Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL INVESTIGATION
PROPOSED TOWNHOUSE DEVELOPMENT
CRANBERRY MARSH ESTATES
11589 HIGHWAY 26
COLLINGWOOD, ONTARIO

for

HILL RIDGE HOMES

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PML Ref.: 21BF201
Report: 2 Revised
January 2021

Peto MacCallum Ltd.
CONSULTING ENGINEERS

January 26, 2022

PML Ref.: 21BF201
Report: 2 Revised

Mr. Frank Fragal
Hill Ridge Homes
110 Jardin Drive, Suite 14
Vaughan, Ontario
L4K 2T7

Dear Mr. Fragal

Geotechnical Investigation
Proposed Townhouse Development
Cranberry Marsh Estates
11589 Highway 26
Collingwood, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for this work was provided by Mr. F. Fragal, in the signed engineering services agreement, September 20, 2021 and provision of a retainer.

It is understood that five blocks of townhouses, with three to six units per block (twenty-six units in total), are proposed for the property at 11589 Highway 26 in Collingwood, Ontario. The property is a 1.3 ha rectangular shaped parcel that is undeveloped (treed) and is located on the south side of Highway 26. The townhouses are to be slab-on-grade. A single road will provide paved access and a full site serving will be provided.

A geotechnical investigation has been requested to determine the subsurface conditions at the site, and based on this information, provide geotechnical engineering recommendations for earthworks, building foundations, site servicing, and pavement design.

A Phase One Environmental Site Assessment is being carried out concurrently and results will be provided under separate cover (Report 1) when complete.

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 works as addressed in the report. Any changes in the proposed plans will require review by PML to re-assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

This report is subject to the Statement of Limitations that is included in Appendix A and must be read in conjunction with the report.

INVESTIGATION PROCEDURES

The geotechnical field work for project was carried out on November 22, 2021 and consisted of Boreholes 1 to 4, advanced to auger refusal at 3.4 to 3.7 m. The borehole locations are shown on Drawing 2-1, appended.

PML laid out the boreholes in the field. The ground surface elevation at Borehole 1 was obtained with a Sokkia SHC5000 GPS System equipped with a GCX3 (network RTK rover) Global Navigation Satellite System (GNSS) Receiver. Vertical and horizontal accuracy of this unit are 0.1 m and 0.5 m, respectively. Due to tree cover interference, the accuracy of the Sokkia SHC5000 survey unit, especially at Borehole 2 to 4, was 0.5 to 1.0 m. To provide borehole location ground surface elevations that are relatively more accurate, topographical survey elevations from a drawing (File 120181, dated October 2021) prepared by Tatham Engineering Limited for this project were used. All elevations in this report are geodetic and expressed in metres.

Co-ordination for clearances of underground utilities was provided by PML. The boreholes were drilled at locations checked/cleared by specialist utility clearance services providers to avoid interference with underground/buried utility installations.

The boreholes were advanced using continuous flight hollow stem augers, powered by a rubber track mounted D-50 drill rig, equipped with an automatic hammer, 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 for identification purposes using a conventional 51 mm OD split spoon sampler. The sampler excludes particles larger than 38 mm. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. The ground

water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of the water level in the open boreholes, if any.

Monitoring wells, comprised of 50 mm diameter pipe, filter sand, bentonite seal, and stick-up protection casing, were installed in three boreholes. The details of the monitoring well installation are shown on the applicable Log of Borehole Sheets. It should be noted that the wells become the property of the Owner and will have to be decommissioned by the Owner when no longer required. PML would be pleased to assist, if requested. PML returned to the site about one month later to measure the ground water level in the wells.

The borehole without a well was backfilled in accordance with O.Reg. 903.

All recovered samples were taken to PML's laboratory for detailed examination and moisture content determinations. Grain size analyses were carried out on two representative samples of the major soil unit. The results are provided on Figure 2-1, appended.

SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The property is a 1.3 ha long rectangular shaped parcel that is undeveloped (treed) and is located on the south side of Highway 26. A marsh area is located near the south end of the site. The site is relatively level with about 1 m of relief. An existing trail was present down the middle of the site. It is noted that during our return to measure the ground water levels, the site had surface water from about Borehole 2 to the south part of the site.

