FISHER ENGINEERING

ENGINEERING

Professional Engineers Ontario

GEOTECHNICAL INVESTIGATION

PROPOSED DORMITORY BUILDING,
39 PINE STREET NORTH,
PORT HOPE, ONTARIO

Prepared for:

2640573 Ontario Corp.

400 Esna Park Drive, Unit 15
Markham, ON
L3R 3K2

Tel: (905) 475-7755
Fax: (905) 475-7718
www.fishereng.com

Project No. FG 23-13246

September 29, 2023

Issued to:	2640573 Ontario Corp.
Contact:	Janus Xu janusxu@globeschool.com
Project Name:	Proposed Dormitory Building
Project Address:	39 Pine Street North, Port Hope, Ontario
Project Number:	FG 23-13246
Issued on:	September 29, 2023
Report Prepared by: **(Primary Contact)**	Rajinder Chahal, P. Eng., Senior Project Engineer 647.227.8473 rajinder@fishereng.com
Project Manager:	Clive Wiggan, PhD., PMP., Project Manager clive@fishereng.com
Reviewed By:	Dave Fisher, C. Chem., P. Eng., President dave@fishereng.com

TABLE OF CONTENTS

1. INTRODUCTION

Fisher Engineering Limited was retained by 2640573 Ontario Corp. to carry out a geotechnical subsurface investigation for the proposed dormitory building at 39 Pine Street North, Port Hope, Ontario.

The purpose of the geotechnical investigation was to determine general subsurface conditions in the proposed building location at the site and to provide geotechnical comments/recommendations for the design of the proposed multi-storey building by means of six (6) boreholes.

This report presents the results of tests performed in accordance with the general terms of reference outlined in the scope of work.

The report has been prepared specifically and solely for the proposed new building in regard to geotechnical aspects of design and construction based on the site plan provided.

2. SITE AND PROJECT DESCRIPTION

The subject property is located on the east side of Pine Street North & south of North Street, south-east of the existing 2-storey brick school building in Port Hope, Ontario.

St. John's Anglican Church building was observed west of the proposed building area. Port Hope United Church is located southeast of the subject area.

Residential dwellings were observed east and southwest of the site investigated herein.

We understand that a five-storey dormitory building with basement along with paved driveway/parking is proposed in the area investigated.

However, design details such as type of structure, anticipated footing type/depths, finished ground/basement floor levels, finished grades etc. were not available at the time of the investigation.

3. SCOPE OF GEOTECHNICAL WORK

The geotechnical scope of work included the following:

- Investigation of subsurface conditions at the site by advancing boreholes, soil sampling and visual evaluation.

- Preparation of a geotechnical report with general comments and recommendations regarding:
  - Appropriate foundation depths, type and bearing pressures (SLS & ULS)
  - Seismic site classification
  - Basement construction
  - Pavement construction
  - Excavation etc.

4. METHOD OF INVESTIGATION

Subsurface exploration for the geotechnical investigation was carried out on August 25, 2023, in which a total of six (6) boreholes (BH1 – BH6) were advanced to approximate depths varying from 3.51m to 9.60m below prevailing grades. The approximate locations of the boreholes and elevations are shown on the Borehole Location Plan in Appendix A.

Elevations at borehole/monitoring well locations were interpolated from the site plan prepared by Elliot and Parr (Peterborough), dated September 19, 2023, which was provided during the investigation.

All boreholes were advanced using a track mounted drill rig equipped with solid stems. Subsurface strata were sampled at regular intervals of depth using a split-spoon sampler following the procedure as detailed in ASTM Standard specification D1586 for Standard Penetration Tests. Field tests to determine engineering parameters of the soil were carried out during drilling, which included Standard Penetration Tests (SPT).

All soil samples were taken to our accredited laboratory for final visual assessment, classification and selected moisture content testing & grain size analyses. The samples were tested and classified in general accordance with the Unified Soil Classification System, ASTM D 2487, and Standard Practice for Classification of Soils for Engineering Purposes.

Soil description and test results are presented in the borehole records at Appendix B.

The soil samples recovered during the investigation will be stored in our laboratory for a period of 30 days after which they will be discarded unless further instructions are received.

5. SUBSOIL CONDITIONS

Subsurface conditions encountered at borehole locations are shown on the Borehole Log Sheets in Appendix B. The logs include stratification at borehole locations along with detailed soil description. Variations in soil stratification may occur and should be expected between borehole locations and elsewhere on the site.

ASPHALT/TOPSOIL/FILL

Asphalt was found at the surface of BH1 while topsoil was encountered at the surface of boreholes BH2 & BH4 to BH6. Fill soils were encountered below the above surficial layers and at the surface of BH3.

Fill extended to approximate depths below prevailing grades/elevations as shown in Table 1.

Table 1: Approximate Fill Depths/Elevations

Borehole No.	Surface Elevation (m asl)	Depth of Borehole (m)	Elevation at Bottom of Borehole (m asl)	Depth of Fill (m)	Elevation at Bottom of Fill (m asl)
BH1(MW)	102.69	3.51	99.18	3.10	99.59
BH2(MW)	102.97	5.03	97.94	0.76	102.21
BH3(MW)	102.80	6.55	96.25	2.28	100.52
BH4(MW)	102.67	9.60	93.07	1.68	100.99
BH5(MW)	102.70	5.03	97.67	1.52	101.18
BH6(MW)	102.48	6.55	95.93	2.28	100.20

The fill consisted of dark brown to brown silty sand with some to trace of roots/topsoil/slag with occasional pieces of porcelain.

BROWN/LIGHT BROWN SAND/SILTY SAND/SANDY SILT

Native soils of brown to light brown sand/silty sand to sandy silt were encountered below the fill. Relative density of these soils varied from compact to very dense and they extended to 4.88m bgs in BH3 and termination depths of 3.51m (BH1& BH2), 6.55m (BH6), 9.60m (BH4) and 5.03m (BH5).

BROWN SILT

A dense layer of brown silt was encountered below the brown sand/silty sand of BH3 extending to termination depth of 6.55m.

6. GROUNDWATER CONDITIONS

The boreholes were advanced using dry solid stem auguring and the boreholes were found to be generally dry on completion of the respective soil borings. Monitoring wells were installed in all boreholes to observe groundwater levels and for water sampling and testing.

Groundwater depths/elevations as measured on completion of boreholes and from the monitoring wells are summarized in Table 2.

Table 2: Groundwater Depths and Elevations

Monitoring Well No.	Surface Elevation (m, asl)	Depth of Well, m bgs	Elevation at well base, m asl	In open borehole on Completion		6-Sep-23		22-Sep-23	
				GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl	GW level, m bgs	GW Ele, m asl
BH1(MW)	102.69	3.05	99.64	dry		dry		dry	
BH2(MW)	102.97	4.59	98.38	dry		3.86	99.11	3.93	94.45
BH3(MW)	102.80	4.76	98.04	dry		3.67	99.13	3.73	94.31
BH4(MW)	102.67	6.21	96.46	dry		3.58	99.09	3.64	92.82
BH5(MW)	102.70	4.55	98.15	dry		3.41	99.29	3.48	94.67
BH6(MW)	102.48	4.76	97.72	dry		3.77	98.71	3.82	93.90

Based on the preceding information and visual examination of the soil samples, we consider that water bearing aquifer was encountered within the depths penetrated by boreholes and groundwater levels represent the local groundwater table. Groundwater may also be encountered from the wet seams/pockets/layers trapped inside the fill. This groundwater table may fluctuate with seasonal weather changes.

It should be noted that Fisher also carried out a hydrogeological investigation in conjunction with this geotechnical investigation. Issues pertaining to the groundwater, such as requirements for temporary dewatering, permanent drainage, amount/quality of water for discharge etc., have been discussed/addressed separately in the hydrogeological investigation report. These reports should be read in conjunction when finalizing the subsurface structure design process.

7. GEOTECHNICAL DISCUSSIONS AND RECOMMENDATIONS

7.1 General Discussion

We understand that a 5-storey dormitory building with basement is proposed in the area investigated herein. However, design details such as type of structure, anticipated footing type/depths, finished ground floor levels, finished grades etc. were not available at the time of investigation. For a heated basement, footings will likely be placed at 3m or more below the ground floor level.

The following sections provide general geotechnical comments/recommendations for design and construction for the proposed building.

7.2 Foundation Considerations

Boreholes indicate that natural soils may be used for foundation support using conventional strip and/or spread footing foundations.

- For footings placed over undisturbed natural soils at approximate minimum depths of 1.0m (BH2), 2.4m (BH3), 1.8m (BH4), 1.7m (BH5) and 2.4m (BH6) below existing grades, soil bearing pressures of 240kPa (SLS) & 360kPa (ULS) can be used for foundation design purposes.
- For footings placed over undisturbed natural soils at approximate depths of 2.5m (BHs 2 & 6) and 2.9 m (BHs 3, 4 & 5) below prevailing grades, increased soil bearing pressures of 400kPa (SLS) & 600kPa (ULS) can be used.
- For footings founded at different levels in the vicinity of each other or located adjacent to excavated and backfilled areas, such as sewer trenches/other excavations etc., the slope of the imaginary line joining the bottom of two footings or the bottom of footing and excavation should not be steeper than 1.5H:1V.

- Subsoil conditions at the footing founding levels should be inspected by soils engineer from our office prior to pouring concrete, to ensure that the design soil bearing pressures are being attained.
- Footings subjected to seasonal winter weather, such as exterior wall and column footings, should be founded at least 1.2m below the adjacent finished grades to prevent any damage due to frost penetration.
- During cold/freezing weather conditions founding soils should be adequately protected to prevent any damage due frost penetration.

