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Our ref: 12563534-01

26 November 2021

Tom Livi
tomlivis@gmail.com

Geotechnical Investigation – Proposed Storage Facility
192 County Road 4, Peterborough, Ontario

Attn: Tom Livi

1. Introduction

This letter presents the results of a geotechnical investigation conducted to support design and construction of a proposed storage facility at the property located on 192 County Road 4, Peterborough, Ontario (the Site). The site location is illustrated on the attached Site Location Map (Figure 1). GHD Limited (GHD) was retained by Tom Livi (the Client) to complete this work. The work conducted for this investigation was carried out in accordance with our proposal Livi-2 dated September 20, 2021.

It is GHD's understanding that the proposed development will include construction of multiple 1-storey storage units with associated asphalt paved access / parking areas. Further details of proposed development, such as development layout, site grading plans and structural parameters of storage units, were not available at the time of preparation of this report.

The purpose of this investigation was to verify the subsurface soils and groundwater conditions at the Site and to develop geotechnical engineering recommendations relevant to earthwork construction, reuse of existing soils as backfill material, foundations and pavement structure design.

2. Field and Laboratory Procedures

A field investigation was conducted under the supervision of GHD staff on October 15, 2021. The work consisted of subsurface exploration by means of advancing and sampling a total of eight (8) test pits to depths ranging from 1.5 to 3.0 metres below ground surface (mbgs). The location of each test pit is illustrated on the attached Test Hole Plan (Figure 2).

A detailed log of each borehole was maintained, and representative samples of the materials encountered in the boreholes were collected. A detailed log of each borehole is presented in Appendix A.

The test pits were advanced using a rubber-tire backhoe. Soil samples obtained from the test pits were inspected in the field immediately upon retrieval for type, texture, and colour. All samples were sealed in clean plastic containers and transported to the GHD laboratory for further visual-tactile examination, and to select appropriate samples for laboratory analysis.

Groundwater measurements and observations were obtained from the open test pits during excavating operations. Groundwater data is presented on individual test pit logs.

Upon completion, the test pits were backfilled with the excavated soils.

Physical laboratory testing was completed on representative soil samples and consisted of moisture content tests on all samples recovered and gradation analyses on a total of three (3) representative soil samples including hydrometers. The analytical results of the moisture content tests are plotted on the attached logs. The results of the gradation tests are incorporated into the test pit logs and are presented graphically in Appendix B.

3. Subsurface Conditions

Details of the subsurface conditions encountered at the Site are graphically presented on the test pit logs (Appendix A). It should be noted that the boundaries between the strata have been inferred from the test hole observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions may vary between and beyond the test holes.

The test pits generally encountered a surficial layer of topsoil and/or fill, over native till. The topsoil layer was encountered in all test pits, with the exception of test pit TP4-21, and ranged from approximately 50 to 460 mm in thickness. Fill material was encountered in all test pits, with the exception of TP4-21 and TP8-21 and extended to depths ranging from 0.3 to 1.8 mbgs. The fill material encountered in test pit TP3-21 (old septic bed) consisted of filter sand with gravel to depths of about 1.5 mbgs. The fill material encountered in the remaining test pits generally consisted of reworked native silty sand till containing occasional cobbles and boulders and was observed to be in a moist to wet in-situ state. A buried topsoil layer was observed between the fill and native till in test pits TP2-21, TP6-21 and TP7-21. The native till was light brown or brownish grey in colour, generally consisted of sand with varying amount of gravel, silt and clay, occasional cobbles and boulders and extended to the full depth of this investigation.

Representative samples of the material encountered were submitted to the soils laboratory for analyses and characterization. Grain size distribution analyses were carried out on three (3) representative soil samples and are summarized in Table 1 below. The results of the gradation tests are incorporated into the borehole logs and are presented graphically in Appendix B.

Table 1 Summary of Grain Size Distribution Results

Borehole No./ Sample No.	Sample Depth (m)	Grain Size (%)				Observed Soil Unit
		Gravel	Sand	Fines		
				Silt	Clay	
TP1-21/ GS2	2.0 – 2.1	26	33	34	7	Silty Sand Till
TP3-21/ GS2	0.8 – 0.9	15	77	7	1	Sand with Gravel
TP6-21/ GS3	2.1 – 2.3	32	30	33	6	Silty Gravel and Sand Till

Notes:
%Fines indicates silt and clay particles.
Grain size distribution percentages based on a per mass basis.

Groundwater observations and measurements were obtained from the open test pits during and upon completion of excavating each test pit. Groundwater seepage and/or accumulation was observed in all the test pits except for TP3-21 and TP4-21. Groundwater seepage was observed at depths ranging from 0.8 to 1.8 mbgs. Heavy groundwater seepage was observed within TP7-21 at a depth of 2.1 mbgs. This was close to the exterior drainage ditch full of water.

It must be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation, and temperature.