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, soil classifications, including topsoil thicknesses, inferred stratigraphy and thicknesses, Standard Penetration test N Values (N Values – number of blows per 300 mm of penetration of the split spoon sampler), monitoring well installation details, 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 soil boundaries in the field during construction, if required.

The site is characterized by topsoil, over thin units of silt or sand, overlying a major till deposit with assumed bedrock at depth. A description of the distribution and characteristics of the various soil units and ground water observations encountered in the boreholes is presented below.

Topsoil

At the surface of all boreholes, a 50 to 200 mm thick topsoil layer was present.

Silt

A 650 mm thick layer of silt was beneath the topsoil in Borehole 1, and extended down to 0.7 m (elevation 178.4). The compact silt had an N value of 20. The silt was very moist with a moisture content of 22%.

Sand

A 0.5 to 1.3 m thick sand layer was revealed below the topsoil in Boreholes 2 to 4, and extended to 0.7 to 1.4 m (elevation 177.5 to 178.7). The sand was very loose to compact with N values ranging from 3 to 19. The unit contained trace silt and trace organics. The sand was wet and moisture contents ranged from 7 to 28%.

Till

A major till deposit was contacted below the silt or the sand layer and extended to the 3.4 to 3.7 m depth of termination of the boreholes (elevation 175.2 to 176.2). The till density was loose to very dense and N values of 9 to greater than 50 were recorded. The till was typically loose or compact

in the first sample (N values of 5, 9 and 28 in Boreholes 2 to 4), becoming very dense below the first sample, locally very dense from the top of the deposit in Borehole 1.

Two samples of the till were submitted for grain size analysis and the results are provided in Figure 2-1, attached. The till matrix varied from a silt and sand with trace gravel and trace clay to a sandy silt with some gravel and trace clay. The soil was wet near the top of the unit becoming moist with depth and moisture contents ranged from 17 to 5% with depth.

Auger Refusal/Bedrock

Refusal to auger was encountered in all boreholes as noted below.

BOREHOLE	REFUSAL (DEPTH (m) / ELEVATION)
1	3.7 / 175.4
2	3.7 / 175.2
3	3.4 / 176.2
4	3.7 / 175.7

Refusal to auger could have been due to boulders in the till or shallow bedrock common to the area. A program of test pits is recommended to confirm the nature of the shallow refusal.

Bedrock in the area is described as limestone, dolostone, shale, arkose, and/or sandstone of the Simcoe group of the middle Ordovician period.

Ground Water

The first ground water strike during drilling, the water level in the boreholes upon completion, and measured in the wells about one month after installation (December 17, 2021) is provided below.

BOREHOLE	FIRST GROUND WATER STRIKE (DEPTH (m) / ELEVATION)	WATER LEVEL IMMEDIATELY UPON COMPLETION DRILLING (DEPTH (m) / ELEVATION)	WATER LEVEL IN WELLS (DEPTH (m) / ELEVATION) 2021-12-17
1	NW to 3.7 / 175.4	3.4 / 175.7	0.2 / 178.9
2	0.9 / 178.0	0.9 / 178.0	--
3	2.6 / 177.0	NW to 3.4 / 176.2	0.0 / 179.6
4	2.6 / 176.8	3.0 / 176.4	0.0 / 179.4

NW = No Water

Based on the above, the stabilized ground water table is within the 0.5 m of the ground surface. Further, evidenced by the marsh area at the south end of the development and ponded water at the site during the water level measurement.

Ground water levels are subject to fluctuations due to precipitation and seasonal variation. Georgian Bay is only about 250 m north of Highway 26 and the water level was at about elevation 176.7+/- at the time of the investigation.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

It is understood that five blocks of townhouses, with three to six units per block (twenty-six units in total), are proposed for the property at 11589 Highway 26 in Collingwood, Ontario. The property is a 1.3 ha rectangular shaped parcel that is undeveloped (treed) and is located on the south side of Highway 26. The townhouses are to be slab-on-grade. A single road will provide paved access and a full site serving will be provided.

Site Grading and Engineered Fill

Finalized grades were not provided at the time of preparation of this report. Considering the high ground water table, site grades will need to be raised such that the proposed finished floor of the townhouses is above the ground water table. A grade raise of at least 1 m is anticipated.