7.3 Earthquake Considerations

The 2012 OBC Subsection 4.1.8 stipulates that a building should be designed to meet the requirements of the Earthquake Load and Effects. The Site Classification for Seismic Site Response (Table 4.1.8.4.A) is determined from the average Standard Penetration Resistance (N_{60}) of the soils within the upper 30m or the undrained shear strength.

Based on the results of standard penetration tests i.e., “N” values from the current geotechnical investigation of limited depths, site designation for seismic analysis applicable for the proposed building with footings placed over undisturbed natural sandy soils is **"Class D"**. However, we recommend that shear wave velocity measurements should be carried out to determine potential Class ‘C’.

Seismic parameters and analysis requirements are detailed in Subsection 4.1.8 of the 2012 OBC.

7.4 Basement Construction

For basement located above the local water table, the basement walls should be damp proofed and a perimeter weeping tile system should be installed. Perforated weeping tile, at least 100mm in diameter and wrapped in filter fabric, should be placed around the exterior of the perimeter basement wall footings.

The weeping tile should be covered on the top and sides with at least 150mm of 20mm clear stone.

The weeping tile should be placed on original subsoil or compacted backfill in such a way that the top of the weeping tile is below the bottom of the basement floor slab and it drains under gravity into a sewer or frost-free sump pit from which the water is constantly removed.

The exterior faces of perimeter basement walls should be damp-proofed using approved materials & standards of application. In addition, a drainage layer should be installed immediately beside the exterior faces of perimeter basement walls, extending down to the footings. The drainage layer may consist of at least 0.50m wide free draining granular material or Miradrain or equivalent which has a satisfactory/proven record.

Under free drainage conditions, the basement walls may be designed to resist an earth pressure 'P' given by the expression:

$$P = K(\gamma h + q)$$

Where K = coefficient of earth pressure
γ = unit weight of retained soil
h = height of the basement wall below finished grade
q = surcharge load, if any

Recommended estimated values for soil parameters in Table 3 may be used.

Table 3: Soil Parameters

SOIL PARAMETER	FILL	NATIVE SILTY SAND/SAND
Unit weight, γ, *k*N/m^3	18	21
Coefficient of earth pressure at rest (K_o)	0.53	0.38
Coefficient of active earth pressure (K_a)	0.42	0.30
Coefficient of passive earth pressure (K_p)	2.38	3.33

Basement floor slabs can be supported by undisturbed natural soils or engineered fill. A minimum 200mm thick 20mm clear stone bedding should be provided under the basement floor slab.
For basement located below the water table, perimeter and underfloor drainage will be required. Drainage system should be designed by competent professionals; should have sufficient capacity; should be equipped with a backup system and should discharge without migration of any soils.

If above is not feasible or permitted then a water tight basement structure should be provided. Basement walls/floor slab located below the highest water level should be designed to resist lateral/uplift water pressures and water-proofed.

7.5 Pavement Construction

The functional life of a pavement depends directly on subgrade conditions and load carrying capacity of the pavement structure. Minimum flexible pavement structure thicknesses are recommended in Table 4.

The pavement structure should also meet the minimum local municipal/regional design requirements, if any, for the proposed development.

Thicknesses noted in Table 4 are applicable for dry and stable subgrade conditions during summer season construction only. If construction is carried out during winter and for unstable subgrade conditions, the thicknesses of granular materials may have to be increased.

Table 4: Minimum Flexible Pavement Structure Thicknesses

PAVEMENT LAYER	COMPACTED THICKNESSES	
	LIGHT DUTY PARKING	DRIVEWAYS & HEAVY DUTY PARKING
Asphalt top course, HL-3	40mm	40mm
Asphalt base course, HL-8	40mm	60mm
Granular 'A' or 20mm crusher run limestone base	150mm	150mm
Granular 'B' or 50mm crusher run limestone sub-base	200mm	300mm

Granular base materials should conform to O.P.S.S. Form 1010 specifications and be compacted to at least 98% of their SPMDD's. Similarly, asphaltic concretes should meet the O.P.S.S. Form 1150 requirements for specified grades and be compacted to at least 97% of their Marshall Densities.

All topsoil and unsuitable compressible organic & loose fill soils must be removed from the areas to be paved. Exposed subgrade must be proof-rolled to ensure its stability and compactness. Upper 1m of subgrade in fill/backfill areas should be compacted to minimum 98% of SPMDD.

Prior to placement of granular bases, the finished sub-grade should be contoured to eliminate depressions, crowned and sloped at a minimum of 2% towards weeper drains to facilitate drainage of subgrade and base materials.

Water should not be allowed to accumulate at/near the pavement edges. The importance of sub-grade drainage and regular maintenance and repairs cannot be over-emphasized.

7.6 Excavation

It is understood that excavation for the proposed structures/services may extend to depths of 2m or more. According to the Ontario Occupational Health and Safety Act, all excavations deeper than 1.2m should be adequately supported against ground collapse.

Moist fill or sand/silty sand are Type 3 Soils and the cut slopes should be 1H:1V or flatter from the bottom of trench/excavation. However, the presence of wet seams/pockets/layers may require flattening of the side slopes. Wet sand/silty sand, if encountered, is Type 4 Soil.

Field review should be carried out at the time of construction to evaluate the impact of site/groundwater conditions. Excavations extending into wet subsoils, if any, should not proceed until they have been brought into moist state by appropriate dewatering methods.

The excavation sides should be protected to prevent erosion from surface water or water bearing wet pockets/layers.

8. SULPHATE ATTACK

Six (6) soil samples from boreholes BH3 & BH5 between depths of 0.76m and 3.51m were submitted to Fisher Environmental laboratories for chemical analyses related to potential sulphate attack on buried concrete. Results of testing are presented in Appendix C.

- Sulphate concentration in the soil samples tested varied from 0.266mg/kg to 0.322mg/kg or 0.0000266% to 0.0000322%.
- According to CSA-A23. 1-09 Table 3, the above results indicate negligible degree of exposure to sulphate attack (much less than 0.10 to 0.20% for S-3 class exposure).
- pH values varied from 7.47 to 8.22 which are within the acceptable range of 5 - 11 for soils.
- Chloride content was found to vary from less than 10µg/g to 85µg/g.

9. GENERAL CONSIDERATIONS

This report is limited in scope to those items specifically referenced in the text. No other testing and design calculations have been performed except as specifically reported.

The discussions and recommendations presented in this report are intended for the sole guidance of the client named and the design consultants. It should not be relied upon for any other purposes.

The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction.

The fact that localised variations in subsurface conditions may be present between and beyond the boreholes/depths investigated and that those conditions may be significantly different from the general description provided for design purposes should be understood.

Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the subsurface soils and the potential disposal/reuse of these soils on/off Site. Contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.

It is recommended that Fisher be contacted to provide assistance in the interpretation of the borehole records by anyone undertaking work on/or below the ground surface at this site prior to this work being carried out.

The client expressly agrees that Fisher's employees and principals shall have no personal liability to the client in respect of a claim, whether in contract, tort and/or any other cause of action in law. Accordingly, the client expressly agrees that it will bring no proceedings and take no action in any court of law against any of Fisher's employees or principals in their personal capacity.

10. CLOSING

We trust that the foregoing information is sufficient for your present needs and will be pleased to review the contents of this report in greater detail should you so require. Should you require our services further in this regard, please do not hesitate to contact our office.

APPENDIX A – SITE & BOREHOLE LOCATION PLANS

FISHER ENGINEERING

400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755

NORTH

N

LEGEND

PROJECT NAME AND ADDRESS

GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

39 Pine Street North,
Port Hope, ON

FIGURE A1:

SITE LOCATION PLAN

PROJECT NO.	SHEET NO.
FE- 23-13246/47	A1
DATE: 11 September 2023	
SCALE: AS SHOWN	

FISHER ENGINEERING
400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2
Tel: 905 475-7755

NORTH

LEGEND

- SITE BOUNDARY
- BUILDING FOOTPRINT
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- METHANE PROBE LOCATION

PROJECT NAME AND ADDRESS

GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

39 Pine Street North,
Port Hope, ON

FIGURE A2:

SITE PLAN WITH BOREHOLES / MONITORING WELL LOCATIONS

PROJECT NO.	SHEET NO.
FE- 23-13246/47	A2
DATE: 11 September 2023	
SCALE: AS SHOWN	

APPENDIX B – LOGS OF BOREHOLES

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW1 SHEET. 1 of 1

PROJECT NO.: FE-P# 23-13246/47

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 39 Pine Street North., Port Hope, ON

DRILLING METHOD: CME-75 Solid Stem

DRILLING DATE: 25 August, 2023

DEPTH (feet)	DEPTH (meters)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
			102.69			
0	0	ASPHALT ~76mm	0.20 / 102.49		SS-1	16
		FILL: Black foundry slag, occ. pieces of porcelain, moist				
2		FILL: Dark brown to brown silty sand, trace to some slag, pockets of sandy silt, trace roots/topsoil, moist			SS-2	2
4	1					
6					SS-3	5
	2					
8					SS-4	17
10	3	SAND/SILTY SAND: Brown, occ. trace of gravel, moist, compact	3.10 / 99.59		SS-5	25
			3.51 / 99.18			
12	4	End of borehole at 3.51m				
14						
16	5					
18						
20	6					
22						
24	7					
26	8					
28						
30	9					
32						
34	10					

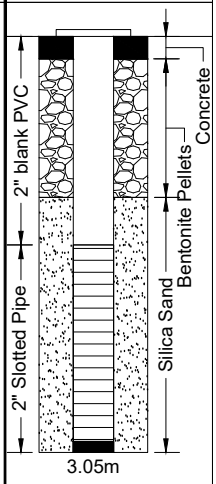
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth (m): on completion: Dry/ On September 6, 2023: Dry

DRAWN: A.M LOGGED: D.G. CHECKED: C.W.