4. Conclusions and Recommendations

Supporting data upon which our recommendations are based have been presented in the foregoing sections of this report. The following recommendations are governed by the physical properties of the subsurface materials that were encountered at the site and assume that they are representative of the overall site conditions. It should be noted that these conclusions and recommendations are intended for use by the designers only. Contractors bidding on or undertaking any work at the Site should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of this factual data as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and the like. Comments, techniques, or recommendations pertaining to construction should not be construed as instructions to the contractor.

It is GHD's understanding that the proposed development will include construction of multiple 1-storey storage units with associated asphalt paved access / parking areas. Further details of proposed development, such as development layout, site grading plans and structural parameters of storage units, were not available at the time of preparation of this report.

4.1 Site Preparation Grading and Backfill

Based on the subsurface conditions encountered in the boreholes, the Site is generally underlain by a surficial layer of topsoil and/or fill (reworked till), underlain by native soils generally consisting of native silty sand with gravel till.

Any topsoil, asphalt, vegetation, disturbed earth, fill, organic and organic-bearing material should be removed from the footprint of the proposed building area and from within pavement areas prior to site grading activities. If reuse of the removed fill soil is planned, care will be required during excavation to separate materials containing significant amounts of topsoil / organics or rootlets from the clean excavated material.

The subgrade soils exposed after the removal of the disturbed native soils within the proposed building areas and unsuitable materials within proposed pavement areas should be visually inspected, compacted if required, and proof rolled using large axially loaded equipment. Any loose, organic, or unacceptable areas should be subexcavated and removed as directed by the Engineer and replaced with suitable fill materials compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD). Clean earth fill used to raise grades in the proposed buildings and pavement areas should be placed in thin layers (200 mm thick or less) and compacted by a heavy appropriate roller to 98 percent SPMDD. Installation of engineered fill, where required, must be continuously monitored on a full-time basis by qualified geotechnical personnel.

The native and clean fill soils encountered at the Site are generally suitable for reuse as trench backfill during installation of buried services or pavement subgrade backfill, provided it is free of organic material and at a moisture content that will permit adequate compaction. Based on moisture content measurements of the recovered soil samples, the native soils are generally found to be wet, they may be left aside to dry, or mixed with drier material that is to be used as backfill to lower the moisture content to appropriate levels of the minimum required compaction. Further, the native soils are naturally more susceptible and sensitive to climatic conditions including frost and rain – this should be taken into account when considering the season in which the construction earthworks will occur. A final review and approval to reuse any soils should be made at the time of construction.

It is recommended that all grade increases or infilling below the granular pad for the proposed storage units should utilize well graded, free draining Granular "B", Type 1 backfill as per OPSS 1010, placed in lifts no thicker than 200 mm before compaction, and compacted to a minimum of 100 % of its SPMDD.

Installation of engineered fill, where required, must be continuously monitored on a full-time basis by qualified geotechnical personnel.

4.2 Preliminary Foundation Design

The proposed 1-story storage unit buildings may be supported on a concrete structural slab placed on undisturbed, competent native soils or engineered full over competent native soils. The competent native soils were encountered at depths ranging from 0.6 to 1.8 m below existing grade within the test holes advanced.

The structural slab should be formed over a base course consisting of at least 150 mm of Granular “A” backfill as per Ontario Provincial Standards Specifications (OPSS) compacted to a minimum of 100 % of its SPMDD. It is expected that the slab will have thickening on the exterior wall areas and as such in transitioning the thickened exterior elevation to the remainder of the slab the granular should be sloped at no more than 2H:1V. All fill placed below the granular “A” for the slab should utilize well graded, free draining Granular "B", Type 1 backfill as per OPSS 1010, placed in lifts no thicker than 200 mm before compaction, and compacted to a minimum of 100 % of its SPMDD.

Alternatively, the proposed storage unit building may be supported on concrete piers or footings placed on the undisturbed, competent native soils. All exterior piers/footings or piers/footings in unheated areas should be founded at least 1.2m below the final adjacent grade for frost protection. Piers must be installed to eliminate the potential for frost adhesion and jacking through the use of a bond break or granular (or other frost-free) backfill, with surficial grading and building drains that sheds runoff away from the foundations.

For design purposes, it is recommended that shallow foundation options described above be proportioned and designed using a bearing capacity of 75 kPa at SLS and a factored bearing capacity of 110 kPa at ULS.

Under no circumstances should the foundations be placed above organic materials, loose, frozen subgrade, construction debris, or within ponded water. Prior to forming, all foundation excavations must be inspected and approved by a member of GHD. This will ensure that the foundation bearing material has been prepared properly at the foundation subgrade level and that the soils exposed are similar to those encountered during this investigation.

For slab foundations constructed in accordance with the foregoing manner, total and differential settlements are estimated to be less than 50 mm.

