Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL INVESTIGATION
SIMCOE COUNTY AFFORDABLE HOUSING FACILITY
125 SIMCOE ROAD
BRANDFORD, WEST GWILLIMBURY, ONTARIO

for

THE CORPORATION OF THE COUNTY OF SIMCOE

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PML Ref.: 21BF049
Report: 1 (Revised)

January 2022

Peto MacCallum Ltd.
CONSULTING ENGINEERS

January 12, 2022

PML Ref.: 21BF049
Report: 1 (Revised)

Mr. Jesse Marchand
The Corporation of the County of Simcoe
1110 Highway 26
Midhurst, Ontario
L9X 1N6

Dear Mr. Marchand

Geotechnical Investigation
Proposed Simcoe County Affordable Housing Facility
125 Simcoe Road
Bradford West Gwillimbury, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed for this project. Authorization to proceed with this assignment was provided by Mr. Bradley Spiewak of The Corporation of the County of Simcoe in an email dated September 15, 2021 and was confirmed with a signed Engineering Services Agreement dated September 27, 2021.

It is understood that a new Affordable Housing Facility is planned for the site located at 125 Simcoe Road in Bradford West Gwillimbury, Ontario. Current development plans call for a four-storey building without a basement, covering an approximate plan area of 1,686 m^2 and an associated parking lot. Final grading plans and design founding levels for the proposed building were not provided at the time of this report.

The purpose of this geotechnical investigation was to assess the subsurface soil and ground water conditions at the site. Based on the findings of this investigation, the subsurface stratigraphy revealed in the boreholes typically comprised topsoil fill over sand fill, underlain by sandy silt till and it is considered feasible to construct the building using standard construction practices. Geotechnical comments and recommendations for design and construction of the building and parking lot are provided in the attached report.

It should be noted that a chemical testing program and ground water sampling and testing was not part of the Terms of Reference for this assignment and therefore, no work or comments related to geoenvironmental quality of the site soils or ground water was carried out in this regard.

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We trust the information presented in the attached report will be sufficient for your present purposes. If you have any questions, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.

Scott Jeffrey, P.Eng., QP_{ESA}, $LEED_{GA}$
Senior Associate
Regional Manager, Geotechnical and Geoenvironmental Services

MS/SJ:tm

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1. INTRODUCTION

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed for this project. Authorization to proceed with this assignment was provided by Mr. Bradley Spiewak of The Corporation of the County of Simcoe in an email dated September 15, 2021 and was confirmed with a signed Engineering Services Agreement dated September 27, 2021. Services were provided in accordance with PML's proposal, PML Ref.: 21230097, dated August 31, 2021.

It is understood that a new Affordable Housing Facility is planned for the site located at 125 Simcoe Road in Bradford West Gwillimbury, Ontario. Current development plans call for a four-storey building covering an approximate plan area of 1,686 m^2 and an associated parking lot. Final grading plans and proposed design founding levels for the proposed building were not provided at the time of this report.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation and are applicable only to the proposed development as described in the report. Any changes in development, including finished grades and layout will require review by PML to assess the validity of the report and may require modified recommendations, additional investigation and/or analysis.

2. INVESTIGATION PROCEDURES

The field work was carried out from October 26 to 29, 2021 and consisted of 20 boreholes (BH1 to BH20) drilled to 2.0 to 5.0 m termination depths. Monitoring wells were installed after drilling completion in BH/MW 1, BH/MW 5, BH/MW 7 to BH/MW 9, BH/MW 14, BH/MW 16, and BH/MW 20. The borehole locations are shown on Drawing 1, appended.

The borehole locations were selected by the Corporation of the County of Simcoe and established in the field by PML. Ground surface elevations and UTM co-ordinates at the borehole locations were determined by PML.

The boreholes were advanced using continuous flight solid stem augers, powered by a track-mounted drill rig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of PML's engineering staff.

Representative samples of the overburden were recovered at frequent depth intervals using a conventional split-spoon sampler during drilling. Standard Penetration Tests (SPT) were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata.

The ground water conditions at the borehole locations were assessed during drilling by visual examination of the soil, the sampler and the drill rods as the samples were retrieved and when appropriate by measurement of the water level in the open borehole. Upon completion of drilling, the boreholes without a monitoring well were decommissioned in accordance with O.Reg. 903/90, as amended.

The recovered soil samples were returned to our laboratory for detailed visual examination, classification and routine moisture content determinations. Additionally, six particle size distribution analyses were completed on samples of the major soil types encountered.

3. SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions including soil classifications, inferred stratigraphy, SPT "N" values, ground water observations, and the results of laboratory moisture content determinations.

Due to the soil sampling procedures and limited sample size, the depth demarcations on the borehole logs must be viewed as transitional zones between layers and cannot be construed as exact geologic boundaries between layers. PML would be pleased to assist in defining geologic boundaries during construction if required.

The subsurface stratigraphy revealed in the boreholes typically comprised topsoil fill over sand fill, underlain by sandy silt till.

3.1 Topsoil Fill

A 150 to 400 mm thick topsoil fill layer was contacted at the ground surface in all boreholes except for BH3 where no topsoil was present. The topsoil generally consisted of dark brown sand with organics and was judged to be moist.

3.2 Fill

A layer of fill was encountered at the ground surface in all the boreholes and it was penetrated at depths of 0.7 to 4.0 m at BH1 and BH3 to BH20. The fill layer was extending to the borehole termination depth of 2.0 m below grade in BH2. The fill generally comprised very loose to very dense sand to silty sand soils based on SPT "N" values between 1 blow and refusal per 0.3 m penetration of the split spoon sampler. Occasional cobbles and boulders were contacted throughout the fill in BH3 and BH4. The fill soil was judged to be moist with moisture content levels ranging from 9 to 29%.