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW2 SHEET. 1 of 1

PROJECT NO.: FE-P# 23-13246/47

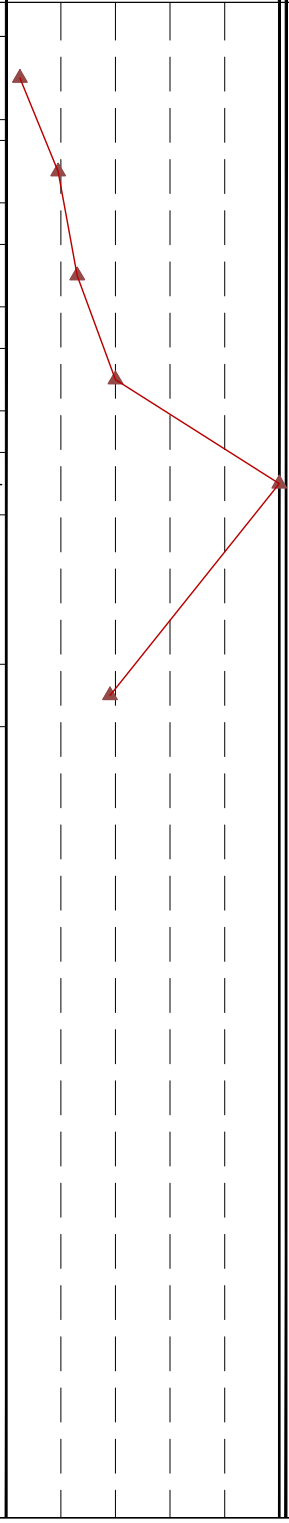
PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

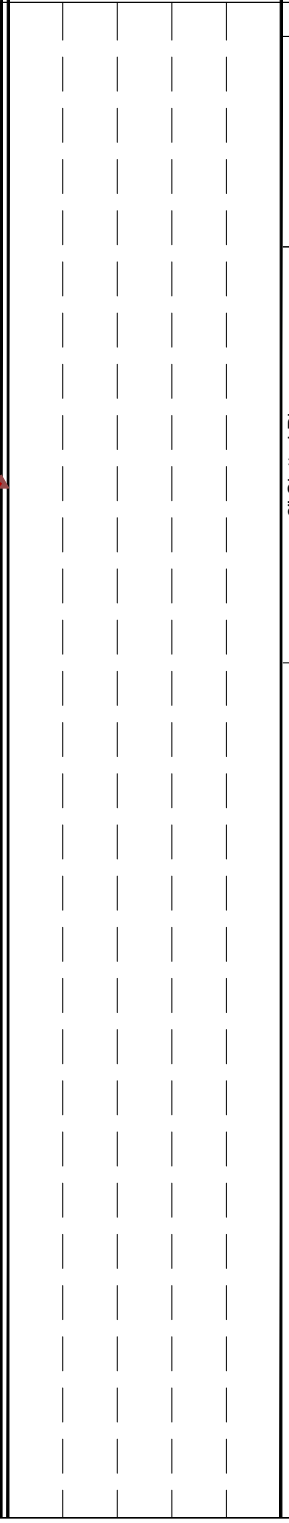
LOCATION: 39 Pine Street North., Port Hope, ON

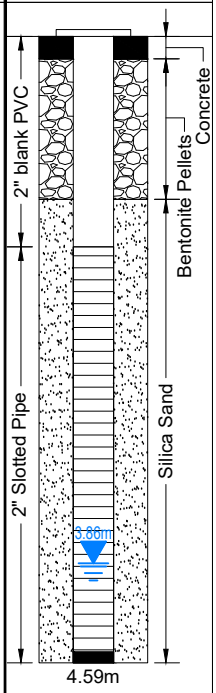
DRILLING METHOD: CME-75 Solid Stem

DRILLING DATE: 25 August, 2023

DEPTH (feet)	DEPTH (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
				102.97			
		TOPSOIL ~150mm		0.15 / 102.82		SS-1	5
0 - 2		FILL: Dark brown to brown silty sand, trace to some topsoil/roots, moist		0.76 / 102.21			
2 - 4	1	SILTY SAND/SANDY SILT: Brown, moist to very moist, compact to very dense				SS-2	19
4 - 6						SS-3	26
6 - 8	2					SS-4	40
8 - 10						SS-5	100+
10 - 12	3			3.51 / 99.46			
12 - 14	4	SAND: Brown, some silt, seam of silt/silty sand, occ. trace of gravel, wet, dense					
14 - 16						SS-6	38
16 - 18	5			5.03 / 97.94			
		End of borehole at 5.03m					
18 - 20							
20 - 22	6						
22 - 24	7						
24 - 26							
26 - 28	8						
28 - 30	9						
30 - 32							
32 - 34	10						







Groundwater Depth (m): on completion: Dry/ On September 6, 2023: 3.86m

DRAWN: A.M | LOGGED: D.G. | CHECKED: C.W.

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW3 SHEET. 1 of 1

PROJECT NO.: FE-P# 23-13246/47

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 39 Pine Street North., Port Hope, ON

DRILLING METHOD: CME-75 Solid Stem

DRILLING DATE: 25 August, 2023

DEPTH (feet)	DEPTH (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
				102.80			
0	0	FILL: Brown to greyish brown silty sand, some slag/pieces of porcelain, moist				SS-1	8
2				0.76 / 102.04			
4	1	FILL: Dark brown to grey sandy to clayey silt, pockets of topsoil/topsoil mixed soil, trace to some roots, trace of gravel, moist				SS-2	6
6	2					SS-3	9
8		SAND/SILTY SAND: Brown, seam/pockets of silt, very moist to wet, compact to very dense		2.28 / 100.52		SS-4	21
10	3					SS-5	58
12							
14	4						
16	5	SILT: Brown, seams/layers of sand/silty sand, wet, dense		4.88 / 97.92		SS-6	48
18							
20	6					SS-7	30
22	7	End of borehole at 6.55m		6.55 / 96.25			
24							
26	8						
28							
30	9						
32							
34	10						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

19.9%

16.3%

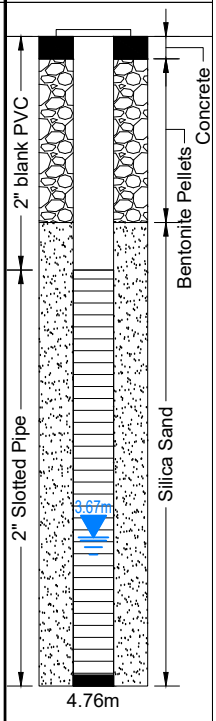
18.6%

18.4%

18.4%

17.1%

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth (m): on completion: Dry/ On September 6, 2023: 3.67

DRAWN: A.M | LOGGED: D.G. | CHECKED: C.W.

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW4 SHEET. 1 of 1

PROJECT NO.: FE-P# 23-13246/47

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 39 Pine Street North., Port Hope, ON

DRILLING METHOD: CME-75 Solid Stem

DRILLING DATE: 25 August, 2023

DEPTH (feet)	DEPTH (meters)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
			102.67			
0	0	TOPSOIL ~102mm				
		FILL: Dark brown to brown silty sand, trace of topsoil/roots/slag/gravel, moist			SS-1	5
2	1				SS-2	5
4						
			1.68 / 100.99		SS-3	24
6	2	SAND/SILTY SAND: Brown to light brown, trace of gravel, moist, compact				
8					SS-4	27
10	3		3.05 / 99.62			
		SANDY SILT: Light brown, trace of clay/gravel, moist, very dense			SS-5	100+
12			3.96 / 98.71			
	4	SAND/SILTY SAND: Brown, very moist to wet, very dense to dense				
14						
16	5				SS-6	100+
18						
20	6				SS-7	37
22	7					
24						
26	8				SS-8	42
28			8.53 / 94.14			
	9	SAND: Grey, some silt, wet, dense				
30					SS-9	34
			9.60 / 93.07			
32	10	End of borehole at 9.60m				
34						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

14.0%

4.3%

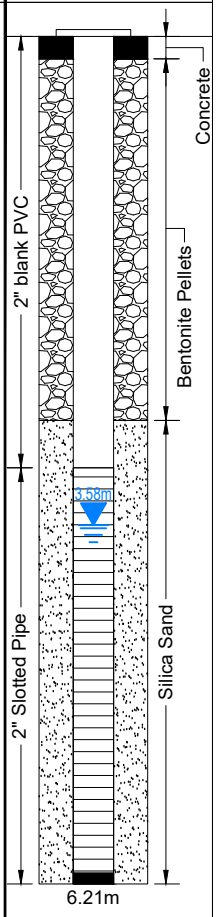
5.1%

12.6%

17.4%

19.3%

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth (m): on completion: Dry/ On September 6, 2023: 3.58m

DRAWN: A.M LOGGED: D.G. CHECKED: C.W.

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW5 SHEET. 1 of 1

PROJECT NO.: FE-P# 23-13246/47

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 39 Pine Street North., Port Hope, ON

DRILLING METHOD: CME-75 Solid Stem

DRILLING DATE: 25 August, 2023

DEPTH (feet)	DEPTH (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
				102.70			
0	0	TOPSOIL ~102mm				SS-1	5
2	1	FILL: Dark brown to brown silty sand, trace of roots/topsoil/slag, moist				SS-2	5
4				1.52 / 101.18			
6	2	SANDY SILT: Light brown, trace of clay/gravel, moist, compact to dense				SS-3	22
8						SS-4	32
				2.79 / 99.91			
10	3	SAND/SILTY SAND: Brown, seam/pockets of silt/sandy silt, moist to very moist, very dense to dense				SS-5	100+
12	4						
14							
16	5					SS-6	36
				5.03 / 97.67			
		End of borehole at 5.03m					
18							
20	6						
22	7						
24							
26	8						
28							
30	9						
32	10						
34							

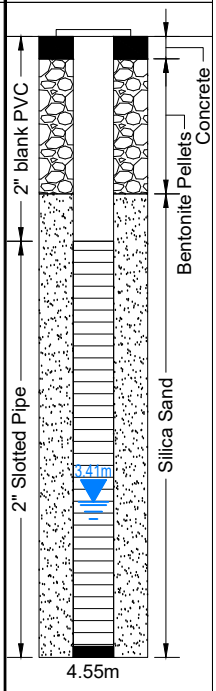
PENETRATION TESTING (SPT) ▲ 20 40 60 80

SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth (m): on completion: Dry/ On September 6, 2023: 3.41m

DRAWN: A.M LOGGED: D.G. CHECKED: C.W.