4.3 Pavement Design

Based on the results of this investigation, we would recommend the following procedures be implemented to prepare the proposed asphalt paved areas for its construction:

1. Remove all asphalt, fill, organics, organic-bearing materials and other deleterious materials from the planned pavement areas.
2. Inspect and proof roll the subgrade for the purpose of detecting possible zones of overly wet or soft subgrade. If further stabilization of the pavement subgrade is deemed necessary, either subexcavate to suitable soils and backfill with approved granular material compacted to 98 % SPMDD, or place woven geotextile such as Terrafix 200W or Mirafi HP270 on the exposed pavement subgrade surface, after its approval and prior to placement of any subsequent fill.
3. Contour the subgrade surface to prevent ponding of water during the construction and to promote rapid drainage of the sub-base and base course materials.
4. To maximize drainage potential, 150 mm diameter perforated pipe subdrains should be installed radiating from catchbasins or catchbasin manholes. The pipe should be encased in filter fabric and surrounded by clear stone aggregate. It is recommended that the subdrains discharge to a suitable, frost-free outlet.
5. Construct transitions between varying depths of granular base materials at a rate of 1:25 minimum.

The subgrade materials in the proposed pavement areas will consist of native silty sand with gravel till or fill. The frost susceptibility of these soils is assessed as being generally moderate to high. In this regard, the following minimum flexible pavement structures are recommended for the construction of the new access and parking areas.

Table 2 Asphalt Pavement Structure

Profile	Material	Thickness (mm)		In Conformance with OPSS Form
		Light Duty	Heavy Duty	
Asphalt Surface	H.L.3	40	40	1150
Asphalt Base	H.L.8	50	60	
Granular Base	Granular "A"	150	150	1010
Granular Subbase	Granular "B"	300	450	

The following steps are recommended for optimum construction of paved areas:

1. The Granular "A" and "B" courses should be compacted to a minimum 100 % of their respective SPMDD's.
2. All asphaltic concrete courses should be placed, spread and compacted conforming to OPSS Form 310 or equivalent. All asphaltic concrete should be compacted to a minimum 92.0 % of their respective laboratory Maximum Relative Densities (MRDs).
3. Adequate drainage including short subdrain stubs surrounded by granular 'B' extending from catch basin manholes should be provided to ensure satisfactory pavement performance.

It is recommended that all fill material be placed in uniform lifts not exceeding 200 mm in thickness before compaction. It is suggested that all granular material used as fill should have an in-situ moisture content within 2 % of their optimum moisture content. All granular materials should be compacted to 100 % SPMDD. Granular materials should consist of Granular "A" and "B" conforming to the requirements of OPSS Form 1010 or equivalent.

The performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible. It is noted that the above recommended pavement structures are for the end use of the project. The most severe loading conditions on pavement areas and the subgrade may occur during construction. As such, during construction of the project the recommended granular depths may not be sufficient to support loadings encountered. Consequently, special provisions such as restricted lanes, half-loads during paving, etc. may be required, especially if construction is carried out during unfavourable weather.

4.4 Excavation and Temporary Shoring

The Occupational Health and Safety Act (OHSA) regulations require that if workmen must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and/or braced in accordance with the OHSA requirements. OHSA specifies maximum slope of the excavations for four broad soil types as summarized in the following table:

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 metres of bottom	1 horizontal to 1 vertical
2	Within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	From bottom of excavation	1 horizontal to 1 vertical
4	From bottom of excavation	3 horizontal to 1 vertical

The earth fill and native soils underlying the Site are considered Type 3 soils above groundwater level, and Type 4 if affected by surface water or groundwater seepage. If the above recommended excavation side slopes cannot be maintained due to lack of space or any other reason, the excavation side slopes must be supported by an engineered shoring system. The shoring system should be designed in accordance with Canadian Engineering Foundation Manual (4th Edition) and the OHSA Regulations for Construction Projects.

Prior to removing any excess soils from the Site, it is recommended that such materials be subjected to chemical testing to characterize the excess soils for handling and disposal purposes.

An examination of the slopes should be carried out by qualified soils personnel before any worker enters the excavation. The exposed fill material and native soil should be protected against erosion from water run-off or rain.

5. Limitations of Investigation

This report is intended solely for Tom Livi and their designers and is prohibited for use by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevation and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, GHD is the geotechnical engineer of record. It is recommended that GHD be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only. The subsurface conditions confirmed at the test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (e.g., excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the

recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.

