



**SUPPLEMENTAL GEOTECHNICAL INVESTIGATION  
PROPOSED RESIDENTIAL SUBDIVISION  
CRAIGLEITH RIDGE  
209621 HIGHWAY 26 AND 208 LAKESHORE ROAD EAST  
TOWN OF THE BLUE MOUNTAINS, ONTARIO**

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PML Ref.: 15BF041  
Report: 4 Revised  
January 2018

January 23, 2018

PML Ref.: 15BF041  
Report: 4 Revised

Mr. Michael Sproule, C.E.T.  
Parkbridge Lifestyle Communities Inc.  
85 Theme Park Drive  
Wasaga Beach, Ontario  
L9Z 1X7

Dear Mr. Sproule

**Supplemental Geotechnical Investigation  
Proposed Residential Subdivision  
Craigleith Ridge  
209621 Highway 26 and 208 Lakeshore Road East  
Town of The Blue Mountains, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the supplemental geotechnical investigation recently completed at the above noted project site. Authorization for this assignment was provided by Mr. R. Wagner, in the signed Engineering Services Agreement Change Order 4, dated October 23, 2017.

Parkbridge is planning an approximate 211 lot residential subdivision for the approximate 25 Ha parcel of land at 209621 Highway 26 & 208 Lakeshore Road East, in the Town of Blue Mountains. The site is terraced comprising low lying ground in the northern portion, with frontage on Lakeshore Road East, rising some 15 to 20 m up the Niagara Escarpment in the south part of the site. The southwest part of the site has limited frontage along Grey Road 19. The configuration is shown on Drawing 4-1, appended, however grading has yet to be finalized for all parts of the subdivision. It is understood that site servicing is proposed and full depth basements are preferred.

Reference is made to Report 2, dated December 7, 2015, where a geotechnical investigation was conducted and geotechnical engineering recommendations for the proposed development were provided.

The purpose of this supplemental borehole investigation was to obtain more detailed subsurface information for the entire site, and based on this information, provide any revisions to the recommendations provided in Report 2.



## **INVESTIGATION PROCEDURES**

The field work for this supplemental investigation was carried out on November 16 and 17, 2017, and consisted of Boreholes 101 to 110 drilled to depths of 0.9 to 5.0 m. The borehole locations are shown on the Borehole Location Plan, Drawing 4-1, appended. The boreholes from the previous investigation are also shown.

The boreholes were established in the field by PML. Co-ordination for clearances of underground public utilities was provided by PML. The boreholes were drilled cognizant of underground utilities.

The boreholes were advanced using continuous flight solid stem augers, powered by a rubber tire mounted CME-75 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 in the boreholes were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the substrata. 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.

The boreholes were backfilled in accordance with O.Reg. 903.

All recovered soil samples were returned to our laboratory for moisture content determinations and detailed examination to confirm field classification.



## **SUMMARIZED SUBSURFACE CONDITIONS**

Reference is made to the appended Log of Borehole sheet for details of the subsurface conditions, including soil classifications, inferred stratigraphy, Standard Penetration test 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 should be retained to assist in determining geologic boundaries in the field during construction, if required.

### **Elevated Southern Part of the Site – Boreholes 101 to 103**

The stratigraphy revealed in the initial boreholes carried out for Report 2, comprised topsoil over local layers of silt and sand, over a major till deposit. The soils were typically dense to very dense and ground water was only noted in one borehole.

Boreholes 101 to 103 from the supplemental investigation revealed similar subsurface conditions as summarized below.

A topsoil mantle was at the surface and was 100 to 150 mm thick.

A sandy silt or silty sand unit was below the topsoil extending to 0.7 to 1.4 m depth in all three boreholes. The sandy silt was loose and the silty sand was very loose to very dense. The material was moist with moisture contents of 3 to 18%.

The major till deposit underlying the topsoil and upper soil units comprised silty sand to sandy silt with some gravel. Cobbles and boulders were noted. The till extended to the 4.7 to 5.0 m depth of investigation. The till was dense to very dense and moist with moisture contents of 5 to 11%.

Upon completion of augering, all three boreholes wet dry.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.



### **Lower Lying Northern Part of the Site – Boreholes 104 to 110**

The stratigraphy revealed in the initial boreholes carried out for Report 2 was variable. Below the topsoil, the stratigraphic sequence comprised surficial fill (due to grooming of the fields for archeological purposes) over deposits of sand, silt and till, locally clayey silt or sand and silt, over areas where auger refusal was encountered, assumed to be shallow bedrock or boulders. The stabilized ground water level is believed to be about 1.5 to 3.0 m below existing grade.

Boreholes 104 to 110 from the supplemental investigation revealed similar subsurface conditions as summarized below.

The topsoil at the surface of the boreholes, except Borehole 109, and was 100 to 150 mm thick.

At the surface of Borehole 109 a thin fill layer was present to 0.2 m depth. The fill comprised silty sand which was moist with a moisture content of about 6%.

A sand layer was noted underlying the topsoil in Boreholes 106, 109 and 110 and extended to 2.1 to 2.9 m depth. The layer contained trace to some silt and gravel. The sand was very loose to very dense with depth and typically moist to wet with depth. Moisture contents ranged from 5 to 21%.

A silt or sandy silt unit was revealed in Boreholes 104 to 106, 107 and 110. A single layer was noted in Boreholes 105, 106 and 110, from 0.1 to 2.1 m depth and extending to 1.4 to 3.7 m depth. Two layers were noted in Boreholes 104 and 107, from beneath the topsoil to 1.4 m depth and again from 2.1 or 2.9 m depth to the 4.3 m depth of the boreholes. The layers ranged from loose to very dense. Moisture contents ranged from 6 to 24%, moist to very moist.

