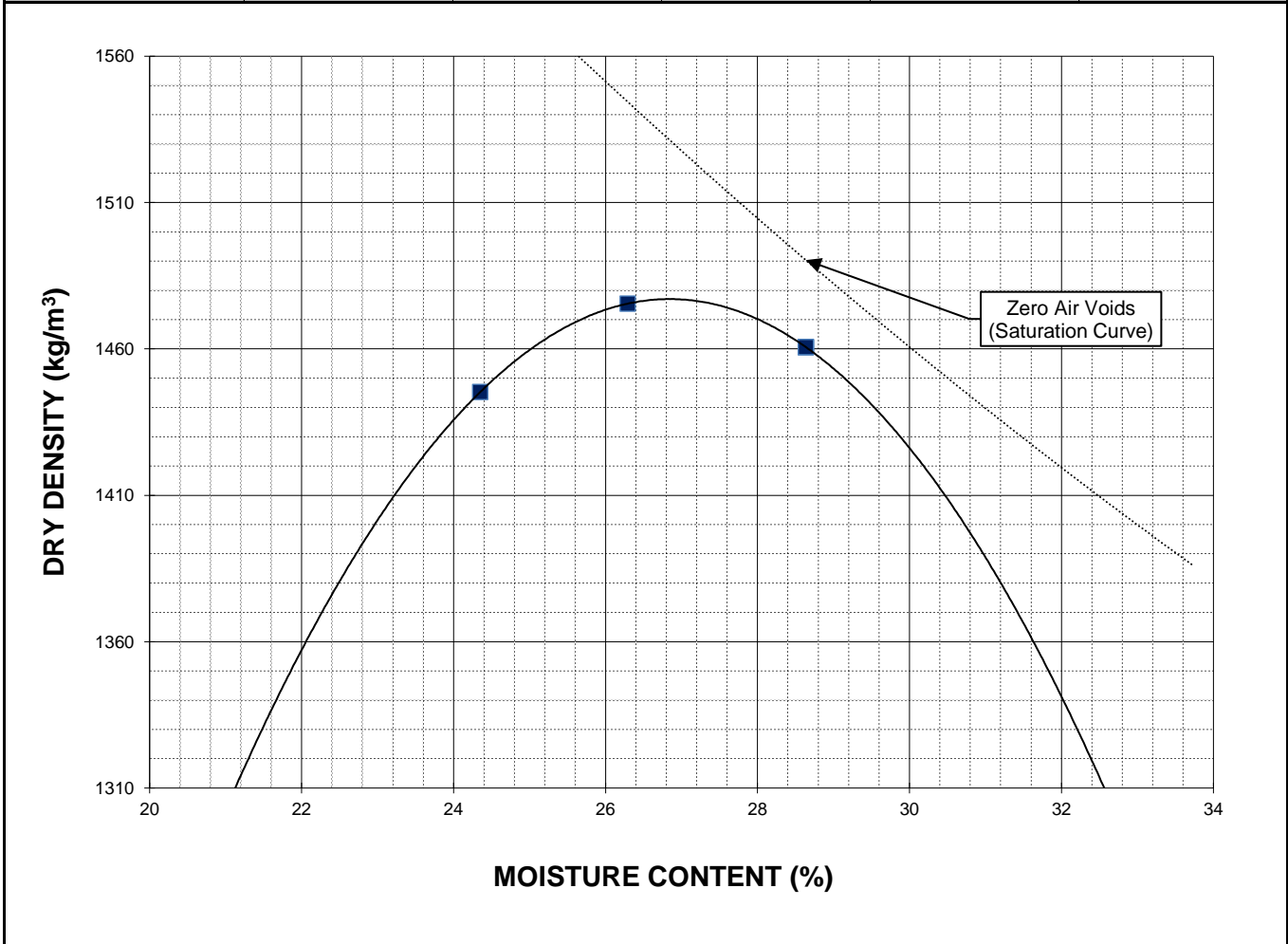
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Craig St/Stiles St



**Sample #** TH20-05 (0.2 - 1.5 m)  
**Source** Back Alley between Craig St/Stiles St  
**Material** Silt and Clay  
**Sample Date** 06-Oct-20  
**Test Date** 10-Oct-20  
**Technician** BMH

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1477
<b>Optimum Moisture (%)</b>	26.8

Trial Number	1	2	3		
<b>Wet Density (kg/m<sup>3</sup>)</b>	1797	1863	1879		
<b>Dry Density (kg/m<sup>3</sup>)</b>	1445	1475	1461		
<b>Moisture Content (%)</b>	24.4	26.3	28.6		





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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley btw Craig St/Stiles St
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-08
<b>Sample #</b>	TH20-05 (0.2 - 1.5 m)	<b>Test Date</b>	2020-10-15
		<b>Technician</b>	AB

**Proctor Results (ASTM D698)**

Maximum Dry Density	1477 kg/m <sup>3</sup>
Optimum Moisture Content	26.8 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1407 kg/m <sup>3</sup>
Initial Moisture Content	29.0 %
Relative Density	95.3 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.4 %
Moisture Content in top 25 mm	31.1 %
Immersion Period	99 h

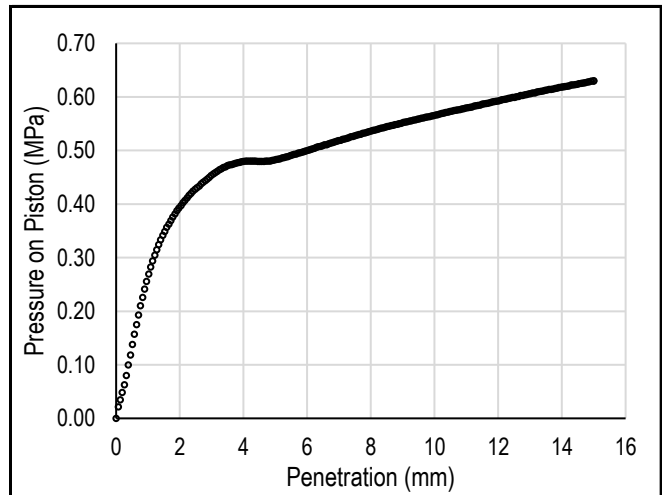
**CBR Results**

CBR at 2.54 mm	6.2 %
CBR at 5.08 mm	4.7 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.18	0.18
1.27	0.32	0.32
1.91	0.39	0.39
2.54	0.43	0.43
3.18	0.46	0.46
3.81	0.48	0.48
4.45	0.48	0.48
5.08	0.48	0.48
7.62	0.53	0.53
10.16	0.57	0.57
12.70	0.60	0.60

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley between Craig St/ Stiles St.
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-08
<b>Sample #</b>	TH20-06/07 (0.2 - 1.5 m)	<b>Test Date</b>	2020-10-21
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1591 kg/m <sup>3</sup>
Optimum Moisture Content	21.1 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1508 kg/m <sup>3</sup>
Initial Moisture Content	24.1 %
Relative Density	94.8 % SPMDD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.6 %
Moisture Content in top 25 mm	30.1 %
Immersion Period	96 h

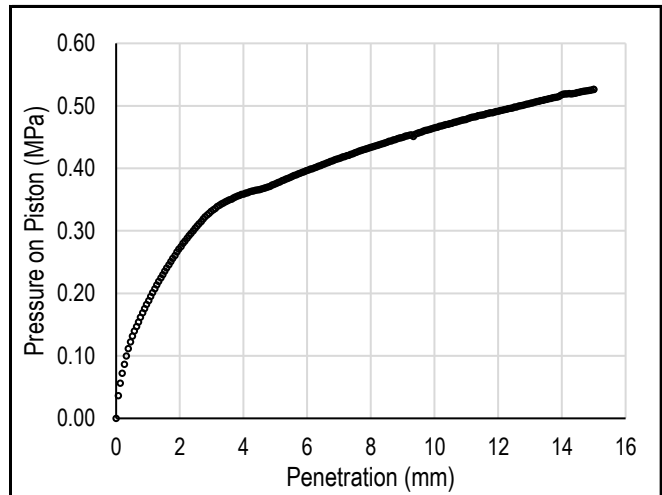
**CBR Results**

CBR at 2.54 mm	4.5 %
CBR at 5.08 mm	3.7 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.15	0.15
1.27	0.21	0.21
1.91	0.27	0.27
2.54	0.31	0.31
3.18	0.34	0.34
3.81	0.36	0.36
4.45	0.37	0.37
5.08	0.38	0.38
7.62	0.43	0.43
10.16	0.47	0.47
12.70	0.50	0.50

**Load/Penetration Curve**



**Comments:**



Photo 1: Pavement Core Sample at Test Hole TH20-05



Photo 2: Pavement Core Sample at Test Hole TH20-06



Photo 3: Pavement Core Sample at Test Hole TH20-07



**Appendix D**

**Westminster Avenue & Dundurn Place Back Alley**

**Test Hole Logs, Summary Table, Lab Testing  
Results and Pavement Core Photos**

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## 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			
<b>Coarse-Grained soils</b> (More than half the material is larger than No. 200 sieve size)	<b>Gravels</b> (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			
		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					
	<b>Sands</b> (More than half of coarse fraction is smaller than 4.75 mm)	<b>Clean sands</b> (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		
			SP		Poorly-graded sands, gravelly sands, little or no fines				
		<b>Sands with fines</b> (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
					<b>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:</b>  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*				
<b>Fine-Grained soils</b> (More than half the material is smaller than No. 200 sieve size)	<b>Silts and Clays</b> (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	<b>Plasticity Chart</b> 	Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19 > 12 in. 3 in. to 12 in. 3/4 in. to 3 in. #4 to 3/4 in.			
		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					
	<b>Silts and Clays</b> (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					
	<b>Highly Organic Soils</b>	Pt		Peat and other highly organic soils			Von Post Classification Limit	Strong colour or odour, and often fibrous texture	<b>Material</b> 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 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 TH20-08

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5527078 m N, 632042 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	25	50	75	100	125
		CONCRETE - 150 mm thick														
		SAND AND GRAVEL - trace silt - brown, moist - compact, 75 mm down "pit run", poorly graded, rounded, AASHTO: A-1-a (0)	<input checked="" type="checkbox"/>	G51												
0.5		CLAY - silty, some sand, trace gravel (diam. < 20 mm), trace organics - black - moist, very stiff - high plasticity - AASHTO: A-7-6 (30)	<input checked="" type="checkbox"/>	G52												>>
			<input checked="" type="checkbox"/>	G53												>>
			<input checked="" type="checkbox"/>	G54												△
			<input checked="" type="checkbox"/>	G55												>>
		SILT - trace clay - light brown - moist, soft - no to low plasticity, AASHTO: A-4 (I)	<input checked="" type="checkbox"/>	G56												
		CLAY - silty, brown, moist, stiff, high plasticity, AASHTO: A-7-6 (I)	<input checked="" type="checkbox"/>	G57												△

END OF TEST HOLE AT 2.0 m IN CLAY  
 1) Seepage or sloughing not observed.  
 2) Test hole open to 2.0 m immediately after drilling.  
 3) Test hole backfilled with granular fill and cold patch asphalt.  
 4) Test hole located in back alley of house # 756 Westminster Ave, 1.0 m South of North edge of alley.

Logged By: Bryan Hiebert Reviewed By: Angela Fidler-Kliwer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS WESTMINSTER 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_C\_JSB\_1000-043-12.GPJ\_TREK GEOTECHNICAL.GDT\_11/1/20



# Sub-Surface Log

Test Hole TH20-09

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5527081 m N, 631963 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	25	50	75	100	125					
0.00 - 0.05		CONCRETE - 135 mm thick													
0.05 - 0.10		SAND AND GRAVEL - trace silt - brown, moist - compact, 75 mm down "pit run", poorly graded, rounded, AASHTO: A-1-a (I)	<input checked="" type="checkbox"/>	G58											
0.10 - 0.50		SILT AND CLAY - some to trace sand, trace organics - black - wet, firm to stiff - high plasticity - AASHTO: A-7-6 (49)	<input checked="" type="checkbox"/>	G59											
0.50 - 1.10		- no organics, brown below 1.1 m.	<input checked="" type="checkbox"/>	G60											
1.10 - 1.30			<input checked="" type="checkbox"/>	G61											
1.30 - 1.50			<input checked="" type="checkbox"/>	G62											
1.50 - 1.70			<input checked="" type="checkbox"/>	G63											
1.70 - 1.90			<input checked="" type="checkbox"/>	G64											

END OF TEST HOLE AT 2.0 m IN CLAY  
 1) Seepage or sloughing not observed.  
 2) Test hole open to 2.0 m immediately after drilling.  
 3) Test hole backfilled with granular fill and cold patch asphalt.  
 4) Test hole located in back alley of house # 756 Westminster Ave, 1.0 m South of North edge of alley.

Logged By: Bryan Hiebert Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS WESTMINSTER 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_C\_JSB\_1000-043-12.GPJ\_TREK GEOTECHNICAL.GDT\_11/11/20



2021 Alley Renewal Package (21-RL-03)

Sub-Surface Investigation

Westminster Avenue & Dundurn Place Alley : bounded by Walnut Street and Maryland Street

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	
TH20-08	UTM: 14U 5527078 m N, 632042 m E Located in back alley of House # 744 Westminster Ave, 1.0 m South of North edge of alley.	-	-	Concrete	150	Sand and Gravel: AASHTO: A-1-a (I)	0.2	0.3	4	1	1	32	66				
						Clay: AASHTO: A-7-6 (30)	0.5	0.6	25	47	28	22	3	22	62	40	
						Clay: AASHTO: A-7-6 (30)	0.8	0.9	30								
						Clay: AASHTO: A-7-6 (30)	1.1	1.2	34								
						Clay: AASHTO: A-7-6 (30)	1.4	1.5	30								
						Silt: AASHTO: A-4 (I)	1.5	1.7	21								
						Clay: AASHTO: A-7-6 (I)	1.8	2.0	37								
TH20-09	UTM: 14U 5527081 m N, 631963 m E Located in back alley of House # 756 Westminster Ave., 1.0 m South of North edge of alley.	-	-	Concrete	135	Sand and Gravel: AASHTO: A-1-a (I)	0.2	0.3	6								
						Silt and Clay: AASHTO: A-7-6 (49)	0.5	0.6	35								
						Silt and Clay: AASHTO: A-7-6 (49)	0.8	0.9	36	62	32	6	0	22	69	47	
						Silt and Clay: AASHTO: A-7-6 (49)	1.1	1.2	34								
						Silt and Clay: AASHTO: A-7-6 (49)	1.4	1.5	35								
						Silt and Clay: AASHTO: A-7-6 (49)	1.7	1.8	36								
						Silt and Clay: AASHTO: A-7-6 (49)	1.8	2.0	38								

(I) - AASHTO classification was interpreted based on visual classification.