3.3 Sandy Silt Till

Below the fill, sandy silt till was contacted to the borehole termination depths of 3.4 to 5.0 m below grade in all the boreholes, except BH2 where the borehole was terminated in the fill. The upper zone of the till layer, to depths in the range of 1.2 to 2.7 m was generally compact based on SPT "N" values between 11 and 25 blows per 0.3 m penetration of the split spoon sampler. The surface of the till was locally loose at BH6 with an N value of 9. Below 1.2 to 2.7 m the till deposit was dense to very dense with N values in the range of 30 to greater than 50. Based on a review of nearby subsurface information, these dense to very dense soil conditions are expected to continue below the depths investigated. Probable cobbles and/or boulders were occasionally contacted throughout this deposit in BH5, BH7 to BH11 and BH13 to BH20. The sandy silt till was judged to be moist to wet with in-situ moisture content determinations typically ranging from 5.3 to 18%.

Figure 1 attached, presents the results of six particle-size distribution analyses conducted on typical samples of the sandy silt till deposit contacted in the boreholes. The results indicate 2 to 12% gravel, 27 to 41% sand and 48 to 67% silt and clay, with the predominant fraction being silt sized particles.

3.4 Ground Water Conditions

In general, ground water was contacted during drilling in the fill soils at BH4 and in the native sandy silt till deposit in BH1, BH6, BH7, BH9 to BH17, BH19, and BH20. After completion of drilling, free water was observed at BH1, BH4, BH6, BH7, BH9 to BH17, BH19, and BH20. Ground water level readings taken on November 24 and December 17, 2021 in the installed monitoring wells indicated ground water level depths ranging from 0.6 to 3.1 m below surface grade corresponding to geodetic elevation between 220.2 and 223.0 m. Ground water observations are fully summarized on the appended Log of Borehole Sheets. Observed ground water levels may fluctuate subject to seasonal variations and precipitation patterns.

4. ENGINEERING DISCUSSION AND RECOMMENDATIONS

As noted above, the project involves the proposed construction of a new Affordable Housing Facility planned at the Site located at 125 Simcoe Road in Bradford West Gwillimbury, Ontario. Current development plans call for a four-storey building without a basement, covering an approximate plan area of 1,686 m^2, an associated parking lot, paved driveways, water and sewer servicing, and stormwater infiltration facilities.

Final grading plans and proposed design founding levels for the proposed building were not provided at the time of this report. Once the design details for the proposed development are finalized, the recommendations in this report should be revisited to confirm that they remain applicable.

Based on the findings of this investigation, the subsurface stratigraphy revealed in the boreholes typically comprised topsoil fill over fill, underlain by sandy silt till and it is deemed feasible to construct the building using standard construction practices using conventional shallow foundations. Geotechnical comments and recommendations for design and construction of the building and parking lot are provided below.

4.1 General Site Grading

The existing in place fill is not considered suitable to support building foundations or any settlement sensitive structures and will require removal.

Outside of the building footprint, it will be necessary to strip all topsoil and otherwise deleterious fill; however, it is envisaged that the majority of the remaining pre-existing in place inorganic fill materials may be left in place below pavement areas subject to adequate subgrade preparation and heavy proofrolling under geotechnical supervision to expose soft / loose or unstable material. Any soft / loose or unstable material should be subexcavated, removed and replaced with approved soil.

Bulk fill placed to raise site grades to the proposed design levels or to backfill subexcavated areas should comprise approved inorganic material having a moisture content within 3% of the optimum value, placed in maximum 200 mm thick lifts, and compacted to at least 95% of standard Proctor maximum dry density (SPMDD).

It is expected that the on-site excavated inorganic sand fill and native sandy silt till will be generally suitable for reuse as bulk fill provided that it is maintained within 3% of the optimum moisture content for compaction.

Exterior grades should be maintained at least 150 mm below the ground floor level of the building and should be sloped to promote drainage away from the building.

4.2 Excavation

Excavation through the fill and into the native sandy silt till is expected to be relatively straight forward using conventional equipment. The possibility of debris and/or cobbles and boulders in the fill and sandy silt till should not be overlooked. It is noted that obstructions and/or drilling resistance consistent with the presence of cobbles and/or boulders were encountered in several boreholes.

Provided adequate ground water control is achieved, the fill and in-situ native soil are classified as Type 3 soil according to the Occupational Health and Safety Act (OHSA) criteria. Therefore, excavation sidewalls should be cut at a maximum inclination of 1horizontal:1vertical (1H:1V) from the bottom of the excavation. It may be necessary to further flatten the excavation side slopes if excessively loose / soft conditions or concentrated seepage zones are encountered locally.

Where open cut excavations are not possible, a braced excavation system would be necessary to support the excavation walls. The following earth pressure design parameters may be assumed for design of temporary shoring.

PARAMETER	SAND TO SILTY SAND FILL	SANDY SILT TILL
Angle of Internal Friction (degrees)	28	34
Unit Weight (kN/m^3)	17	22
Coefficient of Active Earth Pressure (K_a)	0.36	0.28
Coefficient of Earth Pressure At Rest (K_o)	0.5	0.6
Coefficient of Passive Earth Pressure (K_p)	2.8	3.5

NOTE: Earth pressure coefficients assume Rankin analysis (wall friction ignored, non-sloping backfill)

Lateral earth pressure caused by surcharge loadings such as line and strip loading due to stock piled material and/or construction equipment should also be considered. The braced systems may be designed using the theory of elasticity in accordance with the methods outlined in the latest Canadian Foundation Engineering Manual (CFEM).

4.3 Foundations

4.3.1 Shallow Foundations

Details concerning the proposed floor slab elevation for the structure were not provided. For this report it is assumed that it will be desirable to construct conventional strip / spread footings at a typical depth of about 1.5 m below finished grade levels. Footings at these depths will not fully penetrate the existing fill material in all areas and will need to be extended deeper to reach competent native undisturbed soil, including in the vicinity of Boreholes 1, 3, 4, 5. 10 and 11. It is noted that footings in the vicinity of BH4 and BH11, located within the building footprint encountered relatively deeper fill extending to depths of 4.0 and 2.9 m, respectively.

The following table provides the minimum recommended founding depths and elevations along with the corresponding bearing resistance values in the vicinity of the proposed four-storey building.