The existing topsoil and upper loose to very loose 0.6 m of native soil are unsuitable to support footings and floor slab-on-grade due to potential for excessive gross and differential settlement. The topsoil and upper 0.6 m of very loose to loose sand in Borehole 2 to 4 will have to be removed/subexcavated. There may be local areas where deeper excavation is required to remove unsuitable soil, subject geotechnical review. Grades can then be raised with engineered fill. The proposed building footings can then be founded on engineered fill or competent native soils with floor slab-on-grade supported on engineered fill.

Where grades are raised under pavements, the fill should also be constructed as engineered fill.

General guidelines for engineered fill construction are provided in Appendix B. Highlights are as follows:

- Sub-excavate the existing topsoil, upper 0.6 m of very loose to loose native soil and other deleterious materials down to competent native soil. The excavated soil should be stockpiled for reuse in landscaping areas and/or disposal;

- The exposed subgrade should then be compacted with a heavy roller to ensure 100% Standard Proctor maximum dry density (SPMDD), under geotechnical review during construction;

- Following geotechnical subgrade approval, the site can be raised up to the design level using engineered fill. The engineered fill material must be spread in maximum 200 mm thick loose lifts and uniformly compacted to 100% of SPMDD under buildings and minimum 95% of SPMDD under pavements/services;

- Engineered fill material should comprise inorganic soil, free of deleterious material, at moisture content suitable for compaction. Excavated site soil is generally expected to comprise wet sand which is considered generally unsuitable for reuse in building and pavement areas. Imported material will be required and should comprise select granular soil such as OPSS.MUNI 1010 Select Subgrade Material (SSM) or OPSS.MUNI 1010 Granular B and must be at a moisture content suitable for compaction. Prospective imported material should be reviewed by our office to ensure suitability;

- The engineered fill pad, must extend at least 1 m beyond the structures to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved native subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported;

- Engineered fill construction must be carried out under full-time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

Foundations

The proposed townhouses can be supported on conventional strip and spread footings founded at normal depth on native soil or engineered fill. A geotechnical bearing resistance at Serviceability Limit State (SLS) of 100 kPa, and factored bearing resistance at Ultimate Limit State (ULS) of 150 kPa are recommended for design of footings founded on native compact soil or engineered fill, constructed as described above.

The geotechnical bearing resistance at SLS is based on 25 mm or settlement in the bearing stratum with differential settlement not exceeding 75% of the value.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent insulation. It is noted that 25 mm of polystyrene insulation is equivalent to 600 mm of earth cover.

Prior to placement of structural concrete, all founding surfaces must be examined by PML to check the design bearing capacity is available, and/or to reassess the available soil capacity.

Seismic Design

Based on the soil profile revealed in the boreholes (N values), Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site, the soils have a low potential for liquefaction.

Floor Slab-on-Grade

Floor slab-on-grade construction is considered feasible on engineered fill constructed as described earlier in the report.

A minimum 200 mm thick base layer of crushed stone (nominal 20 mm size) is recommended directly beneath the floor slab. Where a vapour sensitive floor finish is to be used then the use of polyethylene sheeting or similar means should be incorporation as a vapour barrier. Underfloor drains are not considered necessary where the floor slabs are a minimum 1.0 m above existing grade.

Exterior grades should be established to promote surface drainage away from the building.

Site Servicing

At the time of this report, design inverts were not established. Services are anticipated to be as much as 3.0 m below proposed grades.

Excavation and Ground Water Control

Excavation is anticipated to about 1.0 m depth for removals for engineered fill and about 2 to 3 m below existing grade for site servicing considering the anticipated grade raise. Excavation will encounter topsoil over layers of native silt and sand overlying a major till deposit. Harder digging and the presence of cobbles and boulders can be expected in the till deposit.

Subject to effective ground water control, the site soils should be considered as Type 3 soil requiring excavation side walls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act.

Excavation side slopes will need to be continuously examined and reviewed for evidence of instability, particularly following periods of heavy rain or thawing. When required, remedial action must be taken to ensure the continued stability of the excavation slope and the safety of the workers.