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI

**Sample Date** 8-Oct-20  
**Test Date** 10-Oct-20  
**Technician** AD

<b>Test Hole</b>	TH20-08	TH20-08	TH20-08	TH20-08	TH20-08	TH20-08
<b>Depth (m)</b>	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.5 - 1.7
<b>Sample #</b>	G51	G52	G53	G54	G55	G56
<b>Tare ID</b>	H72	W75	N84	W73	AB16	C23
<b>Mass of tare</b>	8.6	8.6	8.5	8.9	6.6	9.5
<b>Mass wet + tare</b>	168.2	458.6	170.5	174.0	177.1	165.5
<b>Mass dry + tare</b>	162.8	370.0	133.4	132.1	137.9	138.8
<b>Mass water</b>	5.4	88.6	37.1	41.9	39.2	26.7
<b>Mass dry soil</b>	154.2	361.4	124.9	123.2	131.3	129.3
<b>Moisture %</b>	3.5%	24.5%	29.7%	34.0%	29.9%	20.6%

<b>Test Hole</b>	TH20-08	TH20-09	TH20-09	TH20-09	TH20-09	TH20-09
<b>Depth (m)</b>	1.8 - 2.0	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
<b>Sample #</b>	G57	G58	G59	G60	G61	G62
<b>Tare ID</b>	Z94	P17	F6	W87	Z57	P04
<b>Mass of tare</b>	8.5	8.5	8.7	8.6	8.7	8.7
<b>Mass wet + tare</b>	171.5	178.7	167.3	174.2	160.1	159.7
<b>Mass dry + tare</b>	127.4	169.5	126.4	130.6	122.0	121.0
<b>Mass water</b>	44.1	9.2	40.9	43.6	38.1	38.7
<b>Mass dry soil</b>	118.9	161.0	117.7	122.0	113.3	112.3
<b>Moisture %</b>	37.1%	5.7%	34.7%	35.7%	33.6%	34.5%

<b>Test Hole</b>	TH20-09	TH20-09				
<b>Depth (m)</b>	1.7 - 1.8	1.8 - 2.0				
<b>Sample #</b>	G63	G64				
<b>Tare ID</b>	F17	N71				
<b>Mass of tare</b>	8.7	8.7				
<b>Mass wet + tare</b>	176.9	164.0				
<b>Mass dry + tare</b>	132.8	121.5				
<b>Mass water</b>	44.1	42.5				
<b>Mass dry soil</b>	124.1	112.8				
<b>Moisture %</b>	35.5%	37.7%				



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI

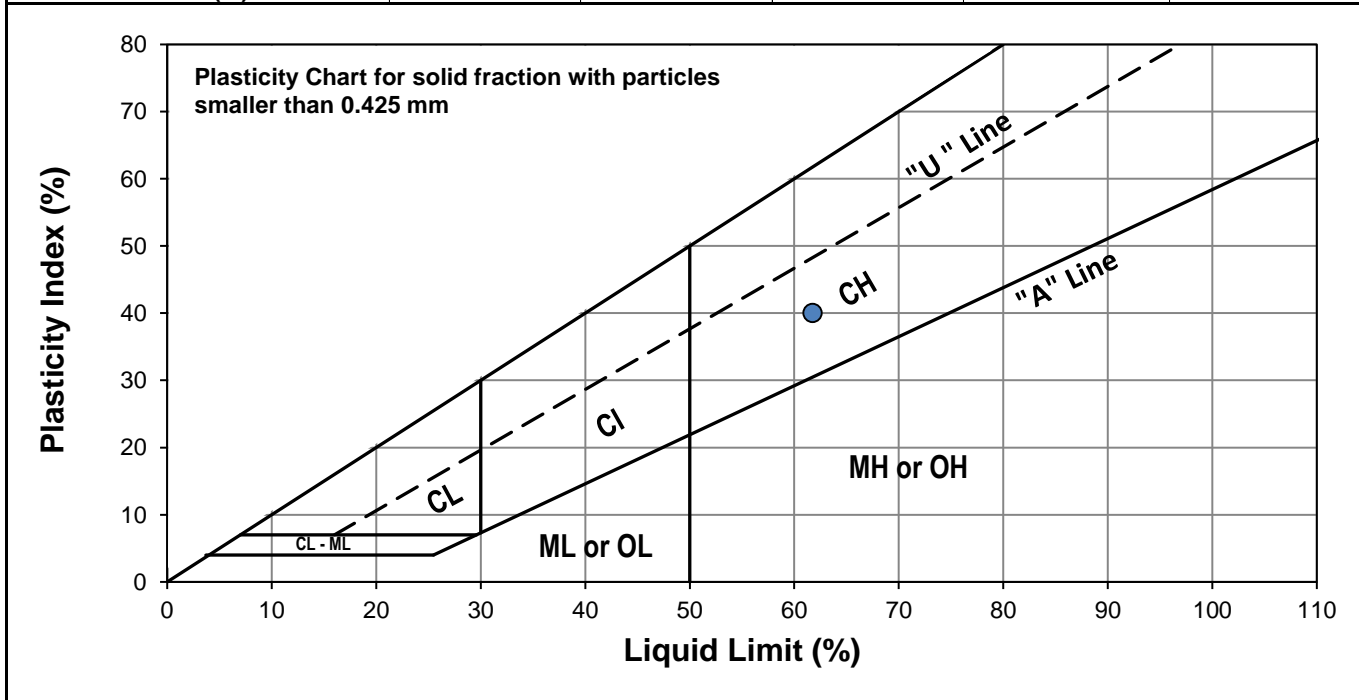


**Test Hole** TH20-08  
**Sample #** G52  
**Depth (m)** 0.5 - 0.6  
**Sample Date** 8-Oct-20  
**Test Date** 14-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	62
<b>Plastic Limit</b>	22
<b>Plasticity Index</b>	40

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	15	26	30
<b>Mass Wet Soil + Tare (g)</b>	26.968	23.388	26.521
<b>Mass Dry Soil + Tare (g)</b>	21.954	19.933	21.930
<b>Mass Tare (g)</b>	14.113	14.323	14.402
<b>Mass Water (g)</b>	5.014	3.455	4.591
<b>Mass Dry Soil (g)</b>	7.841	5.610	7.528
<b>Moisture Content (%)</b>	63.946	61.586	60.986



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	13.897	14.019			
<b>Mass Wet Soil + Tare (g)</b>	21.959	21.303			
<b>Mass Dry Soil + Tare (g)</b>	20.514	20.006			
<b>Mass Water (g)</b>	1.445	1.297			
<b>Mass Dry Soil (g)</b>	6.617	5.987			
<b>Moisture Content (%)</b>	21.838	21.664			





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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI

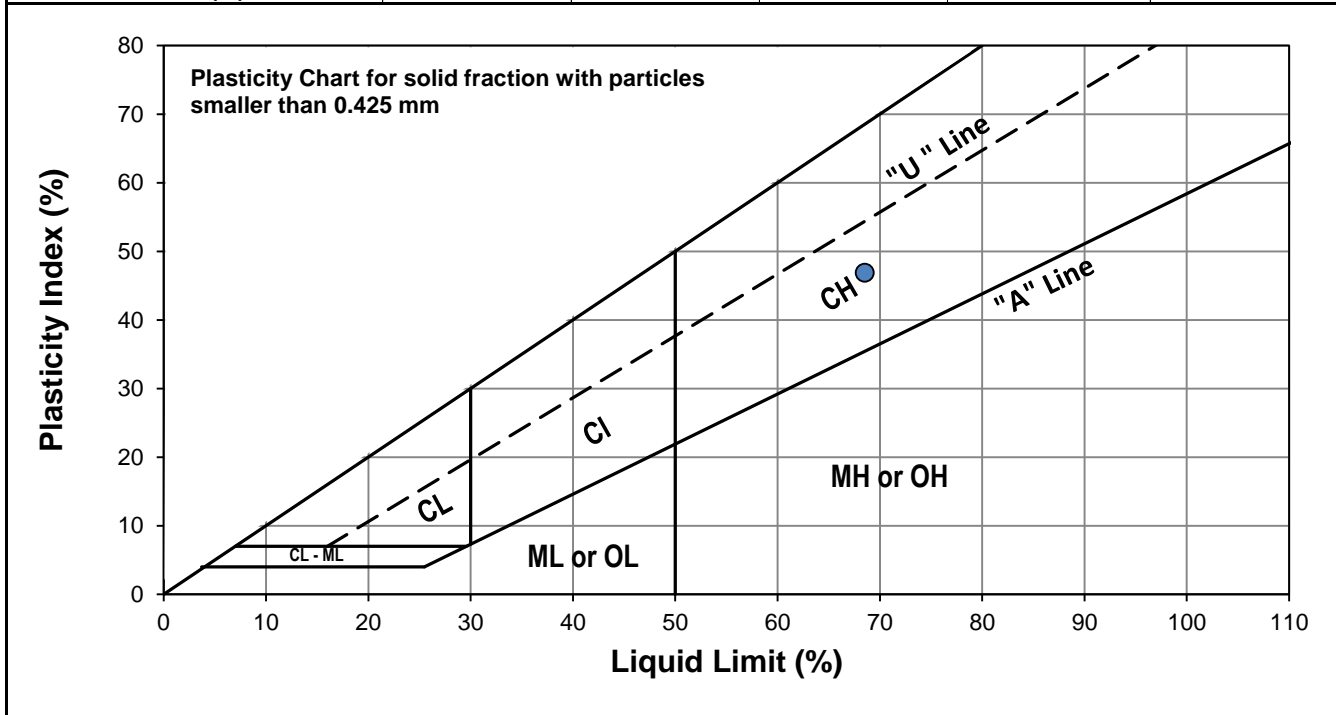


**Test Hole** TH20 - 09  
**Sample #** G60  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 08-Oct-20  
**Test Date** 31-Oct-20  
**Technician** JSB

<b>Liquid Limit</b>	69
<b>Plastic Limit</b>	22
<b>Plasticity Index</b>	47

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	20	27	34
<b>Mass Wet Soil + Tare (g)</b>	22.359	23.984	23.985
<b>Mass Dry Soil + Tare (g)</b>	18.984	20.006	19.978
<b>Mass Tare (g)</b>	14.104	14.181	14.055
<b>Mass Water (g)</b>	3.375	3.978	4.007
<b>Mass Dry Soil (g)</b>	4.880	5.825	5.923
<b>Moisture Content (%)</b>	69.160	68.292	67.652



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	13.728	13.929			
<b>Mass Wet Soil + Tare (g)</b>	21.643	20.687			
<b>Mass Dry Soil + Tare (g)</b>	20.238	19.481			
<b>Mass Water (g)</b>	1.405	1.206			
<b>Mass Dry Soil (g)</b>	6.510	5.552			
<b>Moisture Content (%)</b>	21.582	21.722			



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**Grain Size Analysis (Sieve Method)**

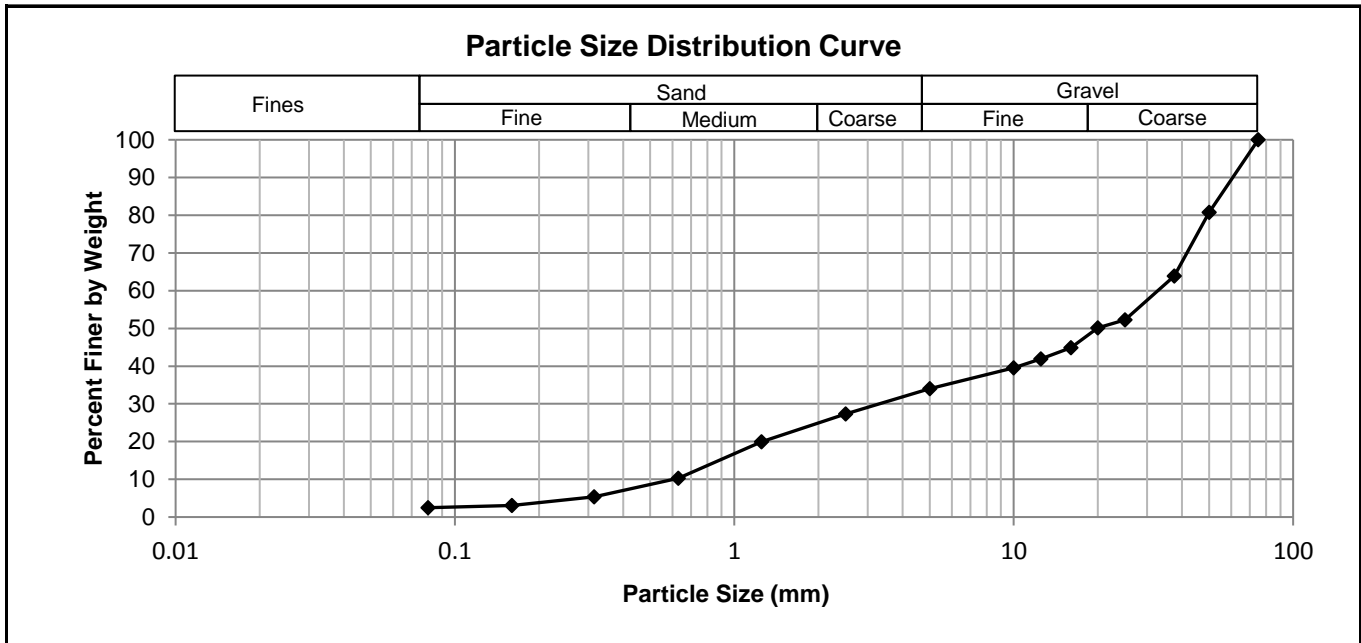
ASTM C136-14

ASTM C117-13

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI

**Test Hole** TH20-08  
**Sample #** G51  
**Depth (m)** 0.2 - 0.3  
**Date Sampled** 8-Oct-20  
**Date Tested** 13-Oct-20  
**Technician** AB

<b>Gravel %</b>	65.9
<b>Sand %</b>	31.6
<b>Fines %</b>	2.5



Sieve Opening (mm)	Percent Passing	Specification (Min - Max)
75.0	100	-
50.0	81	-
37.5	64	-
25.0	52	-
20.0	50	-
16.0	45	-
12.5	42	-
10.0	40	-
5.00	34	-
2.50	27	-
1.25	20	-
0.630	10	-
0.315	5.4	-
0.160	3.1	-
0.080	2.5	-



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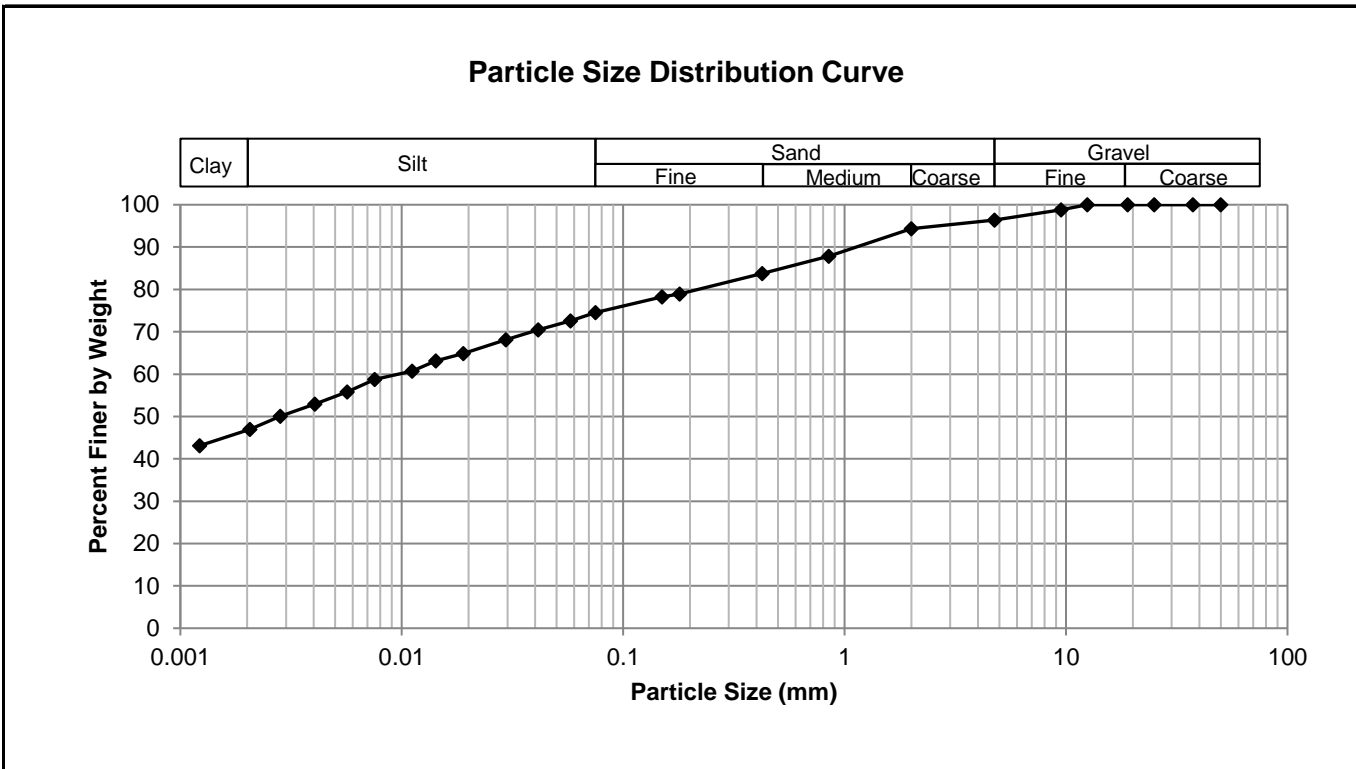
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI



**Test Hole** TH20-08  
**Sample #** G52  
**Depth (m)** 0.3 - 0.6  
**Sample Date** 10-Oct-20  
**Test Date** 14-Oct-20  
**Technician** JSB

<b>Gravel</b>	3.6%
<b>Sand</b>	21.8%
<b>Silt</b>	27.9%
<b>Clay</b>	46.7%



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	96.40	0.0750	74.56
37.5	100.00	2.00	94.31	0.0579	72.54
25.0	100.00	0.850	87.85	0.0414	70.48
19.0	100.00	0.425	83.75	0.0296	68.12
12.5	100.00	0.180	78.92	0.0190	64.88
9.50	98.79	0.150	78.27	0.0142	63.11
4.75	96.40	0.075	74.56	0.0111	60.75
				0.0076	58.75
				0.0057	55.80
				0.0041	52.91
				0.0028	50.09
				0.0021	46.96
				0.0012	43.11



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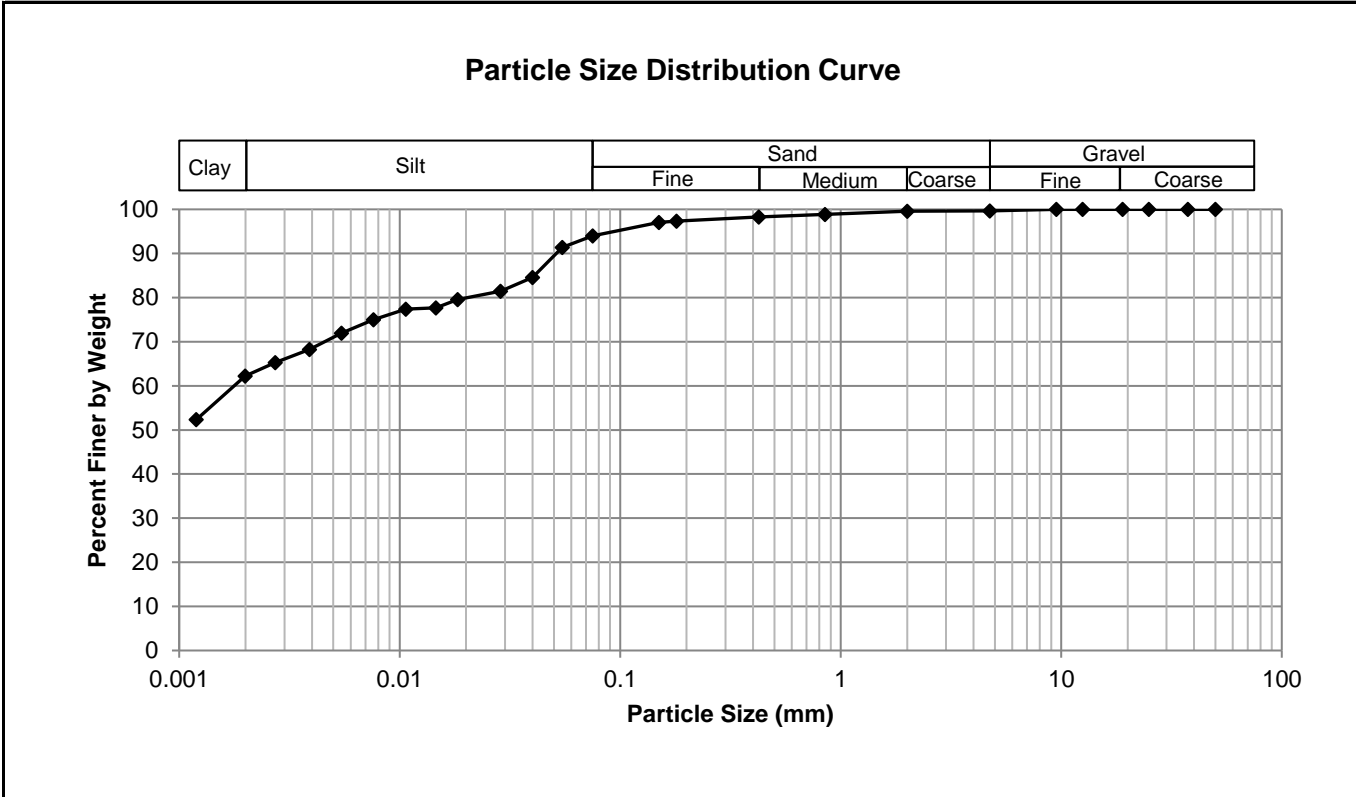
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI

**Test Hole** TH20-09  
**Sample #** G60  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 6-Oct-20  
**Test Date** 30-Oct-20  
**Technician** JSB



<b>Gravel</b>	0.3%
<b>Sand</b>	5.7%
<b>Silt</b>	31.8%
<b>Clay</b>	62.2%



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	99.66	0.0750	93.99
37.5	100.00	2.00	99.56	0.0547	91.40
25.0	100.00	0.850	98.83	0.0400	84.55
19.0	100.00	0.425	98.27	0.0287	81.43
12.5	100.00	0.180	97.32	0.0183	79.57
9.50	100.00	0.150	97.07	0.0146	77.70
4.75	99.66	0.075	93.99	0.0107	77.39
				0.0076	74.97
				0.0054	71.93
				0.0039	68.27
				0.0027	65.30
				0.0020	62.19
				0.0012	52.34



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**Standard Proctor Compaction Test**  
**ASTM D698-12e2**

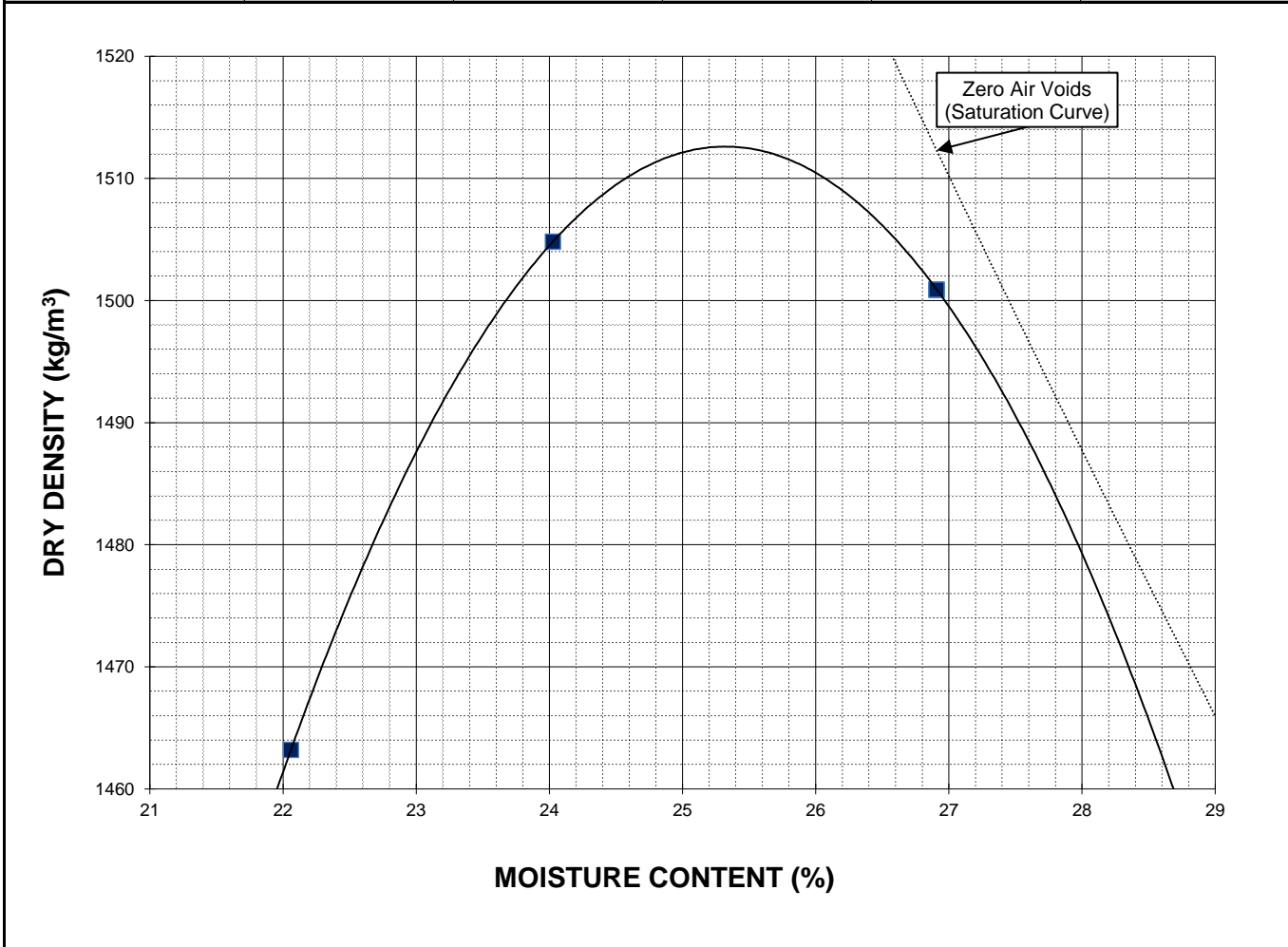
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI



**Sample #** TH20-08 (0.4 - 1.5 m)  
**Source** Back Alley between Westminster Ave/Dundurn PI  
**Material** Silt and Clay  
**Sample Date** 08-Oct-20  
**Test Date** 15-Oct-20  
**Technician** BMH

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1513
<b>Optimum Moisture (%)</b>	25.3

Trial Number	1	2	3		
<b>Wet Density (kg/m<sup>3</sup>)</b>	1786	1866	1905		
<b>Dry Density (kg/m<sup>3</sup>)</b>	1463	1505	1501		
<b>Moisture Content (%)</b>	22.1	24.0	26.9		





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## Standard Proctor Compaction Test ASTM D698-12e2

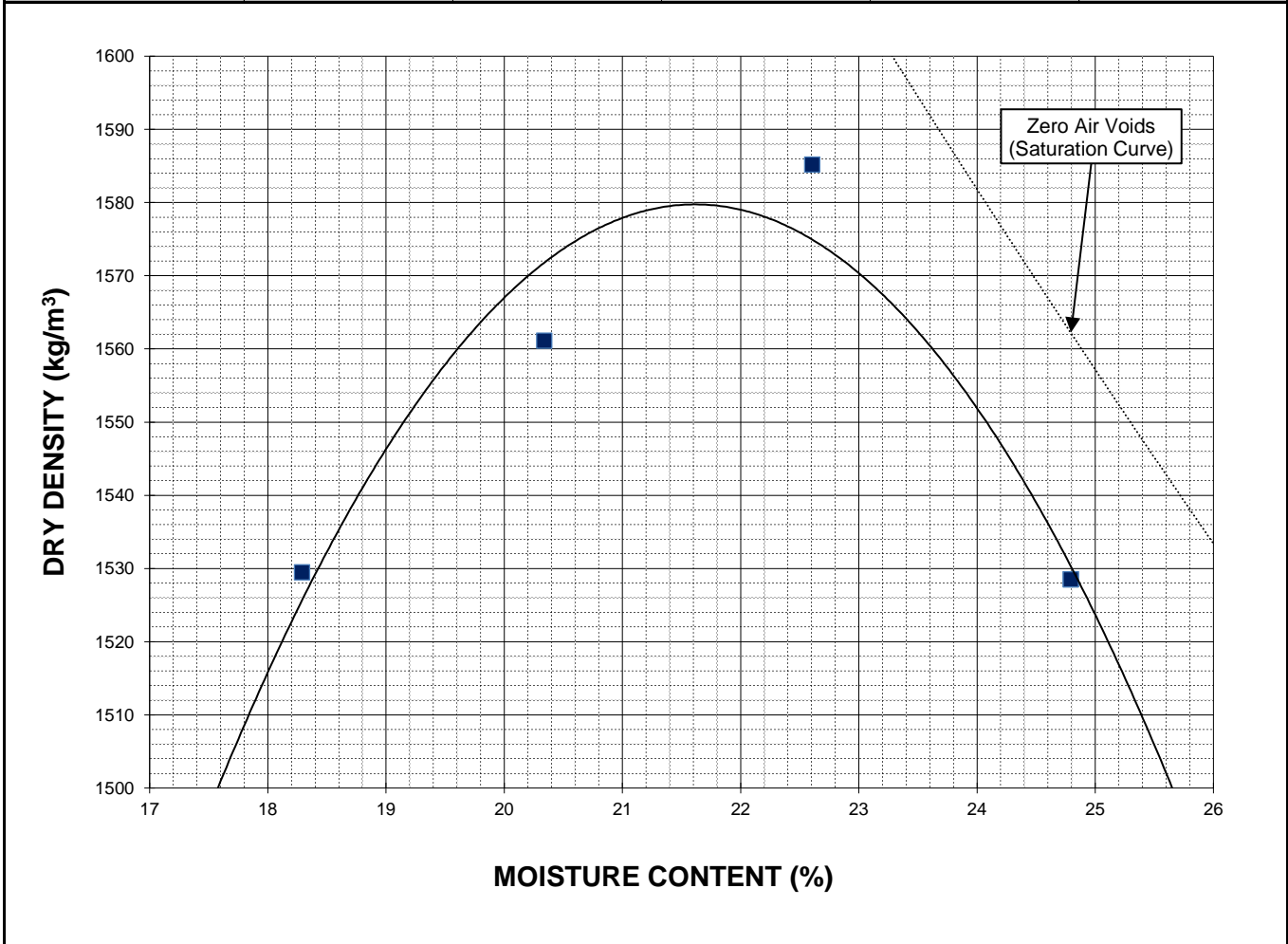
**Project No.** 1000-043-12  
**Client** WSP Canada  
**Project** 2021 Alley Renewal Package - Westminster Ave/Dundurn PI



**Sample #** TH20-09 (0.3 - 1.5 m)  
**Source** Back Alley between Westminster Ave/Dundurn PI  
**Material** Silt and Clay  
**Sample Date** 14-Oct-20  
**Test Date** 15-Oct-20  
**Technician** MT

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1580
<b>Optimum Moisture (%)</b>	21.6

Trial Number	1	2	3	4
<b>Wet Density (kg/m<sup>3</sup>)</b>	1809	1879	1944	1908
<b>Dry Density (kg/m<sup>3</sup>)</b>	1529	1561	1585	1529
<b>Moisture Content (%)</b>	18.3	20.3	22.6	24.8