BOREHOLE NO.	DEPTH (m)	ELEVATION (m)	BEARING RESISTANCE AT SERVICEABILITY LIMIT STATES (kPa)	FACTORED BEARING RESISTANCE AT ULTIMATE LIMIT STATES (kPa)
1	Below 2.4	Below 221.7	250	375
3	Below 2.4	Below 221.2	250	375
4	Below 4.3 (1)	Below 219.6	250	375
5	1.7 to 2.6	222.5 to 221.6	200	300
	Below 2.6	Below 221.6	250	375
6	1.2 to 3.1	221.8 to 219.9	120	180
	Below 3.1	Below 219.9	250	375
7	1.2 to 2.4	222.2 to 221.0	200	300
	Below 2.4	Below 221.0	250	375
8	1.2 to 2.4	224.4 to 221.2	200	300
	Below 2.4	Below 221.2	250	375
9	1.2 to 1.8	221.8 to 221.2	200	300
	Below 1.8	Below 221.2	250	375

BOREHOLE NO.	DEPTH (m)	ELEVATION (m)	BEARING RESISTANCE AT SERVICEABILITY LIMIT STATES (kPa)	FACTORED BEARING RESISTANCE AT ULTIMATE LIMIT STATES (kPa)
10	1.7 to 2.6	221.5 to 220.6	200	300
	Below 2.6	Below 220.6	250	375
11	Below 3.1 (1)	Below 219.6	250	375
13	Below 1.2	Below 220.8	250	375

(1) Relatively deeper fill deposits were encountered in the vicinity of BH4 and BH11. Footings in these areas will need to be extended deeper to reach native undisturbed soil at the elevations indicated.

(2) Higher bearing resistance values may be available for deeper footing subject to further site investigation

To reduce excavation, backfilling and structural concrete quantities, in areas where footings need to be extended deeper than the desired founding level due to localized fill deposits, the foundation excavation may be partially backfilled with non-shrinkable fill to the underside of the desired footing level. With this approach, the footings may be constructed at nominal depth as required for design considerations and frost protection.

Alternatively, lightly loaded footings may be supported on engineered fill placed and compacted to 98% Standard Proctor maximum dry density (SPMDD) in accordance with the guidelines presented in Appendix A. Footing constructed on adequately prepared engineered fill may be designed for a bearing resistance of 100 kPa SLS and 150 kPa ULS.

Footings subject to heavier loading may be supported on engineered fill comprised of approved well graded crushed granular material meeting the specifications of Ontario Provincial Standard Specification (OPSS) 1010 Granular A or Granular B – Type II, placed and compacted to a minimum of 100% SPMDD, and may be designed for a bearing resistance of 200 kPa SLS and 300 kPa ULS. The general recommendations of Appendix A apply.

Total settlements of footings founded on the approved native undisturbed sandy silt till or adequately prepared engineered fill, and designed as outlined above, are not expected to exceed 25 mm, with differential settlements between footings being no more than 75% of this value.

Where founding levels of adjacent footings vary, the founding elevation between footings should be stepped in maximum 600 mm steps at a maximum inclination of 10H:7V. If adequate stepping of the footings is not possible due to site or design limitations, the need for underpinning of the existing foundations should be evaluated.

Prior to placement of structural concrete, all foundation excavations must be examined by geotechnical personnel from PML to verify that the founding stratum is in accordance with the assumptions and recommendations of this report.

4.3.2 Frost Protection

All footings subject to frost action including all perimeter and exterior foundation elements or interior foundation element in unheated areas such as parking garages and ventilation shafts should be provided with the normal 1.2 m of earth cover or equivalent thermal insulation. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

All work should be carried out in accordance with the Occupational Health and Safety Act (Ontario Regulation 213/91) and with local regulations.

4.3.3 Earthquake Considerations

Design provisions for earthquake loading should also be applied. Based on the characteristics of the subsoils at this site as encountered in the boreholes and from available deeper subsurface information from nearby locations, the subject property would be classified as Site Class D for footings bearing on native sandy silt till per The Ontario Building Code Act, (2012) Section 4.1.8.4. If required, a higher Site Class may be available subject to site specific seismic analysis such as by multichannel Analysis of Surface Waves (MASW).

4.4 Slab-on-grade Floor

Construction of the floor slab as a conventional slab-on-grade is considered to be feasible provided that the subgrade is adequately prepared.

Preparation of the subgrade should include stripping of all topsoil, fill, disturbed or otherwise deleterious material followed by proofrolling of the exposed subgrade with a heavy roller to ensure uniform adequate support. Excessively loose / soft or compressible materials revealed during the proofrolling operations should be subexcavated and replaced with well compacted approved material.

It is envisaged that some of the deeper pre-existing, inorganic, compact to very dense sand fill such as in the vicinity of Boreholes BH 4 and BH11 may be left in place below slab-on-grade floors subject to geotechnical inspection and proofrolling as outlined above.

Fill placed under the floor slab to achieve finished subgrade levels or as foundation excavation backfill should comprise approved inorganic material having a moisture content within 3% of the optimum value, placed in maximum 200 mm thick lifts, and compacted to at least 95% SPMDD.

A minimum 150 mm thick layer of well compacted free draining Granular A type material is recommended directly beneath the slab-on-grade. A polyethylene vapour barrier should be placed under the slab if a moisture sensitive finish is to be placed on the floor.

Finished floor slab elevations should be set a minimum of 150 mm above the exterior grades and exterior grades should be established to promote surface drainage away from the building.

4.5 Pipe Bedding and Backfilling

It is expected that site servicing for the development will extend to typical depths in the range of about 2 to 3 m. In general, no bearing problems are anticipated for pipes founded at these depths in the native undisturbed soils encountered at the site; however, a provision should be made for localised subexcavation of unsuitable fill materials which could be present locally where fill depths extend below the pipe inverts. On stable subgrade, a minimum 150 mm thick bedding course of Granular A material compacted to 95% SPMDD is recommended beneath the pipes. The Granular A material should extend around the pipe to at least 300 mm above the pipe obvert or as set out by Ontario Provincial Standards (OPS), or the local authority. Material containing stones larger than 50 mm size should not be used in the bedding or cover layers.