The stabilized ground water level is believed to be within 0.5 m of the ground surface as a wet marsh area is to the south of the site. The ground water appears to be perched in the sand above the less pervious till. For shallow excavation to about 1 m depth conventions sump pumping should suffice. Deeper excavation will require more aggressive pumping, such as pumping from multiple sumps or larger keg wells. It is recommended that excavation be carried out in small manageable sections that can be completed at the end of the day, to reduce ground water control requirements. Excavation during the dry summer months is also recommended to aid in reducing ground water control requirements.

There may be a requirement for blasting/bedrock excavation due to the potentially shallow bedrock common to the area. In this regard, it is recommended that a program of rock coring or test pits be carried out to verify the presence/absence of bedrock when the design details have been established. Where blasting/rock excavation is required, a precondition survey should be carried out for structures in the area prior to construction and vibration monitoring should be conducted during construction. This documentation will assist in resolution of potential claims arising during blasting/rock excavation. It is noted that the boreholes may have penetrated the upper surface of the bedrock while initially trying to penetrate the obstruction. The top of the bedrock surface is likely slightly higher than the refusal depth. The contract should compensate for this possible discrepancy when it comes to bedrock excavation quantities.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation O. Reg. 387/040, Section 34 of the OWRA requires any one taking more than 50,000 L/d to obtain a Permit-to-Take-Water (PTTW). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering or permanent drainage improvements. Projects assessed to be taking more than 50,000 L/d but less than 400,000 L/d of ground water can obtain a permit/permission online via the Environmental Activity and Sector Registry (EASR) system. If it is assessed that more than 400,000 L/d is required then a Category 3 PTTW will be required.

Based on the discussion above, a PTTW is not anticipated. Registry on the EASR system may be required depending on grading requirements and should be reviewed once design details have been established.

It is recommended that a test dig be undertaken to allow prospective contractors an opportunity to observe and evaluate the subsurface conditions likely to be encountered and assess preferred means of excavation and ground water control measures based on their own experience.

Pipe Support, Pipe Bedding and Cover

Native soil is expected at invert levels which is considered satisfactory for pipe support. Where existing fill, or other deleterious material is encountered at the design invert level, such material

shall be re-compacted or sub-excavated and replaced with an increased thickness of bedding material, subject to geotechnical field review and approval.

OPSS bedding and cover thickness and compaction standards are recommended. Bedding and cover material should comprise OPSS.MUNI 1010 Granular A.

Trench Backfill

Backfill in trenches shall comprise select inorganic soil, placed in maximum 200 mm thick loose lifts and compacted to at least 95% of SPMDD to minimize post construction settlement in the backfill. Topsoil, organic, excessively wet, frozen oversized (greater than 150 mm in diameter), or otherwise deleterious material must not be incorporated as trench backfill. The moisture content of the trench backfill shall be within 2% of the optimum moisture content in order to achieve the specified compaction and be close to optimum moisture content in the upper 1 m to prevent subgrade instability issues. Ideally the backfill shall comprise excavated site soil, in order to minimize differential frost heave.

The excavated soil will comprise topsoil and native sand and silt and the upper portion of the till deposit. The excavated native soil will generally be acceptable for reuse as trench backfill subject to geotechnical review during construction for moisture content and general composition acceptance. Any existing topsoil is unsuitable for use as trench backfill as well as the sand unit where organics are encountered.

Earthworks operations must be inspected by PML to verify subgrade preparation, backfill materials, placement and compaction efforts and ensure the specified degree of compaction is achieved throughout.

Pavement Design and Construction

It is anticipated that the pavement subgrade will comprise engineered fill due to the anticipated grade raise. The following pavement structure thicknesses are recommended considering the engineered fill will comprise OPSS.MUNI 1010 SSM or OPSS.MUNI 1010 Granular B, and should be reviewed when grading/subgrade soils are determined:

	LIGHT DUTY (mm)	HEAVY DUTY (mm)
Asphaltic Concrete (Two lifts)	90	120
Granular A Base Course	150	150
Granular B Subbase Course	300	450
Total Thickness	690	720

It is anticipated that the subgrade will comprise engineered fill as noted above. Where engineered fill does not comprise the subgrade, it is recommended that following rough grading to the subgrade level, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy compactor to 95% of SPMDD under geotechnical review. Any unstable zones identified during this process should be sub-excavated and replaced with compacted select site material, subject to geotechnical field review. Any grade raises required should be constructed as engineered fill as described earlier in the report.