Sincerely yours,

GHD Limited

Leandro Ramos, P.Eng.
Senior Geotechnical Engineer

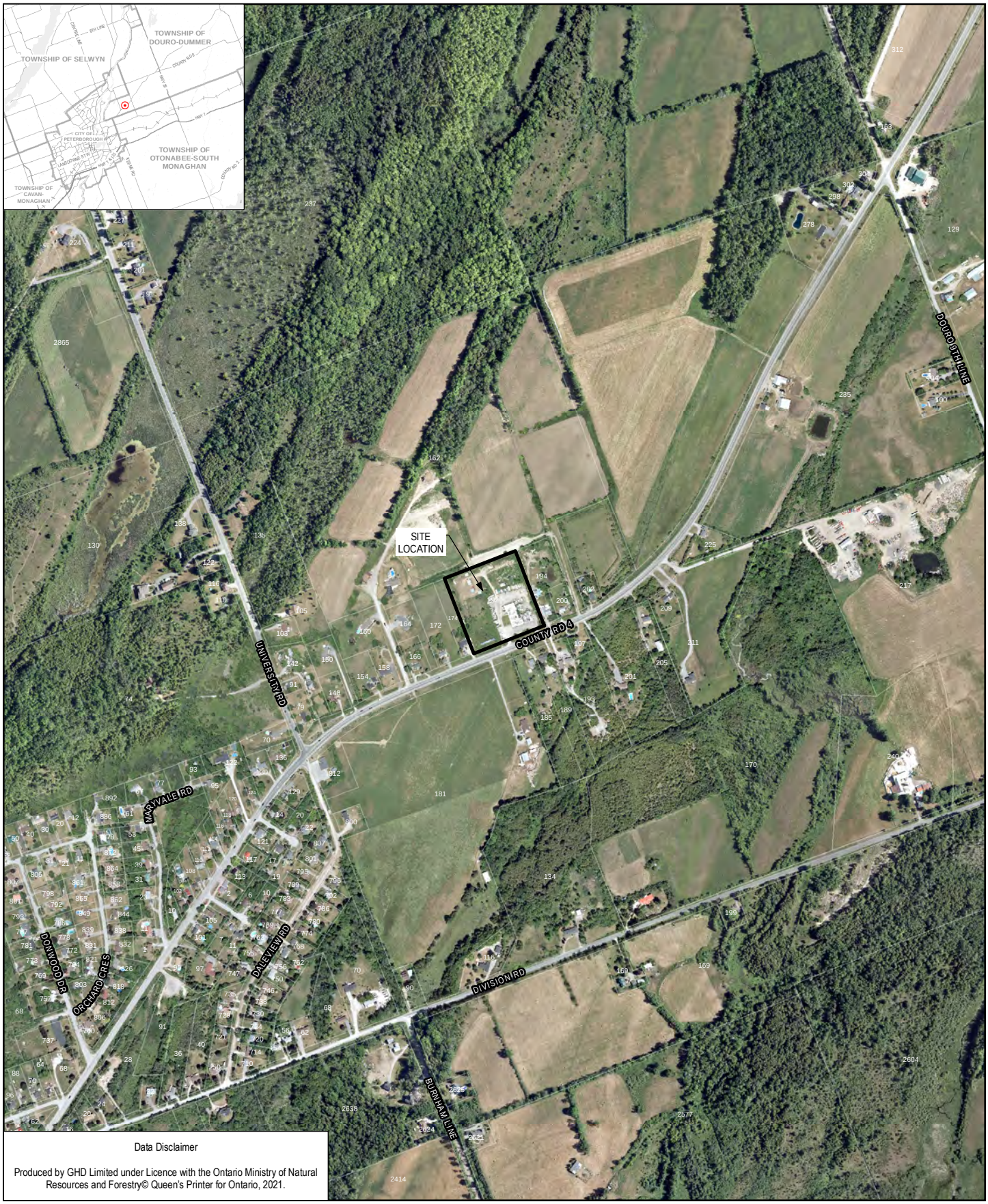
Steve Gagne, H.B.Sc.
Project Director

/KG/lr/sg

Enclosures

- Figure 1: Site Location Map
- Figure 2: Test Hole Location Plan
- Appendix A: Test Pit Records
- Appendix B: Geotechnical Laboratory Testing Results

Figures



Data Disclaimer

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Paper Size ANSI A

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

2780811 ONTARIO INC.
192 COUNTY ROAD ROAD 4, DOURO, ON
PT LOT 2, CON 10, GEOGRAPHIC TOWNSHIP OF DOURO
TOWNSHIP OF DOURO-DUMMER
COUNTY OF PETERBOROUGH

GEOTECHNICAL INVESTIGATION
SITE LOCATION PLAN

Project No. 12563534
Revision No.
Date Nov 3, 2021

FIGURE 1

O:\GIS\PROJECTS\12563000s\12563534\Layouts\202111_RPT001\12563524_202111_RPT001_GIS001 - Site Location Plan.mxd
Print date: 03 Nov 2021 - 06:58

Data source: © City of Peterborough, 2021.