4.6 Stormwater Infiltration Facility

It is understood that a stormwater infiltration facility is to be considered as part of the site servicing installations. For a preliminary design stage, an estimated coefficient of permeability, based on sieve analysis of the samples of the native soil, of 1 x 10^{-5} cm/sec, corresponding to an unfactored infiltration rate of 25 mm/hour, may be used for preliminary design. A sufficient factor of safety should be applied. Once preliminary designs are in place, it is recommended that in-situ Guelph Permeameter testing be carried out by PML in order to verify design infiltration rates.

4.7 Ground Water Control

Short term ground water levels were measured at relatively shallow depths of 0.5 to 2.8 m within the monitoring wells; however, these levels are likely reflective of perched water within the surficial till deposits. In general, wet soil conditions were generally observed below about 1.5 to 4.5 m below ground surface. Based on the relatively low permeability of the native soils, it is expected that seepage or surface water that enters the excavations will be adequately handled by conventional sump pumping techniques. Observed ground water levels may fluctuate subject to seasonal variations and precipitation patterns. The installed wells should be monitored periodically leading up to construction in order to obtain additional information on stabilized ground water levels and ground water fluctuations.

It should be noted that water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Takings and Transfer Regulation O. Reg. 387/04. Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the MECP. This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering, or permanent drainage improvements. Where it is assessed than more than 50,000 L/d but less than 400,000 L/d of ground water taking is required, the Owner can register online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 Permit-To-Take-Water (PTTW) is required. Based on the conditions revealed in the boreholes and anticipated excavation depths discussed above, water takings needed to facilitated construction are not expected to require a PTTW or registration on the EASR.

4.8 Re-use of Site Material

It is anticipated that the excavated material will generally consist of sand fill, and native sandy silt till. Subject to environmental assessment, inorganic portion of the fill and native soil are considered suitable for re-use as foundation and underfloor backfill, subject to evaluation at time of construction. If the in-situ moisture content of portions of the inorganic fill is higher than the optimum moisture content it will not be considered suitable for re-use as foundation and underfloor backfill; however, the fill may be considered suitable for landscaped areas, subject to evaluation at the time of construction. Depending on seasonal conditions, some moisture content adjustments to the backfill materials may be required. The on-site soils are frost susceptible and are considered unsuitable for use where free draining backfill is required or at locations where frost related movement would present a concern.

In general, backfill should comprise inorganic, debris free material having a moisture content within 3% of the optimum value. Organic soil, topsoil, deleterious or excessively wet material should not be used as backfill. If construction is extended into the winter season, particular attention must be given to ensure that frozen material is not used as backfill.

In general, the relatively cohesionless fill and native sandy silt tills are expected to break down readily when properly compacted; however, it should be noted that some excavated native soils with some clay may retain a voided structure when placed as engineered fill, including foundation and trench backfill. In this regard, it will be important to ensure that sufficient compaction effort is applied to thoroughly break down all lumps / clods within the backfill soil matrix to achieve a non-voided condition. Significant post construction settlement could otherwise result. Excavated materials intended for backfilling purposes should not be exposed to the elements for prolonged time periods, as they might be rendered unsuitable for re-use.

In areas that underlie floor slabs, pavements and walkways, the foundation and service trench backfill should be compacted to at least 95% SPMDD. In landscaped areas, compaction to at least 90% SPMDD will be adequate.

It is recommended that full time site observation should be carried out by PML to examine and approve backfill material, to carefully inspect placement operations, and to verify the backfill compaction by in situ density testing using nuclear gauges.

4.9 Pavement Construction

The anticipated subgrade for pavement construction is anticipated to consist of pre-existing fill, native sandy silt till and engineered fill. Based on typical traffic patterns for parking lots and access roads, the estimated strength and frost susceptibility of the anticipated subgrade and assuming adequate drainage, the following pavement structure is recommended:

PAVEMENT COMPONENT	LIGHT DUTY PAVEMENT THICKNESS (mm)	HEAVY DUTY PAVEMENT THICKNESS (mm)
Asphalt	80	120
Granular A Base Course	150	150
Granular B Type II Subbase Course	250	300

Light duty pavement is for car parking areas. Heavy duty pavement should be used for access roads and areas where buses, heavy service vehicles, delivery vehicles or garbage trucks will travel.

The pavement granular courses should conform to the OPS specifications for select granular materials. They should be placed in maximum 200 mm thick lifts and compacted to at least 100% SPMDD. The asphalt should be placed and compacted to a minimum of 92% of the material's maximum relative density (MRD). Reference is made to OPS Specification 310, revised November 2017.

Preparation of the subgrade for pavement construction should involve stripping obvious deleterious materials followed by proofrolling of the subgrade with a heavy roller. Excessively soft, wet or deleterious material revealed by the proofrolling operations should be subexcavated and replaced. The subgrade surface should be compacted to at least 95% SPMDD.

The pavement design considers that construction will be carried out during the drier time of the year and that the subgrade is stable, as determined by proofrolling operations. If the subgrade should become excessively wet or rutted during construction activities, additional subbase material may be required. The need for additional subbase is best determined during construction.

For the pavement to function properly, provision must be made for water to drain out of, and not collect in, the granular courses. The pavement subgrade should be sloped to promote drainage towards catch basins and manholes. The excavation around catch-basins and manholes should be backfilled with free-draining granular material to minimize differential movements between the pavement and structures due to frost action. The manholes / catchbasins should be provided with perforated stub drains to permit drainage of the backfill.

Site review should be carried out by PML personnel to examine and approve subgrade, backfill / granular materials, to observe placement operations and verify the compaction (granular and asphalt) by in situ testing using nuclear gauges.

5. GEOENVIRONMENTAL CONSIDERATIONS

It is noted that no environmental sampling or testing was completed as part of this investigation. Accordingly, soil and ground water impairment may exist at the site. If excess soil is to be generated during the construction, then environmental assessment in accordance with Ontario Regulation 406/19: On-Site and Excess Soil Management, will be required in order to verify the chemical quality of the excess soil to assess the appropriate off-site beneficial re-use options and/or disposal options for the soil leaving the site.

We trust the information presented in this report is sufficient for your present purposes. If you have any questions, please do not hesitate to contact our office.