Imported material for the granular base and subbase should conform to OPSS.MUNI 1010 gradation specifications for Granular A and Granular B, and should be compacted to 100% of SPMDD. Asphalt should be compacted in accordance with OPSS.MUNI 310.

The pavement design considers the construction will be carried out during the dry time of the year and the subgrade is stable and not heaving under construction traffic. If wet or unstable subgrade conditions are encountered, and additional sub-excavation/additional granular subbase required, the use of Granular B Type II and/or the use of geogrid may be warranted, subject to geotechnical review during construction.

For the pavement to function properly, it is essential that provisions be made for water to drain out of and not collect in the base material. The incorporation of subdrains should be considered in conjunction with crowning of the final subgrade to promote drainage towards the pavement edge. Subdrains should be installed at least 300 mm below the subgrade level. Refer to OPSD 216 Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Maintenance hole/catch basins should be backfilled with free draining Granular B. The above measures will help drain the pavement structure as well as alleviate the problems of differential frost movement between the catchbasins and pavement.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the final drawings be submitted to PML for geotechnical review for compatibility with the site conditions and the recommendations provided in this report.

Earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures, and verify that the specified compaction standards are achieved throughout fill materials.

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions.

The comments and recommendations provided in the report are based on the information revealed in the boreholes. Conditions away from and between boreholes may vary. Geotechnical review during construction should be on going to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

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CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Sincerely
Peto MacCallum Ltd.

LICENSED PROFESSIONAL ENGINEER
G. G. UWIMANA
January 26/2022
PROVINCE OF ONTARIO

Geoffrey Uwimana, M.Eng., P.Eng.
Vice President
Discipline Head – Geotechnical Engineering Services

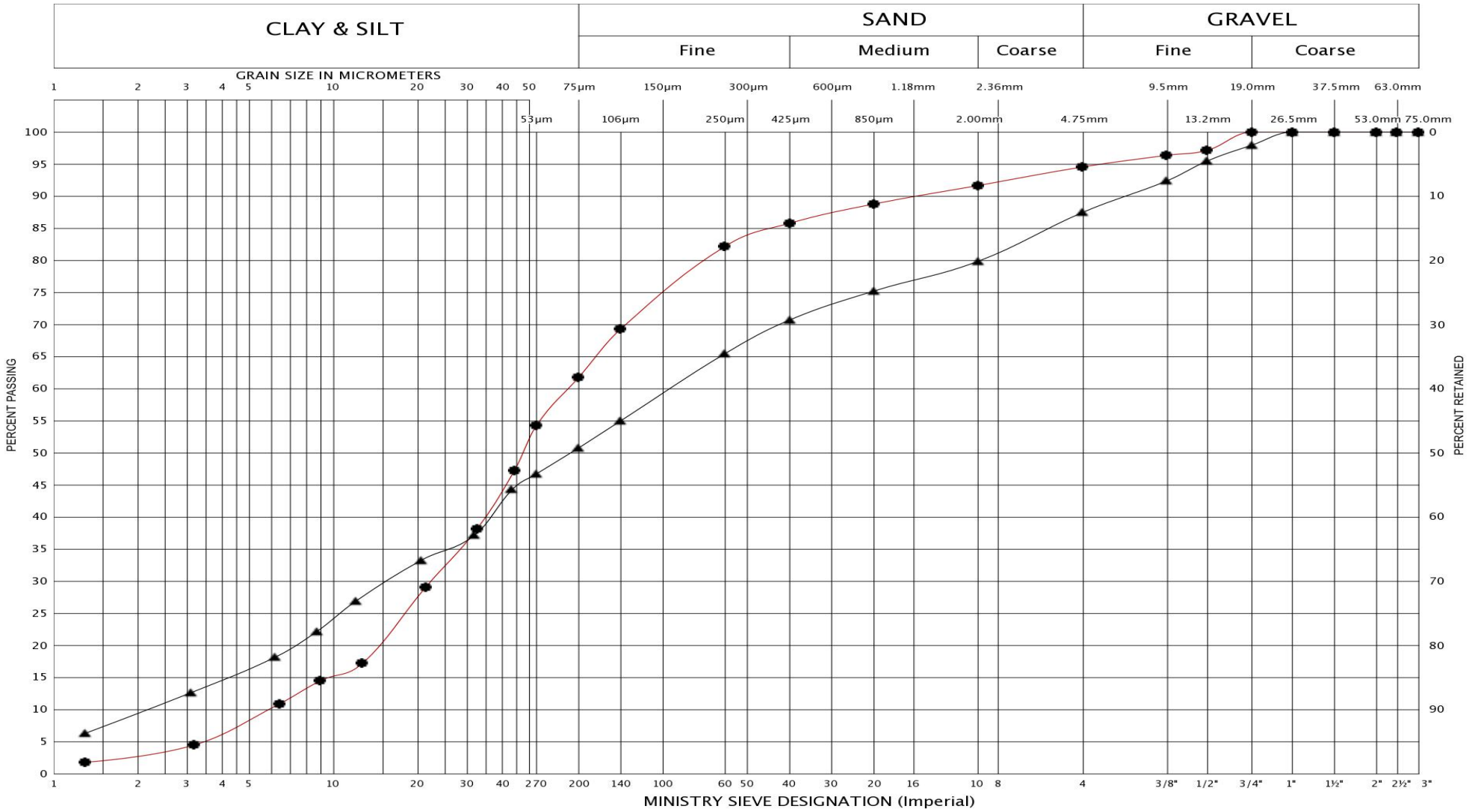
REGISTERED PROFESSIONAL ENGINEER
B. R. GRAY
January 26/2021
PROVINCE OF ONTARIO