FISHER ENGINEERING

LOG OF BOREHOLE

NO. MW6 SHEET. 1 of 1

PROJECT NO.: FE-P# 23-13246/47

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 39 Pine Street North., Port Hope, ON

DRILLING METHOD: CME-75 Solid Stem

DRILLING DATE: 25 August, 2023

DEPTH (feet)	DEPTH (meters)	DESCRIPTION	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE
			102.48			
0	0	TOPSOIL ~102mm				
		FILL: Dark brown to brown silty sand, trace to some topsoil/slag, occ. pieces of porcelain, trace of gravel, moist			SS-1	7
2	1				SS-2	9
4						
6	2				SS-3	7
			2.28 / 100.20			
8		SAND/SILTY SAND: Brown, seam/pockets of silt/sandy silt, moist, dense to very dense			SS-4	32
10	3				SS-5	100+
12						
	4	Wet below 4m				
14						
16	5				SS-6	61
18						
20	6				SS-7	60
			6.55 / 95.93			
22	7	End of borehole at 6.55m				
24						
26	8					
28						
30	9					
32						
	10					
34						

PENETRATION TESTING (SPT) ▲ 20 40 60 80

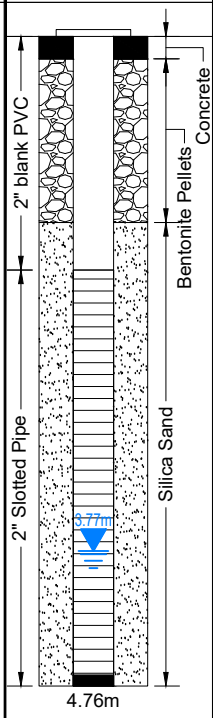
SHEAR STRENGTH (Kpa) ✚ 40 80 120 160

VAPOUR READING (ppm) □ 20 40 60 80

MOISTURE CONTENT (%) ● 10 20 30 40

SS-2	7.0%
SS-3	7.2%
SS-4	17.6%
SS-5	17.1%
SS-6	18.1%
SS-7	18.7%

PIEZOMETER OR WELL CONSTRUCTION



Groundwater Depth (m): on completion: Dry/ On September 6, 2023: 3.77m

DRAWN: A.M LOGGED: D.G. CHECKED: C.W.

APPENDIX C – LABORATORY TEST RESULTS

Project Name:	Geotechnical Investigation	***F.E. Lab #:***	23-754
Client:	2640573 Ontario Inc.	***Date Sampled:***	25-Aug-2023
Project ID:	23-13246	***Date Received:***	28-Aug-2023
Location:	39 Pine Street North, Port Hope, Ontario	***Date Reported:***	12-Sep-2023

Certificate of Analysis

Analyses	Matrix	Quantity	Testing Date	Method Reference
Moisture Content	Soil	18	28-Sep-23	ASTM D2216
Grain Size (Sieve Analysis)	Soil	7	05-Sep-23	LS-602
Grain Size (Hydrometer)	Soil	3	11-Sep-23	LS-702
Atterberg test	Soil	0	N.A.	LS-703/704

Authorized by: Behnam Sayad-Pour

Behnam Sayad Pour Zanjani
Geo-Lab Supervisor

400 Esna Park Drive, Unit 15, Markham, ON L3R 3K2
Tel:(905) 475-7755 www.fishereng.com

Certificate of Analysis

Analysis Requested:	Moisture Content	***Sample Description:***	18 Soil Sample(s)

Sample Info	BH3 SS2	BH3 SS3	BH3 SS4	BH3 SS5	BH3 SS6 A	BH3 SS6 B
Sample Depth (m)	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51	4.58-4.88	4.88-5.03
Moisture Content (%)	19.9	16.3	18.6	18.4	18.4	17.1

Sample Info	BH4 SS2	BH4 SS3	BH4 SS4	BH4 SS5	BH4 SS6	BH4 SS7
Sample Depth (m)	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51	4.58-5.03	6.1-6.56
Moisture Content (%)	14.0	4.3	5.1	12.6	17.4	19.3

Sample Info	BH6 SS2	BH6 SS3	BH6 SS4	BH6 SS5	BH6 SS6	BH6 SS7
Sample Depth (m)	0.76-1.22	1.53-1.98	2.29-2.75	3.05-3.51	4.58-5.03	6.1-6.56
Moisture Content (%)	7.0	7.2	17.6	17.1	18.1	18.7

Certificate of Analysis

Analysis Requested:	Grain Size (Sieve Analysis)	***Sample Quantity:***	7	Soil Sample(s)

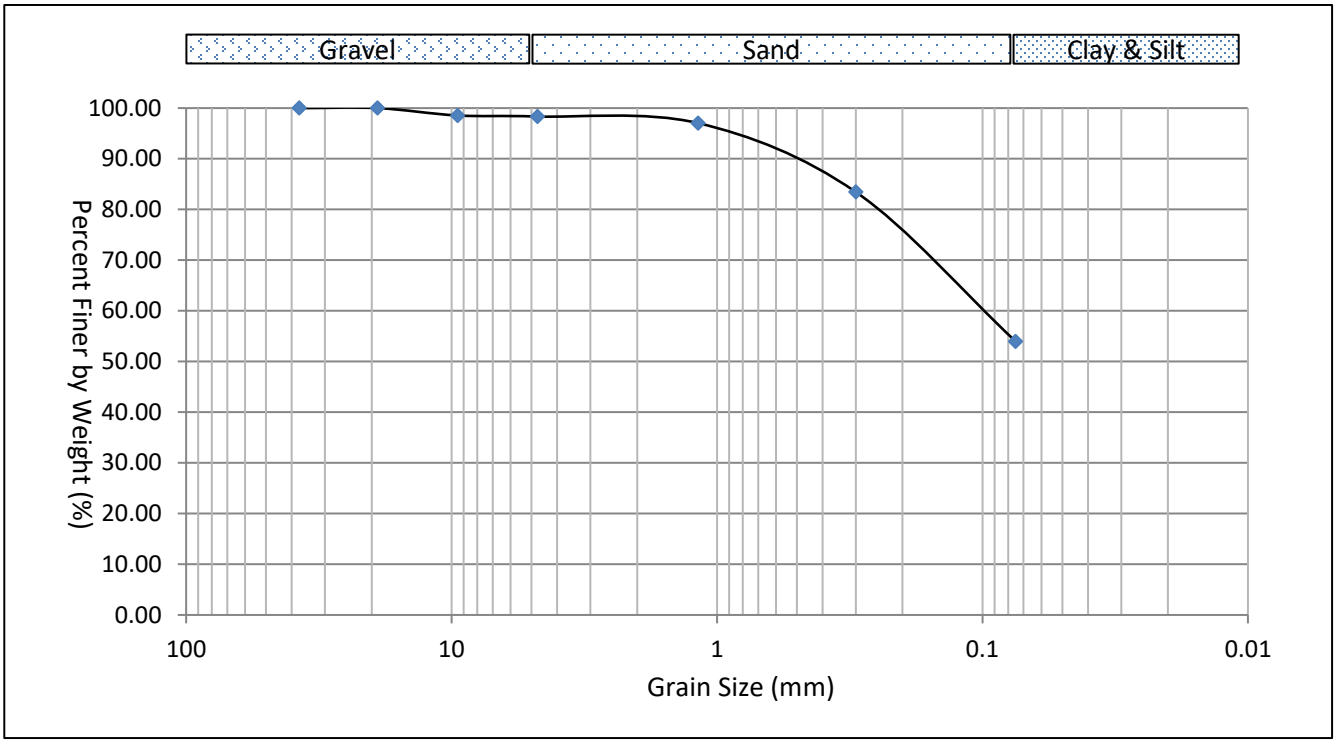
Sample Info	***23-755 BH3 SS2***	***23-757 BH3 SS6 A***	***23-758 BH3 SS6 B***	***23-759 BH4 SS2***	***23-760 BH4 SS4***	***23-762 BH6 SS2***
Sample Depth (m)	***0.76-1.22***	***4.58-4.88***	***4.88-5.03***	***0.76-1.22***	***2.29-2.75***	***0.76-1.22***
Grain Size (%)						
>19mm	0.0	0.0	0.0	0.0	0.0	0.0
9.5mm-19mm	1.5	0.0	0.0	2.0	1.3	12.4
4.75mm-9.5mm	0.2	0.2	0.0	2.2	2.6	15.0
1.18mm-4.75mm	1.3	0.1	0.2	1.7	1.7	15.7
300um-1.18mm	13.6	1.1	0.9	21.6	35.2	12.6
75um-300um	29.5	64.4	8.9	43.8	47.0	27.2
<75um	54.0	34.3	90.0	28.7	12.2	17.1
Clay and Silt	**54.0**	**34.3**	**90.0**	**28.7**	**12.2**	**17.1**
Sand	**44.4**	**65.6**	**10.0**	**67.1**	**83.9**	**55.5**
Gravel	**1.7**	**0.2**	**0.0**	**4.2**	**3.9**	**27.4**