A till layer was noted in all boreholes at varying depths. The till was typically 1.0 to 2.0 m thick and comprised silty sand to sandy silt with some gravel and trace clay. Cobbles and boulders were noted. The material was compact to very dense, typically with depth, and moist with moisture contents of 5 to 15%.



Auger refusal was encountered in Boreholes 104, and 107 to 109 between 0.9 and 4.3 m depth. Auger refusal is assumed to reflect shallow bedrock common to the area however, may also be due to boulders in the till soils.

A review of MOECC well records within about 300 m of the site revealed shale and/or limestone bedrock as shallow as 1.5 m.

It is noted that Rotary diamond coring is typically recommended to prove out bedrock. In this case it is further noted that bedrock, typically limestone, was encountered in some of the test pits from Report 1 at similar depths as noted above.

The following table provides the first water strike depths and the water level upon completion of augering.

<b>BOREHOLE</b>	<b>FIRST WATER STRIKE (Depth m)</b>	<b>WATER LEVEL UPON COMPLETION (Depth m)</b>
104	2.1	3.0
105	No Water	No Water
106	No Water	No Water
107	2.1	4.1
108	No water	No Water
109	2.1	1.5
110	2.1	3.0

Based on the data above, the stabilized water level is estimated to be 1.5 to 2.0 m below existing grade.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.



## **GEOTECHNICAL ENGINEERING CONSIDERATIONS**

### **Elevated Southern Part of the Site**

The subsurface conditions revealed in supplemental Boreholes 101 to 103 in the higher grounds in the southern part of the site were consistent with the initial boreholes carried out for Report 2. As such the recommendations provided in Report 2 for the elevated southern lands are still considered applicable.

### **Lower Lying Northern Part of the Site**

Similar to the higher grounds to the south, the subsurface conditions revealed in supplemental Boreholes 104 to 110 in the lower lying lands in the northern part of the site were generally consistent with the initial boreholes carried out for Report 2. As such the recommendations provided in Report 2 for the elevated southern lands are still considered applicable, except as follows.

The Storm Water Management (SWM) pond has been shifted to the east half of the low lying lands in the north.

Borehole 109 was advanced in the new location of the SWM pond. Below a 200 mm layer of surficial fill, a native sand deposit was revealed to 2.9 m depth. The sand was very loose to very dense with depth and moist to wet with depth (moisture contents of 6 to 14%). Below the sand to the 4.0 m depth (where auger refusal was encountered) a till deposit was present comprising a silty sand/sandy silt matrix with some gravel and trace clay. Cobbles and boulders were noted. Auger refusal could have been on assumed shallow bedrock common to the area or boulders in the till. First water strike was noted at 2.1 m depth and water in the borehole upon completion was at 1.5 m depth.

At the time of this report, the SWM pond design was not established. The general comments and recommendations provided in Report 2 are provided below and have been revised accordingly. When final grading and details of the pond are established they should be submitted to PML for geotechnical review:



- A maximum proposed depth of 1.0 m below existing grade should be considered to keep the pond base above the ground water level to allow for ease of excavation/construction and so that the capacity of the pond is not compromised by ground water. Excavation below the ground water table will require dewatering and ground water will have to be considered in the capacity design. The permeability of the in-situ sand is estimated to be  $10^{-2}$  to  $10^{-3}$  cm/sec and the underlying till is about  $10^{-4}$  to  $10^{-5}$  cm/sec;
- Berms should be constructed as engineered fill, using select material, compacted to 95% Standard Proctor maximum dry density as discussed earlier in the report;
- For storm water retention or to maintain a permanent pool level, an impermeable pond liner will be needed (permeability of  $10^{-6}$  cm/sec or less). Interior side slopes for ponds should be no steeper than 5 horizontal to 1 vertical (5H:1V) with exterior side slopes no steeper than 3H:1V. Vegetation cover, granular blanket, rip rap or the likes will be required for erosion control.
- Maintenance of the side slopes will be required until vegetation, rip rap and/or other protective measures have taken root or have been installed.

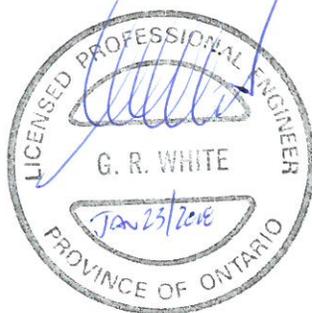


## **CLOSURE**

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 call our office.

Sincerely

Peto MacCallum Ltd.



Geoffrey R. White, P.Eng.  
Associate  
Manager, Geotechnical and Geoenvironmental Services

GRW:jlb

Enclosure(s):  
List of Abbreviations  
Log of Borehole Nos. 101 to 110  
Drawing No. 4-1 - Borehole Location Plan

# 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:

<u>CONSISTENCY</u>	<u>N (blows/0.3 m)</u>	<u>c (kPa)</u>	<u>DENSENESS</u>	<u>N (blows/0.3 m)</u>
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	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		