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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley btw Westminister / Dundurn
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-08
<b>Sample #</b>	TH20-08 (0.4 - 1.5 m)	<b>Test Date</b>	2020-10-21
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1513 kg/m <sup>3</sup>
Optimum Moisture Content	25.3 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1447 kg/m <sup>3</sup>
Initial Moisture Content	28.7 %
Relative Density	95.7 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.3 %
Moisture Content in top 25 mm	33.4 %
Immersion Period	96 h

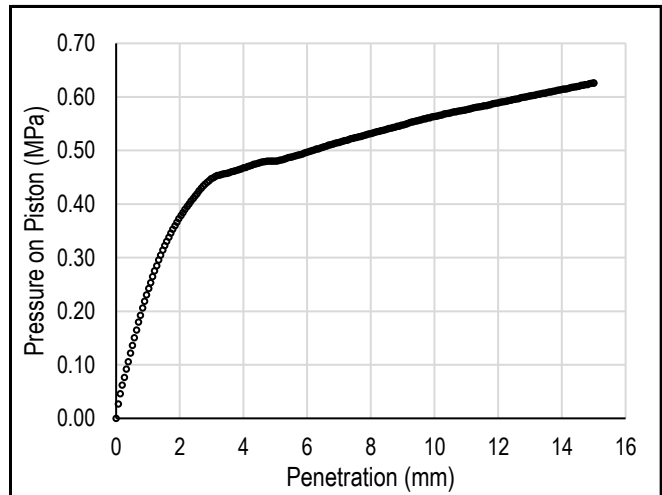
**CBR Results**

CBR at 2.54 mm	6.1 %
CBR at 5.08 mm	4.7 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.17	0.17
1.27	0.29	0.29
1.91	0.37	0.37
2.54	0.42	0.42
3.18	0.45	0.45
3.81	0.46	0.46
4.45	0.48	0.48
5.08	0.48	0.48
7.62	0.53	0.53
10.16	0.57	0.57
12.70	0.60	0.60

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-042-12	<b>Source</b>	Back Alley btw Westminister / Dundurn
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-08
<b>Sample #</b>	TH20-09	<b>Test Date</b>	2020-10-27
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1580 kg/m <sup>3</sup>
Optimum Moisture Content	21.6 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1502 kg/m <sup>3</sup>
Initial Moisture Content	25.9 %
Relative Density	95.1 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.2 %
Moisture Content in top 25 mm	28.7 %
Immersion Period	96 h

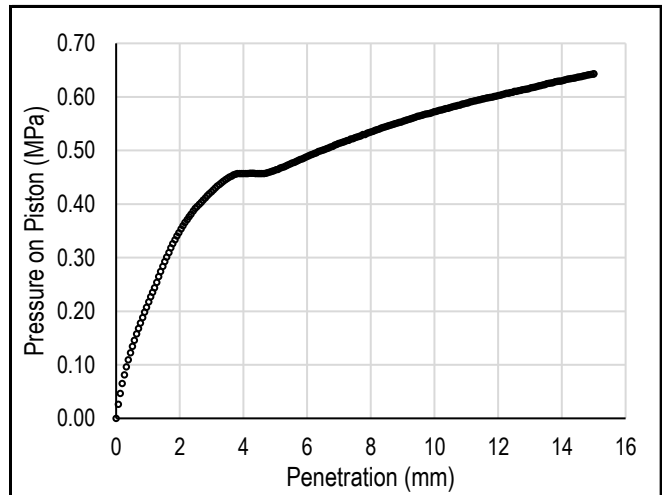
**CBR Results**

CBR at 2.54 mm	5.7 %
CBR at 5.08 mm	4.5 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.16	0.16
1.27	0.25	0.25
1.91	0.34	0.34
2.54	0.40	0.40
3.18	0.43	0.43
3.81	0.46	0.46
4.45	0.46	0.46
5.08	0.47	0.47
7.62	0.53	0.53
10.16	0.58	0.58
12.70	0.61	0.61

**Load/Penetration Curve**



**Comments:**





Photo 1: Pavement Core Sample at Test Hole TH20-08



Photo 2: Pavement Core Sample at Test Hole TH20-09

**Appendix E**

**Banning Street & Lipton Street Back Alley**

**Test Hole Logs, Summary Table, Lab Testing  
Results and Pavement Core Photos**

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## 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		Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19 3 in. to 12 in. 3/4 in. to 3 in. #4 to 3/4 in.
						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 Sand Coarse Medium Fine Silt or Clay					
	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 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 TH20-12

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5529235 m N, 631274 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	25	50	75	100	125
0.0 - 0.1		ASPHALT - 25 mm thick														
0.1 - 0.2		CONCRETE - 200 mm thick														
0.2 - 0.5		SILT AND CLAY - sandy, trace gravel (diam. <20 mm), trace organics - black - moist, firm - intermediate plasticity - AASHTO: A-7-6 (36)	G78													
0.5 - 1.0		- some sand, no gravel, very stiff below 0.6 m.  - no organics, brown below 0.9 m.	G79													
1.0 - 1.5		SILT - trace clay - light brown - moist, soft - no to low plasticity - AASHTO: A-4 (I)	G80													
			G81													
			G82													
			G83													

END OF TEST HOLE AT 2.0 m IN SILT

- 1) Seepage or sloughing not observed.
- 2) Test hole open to 2.0 m immediately after drilling.
- 3) Test hole backfilled with granular fill and cold patch asphalt.
- 4) Test hole located in back alley of house # 837 Lipton St., 1.0 m East of West edge of alley.

Logged By: Bryan Hiebert Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS BANNING 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_C\_JSB\_1000-043-12.GPJ TREK GEOTECHNICAL.GDT\_11/2/20



# Sub-Surface Log

Test Hole TH20-13

1 of 1

Client: WSP Project Number: 1000-043-12  
 Project Name: 2021 Alley Renewal Package (21-RL-03) Location: UTM 14U 5529319 m N, 631276 m E  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 8, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	25	50	75	100	125					
0.0 - 0.1		ASPHALT - 25 mm thick													
0.1 - 0.2		CONCRETE - 200 mm thick													
0.2 - 0.6		SILT AND CLAY - some sand, trace gravel (diam. < 20 mm), trace organics - black - moist, firm - intermediate plasticity - AASHTO: A-7-6 (50)  - trace sand, no gravel, stiff, high plasticity below 0.6 m.	G84												
0.6 - 0.8			G85												
0.8 - 1.0			G86												
1.0 - 1.5		SILT - trace clay - light brown - moist, soft - no to low plasticity - AASHTO: A-4 (I)	G87												
1.5 - 1.8			G88												
1.8 - 2.0			G89												

END OF TEST HOLE AT 2.0 m IN SILT

- 1) Seepage or sloughing not observed.
- 2) Test hole open to 2.0 m immediately after drilling.
- 3) Test hole backfilled with granular fill and cold patch asphalt.
- 4) Test hole located in back alley of house # 867 Lipton St., 1.0 m East of West edge of alley.

Logged By: Bryan Hiebert Reviewed By: Angela Fidler-Kliewer Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS BANNING 2020-10-25 ALLEY RENEWAL PACKAGE (21-RL-03) 0\_C\_USB\_1000-043-12.GPJ TREK GEOTECHNICAL.GDT\_11/2/20



2021 Alley Renewal Package (21-RL-03)

Sub-Surface Investigation

Banning Street & Lipton Street Alley : bounded by Wellington Avenue and Yarwood 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		
TH20-12	UTM: 14U 5529235 m N, 631274 m E Located in back alley of House # 837 Lipton St., 1.0 m East of West edge of alley.	Asphalt	25	Concrete	200	Silt and Clay: AASHTO: A-7-6 (36)	0.3	0.5	24									
						Silt and Clay: AASHTO: A-7-6 (36)	0.6	0.8	29	48	35	17	0	17	59	41		
						Silt and Clay: AASHTO: A-7-6 (36)	0.9	1.1	29									
						Silt and Clay: AASHTO: A-7-6 (36)	1.2	1.4	29									
						Silt: AASHTO: A-4 (I)	1.5	1.7	23									
						Silt: AASHTO: A-4 (I)	1.8	2.0	21									
TH20-13	UTM: 14U 5529319 m N, 631276 m E Located in back alley of House # 867 Lipton St., 1.5 m East of West edge of alley.	Asphalt	25	Concrete	200	Silt and Clay: AASHTO: A-7-6 (50)	0.3	0.5	21									
						Silt and Clay: AASHTO: A-7-6 (50)	0.6	0.8	39	60	31	9	0	23	72	49		
						Silt and Clay: AASHTO: A-7-6 (50)	0.9	1.1	32									
						Silt: AASHTO: A-4 (I)	1.2	1.4	24									
						Silt: AASHTO: A-4 (I)	1.5	1.7	22									
						Silt: AASHTO: A-4 (I)	1.8	2.0	21									

(I) - AASHTO classification was interpreted based on visual classification.



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## Moisture Content Report ASTM D2216-10

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St/Lipton St

**Sample Date** 8-Oct-20  
**Test Date** 10-Oct-20  
**Technician** AD

Test Hole	TH20-12	TH20-12	TH20-12	TH20-12	TH20-12	TH20-12
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G78	G79	G80	G81	G82	G83
Tare ID	F38	F99	A13	E83	N27	A104
Mass of tare	8.4	8.6	8.4	9.0	8.6	8.6
Mass wet + tare	485.0	358.8	205.2	275.8	330.4	271.8
Mass dry + tare	393.4	280.9	160.7	216.6	270.4	225.4
Mass water	91.6	77.9	44.5	59.2	60.0	46.4
Mass dry soil	385.0	272.3	152.3	207.6	261.8	216.8
Moisture %	23.8%	28.6%	29.2%	28.5%	22.9%	21.4%

Test Hole	TH20-13	TH20-13	TH20-13	TH20-13	TH20-13	TH20-13
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G84	G85	G86	G87	G88	G89
Tare ID	N113	G75	H73	K20	W63	D49
Mass of tare	8.6	8.5	8.6	8.4	8.4	8.4
Mass wet + tare	278.0	297.4	296.4	270.0	296.4	423.4
Mass dry + tare	231.5	216.6	225.9	218.7	245.5	350.8
Mass water	46.5	80.8	70.5	51.3	50.9	72.6
Mass dry soil	222.9	208.1	217.3	210.3	237.1	342.4
Moisture %	20.9%	38.8%	32.4%	24.4%	21.5%	21.2%





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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St./Lipton St.

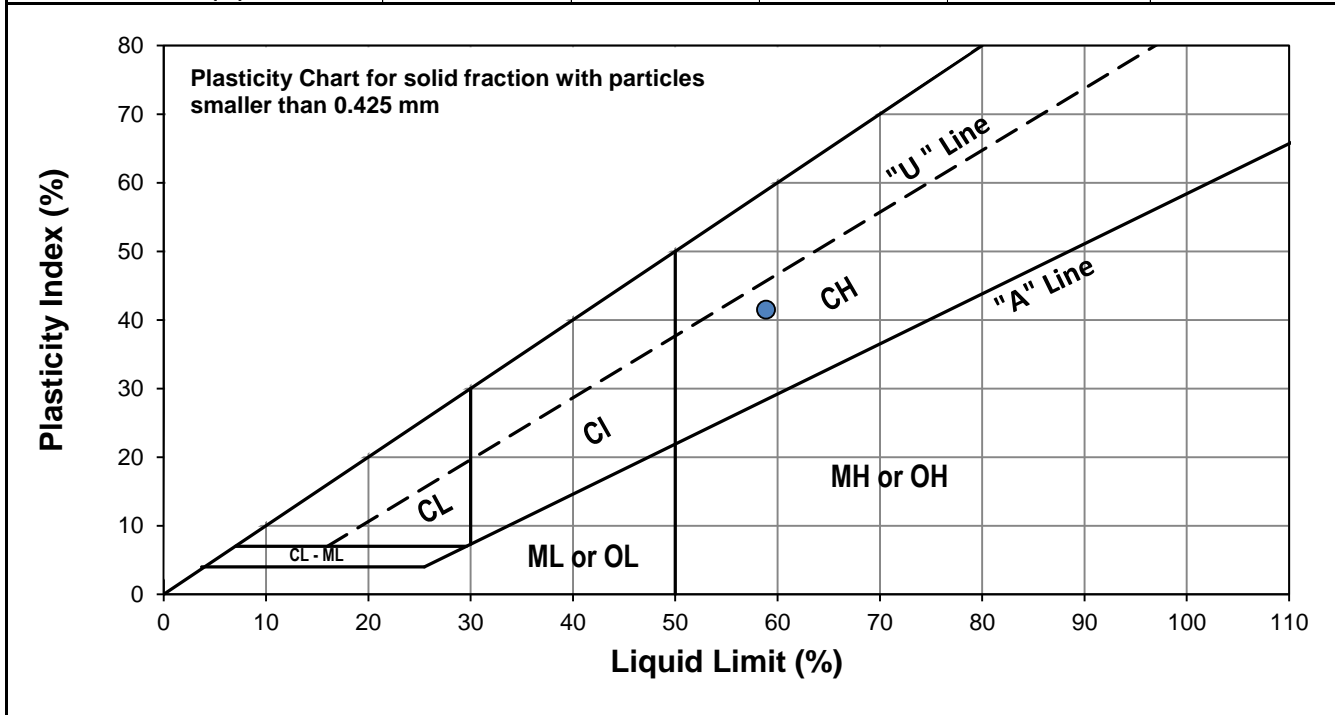


**Test Hole** TH20-12  
**Sample #** G79  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 06-Oct-20  
**Test Date** 23-Oct-20  
**Technician** AD

<b>Liquid Limit</b>	59
<b>Plastic Limit</b>	17
<b>Plasticity Index</b>	41

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	15	25	33
<b>Mass Wet Soil + Tare (g)</b>	26.983	24.614	27.654
<b>Mass Dry Soil + Tare (g)</b>	21.990	20.720	22.734
<b>Mass Tare (g)</b>	13.903	14.050	14.210
<b>Mass Water (g)</b>	4.993	3.894	4.920
<b>Mass Dry Soil (g)</b>	8.087	6.670	8.524
<b>Moisture Content (%)</b>	61.741	58.381	57.719



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.104	14.024			
<b>Mass Wet Soil + Tare (g)</b>	20.179	20.330			
<b>Mass Dry Soil + Tare (g)</b>	19.275	19.400			
<b>Mass Water (g)</b>	0.904	0.930			
<b>Mass Dry Soil (g)</b>	5.171	5.376			
<b>Moisture Content (%)</b>	17.482	17.299			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St./Lipton St.