Sample Info	***23-764 BH6 SS6***					
Sample Depth (m)	***4.58-5.03***					
Grain Size (%)						
>19mm	0.0					
9.5mm-19mm	0.8					
4.75mm-9.5mm	0.9					
1.18mm-4.75mm	0.7					
300um-1.18mm	1.1					
75um-300um	38.0					
<75um	58.6					
Clay and Silt	**58.6**					
Sand	**39.8**					
Gravel	**1.6**					

Grain Size Distribution

Sample ID: 23-755 BH3 SS2 (0.76-1.22m)

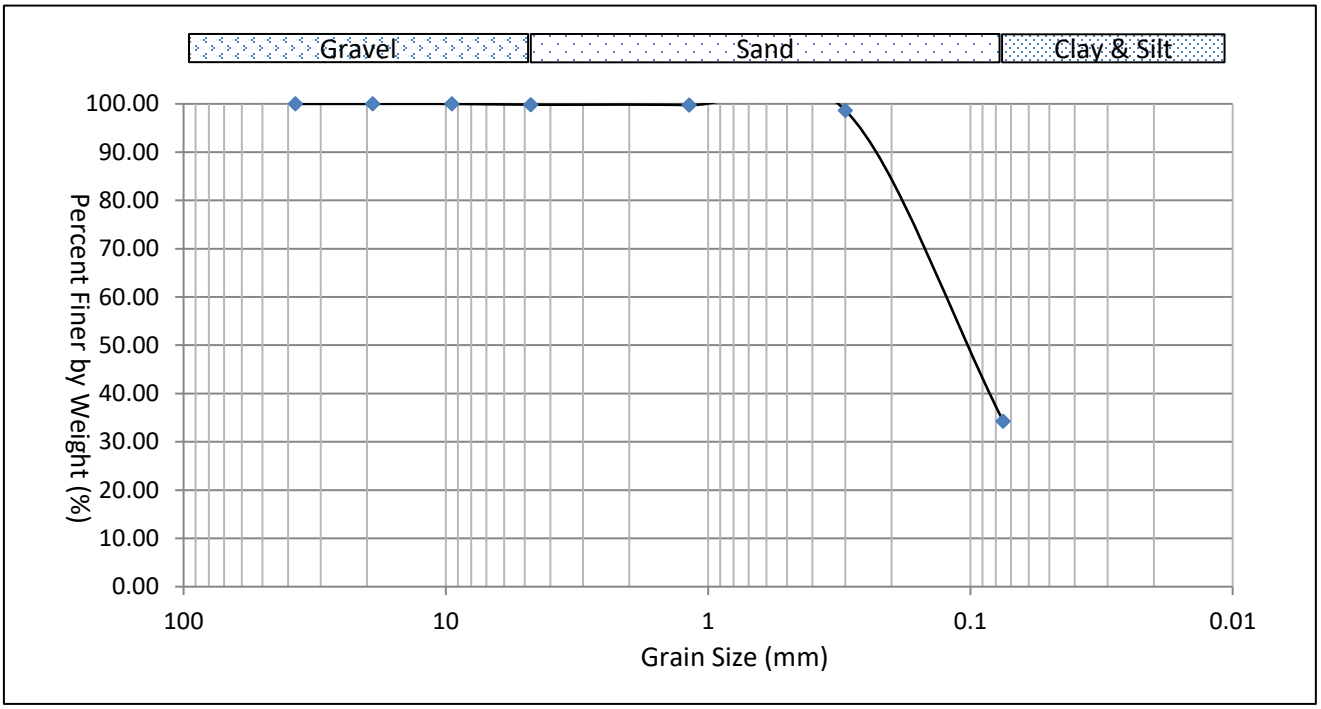
Gravel: 1.7% Sand: 44.4% Clay and Silt 54%



Grain Size Distribution

Sample ID: 23-757 BH3 SS6 A (4.58-4.88m)

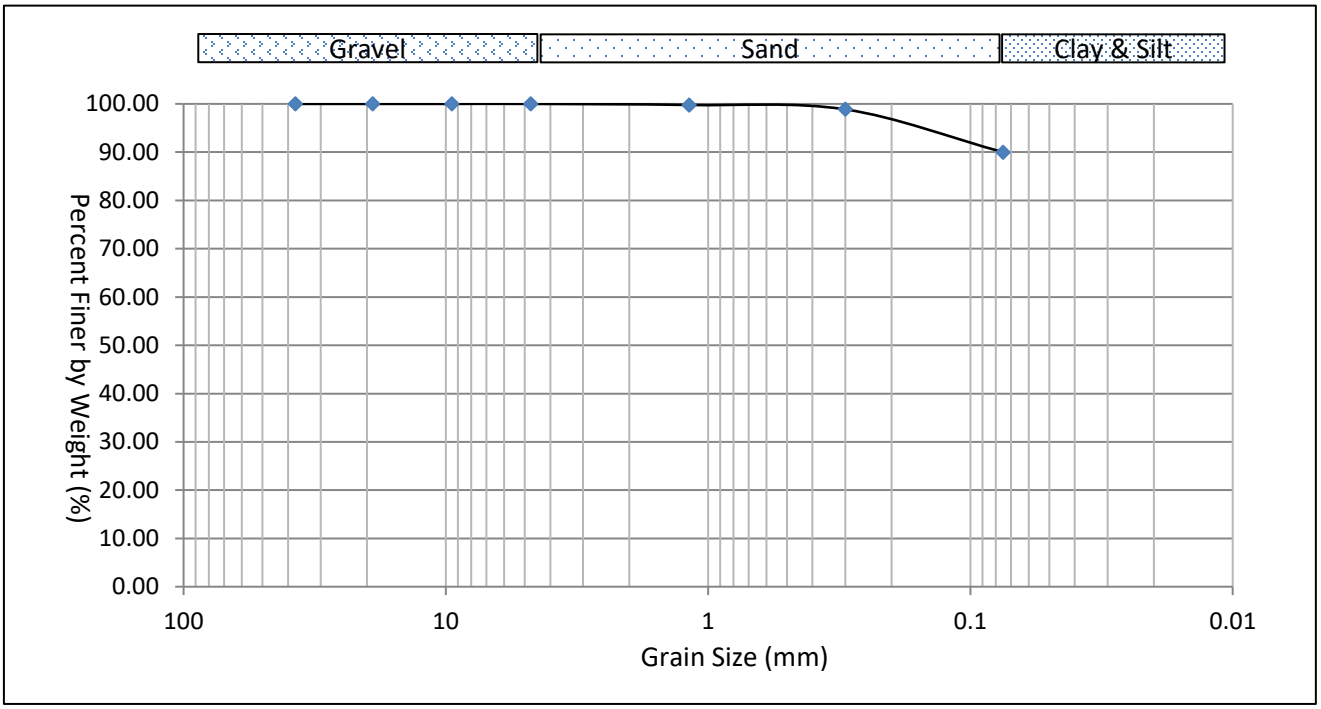
Gravel: 0.2% Sand: 65.6% Clay and Silt 34.3%



Grain Size Distribution

Sample ID: 23-758 BH3 SS6 B (4.88-5.03m)

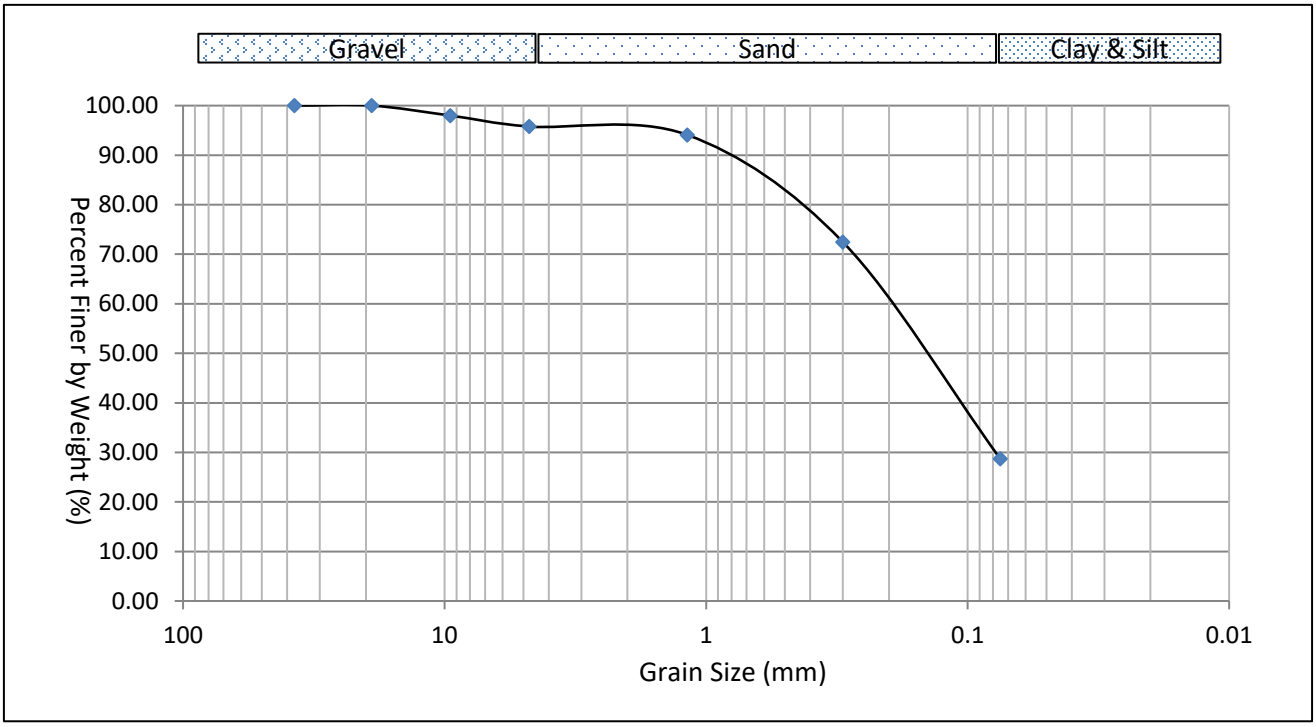
Gravel: 0% Sand: 10% Clay and Silt 90%



Grain Size Distribution

Sample ID: 23-759 BH4 SS2 (0.76-1.22m)