## LOG OF BOREHOLE NO. 101

**PROJECT** Proposed Residential Subdivision - Craigeith Ridge

17T 0553738E  
4929836N

**PML REF.** 15BF041

**LOCATION** Town of The Blue Mountains, Ontario

**BORING DATE** November 16, 2017

**ENGINEER** GW

**BORING METHOD** Continuous Flight Solid Stem Augers

**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT kN/m <sup>3</sup>	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		+ FIELD VANE ▲ POCKET PENETROMETER	△ TORVANE ○ Q <sub>u</sub> ○ Q					
0.0	SURFACE ELEVATION												
0.12	TOPSOIL: Dark Brown, silty sand, trace gravel, moist		1	SS	6								
0.7	SANDY SILT: Loose, brown, sandy silt, trace clay, moist												
1.0	TILL: Dense to very dense, brown to grey, silty sand/sandy silt, some gravel, cobbles and boulders, moist		2	SS	41								
			3	SS	74/250mm								
			4	SS	98/250mm								
			5	SS	76/270mm								
4.7	BOREHOLE TERMINATED AT 4.7 m		6	SS	50/100mm								

**NOTES**

## LOG OF BOREHOLE NO. 102

**PROJECT** Proposed Residential Subdivision - Craigeleith Ridge

17T 0553787E  
4929692N

**PML REF.** 15BF041

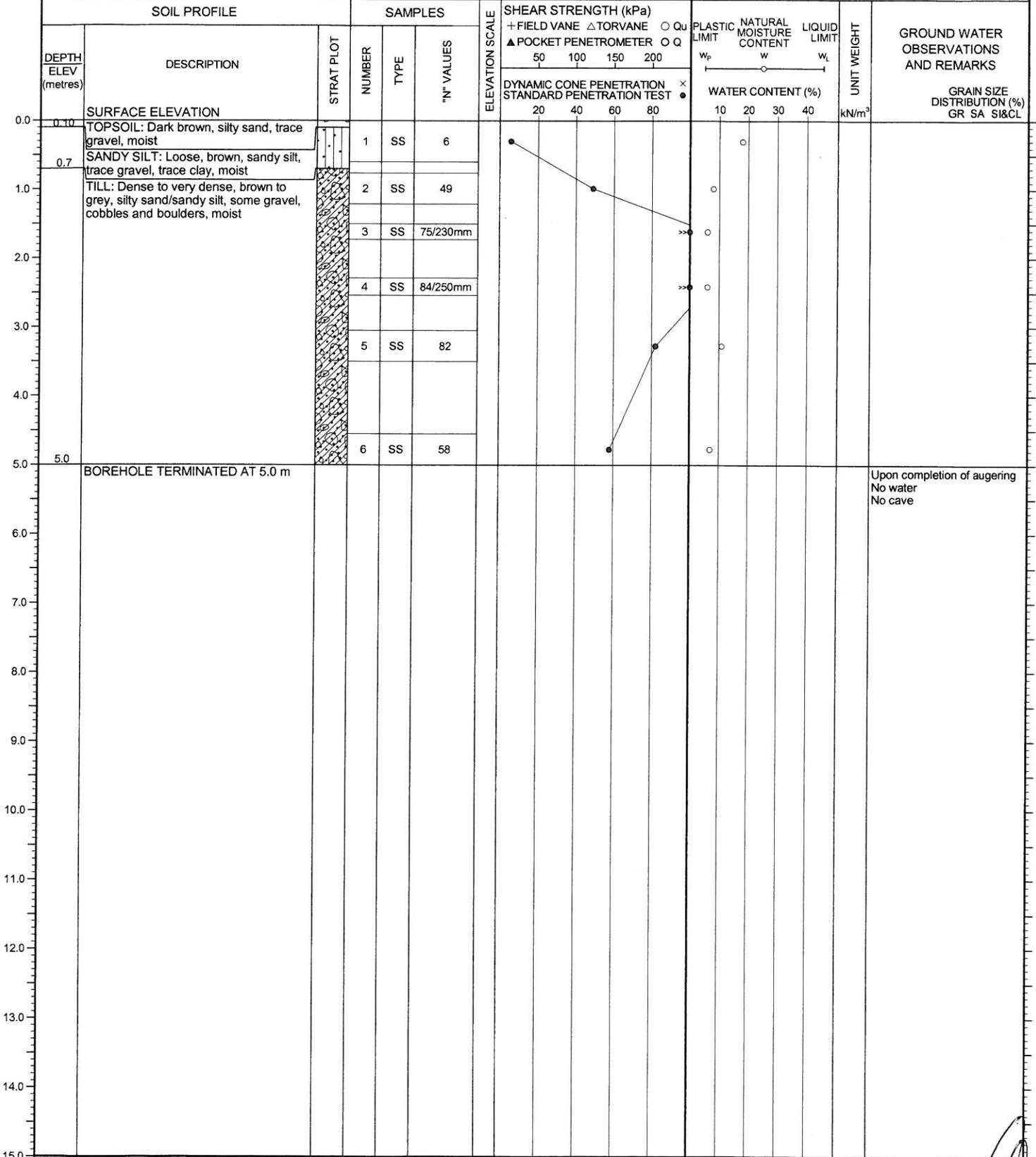
**LOCATION** Town of The Blue Mountains, Ontario

**BORING DATE** November 16, 2017

**ENGINEER** GW

**BORING METHOD** Continuous Flight Solid Stem Augers

**TECHNICIAN** WP



Upon completion of augering  
No water  
No cave

**NOTES**

## LOG OF BOREHOLE NO. 103

**PROJECT** Proposed Residential Subdivision - Craigeleith Ridge  
**LOCATION** Town of The Blue Mountains, Ontario  
**BORING METHOD** Continuous Flight Solid Stem Augers