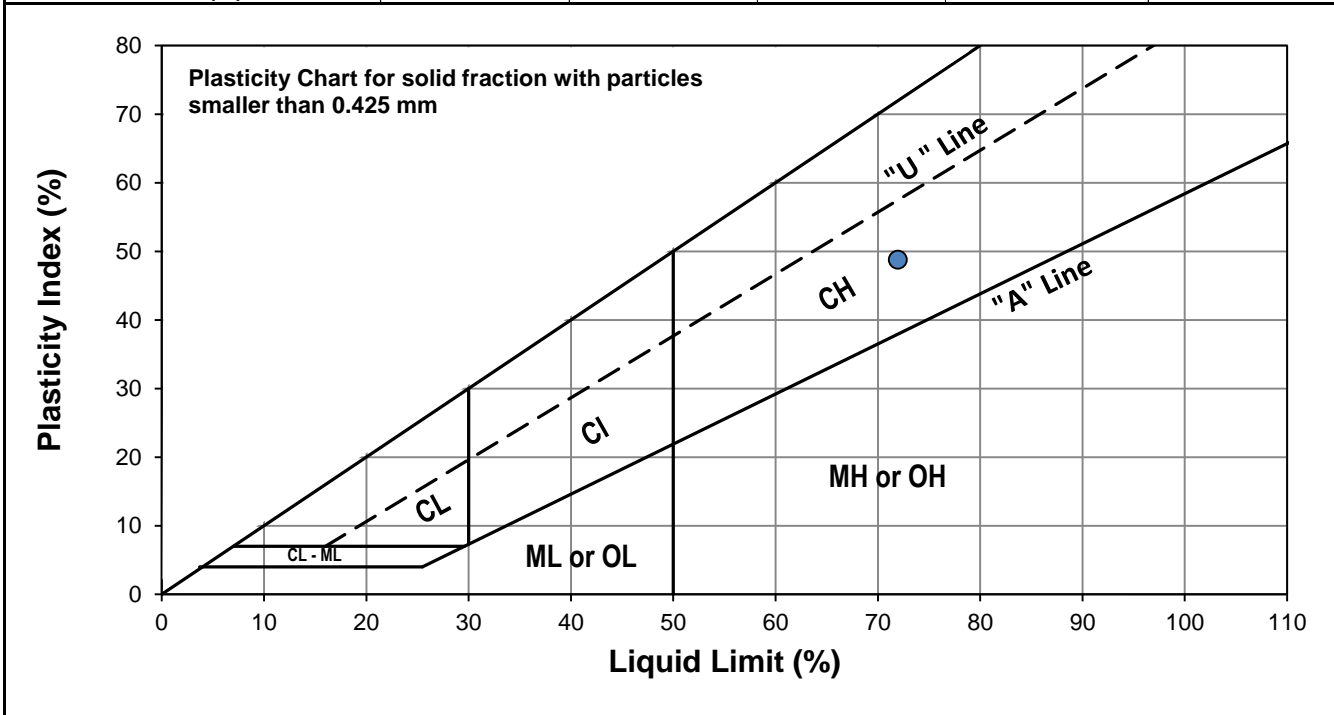


**Test Hole** TH20 - 13  
**Sample #** G85  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 08-Oct-20  
**Test Date** 31-Oct-20  
**Technician** JSB

<b>Liquid Limit</b>	72
<b>Plastic Limit</b>	23
<b>Plasticity Index</b>	49

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	22	30	35
<b>Mass Wet Soil + Tare (g)</b>	24.676	24.407	26.440
<b>Mass Dry Soil + Tare (g)</b>	20.247	20.164	21.351
<b>Mass Tare (g)</b>	14.167	14.165	14.021
<b>Mass Water (g)</b>	4.429	4.243	5.089
<b>Mass Dry Soil (g)</b>	6.080	5.999	7.330
<b>Moisture Content (%)</b>	72.845	70.728	69.427



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	13.970	14.055			
<b>Mass Wet Soil + Tare (g)</b>	21.148	21.379			
<b>Mass Dry Soil + Tare (g)</b>	19.788	20.009			
<b>Mass Water (g)</b>	1.360	1.370			
<b>Mass Dry Soil (g)</b>	5.818	5.954			
<b>Moisture Content (%)</b>	23.376	23.010			



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**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

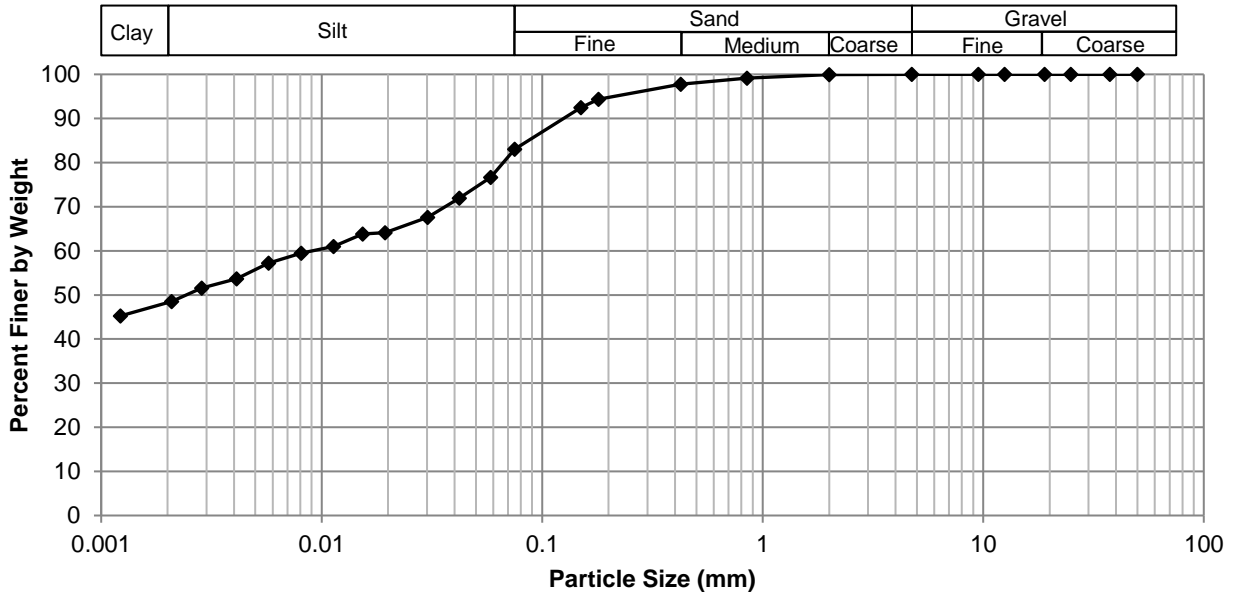
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St./Lipton St.



**Test Hole** TH20-12  
**Sample #** G79  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 6-Oct-20  
**Test Date** 22-Oct-20  
**Technician** JSB

<b>Gravel</b>	0.0%
<b>Sand</b>	16.9%
<b>Silt</b>	34.9%
<b>Clay</b>	48.2%

**Particle Size Distribution Curve**



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	83.07
37.5	100.00	2.00	99.96	0.0583	76.63
25.0	100.00	0.850	99.12	0.0420	71.94
19.0	100.00	0.425	97.76	0.0303	67.57
12.5	100.00	0.180	94.36	0.0194	64.13
9.50	100.00	0.150	92.49	0.0154	63.82
4.75	100.00	0.075	83.07	0.0113	61.00
				0.0081	59.44
				0.0057	57.25
				0.0041	53.63
				0.0029	51.58
				0.0021	48.52
				0.0012	45.25



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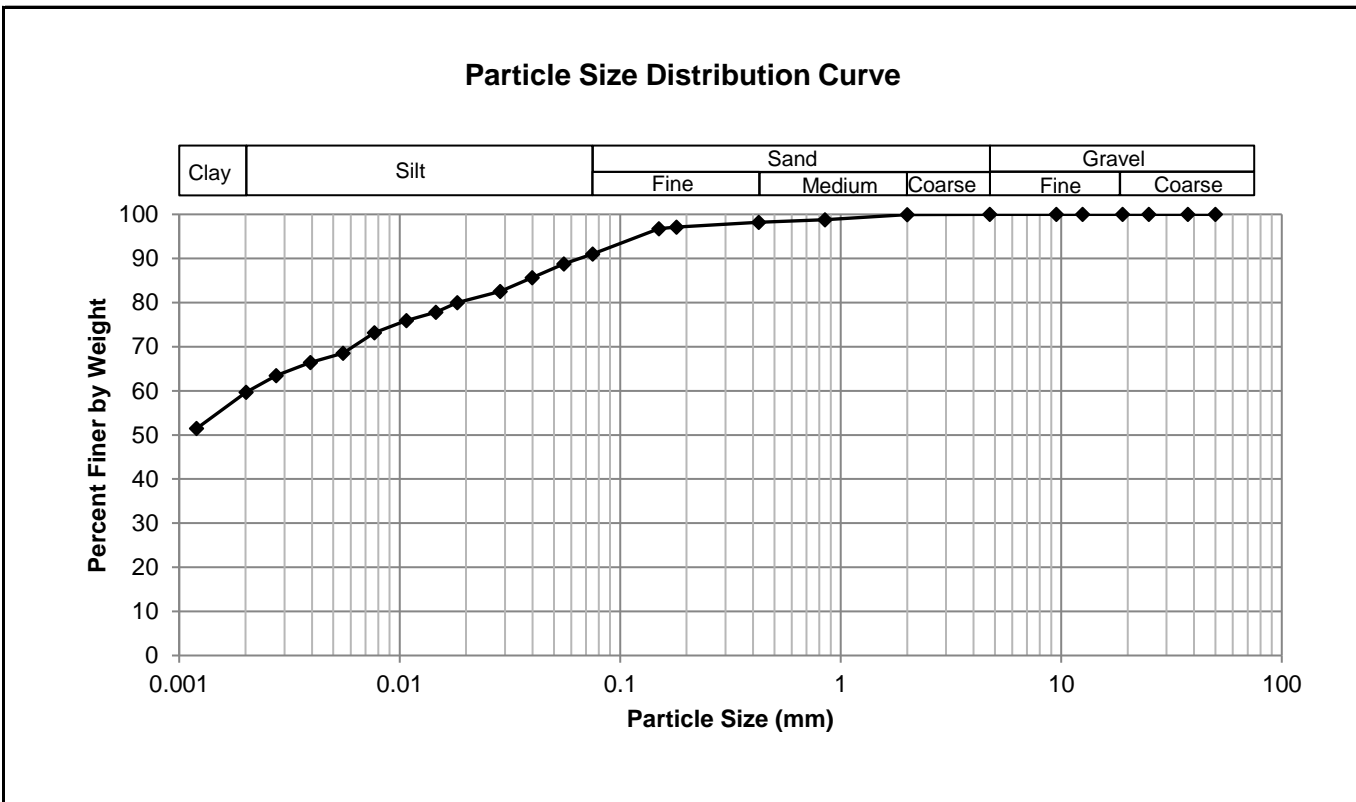
**Grain Size Analysis (Hydrometer Method)**  
**ASTM D422**

**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St./Lipton St.



**Test Hole** TH20-13  
**Sample #** G85  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 6-Oct-20  
**Test Date** 30-Oct-20  
**Technician** JSB

<b>Gravel</b>	0.0%
<b>Sand</b>	9.0%
<b>Silt</b>	31.5%
<b>Clay</b>	59.6%



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	91.04
37.5	100.00	2.00	99.91	0.0555	88.76
25.0	100.00	0.850	98.81	0.0398	85.64
19.0	100.00	0.425	98.19	0.0286	82.51
12.5	100.00	0.180	97.12	0.0183	80.01
9.50	100.00	0.150	96.75	0.0146	77.83
4.75	100.00	0.075	91.04	0.0107	75.95
				0.0077	73.21
				0.0055	68.52
				0.0039	66.46
				0.0028	63.47
				0.0020	59.72
				0.0012	51.46



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# Standard Proctor Compaction Test

ASTM D698-12e2

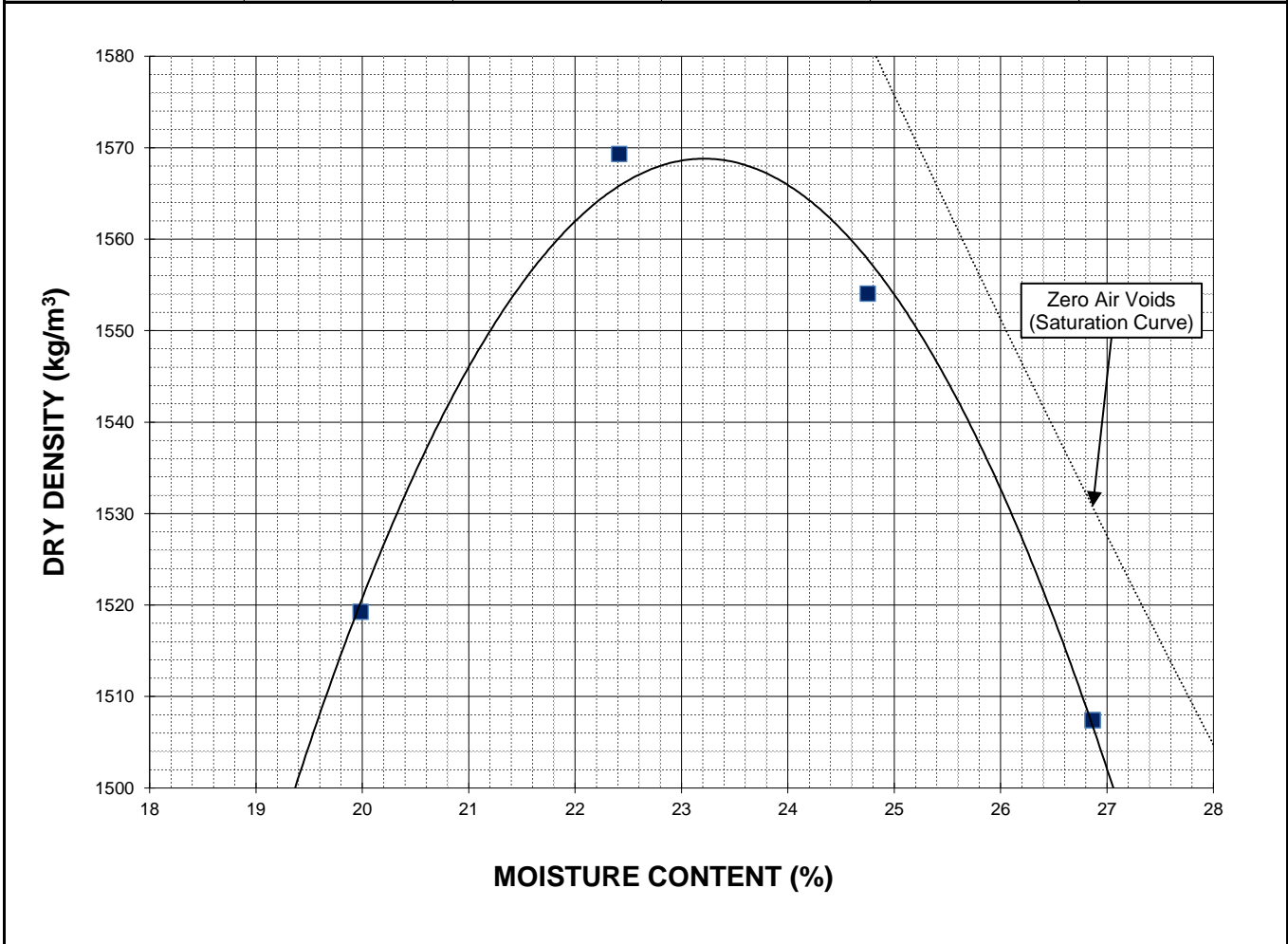
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St/Lipton St



**Sample #** TH20-12 (0.2 - 1.5 m)  
**Source** Back Alley between Banning St/Lipton St  
**Material** Silt and Clay  
**Sample Date** 08-Oct-20  
**Test Date** 16-Oct-20  
**Technician** MT

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1569
<b>Optimum Moisture (%)</b>	23.2

Trial Number	1	2	3	4	
Wet Density (kg/m <sup>3</sup> )	1823	1921	1939	1912	
Dry Density (kg/m <sup>3</sup> )	1519	1569	1554	1507	
Moisture Content (%)	20.0	22.4	24.8	26.9	





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# Standard Proctor Compaction Test