Brian R. Gray, M.Eng., P.Eng.
Principal Consultant

GRW/GU/BRG:tc

Enclosures:
Figure 2-1 – Grain Size Distribution
List of Abbreviations
Log of Borehole No's 1 to 4
Drawing 1 – Borehole Location Plan
Appendix A – Statement of Limitations
Appendix B – Engineered Fill

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	1	3
	SAMPLE	3	3
	SYMBOL	●	▲

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GRAIN SIZE DISTRIBUTION

TILL: SAND AND SILT To SANDY SILT, Trace to Some Gravel, Trace Clay

FIG No.: 2-1

Project No.: 21BF201

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		

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

TYPE OF SAMPLE

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

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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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		

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

TYPE OF SAMPLE

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

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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LOG OF BOREHOLE/MONITORING WELL NO. 1

17T 558774E 4929625N

PROJECT Proposed Townhouse Development - Cranberry Marsh Estates — **PML REF.** 21BF201

LOCATION 11589 Highway 26, Collingwood, ON — **BORING DATE** November 22, 2021 — **ENGINEER** GW

BORING METHOD Continuous Flight Hollow Stem Augers — **TECHNICIAN** CM

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
0.05		SURFACE ELEVATION 179.10				
0.0	179.05	TOPSOIL: Dark brown, sand, trace silt, wet		1[1]	GS	20
0.70	178.40	SILT: Compact, brown, silt, some sand, very moist				
1.0		SAND AND SILT TILL: Very dense, brown to grey, sand and silt, trace clay, trace gravel, cobbles and boulders, wet to moist		2[1]	SS	54
				3	SS	91/250 mm
2.0				4[1]	SS	54
3.0				5	SS	81/200 mm
3.7	175.4	BOREHOLE TERMINATED AT 3.7 m UPON REFUSAL TO AUGER				
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

ELEVATION SCALE: 179, 178, 177, 176

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

Upon completion of augering
Water at 3.4 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-12-17	0.2	178.9

NOTES 1 - Sample submitted for chemical testing

Peto MacCallum Ltd.
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LOG OF BOREHOLE NO. 2

17T 558800E 4929439N

PROJECT Proposed Townhouse Development - Cranberry Marsh Estates
PML REF. 21BF201
LOCATION 11589 Highway 26, Collingwood, ON
BORING DATE November 22, 2021
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN CM

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
0.08	SURFACE ELEVATION 178.85					
178.77	TOPSOIL: Dark brown, sand, trace silt, wet		1[1]	GS	3	
	SAND: Very loose to loose, brown, sand to silty sand, trace organics, wet		2[1]	SS	9	178
1.4						
177.5	SANDY SILT TILL: Loose to very dense, grey, sandy silt, trace clay, trace to some gravel, cobbles and boulders, wet to moist		3	SS	5	177
			4[1]	SS	53	176
			5	SS	64	
3.7						
175.2	BOREHOLE TERMINATED AT 3.7 m UPON REFUSAL TO AUGER					