17T 0553894E  
4929728N

**BORING DATE** November 16, 2017

**PML REF.** 15BF041  
**ENGINEER** GW  
**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT kN/m <sup>3</sup>	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		+ FIELD VANE	△ TORVANE					
0.0	SURFACE ELEVATION												
0.2	TOPSOIL: Dark Brown, silty sand, trace gravel, moist		1	SS	2	●							
1.0	SILTY SAND: Very loose to very dense, brown, silty sand, trace to some gravel, moist		2	SS	67								
2.0			3	SS	50/100mm								
2.1													
3.0	TILL: Very dense, grey, silty sand/sandy silt, some gravel, cobbles and boulders, moist		4	SS	50/100mm								
4.0			5	SS	97/200mm								
4.7			6	SS	50/80mm								
4.7	BOREHOLE TERMINATED AT 4.7 m												Upon completion of augering No water No cave
5.0													
6.0													
7.0													
8.0													
9.0													
10.0													
11.0													
12.0													
13.0													
14.0													
15.0													

**NOTES**

## LOG OF BOREHOLE NO. 104

**PROJECT** Proposed Residential Subdivision - Craigeith Ridge  
**LOCATION** Town of The Blue Mountains, Ontario  
**BORING METHOD** Continuous Flight Solid Stem Augers

17T 0554503E  
4929897N

**BORING DATE** November 16, 2017

**PML REF.** 15BF041

**ENGINEER** GW

**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT kN/m <sup>3</sup>	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		+ FIELD VANE	△ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						20	40	60	80	10	20	30	40		
0.0	SURFACE ELEVATION														
0.2	TOPSOIL: Dark brown, silty sand, some gravel, moist		1	SS	17										
	SILT: Compact, brown, sandy silt, trace gravel, trace clay, moist		2	SS	29										
1.4	TILL: Compact to very dense, brown to grey, silty sand/sandy silt, some gravel, trace clay, cobbles and boulders, moist		3	SS	23										
2.0			4	SS	50/80mm										
2.9			5	SS	40										
3.0	SILT: Dense, grey, silt, some sand, some gravel, moist														
4.3	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 4.3 m														
5.0															Upon completion of augering Water at 3.0 m No cave
6.0															
7.0															
8.0															
9.0															
10.0															
11.0															
12.0															
13.0															
14.0															
15.0															

NOTES

## LOG OF BOREHOLE NO. 105

**PROJECT** Proposed Residential Subdivision - Craigeith Ridge

17T 0554590E  
4929794N

**PML REF.** 15BF041

**LOCATION** Town of The Blue Mountains, Ontario

**BORING DATE** November 16, 2017

**ENGINEER** GW

**BORING METHOD** Continuous Flight Solid Stem Augers

**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT kN/m <sup>3</sup>	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		+ FIELD VANE	△ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						50	100	150	200						
0.0	SURFACE ELEVATION					20	40	60	80						
0.10	TOPSOIL: Dark brown, silt, some sand, trace gravel, moist		1	SS	13										
1.0	SILT: Compact to dense, brown, sandy silt, trace gravel, trace clay, moist		2	SS	36										
1.4	TILL: Very dense, brown, silty sand/sandy silt, some gravel, trace clay, cobbles and boulders, moist		3	SS	60										
2.0			4	SS	50/80mm										
3.0			5	SS	50/30mm										
4.6	BOREHOLE TERMINATED AT 4.6 m		6	SS	50/Bouncing										
5.0															Upon completion of augering No water No cave
6.0															
7.0															
8.0															
9.0															
10.0															
11.0															
12.0															
13.0															
14.0															
15.0															

**NOTES**

## LOG OF BOREHOLE NO. 106

**PROJECT** Proposed Residential Subdivision - Craigeith Ridge  
**LOCATION** Town of The Blue Mountains, Ontario  
**BORING METHOD** Continuous Flight Solid Stem Augers

17T 0554105E  
4929995N

**BORING DATE** November 17, 2017

**PML REF.** 15BF041  
**ENGINEER** GW  
**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		+ FIELD VANE	△ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST				WATER CONTENT (%)					
						20	40	60	80	×	10	20	30	40	GR SA SI&CL
0.0	0.12	SURFACE ELEVATION													
		TOPSOIL: Dark brown, silt, some sand, trace gravel, moist	1	SS	4						○				
		SAND: Loose to very dense, dark brown, sand, some gravel, some silt, cobbles, moist	2	SS	16						○				
			3	SS	67						○				
	2.1										○				
		SILT: Very dense, brown, silt, trace sand, trace gravel, moist	4	SS	75						○				
	2.9										○				
		TILL: Very dense, brown to grey, silty sand/sandy silt, some gravel, trace clay, cobbles and boulders, moist	5	SS	65						○				
											○				
	4.8		6	SS	65/220mm						○				
		BOREHOLE TERMINATED AT 4.8 m													
	5.0														Upon completion of augering No water No cave

**NOTES**

## LOG OF BOREHOLE NO. 107

**PROJECT** Proposed Residential Subdivision - Craigeith Ridge

17T 0553843E  
4930114N

**PML REF.** 15BF041

**LOCATION** Town of The Blue Mountains, Ontario

**BORING DATE** November 17, 2017

**ENGINEER** GW

**BORING METHOD** Continuous Flight Solid Stem Augers

**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			SHEAR STRENGTH (kPa)		PLASTIC NATURAL LIQUID		UNIT WEIGHT	GROUND WATER OBSERVATIONS AND REMARKS				
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	+ FIELD VANE ▲ POCKET PENETROMETER	△ TORVANE ○ QU ○ Q	LIMIT W <sub>p</sub>	MOISTURE CONTENT W			LIMIT W <sub>L</sub>			
						DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT (%)		GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL					
						20	40	60	80	10	20	30	40		
0.0	SURFACE ELEVATION														
0.12	TOPSOIL: Dark brown, silty, trace sand, moist		1	SS	4										
1.0	SANDY SILT: Loose to dense, brown, sandy silt, trace gravel, trace clay, very moist to moist		2	SS	36										
1.4															
2.0	TILL: Very dense, grey, sandy silt, trace gravel, cobbles and boulders, moist		3	SS	79										
2.1	SANDY SILT: Very dense, grey, sandy silt, sand seam, moist to wet		4	SS	75										
3.0			5	SS	78/200mm										
4.3	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 4.3 m														
5.0															
6.0															
7.0															
8.0															
9.0															
10.0															
11.0															
12.0															
13.0															
14.0															
15.0															