ASTM D698-12e2

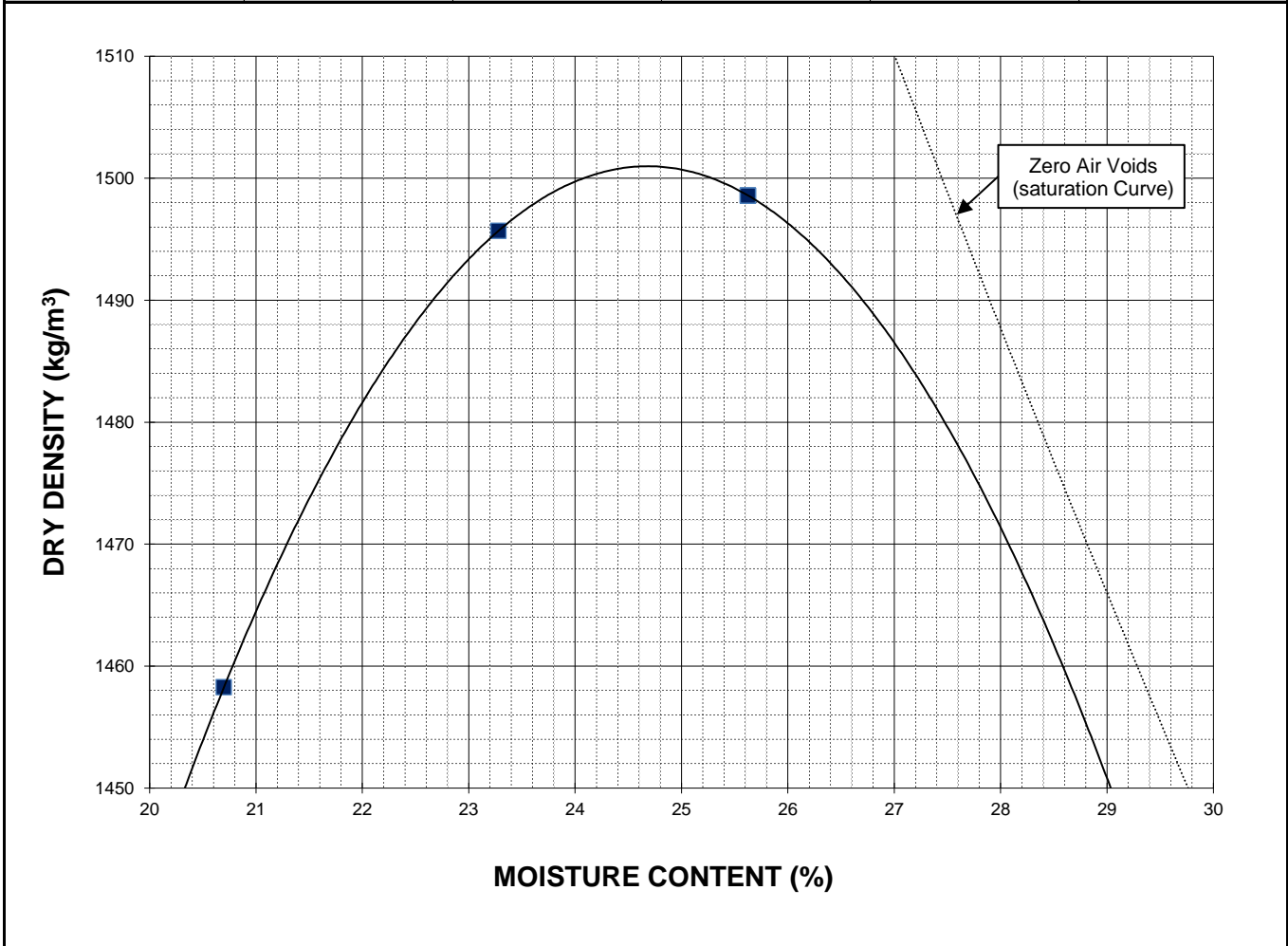
**Project No.** 1000-043-12  
**Client** WSP  
**Project** 2021 Alley Renewal Package - Banning St/Lipton St



**Sample #** TH20-13 (0.2 - 1.2 m)  
**Source** Back Alley between Banning St/Lipton St  
**Material** Silt and Clay  
**Sample Date** 08-Oct-20  
**Test Date** 16-Oct-20  
**Technician** MT

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1501
<b>Optimum Moisture (%)</b>	24.7

Trial Number	1	2	3		
Wet Density (kg/m <sup>3</sup> )	1760	1844	1883		
Dry Density (kg/m <sup>3</sup> )	1458	1496	1499		
Moisture Content (%)	20.7	23.3	25.6		





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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley between Lipton St/Banning St.
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-08
<b>Sample #</b>	TH20-12 (0.2 - 1.5 m)	<b>Test Date</b>	2020-10-23
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1569 kg/m3
Optimum Moisture Content	23.2 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1485 kg/m3
Initial Moisture Content	24.3 %
Relative Density	94.6 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.4 %
Moisture Content in top 25 mm	29.4 %
Immersion Period	96 h

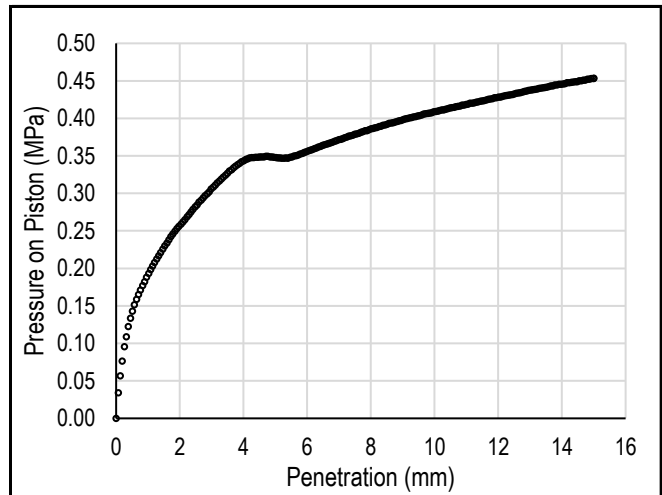
**CBR Results**

CBR at 2.54 mm	4.1 %
CBR at 5.08 mm	3.4 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.16	0.16
1.27	0.21	0.21
1.91	0.25	0.25
2.54	0.28	0.28
3.18	0.31	0.31
3.81	0.34	0.34
4.45	0.35	0.35
5.08	0.35	0.35
7.62	0.38	0.38
10.16	0.41	0.41
12.70	0.43	0.43

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	1000-043-12	<b>Source</b>	Back Alley between Lipton St./Banning St.
<b>Client</b>	WSP	<b>Material</b>	Silt and Clay
<b>Project</b>	2021 Alley Renewal Package	<b>Sample Date</b>	2020-10-08
<b>Sample #</b>	TH20-13 (0.2 - 1.5 m)	<b>Test Date</b>	2020-10-23
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1501 kg/m3
Optimum Moisture Content	24.7 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1431 kg/m3
Initial Moisture Content	26.4 %
Relative Density	95.4 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.7 %
Moisture Content in top 25 mm	33.1 %
Immersion Period	96 h

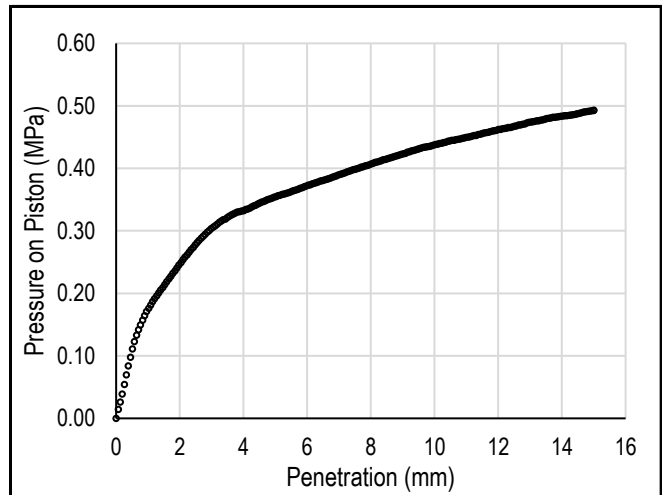
**CBR Results**

CBR at 2.54 mm	4.1 %
CBR at 5.08 mm	3.5 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.13	0.13
1.27	0.20	0.20
1.91	0.24	0.24
2.54	0.28	0.28
3.18	0.31	0.31
3.81	0.33	0.33
4.45	0.34	0.34
5.08	0.36	0.36
7.62	0.40	0.40
10.16	0.44	0.44
12.70	0.47	0.47

**Load/Penetration Curve**



**Comments:**





Photo 1: Pavement Core Sample at Test Hole TH20-12



Photo 2: Pavement Core Sample at Test Hole TH20-13



Quality Engineering | Valued Relationships

WSP Canada Group Winnipeg  
**20-LI-01 Local Alley Renewals**

**Prepared for:**

WSP Canada Group Ltd.  
111-93 Lombard Ave.  
Winnipeg, MB R3B  
Attention: Lissa VanDorp, P.Eng.

**Project Number:**

1000 043 10 400

**Date:**

March 2, 2020  
Final Report



Quality Engineering | Valued Relationships

March 2, 2020

Our File No. 1000 043 10 400

Lissa VanDorp, P.Eng.  
WSP Canada Group Ltd.  
111-93 Lombard Ave.  
Winnipeg, MB R3B

**RE: Road Investigation Report for  
20-LI-01 Local Alley Renewals**

---

TREK Geotechnical Inc. is pleased to submit our report for the road investigations for the 20-LI-01 Local Alley Renewals project.

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", is written over a light blue circular stamp.

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


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

## Revision History

Revision No.	Author	Issue Date	Description
1	AFK	March 2, 2020	Final Report

## Authorization Signatures

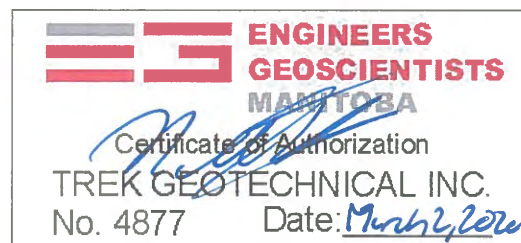
Prepared By:

  
Angela Fidler-Kliewer, C. Tech  
Manager of Laboratory and Field Services



Reviewed By:

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





## Table of Contents

Letter of Transmittal

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Figure 03	Alley Test Hole Location Plan – Highfield St. and Kirkdale St.
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## List of Appendices

Appendix A	Test Hole Logs, Summary Table & Lab Testing Results - Alley – Kirkdale St. and Highfield St.
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## 1.0 Introduction

This report summarizes the results of the road investigation completed for the 20-LI-01 Local Alley Renewal project. The test holes were completed within the alleys of Coniston St. and Gauvin St., Coniston St. and Highfield St., Highfield St. and Kirkdale St., Walmer St. and Kirkdale St. and Prosper St. and Evans St. The information collected describes the soil stratigraphy beneath the surface at the test hole locations.

## 2.0 Road Investigation and Laboratory Program

The investigation included the drilling of test holes. The investigation locations are shown on Figure 01 through Figure 05 (attached) and Table 1 below summarizes the investigation program per alley.

**Table 1 – Road Investigation Program**

Street	# of Locations	Investigation
Alley – Highfield St. to Kirkdale St.	4	Test Holes

The sub-surface investigation was conducted between January 15, 2020 and January 28, 2020. The test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The sub-surface conditions were observed during drilling and visually classified by Nuno Mendonca of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples and bulk samples retrieved during the sub-surface investigation 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 surface. Information gathered for each alley is included in separate appendices (Appendices A through E). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results.

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 distance 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 (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.

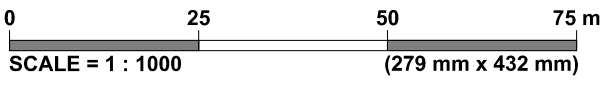
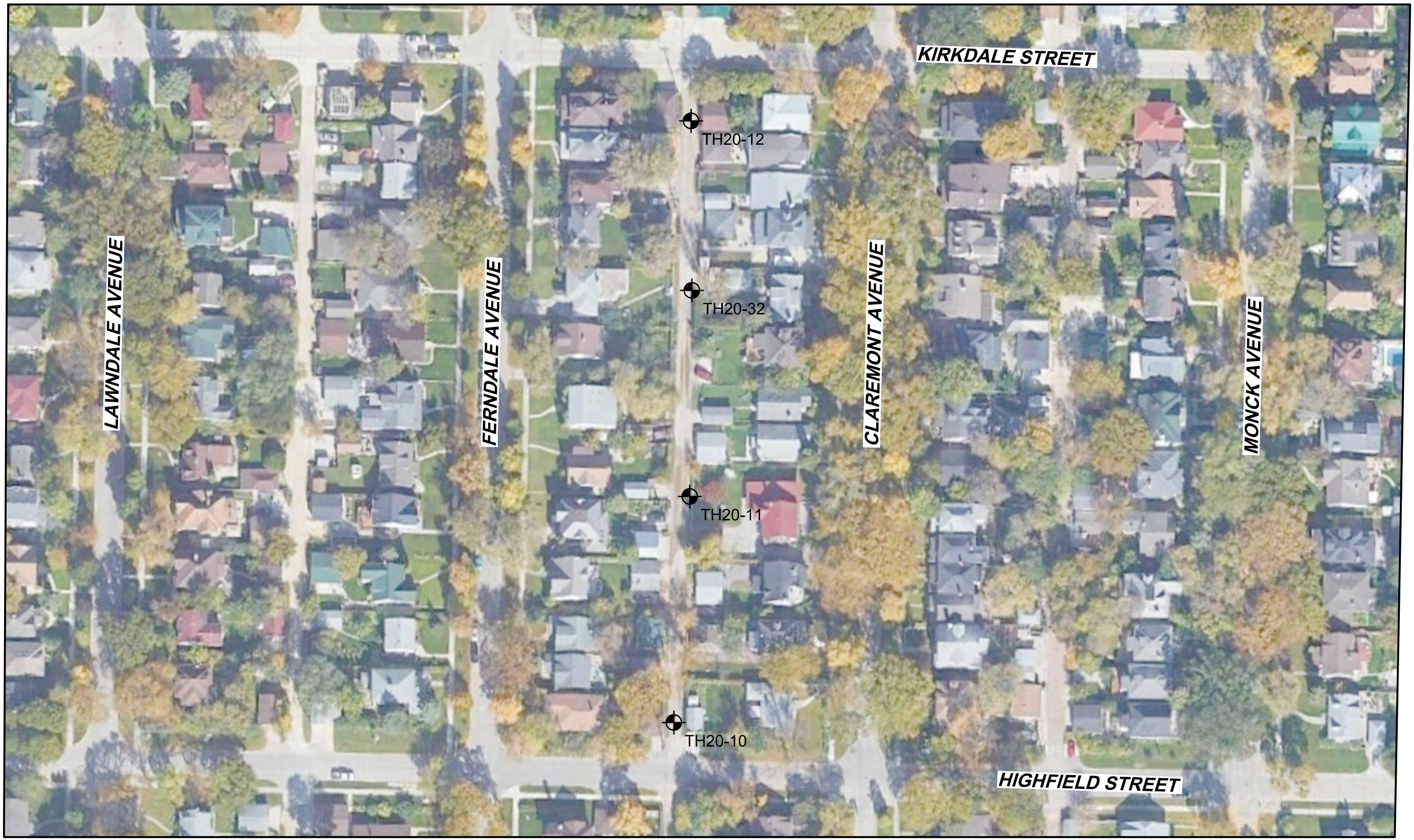
## Figures

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ANSI full bleed B (11.00 x 17.00 inches)