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 0.9 m

Upon completion of augering
Wet cave at 0.9 m

NOTES 1 - Sample submitted for chemical testing

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 3

17T 558802E 4929441N

PROJECT Proposed Townhouse Development - Cranberry Marsh Estates
PML REF. 21BF201
LOCATION 11589 Highway 26, Collingwood, ON
BORING DATE November 22, 2021
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN CM

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
0.08	SURFACE ELEVATION 179.60					
179.52	TOPSOIL: Dark brown, sand, trace silt, wet		1[1]	GS	6	179
	SAND: Loose to compact, brown, sand, trace silt, trace organics, wet		2[1]	SS	19	
1.4						
178.2	SANDY SILT TILL: Compact to very dense, brown to grey, sandy silt, trace gravel, trace clay, cobbles and boulders, wet to moist		3	SS	28	178
			4[1]	SS	96/240 mm	177
			5	SS	50/130 mm	
3.4						
176.2	BOREHOLE TERMINATED AT 3.4 m UPON REFUSAL TO AUGER					

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 2.6 m

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

Date	Depth	Elev.
2021-12-17	0.0	179.6

NOTES 1 - Sample submitted for chemical testing

Peto MacCallum Ltd
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 4

17T 558810E 4929422N

PROJECT Proposed Townhouse Development - Cranberry Marsh Estates
PML REF. 21BF201
LOCATION 11589 Highway 26, Collingwood, ON
BORING DATE November 22, 2021
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN CM

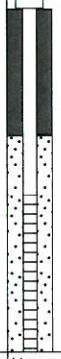
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 179.35					
0.20 / 179.15	TOPSOIL: Dark brown, sand, trace silt, wet		1[1]	GS	5	179
0.70 / 178.65	SAND: Loose, black, sand, trace silt, trace organics, wet					
	SANDY SILT TILL: Loose to very dense, brown to grey, sandy silt, trace clay, trace organics, cobbles and boulders, wet to moist		2[1]	SS	9	178
			3	SS	65	
			4[1]	SS	74	177
			5	SS	50/90 mm	
3.7 / 175.7	BOREHOLE TERMINATED AT 3.7 m UPON REFUSAL TO AUGER					176