First water strike at 2.1 m

Upon completion of augering Wet cave at 4.1 m

NOTES



## LOG OF BOREHOLE NO. 109

**PROJECT** Proposed Residential Subdivision - Craigeleith Ridge  
**LOCATION** Town of The Blue Mountains, Ontario  
**BORING METHOD** Continuous Flight Solid Stem Augers

17T 0554223E  
4930120N

**BORING DATE** November 17, 2017

**PML REF.** 15BF041  
**ENGINEER** GW  
**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT kN/m <sup>3</sup>	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		+ FIELD VANE	△ TORVANE					
						50	100	150	200				
0.0	SURFACE ELEVATION												
0.2	FILL: Dark brown, silty sand, trace gravel, moist		1	SS	3								
1.0	SAND: Very loose to very dense, brown, sand, trace to some gravel, trace to some silt, moist to wet		2	SS	14								
2.0			3	SS	56								
2.9			4	SS	44								
3.0	TILL: Compact, grey, silty sand/sandy silt, some gravel, trace clay, cobbles and boulders, moist		5	SS	21								
4.0	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 4.0 m												Upon completion of augering Water at 1.5 m Cave at 2.1 m

**NOTES**

## LOG OF BOREHOLE NO. 110

**PROJECT** Proposed Residential Subdivision - Craigeith Ridge  
**LOCATION** Town of The Blue Mountains, Ontario  
**BORING METHOD** Continuous Flight Solid Stem Augers