Z:\Projects\1000 Soils Lab\Projects\1000-043 WSP\1000-043-10 Local Streets and Alleys\3 Survey and Dwg\3.4 CAD\3.4.3 Working Folder\20.02.13 TH LOCATIONS - HIGHFIELD\_KIRKDALE.dwg, 2/24/2020 3:08:16 PM



**LEGEND:** TEST HOLE (TREK, 2020)

**NOTES:**

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

**Figure 03**  
TEST HOLE LOCATION PLAN

**Appendix A**

**Kirkdale St. and Highfield St.**

**Test Hole Logs, Summary Table, Lab Testing Results**

---

## 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		<table border="1"> <thead> <tr> <th>Material</th> <th>Particle Size</th> <th>ASTM Sieve Sizes</th> </tr> </thead> <tbody> <tr> <td>Boulders</td> <td>mm</td> <td>&gt; 300</td> </tr> <tr> <td>Cobbles</td> <td>mm</td> <td>75 to 300</td> </tr> <tr> <td rowspan="2">Gravel</td> <td>mm</td> <td>19 to 75</td> </tr> <tr> <td>in.</td> <td>4.75 to 19</td> </tr> <tr> <td rowspan="2">Material</td> <td>in.</td> <td>&gt; 12 in.</td> </tr> <tr> <td>in.</td> <td>3 in. to 12 in.</td> </tr> <tr> <td rowspan="2">Material</td> <td>in.</td> <td>3/4 in. to 3 in.</td> </tr> <tr> <td>in.</td> <td>#4 to 3/4 in.</td> </tr> </tbody> </table>	Material	Particle Size	ASTM Sieve Sizes	Boulders	mm	> 300	Cobbles	mm	75 to 300	Gravel	mm	19 to 75	in.	4.75 to 19	Material	in.	> 12 in.	in.	3 in. to 12 in.	Material	in.	3/4 in. to 3 in.	in.	#4 to 3/4 in.
						Material	Particle Size			ASTM Sieve Sizes																							
Boulders	mm	> 300																															
Cobbles	mm	75 to 300																															
Gravel	mm	19 to 75																															
	in.	4.75 to 19																															
Material	in.	> 12 in.																															
	in.	3 in. to 12 in.																															
Material	in.	3/4 in. to 3 in.																															
	in.	#4 to 3/4 in.																															
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																															
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 TH20-10

1 of 1

Client: WSP Canada Project Number: 1000-043-10  
 Project Name: 20-L1-01 Local Streets and Alleys (Highfield St / Kirkdale St) Location: UTM N-5526471, E-634603  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Existing Ground  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 15, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)											
					16	17	18	19	20	21	0	50	100	150	200	250				
0.0		SAND (FILL) - trace to some clay, trace silt, trace gravel (<10 mm diam.), black, frozen, moist and loose to compact when thawed, poorly graded fine grained sand to gravel, sub-rounded to angular crushed "pit run"	G64																	
0.0		SILT AND CLAY - trace sand - black - frozen to 1.5 m depth, moist and stiff when thawed - high plasticity	G65																	
0.5		- trace wood debris, brown, firm below 0.6 m	G66																	
1.0		- trace sand below 1.0 m	G67																	
1.5		- stiff below 1.2 m	G68																	
1.5		CLAY - silty - brown - moist, firm to stiff - high plasticity	G69																	
3.0			G70																	

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open and dry to 2.9 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings and granular fill to surface.
- 4) Test hole located 1.6 m North and 3.3 m West of the Southwest corner of the garage at house #125 of Claremont Ave.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS\_1000-043-10\_0\_A\_NM HIGHFIELD KIRKDALE GPJ\_TREK GEOTECHNICAL.GDT\_2/28/20



# Sub-Surface Log

Test Hole TH20-11

1 of 1

**Client:** WSP Canada **Project Number:** 1000-043-10  
**Project Name:** 20-L1-01 Local Streets and Alleys (Highfield St / Kirkdale St) **Location:** UTM N-5526534, E-634605  
**Contractor:** Maple Leaf Drilling Ltd. **Ground Elevation:** Existing Ground  
**Method:** 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** January 15, 2020

**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	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)							
					16	17	18	19	20	21	0	50	100	150	200	250
0.0		SAND (FILL) - trace to some clay, trace silt, trace gravel (<10 mm diam.), black, frozen, moist and loose to compact when thawed, poorly graded fine grained sand to gravel, sub-rounded to angular crushed "pit run"	▲	G71	●											
0.2		SILT AND CLAY - trace to some organics, trace sand - black - frozen to 1.5 m depth, moist and firm to stiff when thawed - high plasticity	▲	G72	●											
0.4			▲	G73	●											
0.8			▲	G74	●											
1.2		- trace silt inclusions (<15 mm diam.), trace wood debris at 1.2 m	▲	G75	●											
1.5		- trace silt inclusions (<10 mm diam.), brown below 1.5 m	▲	G76	●											
3.0		- trace oxidation below 2.9 m	▲	G77	●											

END OF TEST HOLE AT 3.0 m IN SILT AND CLAY  
 1) No seepage or sloughing observed.  
 2) Test hole open and dry to 3.0 m immediately after drilling.  
 3) Test hole backfilled with auger cuttings and granular fill to surface.  
 4) Test hole located 9.0 m South and 2.5 m East of Southeast corner of the garage at house #143 of Claremont Ave.

**Logged By:** Nuno Mendonca **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS\_1000-043-10\_0\_A\_NM HIGHFIELD KIRKDALE GPJ\_TREK GEOTECHNICAL\_GDT\_2/28/20



# Sub-Surface Log

Test Hole TH20-12

1 of 1

**Client:** WSP Canada **Project Number:** 1000-043-10  
**Project Name:** 20-L1-01 Local Streets and Alleys (Highfield St / Kirkdale St) **Location:** UTM N-5526630, E-634607  
**Contractor:** Maple Leaf Drilling Ltd. **Ground Elevation:** Existing Ground  
**Method:** 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** January 15, 2020

**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	Bulk Unit Wt (kN/m <sup>3</sup> )						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	20	40	60	80	100	0	50	100	150	200	250	
0.0		SAND (FILL) - trace to some clay, trace silt, trace gravel (<10 mm diam.), black, frozen, moist and loose to compact when thawed, poorly graded fine grained sand to gravel, sub-rounded to angular crushed "pit run"	▲	G85	●												
0.0		SILT AND CLAY - trace to some sand - grey - frozen to 1.5 m depth, moist and stiff when thawed - high plasticity	▲	G86	●												
0.5		- brown, stiff to very stiff below 0.6 m	▲	G87	●								△	+			
1.0		- trace silt inclusions (<10 mm diam.) below 1.0 m	▲	G88	●											+	
1.5		- firm to stiff below 1.5 m	▲	G89	●											△	+
1.5			▲	G90	●												+
3.0			▲	G91	●												+

END OF TEST HOLE AT 3.0 m IN SILT AND CLAY  
 1) No seepage or sloughing observed.  
 2) Test hole open and dry to 2.9 m immediately after drilling.  
 3) Test hole backfilled with auger cuttings and granular fill to surface.  
 4) Test hole located 1.2 m North and 4.3 m East of Southeast corner of garage at house #166 of Ferndale Ave.

**Logged By:** Nuno Mendonca **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS 1000-043-10.0.A.NM.HIGHFIELD.KIRKDALE.GPJ.TREK.GEOTECHNICAL.GDT.2/28/20



# Sub-Surface Log

Test Hole TH20-32

1 of 1

Client: WSP Canada Project Number: 1000-043-10  
 Project Name: 20-L1-01 Local Streets and Alleys (Highfield St / Kirkdale St) Location: UTM N-5526584, E-634607  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Existing Ground  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 15, 2020

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	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)	
					16	17	18	19	20	21
0.0		SAND (FILL) - trace to some clay, trace silt, trace gravel (<10 mm diam.), black, frozen, moist and loose to compact when thawed, poorly graded fine grained sand to gravel, sub-rounded to angular crushed "pit run"		G78						
0.0		SILT AND CLAY - trace organics, trace sand - black - frozen to 1.5 m depth, moist and stiff when thawed - high plasticity		G79						
0.5		- grey below 0.6 m		G80						
1.0		- trace silt inclusions (<10 mm diam.), very stiff below 1.2 m		G81						
1.5		- brown, firm to stiff below 1.5 m		G82						
1.5				G83						
3.0				G84						

END OF TEST HOLE AT 3.0 m IN SILT AND CLAY  
 1) No seepage or sloughing observed.  
 2) Test hole open and dry to 3.0 m immediately after drilling.  
 3) Test hole backfilled with auger cuttings and granular fill to surface.  
 4) Test hole located 4.6 m North and 6.5 m East of hydropole located on the alley at house #154 of Ferndale Ave.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS\_1000-043-10\_0\_A\_NM HIGHFIELD KIRKDALE GPJ\_TREK GEOTECHNICAL\_GDT\_2/28/20







**Project No.** 1000-043-10  
**Client** WSP  
**Project** 2020 Local Street and Alleys- Highfield St. / Kirkdale St.

**Sample Date** 15-Jan-20  
**Test Date** 27-Jan-20  
**Technician** HS

Test Hole	TH20-10	TH20-10	TH20-10	TH20-10	TH20-10	TH20-10
Depth (m)	0.0 - 0.1	0.1 - 0.3	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G64	G65	G66	G67	G68	G69
Tare ID	Z45	AB92	W102	AB45	AA02	F21
Mass of tare	8.8	6.8	8.6	6.7	6.9	8.5
Mass wet + tare	480.7	343.0	404.4	177.9	281.8	258.4
Mass dry + tare	431.6	260.8	311.4	140.9	223.1	203.4
Mass water	49.1	82.2	93.0	37.0	58.7	55.0
Mass dry soil	422.8	254.0	302.8	134.2	216.2	194.9
Moisture %	11.6%	32.4%	30.7%	27.6%	27.2%	28.2%

Test Hole	TH20-10	TH20-11	TH20-11	TH20-11	TH20-11	TH20-11
Depth (m)	2.9 - 3.0	0.0 - 0.1	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
Sample #	G70	G71	G72	G73	G74	G75
Tare ID	F135	N02	A3	P21	H50	H43
Mass of tare	8.7	8.6	8.5	8.6	8.5	8.6
Mass wet + tare	325.2	151.5	462.6	187.4	414.6	267.0
Mass dry + tare	255.9	134.6	345.3	139.0	303.9	198.6
Mass water	69.3	16.9	117.3	48.4	110.7	68.4
Mass dry soil	247.2	126.0	336.8	130.4	295.4	190.0
Moisture %	28.0%	13.4%	34.8%	37.1%	37.5%	36.0%

Test Hole	TH20-11	TH20-11	TH20-12	TH20-12	TH20-12	TH20-12
Depth (m)	1.5 - 1.7	2.9 - 3.0	0.0 - 0.1	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1
Sample #	G76	G77	G85	G86	G87	G88
Tare ID	AA24	W74	F44	AB69	C22	E119
Mass of tare	6.8	8.4	8.5	6.8	8.6	8.6
Mass wet + tare	187.2	242.1	251.2	228.9	159.7	163.5
Mass dry + tare	143.7	184.1	214.4	170.1	124.8	129.1
Mass water	43.5	58.0	36.8	58.8	34.9	34.4
Mass dry soil	136.9	175.7	205.9	163.3	116.2	120.5
Moisture %	31.8%	33.0%	17.9%	36.0%	30.0%	28.5%



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**Moisture Content Report  
 ASTM D2216-10**

**Project No.** 1000-043-10  
**Client** WSP  
**Project** 2020 Local Street and Alleys- Highfield St. / Kirkdale St.

**Sample Date** 15-Jan-20  
**Test Date** 27-Jan-20  
**Technician** HS

<b>Test Hole</b>	TH20-12	TH20-12	TH20-12	TH20-32	TH20-32	TH20-32
<b>Depth (m)</b>	1.2 - 1.4	1.5 - 1.7	2.9 - 3.0	0.0 - 0.1	0.3 - 0.5	0.6 - 0.8
<b>Sample #</b>	G89	G90	G91	G78	G79	G80
<b>Tare ID</b>	W81	N75	Z01	AC40	D17	Z57
<b>Mass of tare</b>	8.9	9.0	8.6	6.7	8.7	8.6
<b>Mass wet + tare</b>	218.1	226.0	225.2	128.6	127.8	192.4
<b>Mass dry + tare</b>	166.2	173.9	171.4	114.1	93.9	146.1
<b>Mass water</b>	51.9	52.1	53.8	14.5	33.9	46.3
<b>Mass dry soil</b>	157.3	164.9	162.8	107.4	85.2	137.5
<b>Moisture %</b>	33.0%	31.6%	33.0%	13.5%	39.8%	33.7%

<b>Test Hole</b>	TH20-32	TH20-32	TH20-32	TH20-32		
<b>Depth (m)</b>	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.9 - 3.0		
<b>Sample #</b>	G81	G82	G83	G84		
<b>Tare ID</b>	Z94	Z99	H72	K35		
<b>Mass of tare</b>	8.5	8.7	8.7	8.6		
<b>Mass wet + tare</b>	140.2	181.8	203.5	170.7		
<b>Mass dry + tare</b>	108.8	141.7	156.9	131.7		
<b>Mass water</b>	31.4	40.1	46.6	39.0		
<b>Mass dry soil</b>	100.3	133.0	148.2	123.1		
<b>Moisture %</b>	31.3%	30.2%	31.4%	31.7%		



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-10  
**Client** WSP  
**Project** 2020 Local Street and Alley - Highfield St. / Kirkdale St.