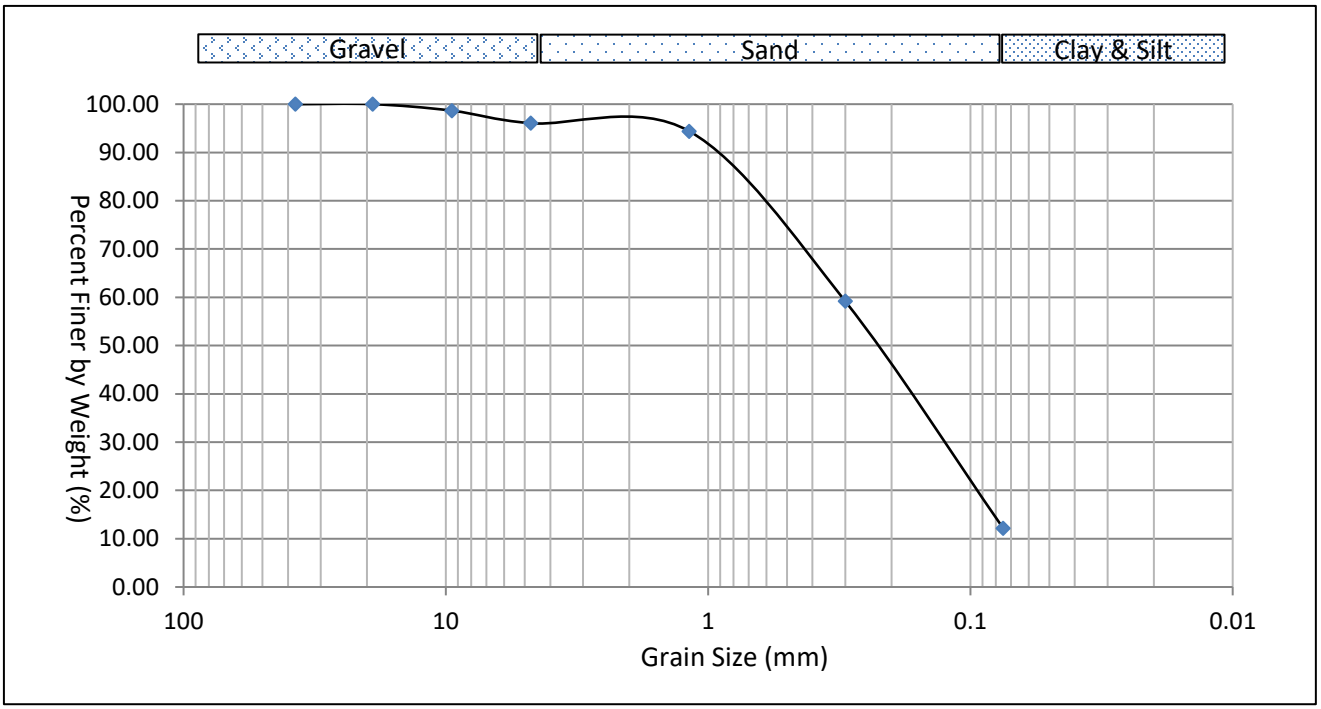
Gravel: 4.2% Sand: 67.1% Clay and Silt 28.7%



Grain Size Distribution

Sample ID: 23-760 BH4 SS4 (2.29-2.75m)

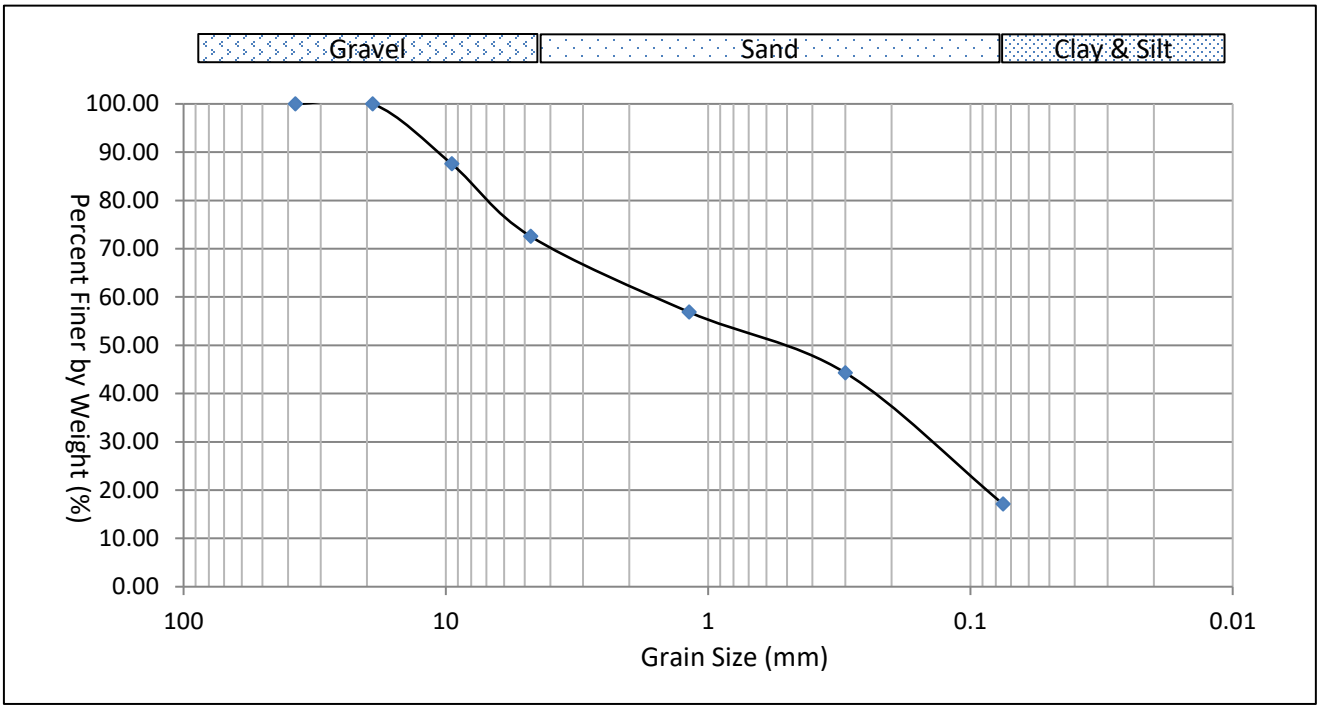
Gravel: 3.9% Sand: 83.9% Clay and Silt 12.2%



Grain Size Distribution

Sample ID: 23-762 BH6 SS2 (0.76-1.22m)

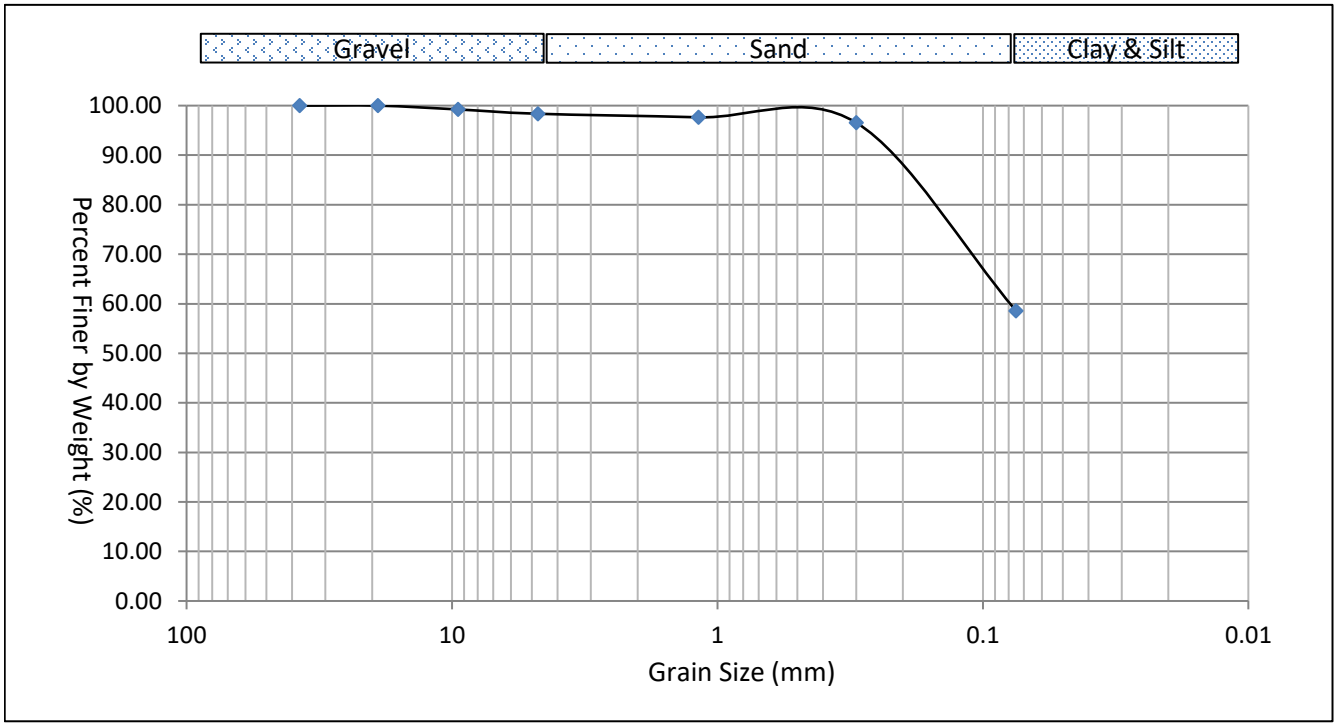
Gravel: 27.4% Sand: 55.5% Clay and Silt 17.1%