Sincerely
Peto MacCallum Ltd.

Milton Segura, MTS, P.Eng.
Geotechnical Services

Scott Jeffrey, P.Eng., QP_{ESA}, $LEED_{GA}$
Senior Associate
Regional Manager, Geotechnical and Geoenvironmental Services

MS/SJ:tm

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample		

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 1

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 29,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

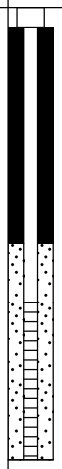
DEPTH (metres) / ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION 224.13			
0.23 / 223.90	TOPSOIL: Dark brown sand, trace gravel, trace organics, moist	1	SS	3
	FILL: Very loose to loose, dark brown to brown sand to sandy silt fill, trace gravel, trace organics, moist	2	SS	5
		3	SS	9
2.1 / 222.0	SANDY SILT TILL: Very dense, brown sandy silt till, trace gravel, trace to some clay, moist	4	SS	56
		5	SS	68/290 mm
4.0 / 220.1	becoming grey, wet			
4.9 / 219.2	BOREHOLE TERMINATED AT 4.86 m	6	SS	50/140 mm

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Water at 4.5 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	1.6	222.5
2021-12-17	1.5	222.6

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 28,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ● Q; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION 223.93						50 100 150 200; 20 40 60 80	10 20 30 40		
0.30 / 223.63	TOPSOIL: Dark brown sand, trace gravel, trace organics, moist		1	SS	15					
	FILL: Compact, dark brown to brown sand to sandy silt fill, some gravel, trace clay, trace organics, moist		2	SS	6	223				
2.0 / 221.9	BOREHOLE TERMINATED AT 2.0 m		3	SS	6	222				Upon completion of augering No water No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 3

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 29,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 223.63				
0.0		FILL: Compact, brown sand to silt fill, some gravel, probable cobbles and boulders, trace clay, trace organics, moist		1	SS	
				2	SS	13
1.0						
				3	SS	6
2.0	2.1 / 221.5	SANDY SILT TILL: Dense, brown sandy silt till, some gravel, trace to some clay, moist		4	SS	50
3.0	2.9 / 220.7	becoming grey, trace gravel		5	SS	99/290 mm
4.0						
				6	SS	98/295 mm
5.0	5.0 / 218.6	BOREHOLE TERMINATED AT 5.0 m				

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

ELEVATION SCALE: 223, 222, 221, 220, 219

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
No water
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 4

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 29,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
		SURFACE ELEVATION 223.89									
0.20	223.69	TOPSOIL: Dark brown sand, some gravel, trace organics, moist		1	SS	18					
		FILL: Very loose to very dense, dark brown sand to silty sand fill, some gravel, probable cobbles and boulders, moist		2	SS	16	223				
				3	SS	2	222				
				4	SS	1					First water strike at 2.3 m
				5	SS	64	221				
4.0	219.9	SANDY SILT TILL: Dense, brown sandy silt till, trace gravel, trace to some clay, wet		6	SS	31	220				
5.0	218.9	BOREHOLE TERMINATED AT 5.0 m					219				Upon completion of augering Water at 1.5 m Cave at 2.6 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 5

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 29,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 224.15				
0.0		TOPSOIL: Dark brown sand, some gravel, trace organics, moist		1	SS	17
0.30	223.85	FILL: Compact to very dense, dark brown sand fill, some gravel, trace organics, moist		2	SS	50/130 mm
1.0						
1.4	222.8	SANDY SILT TILL: Compact to very dense, brown sandy silt till, trace gravel, some clay, probable cobbles and boulders, moist		3	SS	22
2.0				4	SS	37
2.9	221.3	becoming grey		5	SS	47/120 mm
3.0						
4.0						
5.0	219.2	BOREHOLE TERMINATED AT 5.0 m		6	SS	35
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

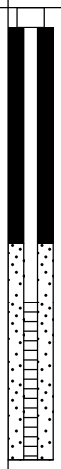
ELEVATION SCALE: 224, 223, 222, 221, 220

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
No water
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	3.1	221.1
2021-12-17	2.8	221.4

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 6

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 26,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 223.00					
0.30	222.70	TOPSOIL: Dark brown sand, trace clay, trace organics, moist		1	SS	4	
0.70	222.30	FILL: Dark brown sand fill, trace silt, trace clay, trace organics, moist					
		SANDY SILT TILL: Loose to compact, brown to grey sandy silt till, trace to some gravel, trace to some clay, moist		2	SS	9	222
				3	SS	12	221
				4	SS	20	
2.9	220.1	becoming dense		5	SS	28	220
							219
5.0	218.0	BOREHOLE TERMINATED AT 5.0 m		6	SS	43	218

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 3.2 m

Upon completion of augering
Water at 3.7 m
Cave at 4.3 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 7

PROJECT Proposed Simcoe County Affordable Housing Facility
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE October 26,2021
PML REF. 21BF049
ENGINEER GW
TECHNICIAN FF

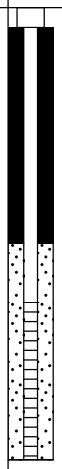
DEPTH (metres) / ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION 223.35			
0.20 / 223.15	TOPSOIL: Dark brown sand, trace organics, moist	1	SS	8
0.70 / 222.65	FILL: Dark brown sand fill, trace gravel, trace organics, moist			
	SANDY SILT TILL: Compact, brown sandy silt till, some gravel, trace to some clay, probable cobbles and boulders, moist	2	SS	20
		3	SS	25
2.1 / 221.3	becoming grey, very dense to dense	4	SS	55
		5	SS	57
		6	SS	45
5.0 / 218.4	BOREHOLE TERMINATED AT 5.0 m			

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Water at 4.6 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	1.8	221.6
2021-12-17	1.8	221.6

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 8

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 26,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