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

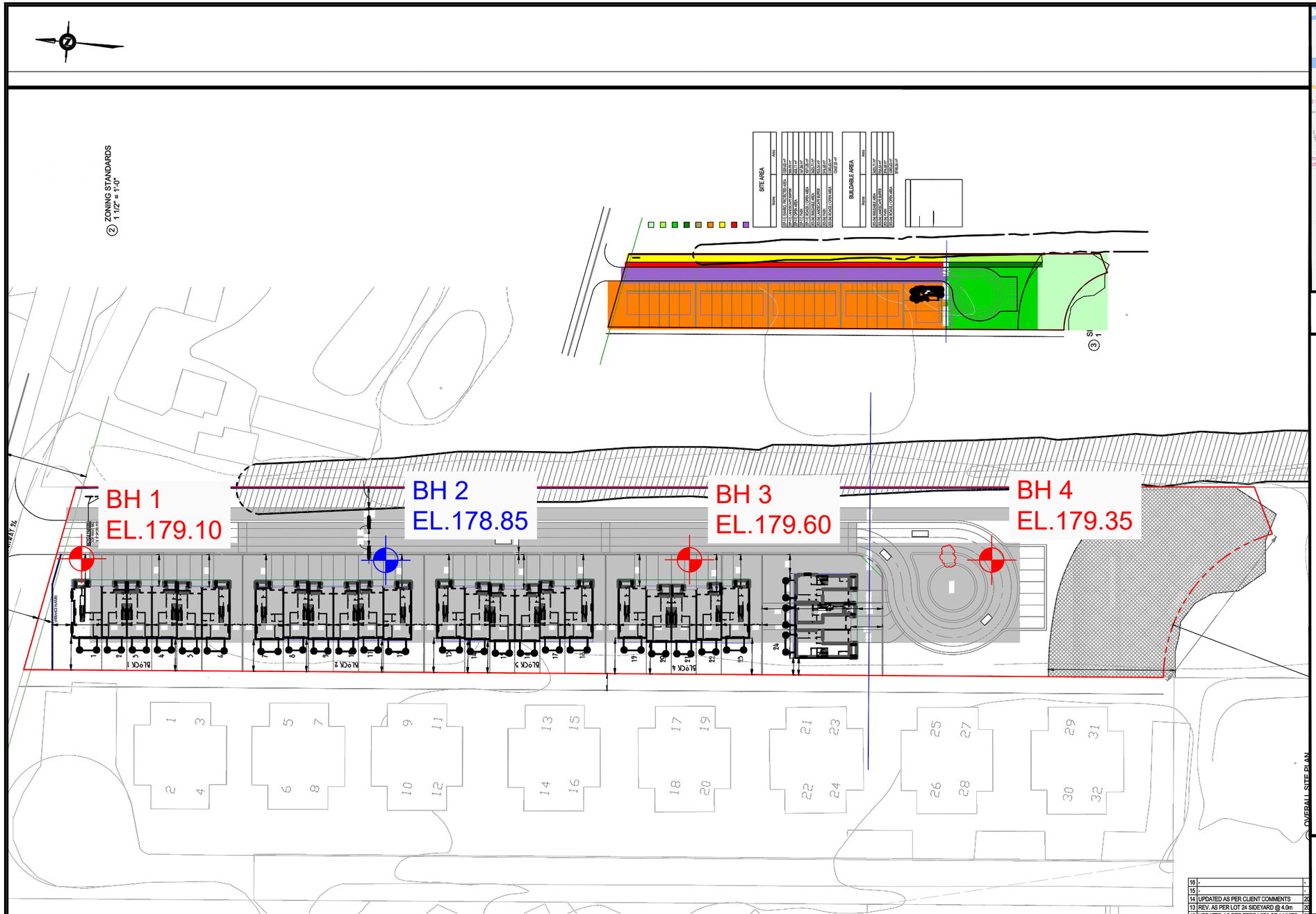


Upon completion of augering
Wet cave at 3.0 m

Water Level Readings:

Date	Depth	Elev.
2021-12-17	0.0	179.4

NOTES 1 - Sample submitted for chemical testing



② ZONING STANDARDS
1 1/2" = 1'-0"

KEY PLAN
COLLINGWOOD , ONTARIO

LEGEND:

BH 1 EL.179.10	BOREHOLE 1 (MONITORING WELL) SURFACE ELEVATION
BH 2 EL.178.85	BOREHOLE 2 SURFACE ELEVATION
	APPROXIMATE SITE LIMITS

REFERENCE:
BASE PLAN PRODUCED BY THE CLIENT

0m 10 20 30 40 50
SCALE

#	DESCRIPTION
16	-
15	-
14	UPDATED AS PER CLIENT COMMENTS
13	REV. AS PER LOT 24 SIDEYARD @ 4.0m
12	UPDATED AS PER TERRACE/LOT 1 UNITS
11	UPDATED AS PER CLIENT COMMENTS
10	UPDATED AS PER CLIENT COMMENTS
9	UPDATED AS PER CLIENT COMMENTS
8	UPDATED AS PER MUNICIPAL COMMENTS
7	UPDATED AS PER CLIENT COMMENTS
6	UPDATED PER MUNICIPAL REVIEW
5	ISSUED FOR MUNICIPAL REVIEW
4	ISSUED FOR CLIENT REVIEW
3	ISSUED FOR CLIENT REVIEW
2	ISSUED FOR CLIENT REVIEW
1	ISSUED FOR CLIENT REVIEW

WATERMARK

HILL RIDGE HOMES (2020-14)
CRANBERRY MARSH ESTATES, COLLINGWOOD, ONT.
(REV 12 - 2021.11.05)

BOREHOLE LOCATION PLAN

PROPOSED TOWNHOUSE DEVELOPMENT
CRANBERRY MARSH ESTATES
11589 HIGHWAY 26, COLLINGWOOD, ON

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	FF	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	JAN 2022	AS SHOWN	21BF201	2-1
APPROVED	BRG				

APPENDIX A

Statement of Limitations

STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

STATEMENT OF LIMITATIONS
(continued)

The findings and comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may affect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence an action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.

APPENDIX B

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.