17T 0554244E  
4930046N

**BORING DATE** November 17, 2017

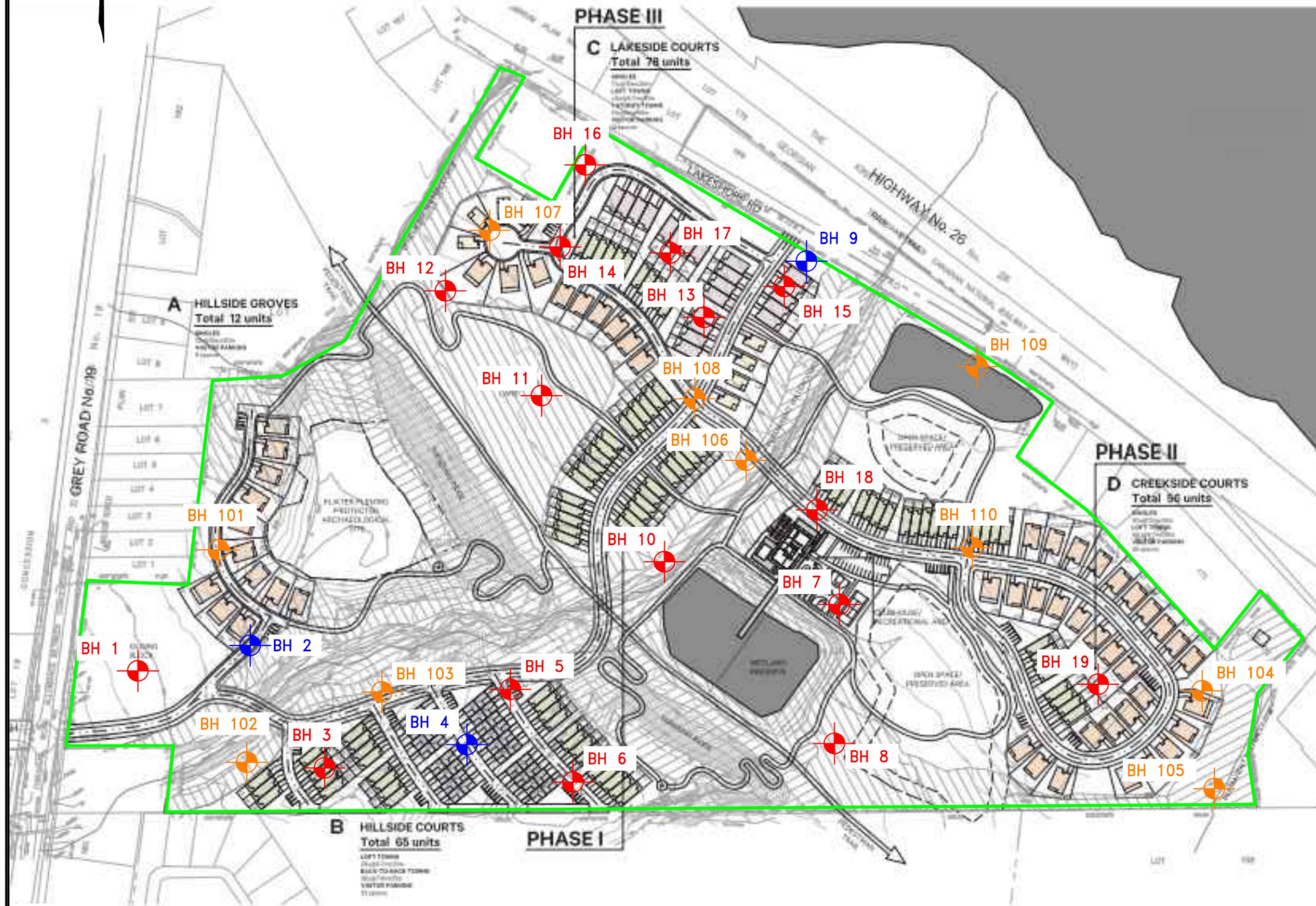
**PML REF.** 15BF041

**ENGINEER** GW

**TECHNICIAN** WP

SOIL PROFILE			SAMPLES			SHEAR STRENGTH (kPa)				PLASTIC NATURAL LIQUID			UNIT WEIGHT	GROUND WATER OBSERVATIONS AND REMARKS	
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	+ FIELD VANE Δ TORVANE ○ Qu				W <sub>p</sub>	W			W <sub>L</sub>
							▲ POCKET PENETROMETER ○ Q								
						DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST × ●				WATER CONTENT (%)					
						20	40	60	80	10	20	30	40	GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL	
0.0	SURFACE ELEVATION														
0.10	TOPSOIL: Dark brown, sand, some silt, moist	[Dotted pattern]	1	SS	3	●				○					
1.0	SAND: Very loose to compact, brown, sand, trace to some silt, moist to wet	[Dotted pattern]	2	SS	9	●				○					
2.0			3	SS	16	●									
2.1															
3.0	SILT: Compact to dense, grey, silt, trace sand, moist	[Horizontal lines]	4	SS	33	●				○					First water strike at 2.1 m
3.7			5	SS	22	●				○					
4.0	TILL: Compact, grey, silty sand/sandy silt, some gravel, trace clay, cobbles and boulders, moist	[Cross-hatch pattern]													
4.0			6	SS	12	●				○					
5.0	BOREHOLE TERMINATED AT 5.0 m														Upon completion of augering Wet cave at 3.0 m
6.0															
7.0															
8.0															
9.0															
10.0															
11.0															
12.0															
13.0															
14.0															
15.0															

NOTES



KEY PLAN  
TOWN OF BLUE MOUNTAINS, ONTARIO

LEGEND:

-  SITE LIMITS
-  BH 101 BOREHOLE 101 (THIS REPORT 4)
-  BH 2 BOREHOLE 2 (WITH MONITORING WELL) (REPORT 2)
-  BH 101 BOREHOLE 1 (REPORT 2)

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.  
KEY PLAN PRODUCED USING GOOGLE MAPS, DECEMBER 2017.



BOREHOLE LOCATION PLAN  
PROPOSED RESIDENTIAL SUBDIVISION  
CRAIGLEITH RIDGE  
TOWN OF BLUE MOUNTAINS, ONTARIO



DRAWN	WP	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	JAN. 2018	AS SHOWN	15BF041	4-1
APPROVED	GW				

February 28, 2017

PML Ref.: 15BF041A  
Report: 1

Ms. Silva Yousif  
Parkbridge Lifestyle Communities Inc.  
85 Theme Park Drive  
Wasaga Beach, Ontario  
L9Z 1X7

Dear Ms. Yousif

**Preliminary Geotechnical Investigation  
BMT – Cragleith (Triangle Parcel)  
Town of Blue Mountains, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the preliminary geotechnical investigation recently completed at the above noted project site. Authorization for this work was provided by Ms. S. Yousif, in an email dated January 30, 2017.

The above referenced lands are to be added to the original 62 acre proposed residential subdivision located on the south side of Lakeshore Road East. PML has conducted previous investigation for the original lands, PML Ref.: 15BF041, Report 1 dated August 24, 2015 (Preliminary Geotechnical), Report 2 dated December 7, 2015 (Geotechnical), and Report 3 dated December 21, 2016 (Slope Stability Assessment).

The purpose of this investigation was to attend the project site to witness test pits excavated by the Client within the lands to be added to the development, and to log the soil and ground water conditions observed in the test pits.

A factual report was requested to provide a summarization of the field observations.

**Investigation**

The location of each test pit was established in the field by the Client, prior to excavating the test pits.

PML attended the site on February 9, 2017 and witnessed Test Pits 101 to 105 excavated to depths of 1.6 to 2.5 m. The test pit locations are shown on the Test Pit Location Plan, Drawing 1, appended.

Co-ordination of clearances of underground utilities was provided by the Client.

The test pits were advanced using a track mounted excavator supplied and operated by the Client.

Subsurface soil stratigraphy was recorded in the test pit logs. The test pits were left open and ground water observations were noted at the end of the day.

Geoenvironmental assessment of the site was not within the terms of reference and no work has been carried out in this regard.



## **Site Description and Summarized Subsurface Conditions**

The lands to be added to the residential development are located on the north side of Lakeshore Drive East and are bounded by Highway 26 to the north. The parcel has a long thin triangle shape. The land is vacant with some trees. Of note during our site visit, a few large slabs/pieces of limestone bedrock (about the size of a car) were at the surface. These pieces of limestone were not bedrock outcropping, but loose pieces of rock left at the surface from some previous activity.

Reference is made to the appended Log of Test Pit sheets for details of the subsurface conditions.

### Topsoil

A 300 to 400 mm layer of topsoil was encountered at the surface of all test pits.