Grain Size Distribution

Sample ID: 23-764 BH6 SS6 (4.58-5.03m)

Gravel: 1.6% Sand: 39.8% Clay and Silt 58.6%



F.E. Job #: 23-754

Certificate of Analysis

Analysis Requested:	Grain Size (Hydrometer)
Sample Description:	3 Soil Sample(s)

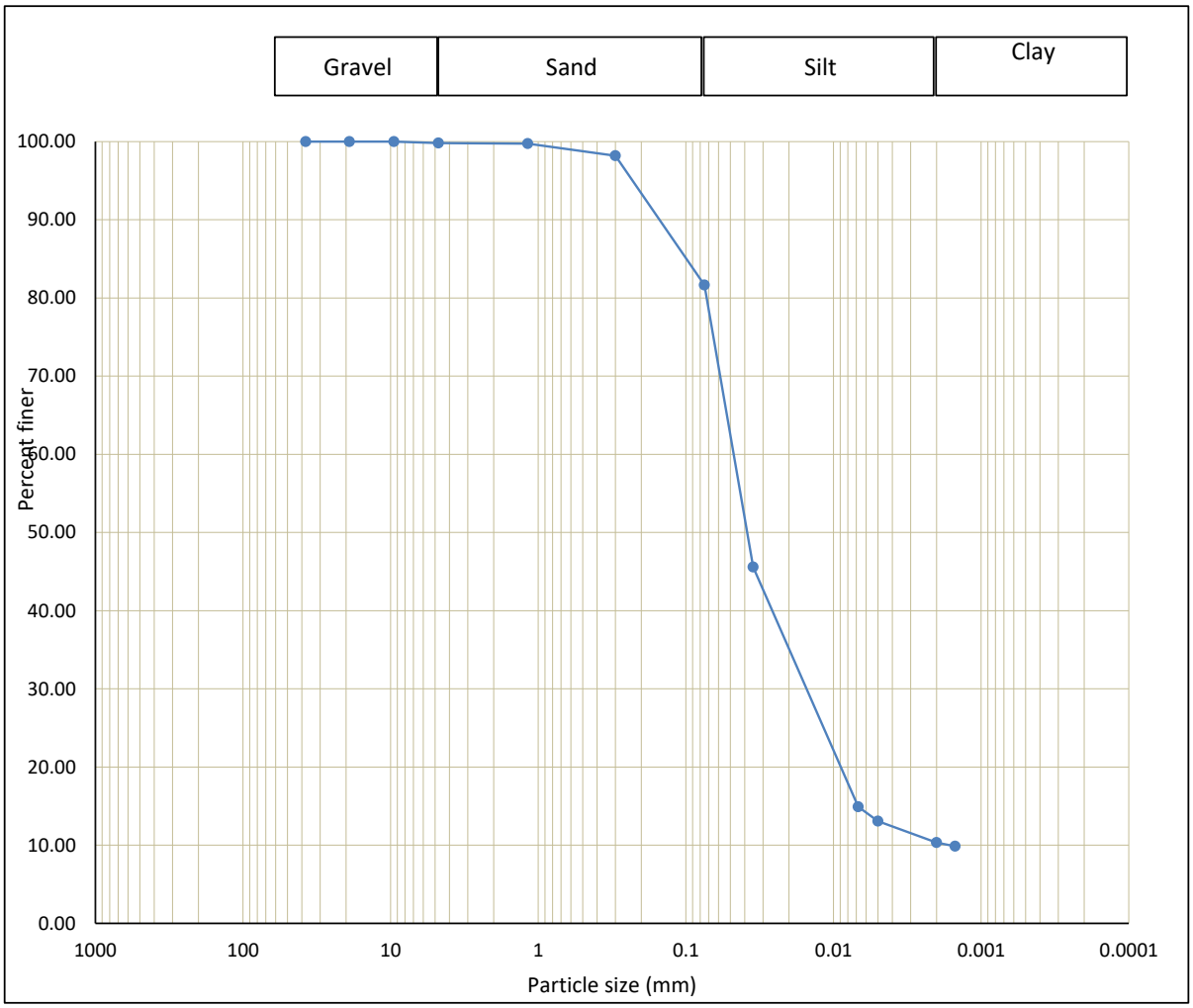
Sample Info	***23-756 BH3 SS4***	***23-761 BH4 SS6***	***23-763 BH6 SS4***			
Sample Depth (m)	***2.29-2.75***	***4.58-5.03***	***2.29-2.75***			
Grain Size (%)						
>19mm	0.0	0.0	0.0			
9.5mm-19mm	0.0	0.0	0.0			
4.75mm-9.5mm	0.2	0.0	0.3			
1.18mm-4.75mm	0.1	0.4	0.1			
300um-1.18mm	1.5	0.4	0.5			
75um-300um	16.5	42.5	24.6			
5um-75um	68.6	48.4	63.9			
2um-5um	2.8	1.7	1.0			
<2um	10.3	6.6	9.5			
Clay	**10.3**	**6.6**	**9.5**			
Silt	**71.3**	**50.1**	**64.9**			
Sand	**18.2**	**43.3**	**25.3**			
Gravel	**0.2**	**0.0**	**0.3**			

F.E. Job #: 23-754

Grain Size Distribution

Sample ID: 23-756 BH3 SS4 (2.29-2.75m)

Gravel: 0.2% Sand: 18.2% Silt: 71.3% Clay: 10.3%

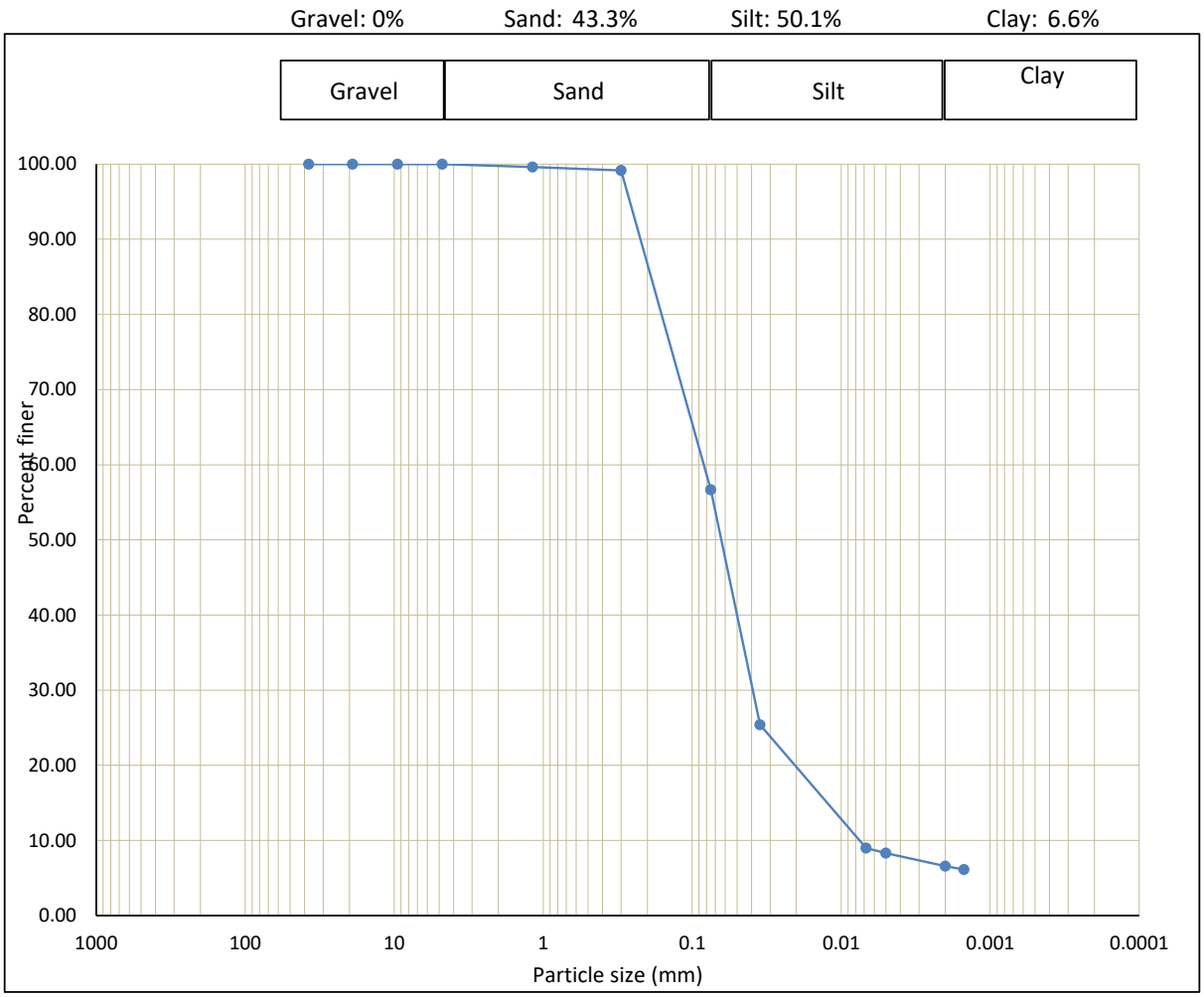


Sample ID: 23-756 BH3 SS4 (2.29-2.75m)		
Diameter	***Weight (%)***	***Grain Size***
>4.75mm	0.2	Gravel
1.18mm-4.75mm	0.1	Coarse Sand
300um-1.18mm	1.5	Medium Sand
75um-300um	16.5	Fine Sand
5um-75um	68.6	Silt
2um-5um	2.8	
<2um	10.3	Clay