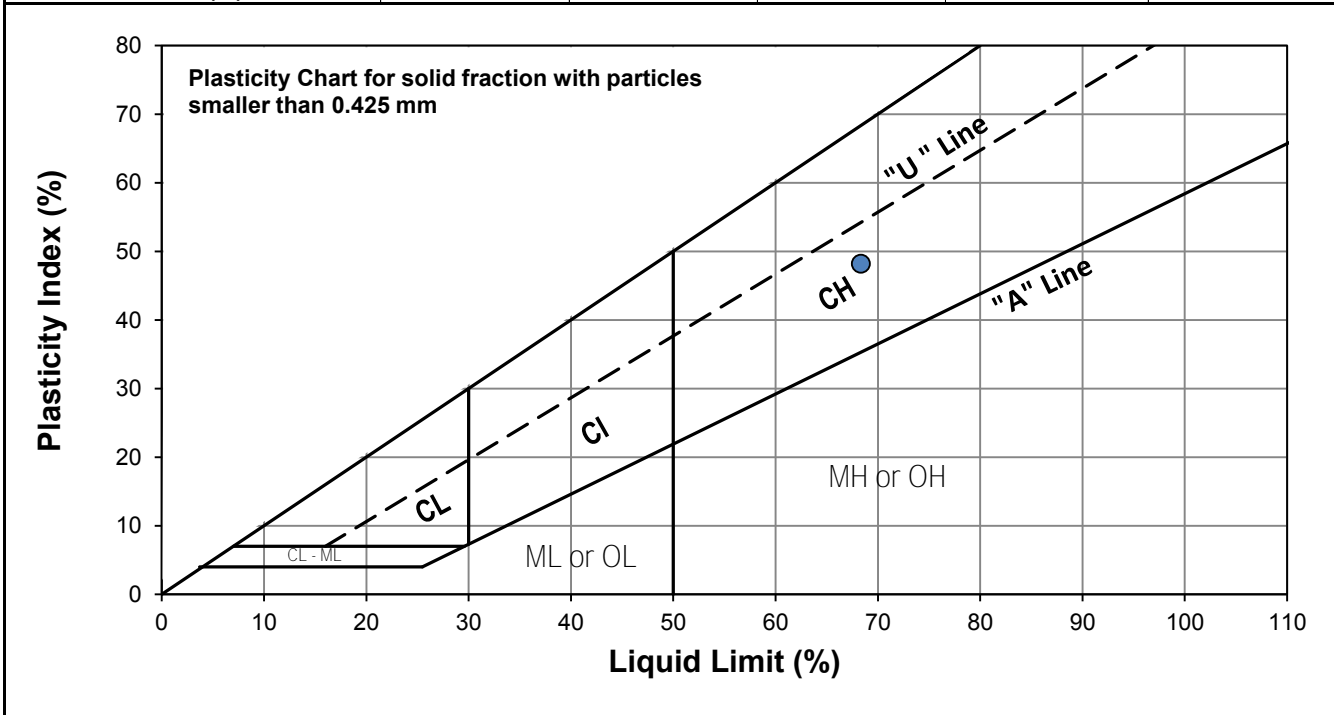


**Test Hole** TH20-10  
**Sample #** G66  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 15-Jan-20  
**Test Date** 6-Feb-20  
**Technician** HS

<b>Liquid Limit</b>	68
<b>Plastic Limit</b>	20
<b>Plasticity Index</b>	48

**Liquid Limit**

Trial #	1	2	3
Number of Blows (N)	17	22	29
Mass Wet Soil + Tare (g)	27.369	24.311	31.230
Mass Dry Soil + Tare (g)	21.805	20.077	24.411
Mass Tare (g)	14.074	14.008	14.204
Mass Water (g)	5.564	4.234	6.819
Mass Dry Soil (g)	7.731	6.069	10.207
Moisture Content (%)	71.970	69.764	66.807



**Plastic Limit**

Trial #	1	2	3	4	5
Mass Tare (g)	14.033	13.866			
Mass Wet Soil + Tare (g)	20.494	20.723			
Mass Dry Soil + Tare (g)	19.415	19.565			
Mass Water (g)	1.079	1.158			
Mass Dry Soil (g)	5.382	5.699			
Moisture Content (%)	20.048	20.319			



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**Atterberg Limits**  
**ASTM D4318-10e1**

**Project No.** 1000-043-10  
**Client** WSP  
**Project** 2020 Local Street and Alley - Highfield St. / Kirkdale St.

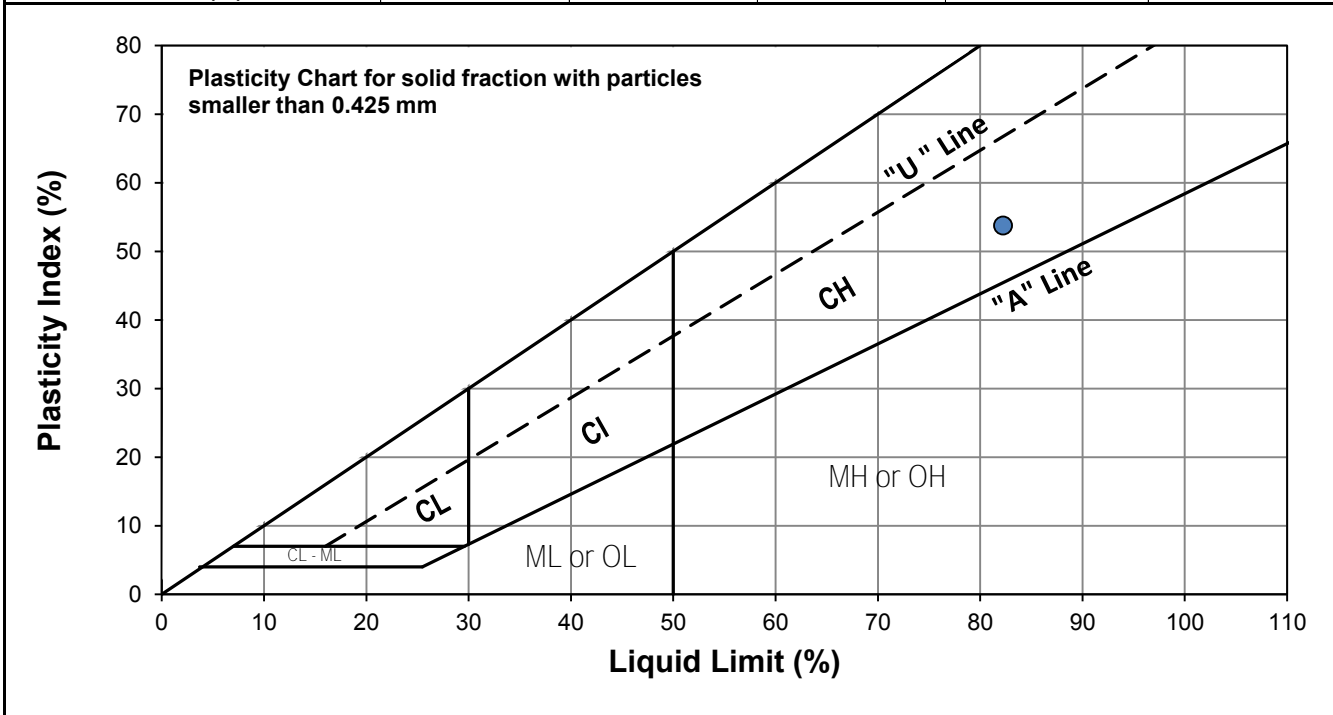


**Test Hole** TH20-11  
**Sample #** G74  
**Depth (m)** 0.9 - 1.1  
**Sample Date** 15-Jan-20  
**Test Date** 20-Feb-20  
**Technician** HS

<b>Liquid Limit</b>	82
<b>Plastic Limit</b>	29
<b>Plasticity Index</b>	54

**Liquid Limit**

Trial #	1	2	3
Number of Blows (N)	17	22	34
Mass Wet Soil + Tare (g)	25.850	26.169	26.723
Mass Dry Soil + Tare (g)	20.363	20.545	21.114
Mass Tare (g)	13.897	13.761	14.130
Mass Water (g)	5.487	5.624	5.609
Mass Dry Soil (g)	6.466	6.784	6.984
Moisture Content (%)	84.859	82.901	80.312



**Plastic Limit**

Trial #	1	2	3	4	5
Mass Tare (g)	13.982	14.160			
Mass Wet Soil + Tare (g)	21.531	20.586			
Mass Dry Soil + Tare (g)	19.851	19.165			
Mass Water (g)	1.680	1.421			
Mass Dry Soil (g)	5.869	5.005			
Moisture Content (%)	28.625	28.392			



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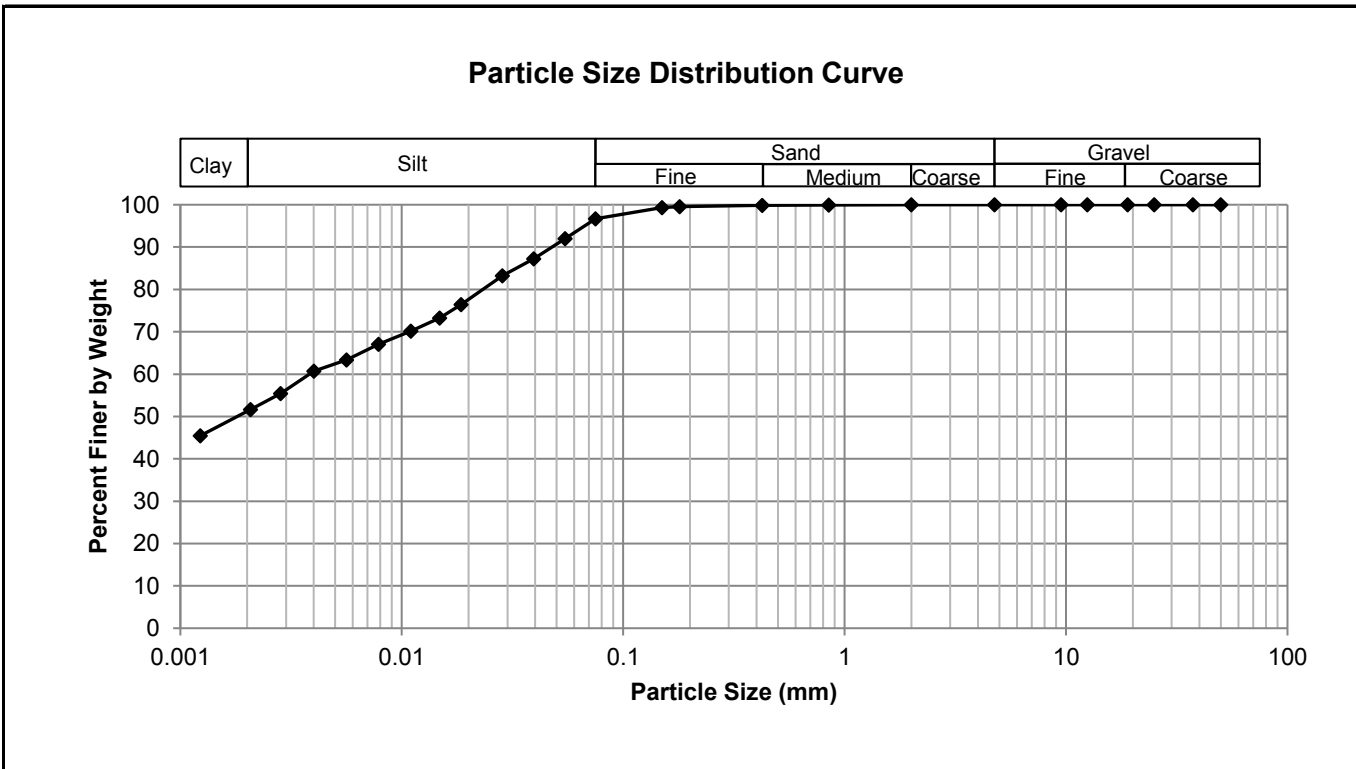
**Grain Size Analysis (Hydrometer Method)**  
**AASHTO T 88**

**Project No.** 1000-043-10  
**Client** WSP  
**Project** 2020 Local Street and Alley- Highfield St. / Kirkdale St.



**Test Hole** TH20-10  
**Sample #** G66  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 15-Jan-20  
**Test Date** 4-Feb-20  
**Technician** HS

<b>Gravel</b>	0.0%
<b>Sand</b>	3.3%
<b>Silt</b>	45.6%
<b>Clay</b>	51.1%



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	100.00	0.0750	96.67
37.5	100.00	2.00	100.00	0.0547	91.97
25.0	100.00	0.850	99.92	0.0395	87.28
19.0	100.00	0.425	99.83	0.0285	83.21
12.5	100.00	0.180	99.55	0.0185	76.40
9.50	100.00	0.150	99.34	0.0149	73.27
4.75	100.00	0.075	96.67	0.0110	70.14
				0.0079	67.08
				0.0056	63.40
				0.0040	60.71
				0.0028	55.40
				0.0021	51.65
				0.0012	45.44



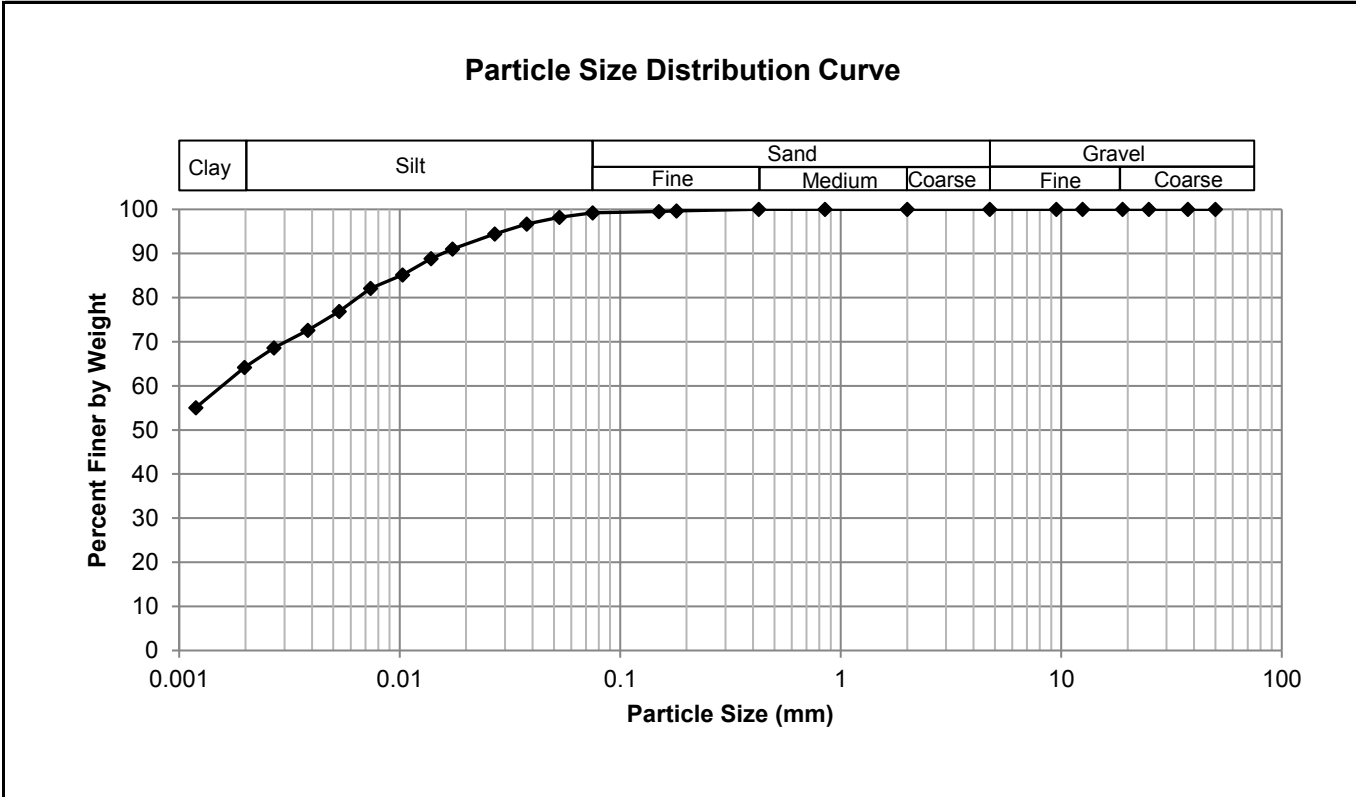
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**Grain Size Analysis (Hydrometer Method)**  
**AASHTO T 88**

**Project No.** 1000-043-10  
**Client** WSP  
**Project** 2020 Local Street and Alley- Highfield St. / Kirkdale St.  
**Test Hole** TH20-11  
**Sample #** G74  
**Depth (m)** 0.9 - 1.1  
**Sample Date** 15-Jan-20  
**Test Date** 20-Feb-20  
**Technician** HS/JSB



<b>Gravel</b>	0.0%
<b>Sand</b>	0.8%
<b>Silt</b>	35.0%
<b>Clay</b>	64.3%



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	99.23
37.5	100.00	2.00	100.00	0.0529	98.22
25.0	100.00	0.850	100.00	0.0377	96.66
19.0	100.00	0.425	99.98	0.0270	94.47
12.5	100.00	0.180	99.62	0.0174	91.03
9.50	100.00	0.150	99.52	0.0139	88.84
4.75	100.00	0.075	99.23	0.0103	85.15
				0.0074	82.09
				0.0053	76.91
				0.0038	72.59
				0.0027	68.59
				0.0020	64.15
				0.0012	55.07