### Sand and Gravel

A silty sand and gravel unit was encountered below the topsoil in all test pits, extending to the 1.6 to 2.5 m depth of exploration. Cobbles, boulders and shale pieces were noted throughout. The material was moist to wet, with depth, and judged to be compact.

### Assumed Bedrock

Assumed limestone bedrock was encountered at the base of Test Pits 101, 102 and 103 at depths of 2.2, 1.6 and 2.2 m respectively. The presence of bedrock could not be confirmed due to the presence of loose pieces of bedrock at the surface as noted above and water in the test pits. In Test Pit 101 limestone was only found in half the test pit and could not be confirmed at depth due to water and sloughing.

### Ground Water

Upon completion of excavating, water was measured at depths of 0.8 to 2.2 m corresponding to elevations 95.8 to 97.1.

The Test Pits were left open for the duration of the visit. At the end of the day water levels had risen and were measured at depths of 0.8 to 1.7 m, corresponding to elevation 96.1 to 97.3.

Ground water levels are subject to seasonal variation and will fluctuate in response to precipitation.

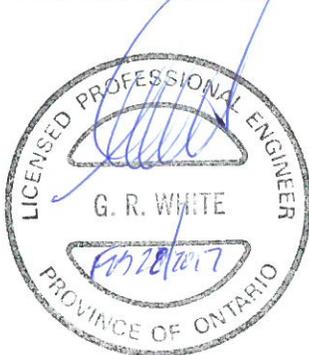


**Closure**

We trust this report is sufficiently detailed. Please do not hesitate to call if you have any questions.

Sincerely

Peto MacCallum Ltd.



Geoffrey R. White, P.Eng.  
Associate  
Manager, Geotechnical and Geoenvironmental Services

GRW:jlb

**Enclosure(s):**

List of Abbreviations  
Log of Test Pits No. 101 to 105  
Drawing 1 – Test Pit Location Plan

**Distribution:**

2 cc: Addressee (+email)  
1 cc: PML Barrie

# 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:

<u>CONSISTENCY</u>	<u>N (blows/0.3 m)</u>	<u>c (kPa)</u>	<u>DENSENESS</u>	<u>N (blows/0.3 m)</u>
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	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		

## LOG OF TEST PIT NO. 101

**METRIC**

**PROJECT** Preliminary Geotechnical Investigation - 161 Lakeshore Road East

1 of 1

**PML PROJECT NO.** 15BF041A

**LOCATION** Town of Blue Mountains, Ontario

**BORING DATE** February 9, 2017

**ENGINEER** GW

**EXCAVATION METHOD** Excavator

**TECHNICIAN** DR

SOIL PROFILE			SAMPLES			SHEAR STRENGTH kPa				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			GAS READINGS	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH in meters	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	○ UNCONFINED + FIELD VANE ▲/△ POCKET PENETROMETER/TORVANE × DYNAMIC CONE PENETRATION ● STANDARD PENETRATION TEST				W <sub>p</sub>	W			W <sub>L</sub>
							20 40 60 80				10 20 30 40				
97.8 0.0	SURFACE ELEVATION														
97.4 0.4	TOPSOIL: Black, silty sand, some gravel, trace organics, moist														
95.8 2.0	SILTY SAND AND GRAVEL: Compact, brown, silty sand and gravel, cobbles and boulders, shale pieces, moist		1	GS		97									
95.3 2.5	Becoming wet					96									
	TEST PIT TERMINATED AT 2.5 m ON ASSUMED BEDROCK IN NORTH HALF OF TEST PIT														Upon completion of excavation Water at 2.0 m Sidewall sloughing at 2.5 m  Test pit left open after excavation, upon return to test pit at end of day Water at 1.7 m

+7, ×5 : Numbers refer to Sensitivity (% STRAIN AT FAILURE

## LOG OF TEST PIT NO. 102

**METRIC**

**PROJECT** Preliminary Geotechnical Investigation - 161 Lakeshore Road East

**1 of 1**

**PML PROJECT NO.** 15BF041A

**LOCATION** Town of Blue Mountains, Ontario

**BORING DATE** February 9, 2017

**ENGINEER** GW

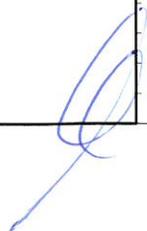
**EXCAVATION METHOD** Excavator

**TECHNICIAN** DR

SOIL PROFILE		SAMPLES			ELEVATION SCALE	SHEAR STRENGTH kPa		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	GAS READINGS	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH in meters	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		"N" VALUES	UNCONFINED + FIELD VANE ○					
97.9 0.0	SURFACE ELEVATION											GR SA SI CL
97.65 0.25	TOPSOIL: Black, silty sand, some gravel, trace organics, moist											
97.1 0.8	SILTY SAND AND GRAVEL: Compact to dense, brown, silty sand and gravel, cobbles and boulders, shale pieces, moist		1	GS								
97.1 0.8	Becoming wet											
96.3 1.6	TEST PIT TERMINATED AT 1.6 m ON ASSUMED BEDROCK				97							Upon completion of excavation Water at 0.8 m No sidewall sloughing
												Test pit left open after excavation, upon return to test pit at end of day Water at 0.8 m