F.E. Job #: 23-754

Grain Size Distribution

Sample ID: 23-761 BH4 SS6 (4.58-5.03m)



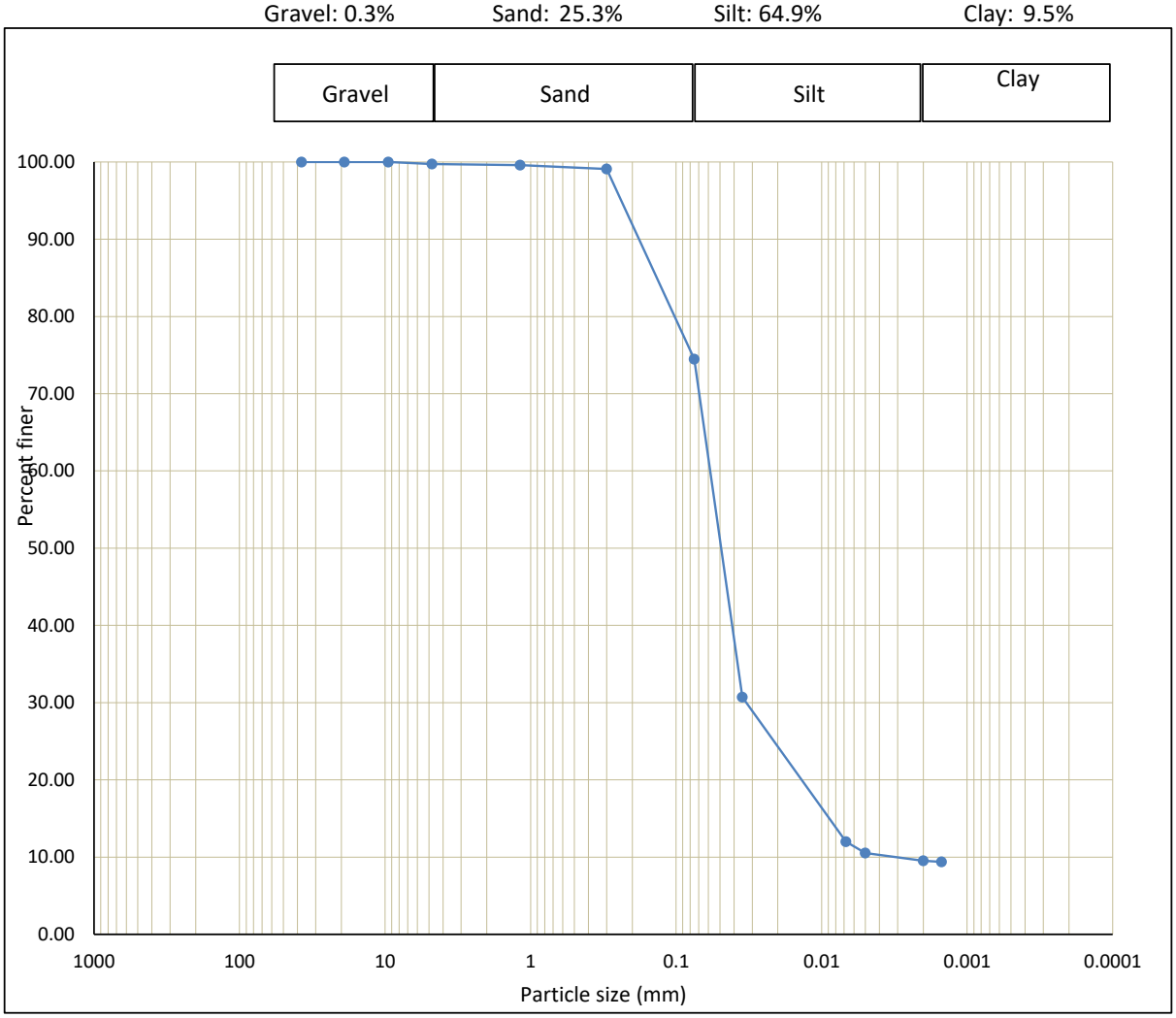
Sample ID: 23-761 BH4 SS6 (4.58-5.03m)		
Diameter	***Weight (%)***	***Grain Size***
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.4	Coarse Sand
300um-1.18mm	0.4	Medium Sand
75um-300um	42.5	Fine Sand
5um-75um	48.4	Silt
2um-5um	1.7	
<2um	6.6	Clay

F.E. Job #: 23-754

Grain Size Distribution

Sample ID: 23-763 BH6 SS4 (2.29-2.75m)

Gravel: 0.3% Sand: 25.3% Silt: 64.9% Clay: 9.5%



Sample ID: 23-763 BH6 SS4 (2.29-2.75m)		
Diameter	***Weight (%)***	***Grain Size***
>4.75mm	0.3	Gravel
1.18mm-4.75mm	0.1	Coarse Sand
300um-1.18mm	0.5	Medium Sand
75um-300um	24.6	Fine Sand
5um-75um	63.9	Silt
2um-5um	1.0	
<2um	9.5	Clay

FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

400 ESNA PARK DRIVE #15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718
www.fisherenvironmental.com

Client: 2640573 Ontario Corp.
Address:

Tel.:
Email:
Attn.:

F.E. Job #: 23-1767
Project Name: Geotechnical Investigation
Project ID: FG-P 23-13246
Date Sampled: 25-Aug-2023
Date Received: 29-Aug-2023
Date Reported: 6-Sep-2023
Location: 39 Pine Street North
Port Hope, ON

Certificate of Analysis

Analyses	Matrix	Quantity	Date Extracted	Date Analyzed	Lab SOP	Method Reference
pH	Soil	6	29-Aug-23	29/30/2023	pH-EC-SAR F-16	SW-846, 9045D
Chloride	Soil	6	N/A	30-Aug-23	Chloride F-20	SM 4500-Cl-E
Sulphate	Soil	6	29-Aug-23	30-Aug-23	Sulphate F-21	SM 4500-SO_4

Fisher Environmental Laboratories is accredited by CALA (the Canadian Association for Laboratory Accreditation Inc.) for specific parameters as required by Ontario Regulation 153/04. All analytical testing has been performed in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act published by Ontario Ministry of the Environment.

Authorized by:

Roger Lin, Ph. D., C. Chem.
Laboratory Manager

Results related only to the items tested

Certificate of Analysis

Analysis Requested:	pH, Chloride, Sulphate
Sample Description:	6 Soil Sample(s)

Parameter	***23-1767-1*** BH3 SS2 0.76-1.22m	***23-1767-2*** BH3 SS3 1.52-1.98m	***23-1767-3*** BH3 SS5 3.05-3.51m	***23-1767-4*** BH5 SS2 0.76-1.22m	***23-1767-5*** BH5 SS3 1.52-1.98m	**Soil Standards** *
pH *(pH unit)*	7.47	7.91	8.22	7.67	7.94	(5-11) 5-9

Parameter	***23-1767-6*** BH5 SS5 3.05-3.51m					**Soil Standards** *
pH *(pH unit)*	7.93					(5-11) 5-9

* Surface soil pH value from 5 - 9, Sub-surface soil pH value from 5-11.

QA/QC Report

Parameter	**LCS**	**AR**	**Duplicate**	**AR**		
	Absolute Difference *(pH Unit)*					
pH *(pH unit)*	6.95	6.90-7.20	0.03	<0.3		

LEGEND:
LCS - Laboratory Control Sample
AR - Acceptable Range

Certificate of Analysis

Analysis Requested:	pH, Chloride, Sulphate
Sample Description:	6 Soil Sample(s)

Parameter	***23-1767-1*** BH3 SS2 0.76-1.22m	***23-1767-2*** BH3 SS3 1.52-1.98m	***23-1767-3*** BH3 SS5 3.05-3.51m	***23-1767-4*** BH5 SS2 0.76-1.22m	***23-1767-5*** BH5 SS3 1.52-1.98m	***23-1767-6*** BH5 SS5 3.05-3.51m
	Concentration (µg/g)					
Chloride in Soil	<10	<10	18	<10	<10	85

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	**Blank**	**RL**	**LCS**	**AR**	**MS**	**AR**
	(µg/g)		**Recovery (%)**		**Recovery (%)**	
Chloride in Soil	<10	10	97	70-130	100	70-130

Parameter	**Duplicate**	**AR**				
	RPD (%)					
Chloride in Soil	8.4	0-20				

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
MS - Matrix Spike
AR - Acceptable Range
RPD - Relative Percent Difference

Certificate of Analysis

Analysis Requested:	pH, Chloride, Sulphate
Sample Description:	6 Soil Sample(s)

Parameter	***23-1767-1*** BH3 SS2 0.76-1.22m	***23-1767-2*** BH3 SS3 1.52-1.98m	***23-1767-3*** BH3 SS5 3.05-3.51m	***23-1767-4*** BH5 SS2 0.76-1.22m	***23-1767-5*** BH5 SS3 1.52-1.98m	***23-1767-6*** BH5 SS5 3.05-3.51m
Sulphate *(mg/kg)*	0.292	0.276	0.266	0.273	0.3	0.322

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	**Blank**	**RL**	**LCS/Spike**	**AR**	**Duplicate**	**AR**
	(mg/kg)		**Recovery (%)**		**RPD (%)**	
Sulphate	<1	1	99	70-130	12	0-30

LEGEND:
RL - Reporting Limit
LCS - Laboratory Control Sample
AR - Acceptable Range
RPD - Relative Percent Difference