Paper Size ANSI A

0 8.5 17 25.5 34

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

2780811 ONTARIO INC.
192 COUNTY ROAD ROAD 4, DOURO, ON
PT LOT 2, CON 10, GEOGRAPHIC TOWNSHIP OF DOURO
TOWNSHIP OF DOURO-DUMMER
COUNTY OF PETERBOROUGH

GEOTECHNICAL INVESTIGATION
TEST HOLE LOCATION PLAN

Project No. 12563534
Revision No.
Date Nov 3, 2021

FIGURE 2

O:\GIS\PROJECTS\12563000s\12563534\Layouts\202111_RPT001\12563524_202111_RPT001_GIS002 - Test Hole Location Plan.mxd
Print date: 03 Nov 2021 - 07:39

Data source: © City of Peterborough, 2021.

Appendices

Appendix A

Test Pit Records

REFERENCE No.: 12563534 ENCLOSURE No.: A-1

GHD

BOREHOLE No.: TP1-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0				**TOPSOIL** (460 mm) - With rootlets						
		0.46								
1	0.5	0.51		**FILL** - Sandy Silt, reddish-brown, moist		GS-1	--	10	--	--
2				Silty Sand, with gravel, trace clay, cobbles and boulders, light brown, moist						
3	1.0									
4										
5	1.5									
6		1.83		**TILL** - Silty Sand, with gravel, trace clay, moist to wet						
	2.0					GS-2	--	8	--	--
7				GS-2 Sieve Analysis Results: 26% Gravel 33% Sand 34% Silt 7% Clay						
						GS-3	--	7	--	--
8	2.5									
9										
10	3.0	3.05		**END OF TESTPIT:**						
				NOTE: - End of Testpit at 3.0 m - Mild groundwater seepage encountered at 1.8 m - Testpit caving at 0.8 m upon completion - No groundwater accumulation after 3.5 hours - N/M denotes not measured						
11	3.5									
12										
13	4.0									
14										
	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-2

BOREHOLE No.: TP2-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0				**TOPSOIL** (200 mm)						
		0.20								
1				**FILL** - Silty Sand, with gravel, trace clay, with cobbles , light brown, moist						
		0.46								
	0.5			**TOPSOIL** (150 mm)						
2		0.61		**TILL** - Silty Sand, with gravel and clay, cobbles, brownish-grey, moist						
3	1.0									
4						GS-1	--	10	--	--
5	1.5					GS-2	--	10	--	--
		1.68		**END OF TESTPIT:**						
6				**NOTE:** - End of Testpit at 1.7 m - Mild groundwater seepage encountered at 0.9 m - Testpit caving at 0.9 m upon completion - 0.2 m of groundwater accumulation after 3.5 hours - N/M denotes not measured						
7	2.0									
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

'N' Value/ SCR(%) scale: 10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-3

BOREHOLE No.: TP3-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

NORTHING: EASTING:

LEGEND

- GS - GRAP SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- ▼ - WATER LEVEL

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0		0.05		**TOPSOIL** (50 mm)						
		0.20		**FILL** - Sand, reddish-brown, moist Weeping tile packed in gravel (0.4 m)		GS-1	--	2	--	--
1	0.5									
2		0.61		Sand, with gravel, trace silt and clay, brown, loose		GS-2	--	6	--	--
3	1.0			GS-2 Sieve Analysis Results: 15% Gravel 77% Sand 7% Silt 1% Clay						
4										
5	1.5	1.52								
		1.55		**TILL** - Silty Sand, with gravel and clay, cobbles, brownish-grey, moist						
6				**END OF TESTPIT:**						
7	2.0			**NOTE:** - End of Testpit at 1.5 m - No noticeable groundwater seepage or accumulation after 3.5 hours - Testpit open and dry upon completion - N/M denotes not measured						
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
	4.5									

'N' Value/ SCR(%) scale: 10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-4

BOREHOLE No.: TP4-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0				**FILL** - Silty Sand, with gravel, trace clay, with cobbles and boulders , with organics, light brown, moist						
1	0.5	0.28		- Approx. 100 mm diameter clay tile at 0.2 m		GS-1	--	11	--	--
				TILL - Silty sand, with clay and gravel, light brownish-grey, moist						
3	1.0									
4						GS-2	--	10	--	--
5	1.5	1.52		**END OF TESTPIT:**						
				NOTE: - End of Testpit at 1.5 m - No noticeable groundwater seepage - Testpit caving at 0.5 m upon completion - N/M denotes not measured						
6	2.0									
8	2.5									
10	3.0									
11	3.5									
13	4.0									
14	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-5

BOREHOLE No.: TP5-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0				**TOPSOIL** (230 mm)						
		0.23								
1		0.30		**FILL** Clayey silt, reddish-brown, moist		GS-1	--	25	--	--
				TILL - Silty sand, with clay and gravel, brown, moist		GS-2	--	17	--	--
	0.5									
2		0.61		Light brown						
3										
	1.0									
						GS-3	--	10	--	--
4										
5	1.5									
6										
	2.0									
7										
8	2.5									
9										
						GS-4	--	10	--	--
10	3.0	3.05		**END OF TESTPIT:**						
11				**NOTE:** - End of Testpit at 3.0 m - Groundwater seepage encountered at 1.2 m - Testpit caving at 0.5 m upon completion - 0.1 m of groundwater accumulation after 1 hour - N/M denotes not measured						
	3.5									
12										
13	4.0									
14										
	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-6