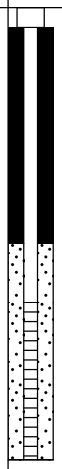
DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	"N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 223.62					
0.20	223.42	TOPSOIL: Dark brown sand trace gravel, trace organics, moist		1	SS	13	223
0.70	222.92	FILL: Dark brown sand fill, trace gravel, trace organics, moist					
		SANDY SILT TILL: Compact, brown sandy silt till, some gravel, trace to some clay, probable cobbles and boulders, moist		2	SS	20	
				3	SS	20	222
2.1	221.5	becoming very dense		4	SS	54	221
				5	SS	85	
				6	SS	57	220
5.0	218.6	BOREHOLE TERMINATED AT 5.0 m					219

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
No water
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	0.7	222.9
2021-12-17	1.5	222.1

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 9

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 29,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION 222.98			
0.30 / 222.68	TOPSOIL: Dark brown sand, trace silt, some gravel, trace organics, moist	1	SS	4
0.70 / 222.28	FILL: Dark brown sand fill, trace silt, some gravel, trace organics, moist			
	SANDY SILT TILL: Compact to dense, brown sandy silt till, some clay, trace to some gravel, probable cobbles and boulders, moist	2	SS	11
		3	SS	35
2.1 / 220.9	becoming grey, trace gravel	4	SS	30
		5	SS	20
		6	SS	25
5.0 / 218.0	BOREHOLE TERMINATED AT 5.0 m			

STRAT PLOT

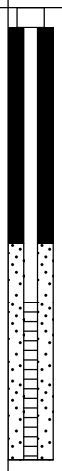
ELEVATION SCALE: 222, 221, 220, 219, 218

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Water at 4.5 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	1.0	222.0
2021-12-17	0.7	222.3

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 10

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 26,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 223.19					
0.0	223.19	TOPSOIL: Dark brown sand, trace clay, trace organics, moist		1	SS	6	223
0.40	222.79	FILL: Dark brown sand to sandy silt fill, trace clay, trace gravel, trace organics, moist		2	SS	8	222
1.4	221.8	SANDY SILT TILL: Compact to very dense brown sandy silt till, some gravel, probable cobbles and boulders, trace to some clay, moist to wet		3	SS	17	221
				4	SS	76	
				5	SS	78	220
4.0	219.2	becoming grey, wet					219
				6	SS	90	
5.0	218.2	BOREHOLE TERMINATED AT 5.0 m					

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 3.0 m

Upon completion of augering
Water at 3.8 m
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 11

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 222.70					
0.26 / 222.44	TOPSOIL: Dark brown sand, trace silt, trace gravel, trace organics, moist		1	SS	30	
	FILL: Compact to dense, dark brown sand to silty sand fill, trace gravel, trace organics, moist		2	SS	18	222
			3	SS	16	221
			4	SS	34	
2.9 / 219.8	SANDY SILT TILL: Very dense, grey sandy silt till, trace gravel, probable cobbles and boulders, trace to some clay,wet		5	SS	63	220
						219
			6	SS	83/290 mm	218
5.0 / 217.7	BOREHOLE TERMINATED AT 5.0 m					

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 2.3 m

Upon completion of augering
Water at 2.9 m
Cave at 3.9 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 12

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 29,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 222.40					
0.35 / 222.05	TOPSOIL: Dark brown sand, trace silt, trace gravel, trace organics, moist		1	SS	5	222
0.70 / 221.70	FILL: Loose, dark brown sand fill, trace silt, trace gravel, trace organics, moist					
	SANDY SILT TILL: Compact, brown sandy silt till, trace gravel, trace to some clay, moist		2	SS	11	
			3[1]	SS	23	221
2.1 / 220.3	becoming grey, very dense		4	SS	53	220
3.5			5	SS	76	219
218.9	BOREHOLE TERMINATED AT 3.5 m					

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
Water at 3.0 m
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 13

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 221.98					
0.20 / 221.78	TOPSOIL: Dark brown sand, some gravel, some organics, moist		1	SS	33	
0.70 / 221.28	FILL: Dark brown sand fill, trace gravel, trace organics, moist					
	SANDY SILT SILT: Compact to dense, brown sandy silt till, some gravel, trace to some clay, moist		2	SS	19	221
1.4 / 220.6	becoming grey, probable cobbles and boulders, very moist		3	SS	30	220
			4	SS	19	
			5	SS	29	219
						218
			6	SS	41	
5.0 / 217.0	BOREHOLE TERMINATED AT 5.0 m					217

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 4.5 m

Upon completion of augering
Water at 4.5 m
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 14

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 28,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

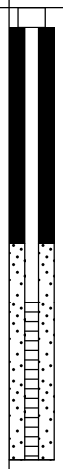
DEPTH (metres)	ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 222.41			
0.25	222.16	TOPSOIL: Dark brown sand, trace gravel, trace organics, moist	1	SS	7
0.70	221.71	FILL: Loose, dark brown sand fill, trace gravel, trace organics, moist			
		SANDY SILT TILL: Compact to dense, brown sandy silt till, trace gravel, trace to some clay, moist to wet	2	SS	11
			3	SS	19
			4	SS	38
2.9	219.5	becoming grey, dense to very dense	5	SS	45
4.6	217.8	probable cobbles and boulders	6	SS	50/75 mm
5.0	217.4	BOREHOLE TERMINATED AT 5.0 m			

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Water at 1.1 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	0.7	221.7
2021-12-17	0.5	221.9

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 15

PROJECT Proposed Simcoe County Affordable Housing Facility — **PML REF.** 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio — **BORING DATE** October 28,2021 — **ENGINEER** GW
BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 221.59					
0.30 / 221.29	TOPSOIL: Dark brown sand, trace silt, trace gravel, trace organics, moist		1	SS	4	221
0.70 / 220.89	FILL: Loose, dark brown sand fill, trace silt, trace gravel, trace organics, moist					
	SANDY SILT TILL: Compact to very dense, brown to grey sandy silt till, trace gravel, trace to some clay, probable cobbles and boulders, moist to wet		2	SS	15	
			3	SS	37	220
			4	SS	54	
3.4 / 218.2	BOREHOLE TERMINATED AT 3.4 m		5	SS	50/40 mm	219

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 1.5 m

Upon completion of augering Wet cave at 1.1 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 16