BOREHOLE No.: TP6-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0		0.05		**TOPSOIL** (50 mm)						
				FILL - Silty sand, brown, moist		GS-1	--	12	--	--
1		0.36		**TOPSOIL** (250 mm)						
	0.5									
2		0.61		**TILL** - Gravelly Sand, with silt, trace clay, brownish-grey, moist to wet		GS-2	--	17	--	--
3	1.0			GS-3 Sieve Analysis Results: 32% Gravel 30% Sand 33% Silt 6% Clay						
4										
5	1.5									
6										
7	2.0					GS-3	--	8	--	--
8	2.5									
9										
10	3.0	3.05		**END OF TESTPIT:** **NOTE:** - End of Testpit at 3.0 m - Groundwater seepage encountered at 0.8 m - Testpit caving at 0.9 m upon completion - No groundwater accumulation after 10 minutes - N/M denotes not measured						
11	3.5									
12										
13	4.0									
14										
	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-7

GHD

BOREHOLE No.: TP7-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0		0.10		**TOPSOIL** (100 mm)						
1				**FILL** - Silty Sand, with gravel, trace clay, with cobbles and boulders, brown, moist						
	0.5					GS-1	--	14	--	--
2		0.61		**TOPSOIL** (305 mm)						
3		0.91		**TILL** - Silty Sand, with clay and gravel, cobbles and boulders, light brown, moist to wet						
4	1.0									
5	1.5					GS-2	--	12	--	--
6										
7	2.0	2.13		Wet		GS-3	--	10	--	--
8	2.5									
9										
10	3.0	3.05				GS-4	--	10	--	--
11				**END OF TESTPIT:**						
	3.5			**NOTE:** - End of Testpit at 3.0 m - Groundwater seepage encountered at 0.9 m - Testpit caving at 0.9 m upon completion - 0.4 m of groundwater accumulation after 20 minutes - N/M denotes not measured						
12										
13	4.0									
14										
	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

REFERENCE No.: 12563534 ENCLOSURE No.: A-8

BOREHOLE No.: TP8-21
ELEVATION: N/M m

TEST PIT REPORT

Page: 1 of 1

CLIENT: 2780811 Ontario Inc.
PROJECT: Livi Parkhill Storage
LOCATION: County Road 4
DESCRIBED BY: J. McEachern CHECKED BY: L. Ramos
DATE (START): 15 October 2021 DATE (FINISH): 15 October 2021

LEGEND

- GS - GRAB SAMPLE
- ST - SHELBY TUBE
- VA - VANE SHEAR
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: EASTING:

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		N/M		GROUND SURFACE			%	%	%	%
0				**TOPSOIL** (405 mm)						
1	0.5	0.41		**TILL** - Silty Sand, with clay and gravel, cobbles and boulders, light brown, wet						
2										
3	1.0									
4										
5	1.5	1.68				GS-1	--	10	--	--
6				**END OF TESTPIT:**						
7	2.0			**NOTE:** - End of Testpit at 1.7 m - Groundwater seepage encountered at 0.9 m - Testpit caving at 0.6 m upon completion - No groundwater accumulation after 5 minutes - N/M denotes not measured						
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
	4.5									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

File: G:\12563534\WORKSHARE\FIELD\PARKHILL STORAGE TEST PIT LOGS.GPJ Library File: GHD_GEOTECH_V05.GLB Report: SOIL LOG WITH GRAPH Date: 25/11/21