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
		SURFACE ELEVATION 221.58				
0.0		TOPSOIL: Dark brown sand, trace gravel, trace organics, moist		1	SS	7
0.34	221.24	FILL: Loose, dark brown sand fill, trace gravel, trace organics, moist		2	SS	5
1.0						
1.4	220.2	SANDY SILT TILL: Compact, brown sandy silt till, trace gravel, some clay, moist to wet		3	SS	20
2.0						
2.1	219.5	becoming grey, probable cobbles and boulders		4	SS	23
3.0						
3.0	218.6	becoming dense to very dense		5	SS	46
4.0						
5.0				6	SS	90/290 mm
5.0	216.6	BOREHOLE TERMINATED AT 5.0 m				

ELEVATION SCALE: 221, 220, 219, 218, 217

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Stick-up casing
Concrete
Bentonite seal
50 mm slotted pipe
Filter sand
First water strike at 4.6 m

Upon completion of augering
Water at 4.3 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	1.3	220.3
2021-12-17	1.2	220.4

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 17

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION 221.62									
0.30 / 221.32	TOPSOIL: Dark brown sandy silt, trace gravel, trace organics, moist		1	SS	8					
	FILL: Loose to very loose, dark brown sand fill, trace silt, trace gravel, trace organics, moist		2	SS	2	221				
1.4 / 220.2	SANDY SILT TILL: Compact to dense, brown sandy silt till, trace gravel, some clay, probable cobbles and boulders, wet		3	SS	18	220				First water strike at 1.5 m
			4	SS	36	219				
3.5 / 218.1	BOREHOLE TERMINATED AT 3.5 m		5	SS	41					Upon completion of augering Water at 2.1 m Cave at 3.0 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 18

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	"N" VALUES
	SURFACE ELEVATION 221.25				
0.15 / 221.10	TOPSOIL: Dark brown sand, trace gravel, some organics, moist		1	SS	14
0.70 / 220.55	FILL: Compact, dark brown sand fill, some gravel, trace organics, moist				
	SANDY SILT TILL: Compact, brown to dark brown sandy silt till, trace gravel, probable cobbles and boulders, some clay, moist		2	SS	21
			3	SS	17
2.1 / 219.2	becoming grey		4	SS	14
			5	SS	20
3.5 / 217.8	BOREHOLE TERMINATED AT 3.5 m				

ELEVATION SCALE: 221, 220, 219, 218

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
No water
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 19

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 221.88					
0.0	221.88	TOPSOIL: Dark brown sand, tace gravel, trace organics, moist		1	SS	10	
0.32	221.56	FILL: Loose, dark brown sand fill, trace organics, trace gravel, moist		2	SS	6	221
1.0							
1.4	220.5	SANDY SILT TILL: Compact to very dense, brown sandy silt till, some clay, probable cobbles and boulders, wet		3	SS	19	220
2.0				4	SS	24	
3.0							219
3.5	218.4	BOREHOLE TERMINATED AT 3.5 m		5	SS	63	
4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							
14.0							
15.0							

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 1.4 m
12, 40, 48
8, 29, 63
Upon completion of augering
Water at 1.5 m
Cave at 2.6 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 20

PROJECT Proposed Simcoe County Affordable Housing Facility
PML REF. 21BF049
LOCATION 125 Simcoe Road, Bradford, Onatrio
BORING DATE October 27,2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN FF

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 220.82				
0.32	220.50	TOPSOIL: Dark brown sand, trace gravel, some organics, moist		1	SS	11
0.70	220.12	FILL: Compact, dark brown sand fill, trace gravel, trace organics, moist				
		SANDY SILT TILL: Compact, brown sandy silt till, trace gravel, trace clay, probable cobbles and boulders, moist		2	SS	14
				3	SS	16
2.1	218.7	becoming dense to very dence, some clay		4	SS	45
				5	SS	100/240mm
				6	SS	69
5.0	215.8	BOREHOLE TERMINATED AT 5.0 m				

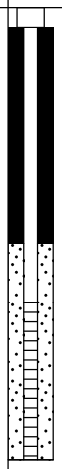
ELEVATION SCALE: 220, 219, 218, 217, 216

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Water at 4.1 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-11-24	0.6	220.2
2021-12-17	0.5	220.3

NOTES

BH 6
EL. 223.00

BH 12
EL. 22.40

BH/MW 1
EL. 224.13

BH 3
EL. 223.63

BH/MW 9
EL. 222.98

BH/MW 14
EL. 221.41

BH 19
EL. 221.88

BH 4
EL. 223.89

BH 10
EL. 223.19

BH 15
EL. 221.59

BH 17
EL. 221.62

BH 2
EL. 223.93

BH/MW 7
EL. 223.35

BH 11
EL. 222.70

BH/MW 5
EL. 224.15

BH/MW 16
EL. 221.58

BH/MW 20
EL. 220.82

BH/MW 8
EL. 223.62

BH 13
EL. 221.98

BH 18
EL. 221.25

PROPERTY LINE

3M SETBACK

RESIDENTIAL SPACES: 50
VISITOR SPACES: 15
ONTARIO WORKS SPACES: 26
TOTAL PARKING SPACES: 94

SMOKING SHELTER

DROP OFF

OUTDOOR AMENITY 257 SM

STORAGE SHED

GARBAGE PAD

LOADING ZONE

PROPOSED 4 STOREY, 50 UNIT APARTMENT BUILDING
BUILDING AREA: 1,686 SM
GFA: 6,422 SM

SIMCOE ROAD

PROPERTY LINE (6.6M ROAD WIDE)

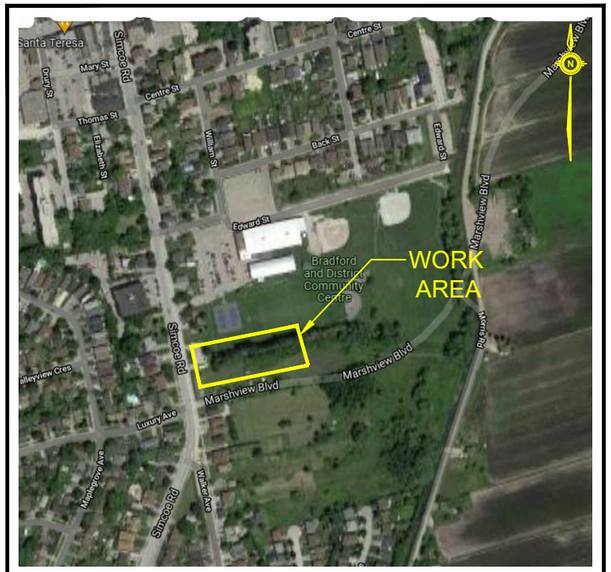
9M SETBACK

5M SETBACK

7.5M SETBACK

MARSHVIEW BLVD.

SCALE
0 m 10 m 20 m 30 m 40 m 50 m



KEY PLAN

LEGEND:

- BOREHOLE WITH MONITORING WELL
- BOREHOLE

REFERENCE:

BOREHOLE LOCATION PLAN REPRODUCED FROM THE DRAWING SUPPLIED BY THE CLIENT.

NOTES:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

THE BOREHOLE LOCATIONS AND GEODETIC ELEVATIONS WERE SURVEYED WITH A SOKKIA GCX3 REAL TIME KINEMATIC RECEIVER CONNECTED TO THE GLOBAL NAVIGATION SATELLITE SYSTEM.

THE CORPORATION OF THE COUNTY OF SIMCOE

PROPOSED SIMCOE COUNTY AFFORDABLE HOUSING FACILITY

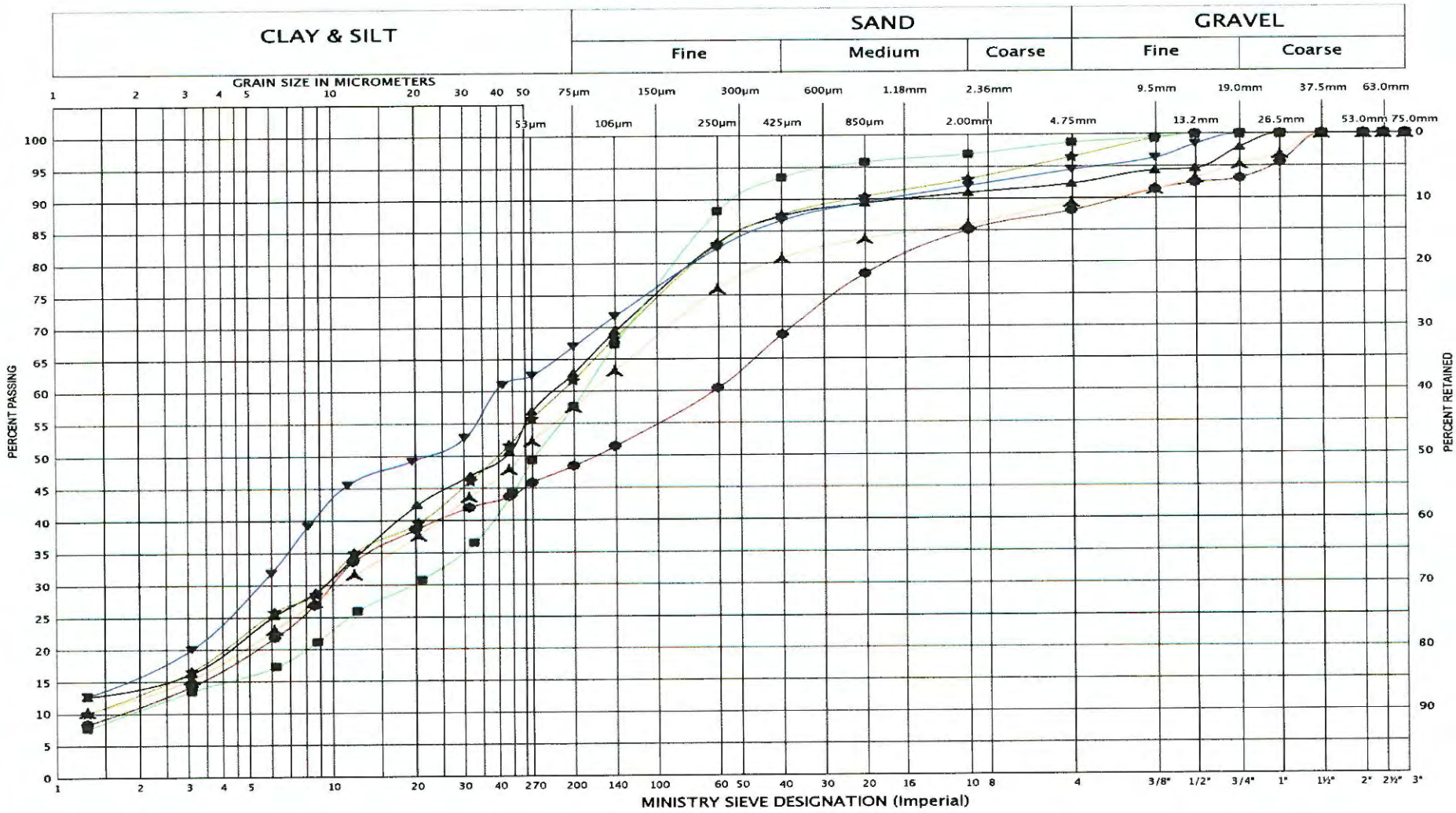
125 SIMCOE ROAD, BRADFORD WEST
GWILLIMBURY, ONTARIO

BOREHOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	D. SUBBURAJ	DATE	SCALE	PML REF.	DWG. NO.
CHECKED	M. SEGURA	JANUARY 2022	AS SHOWN	21BF049	1
APPROVED	M. SEGURA				

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	5	5	9	9	19	19
	SAMPLE	3	6	3	5	3	5
	SYMBOL	▼	★	▲	■	●	▲

PML Peto MacCallum Ltd. CONSULTING ENGINEERS

GRAIN SIZE DISTRIBUTION

FIG No.: 1

January, 2022

Project No.: 21BF049

APPENDIX A

ENGINEERED FILL

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.