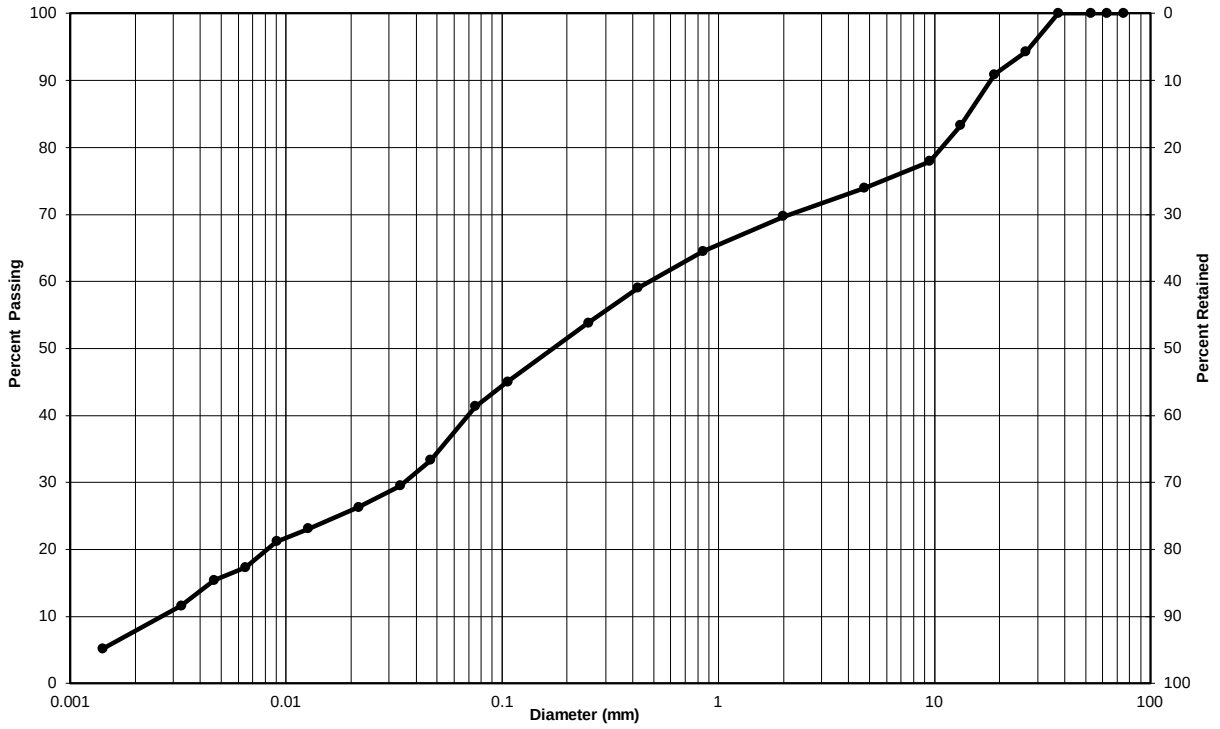
Appendix B

Geotechnical Laboratory Testing Results

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	2780811 Ontario Inc.	**Lab No.:**	SS-21-81
Project/Site:	Livi Parkhill Storage - County Road 4	**Project No.:**	12563534

Borehole no.:	TP1-21	Sample no.:	GS2
Depth:	2.0 to 2.1m	Enclosure:	



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty sand with gravel	26	33	41
Silt-size particles (%):	34		
Clay-size particles (%) (<0.002mm):	7		

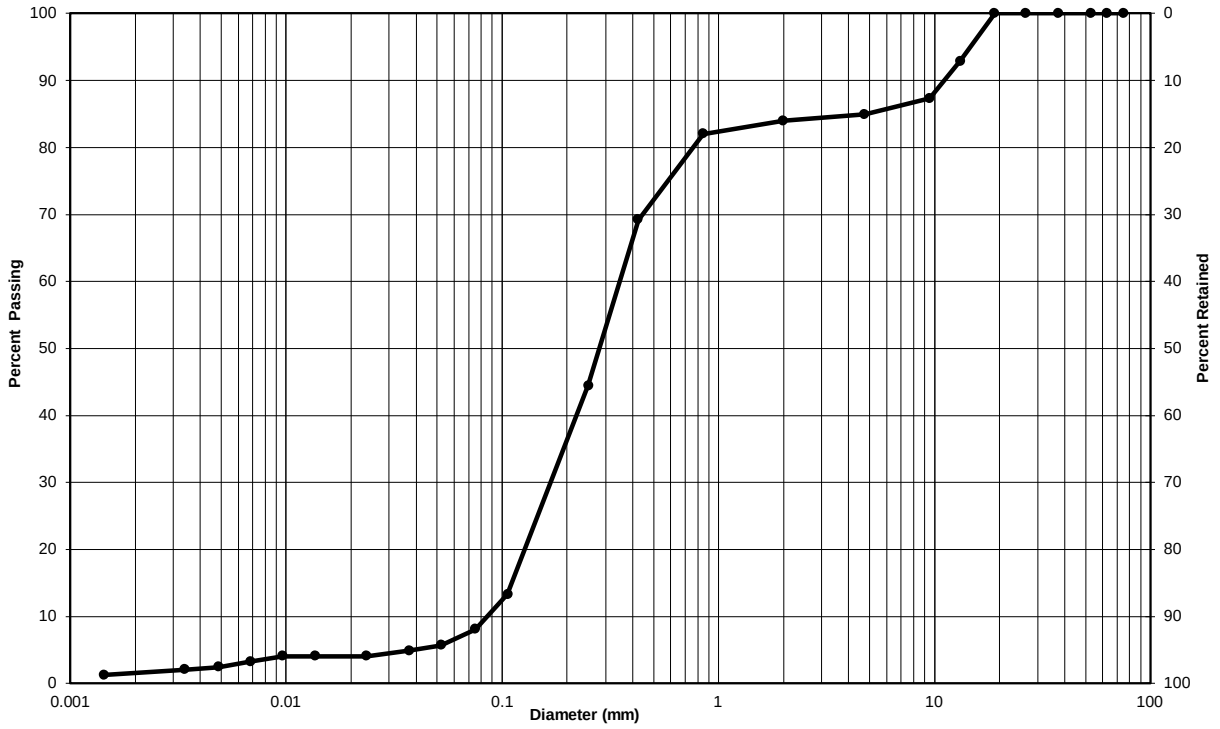
Remarks:

Performed by:	Josh Sullivan	**Date:**	October 22, 2021
Verified by:	Joe Sullivan	**Date:**	October 26, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	2780811 Ontario Inc.	**Lab No.:**	SS-21-81
Project/Site:	Livi Parkhill Storage - County Road 4	**Project No.:**	12563534

Borehole no.:	TP3-21	Sample no.:	GS2
Depth:	0.8 to 0.9m	Enclosure:	



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand with silt and gravel	15	77	8
Silt-size particles (%):	7		
Clay-size particles (%) (<0.002mm):	1		

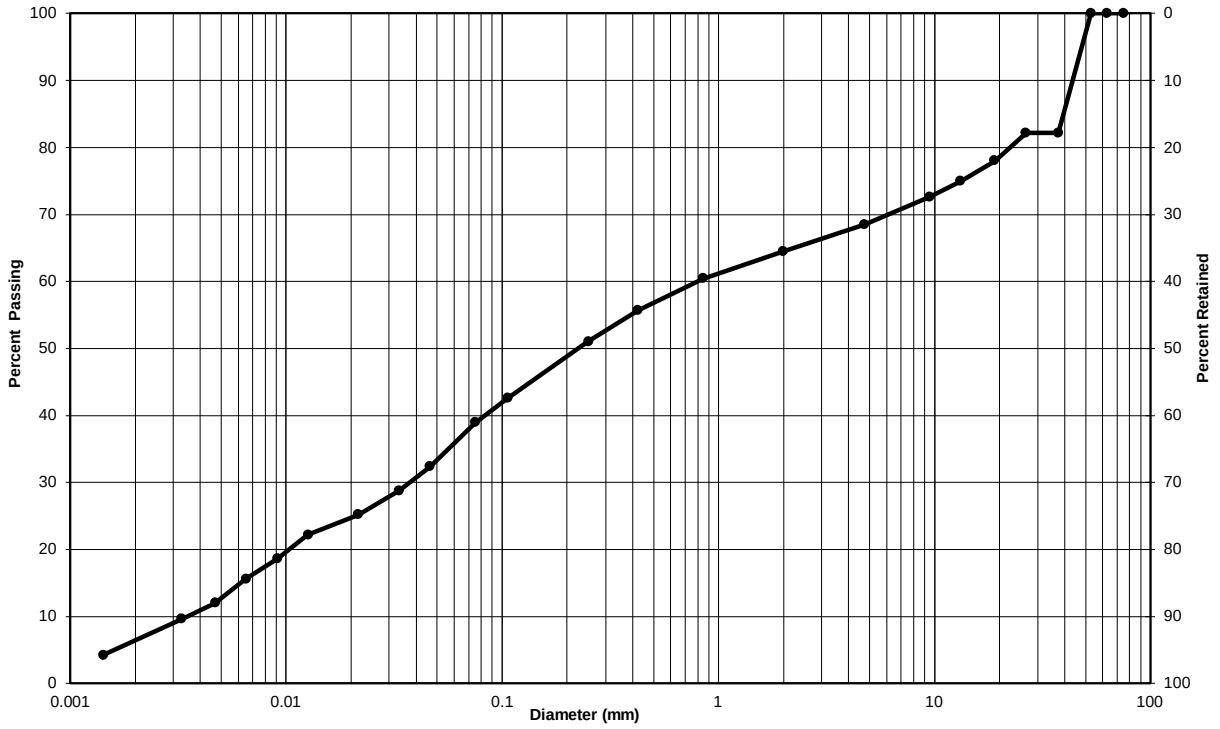
Remarks:

Performed by:	Josh Sullivan	**Date:**	October 22, 2021
Verified by:	Joe Sullivan	**Date:**	October 26, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	2780811 Ontario Inc.	**Lab No.:**	SS-21-81
Project/Site:	Livi Parkhill Storage - County Road 4	**Project No.:**	12563534

Borehole no.:	TP6-21	Sample no.:	GS3
Depth:	2.1 to 2.3m	Enclosure:	



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty gravel with sand	32	30	39
Silt-size particles (%):	33		
Clay-size particles (%) (<0.002mm):	6		

Remarks:

Performed by:	Josh Sullivan	**Date:**	October 22, 2021
Verified by:	Joe Sullivan	**Date:**	October 26, 2021