+7, ×5 : Numbers refer to Sensitivity

(% ) STRAIN AT FAILURE





## LOG OF TEST PIT NO. 104

**METRIC**

**PROJECT** Preliminary Geotechnical Investigation - 161 Lakeshore Road East

1 of 1

**PML PROJECT NO.** 15BF041A

**LOCATION** Town of Blue Mountains, Ontario

**BORING DATE** February 9, 2017

**ENGINEER** GW

**EXCAVATION METHOD** Excavator

**TECHNICIAN** DR

SOIL PROFILE			SAMPLES			SHEAR STRENGTH kPa				PLASTIC NATURAL LIQUID			GAS	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH in meters	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	UNCONFINED		FIELD VANE		W <sub>p</sub>	W	W <sub>L</sub>		
						POCKET PENETROMETER/TORVANE	DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST	50	100				150	200
97.9 0.0	<b>SURFACE ELEVATION</b> TOPSOIL: Black, silty sand, some gravel, trace organics, moist													
97.6 0.3	SILTY SAND AND GRAVEL: Compact, brown, silty sand and gravel, cobbles and boulders, shale peices, moist		1	GS										
95.9 2.0	Becoming wet													
95.4 2.5	TEST PIT TERMINATED AT 2.5 m DUE TO SIDEWALL SLOUGHING													Upon completion of excavation Water at 2.0 m Sidewall sloughing at 2.5 m  Test pit left open after excavation, upon return to test pit at end of day Water at 1.5 m

+7, X<sup>5</sup>: Numbers refer to Sensitivity

20  
15 — 5  
10  
(%) STRAIN AT FAILURE

## LOG OF TEST PIT NO. 105

**METRIC**

**PROJECT** Preliminary Geotechnical Investigation - 161 Lakeshore Road East  
**LOCATION** Town of Blue Mountains, Ontario  
**EXCAVATION METHOD** Excavator

1 of 1

**PML PROJECT NO.** 15BF041A  
**ENGINEER** GW  
**TECHNICIAN** DR

**BORING DATE** February 9, 2017

SOIL PROFILE		SAMPLES			ELEVATION SCALE	SHEAR STRENGTH kPa				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	GAS READINGS	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH in meters	DESCRIPTION	NUMBER	TYPE	"N" VALUES		UNCONFINED ○	FIELD VANE +	POCKET PENETROMETER/TORVANE ▲/△	DYNAMIC CONE PENETRATION ×					
98.4 0.0	<b>SURFACE ELEVATION</b> TOPSOIL: Black, silty sand and gravel, trace organics, moist													GR SA SI CL
98.0 0.4	SILTY SAND AND GRAVEL: Compact, brown, silty sand and gravel, cobbles and boulders, shale pieces, moist				98									
96.4 2.0	Becoming sand and gravel, trace silt, wet	1	GS		97									
95.9 2.5	TEST PIT TERMINATED AT 2.5 m DUE TO SIDEWALL SLOUGHING				96									Upon completion of excavation Water at 2.2 m Sidewall sloughing at 2.5 m  Test pit left open after excavation, upon return to test pit at end of day Water at 1.1 m



**KEY PLAN**  
TOWN OF BLUE MOUNTAINS, ONTARIO

**LEGEND:**

- TP 101  
EL. 97.75 TEST PIT 1
- TBM  
EL. 100.00 TEMPORARY BENCHMARK (TBM)  
TOP NUT OF FIRE HYDRANT 329  
ELEVATION 100.00 (METRIC, ASSIGNED)

**REFERENCE:**  
PLAN PRODUCED FROM COUNTY OF GREY OVERHEAD GIS MAPPING.



**TEST PIT LOCATION PLAN**

PRELIMINARY GEOTECHNICAL INVESTIGATION  
BMT – CRAIGLEITH (TRIANGLE PARCEL)  
TOWN OF BLUE MOUNTAINS, ONTARIO



DRAWN	RM	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GRW	FEB. 2017	AS SHOWN	15BF041A	1
APPROVED	GRW				

March 30, 2017

PML Ref.: 15BF041A  
Report: 2

Ms. Silva Yousif  
Parkbridge Lifestyle Communities Inc.  
85 Theme Park Drive  
Wasaga Beach, Ontario  
L9Z 1X7

Dear Ms. Yousif

**Preliminary Geotechnical Investigation**  
**BMT – Cragleith (Triangle Parcel)**  
**Town of Blue Mountains, Ontario**

Further to our Report 1, dated February 28, 2017, where factual information was provided for the above noted project, this letter provides preliminary geotechnical recommendations.

The above referenced lands are to be added to the original 62 acre proposed residential subdivision located on the south side of Lakeshore Road East. PML has conducted previous investigation for the original lands, PML Ref.: 15BF041, Report 1 dated August 24, 2015 (Preliminary Geotechnical), Report 2 dated December 7, 2015 (Geotechnical), and Report 3 dated December 21, 2016 (Slope Stability Assessment).

The details of subsurface conditions revealed in the test pits for the triangle parcel are provided in Report 1. Beneath the topsoil the native soil comprises compact silty sand and gravel. Shallow bedrock was encountered at 1.6 m to 2.5 m depth in three of five test pits. The ground water table is anticipated to stabilize within about 1.5 m of the existing ground surface. These subsurface conditions are similar to the subsurface conditions revealed in previous test pits and boreholes conducted in the lower lying part of the original 62 acre parcel on the south side of Lakeshore Road East.

As such, the geotechnical recommendations provided for the lower lying parts of the original 62 acres parcel in PML Ref.: 15BF041, Report 2 dated December 7, 2015, can also be utilized for this site.

Please do not hesitate to call if you have any questions.

Sincerely

Peto MacCallum Ltd.



Geoffrey R. White, P.Eng.  
Associate  
Manager, Geotechnical and Geoenvironmental Services

GRW:jlb

2 cc: Parkbridge Lifestyle Communities Inc. (+email)  
1 cc: PML Barrie

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Tel: (705) 734-3900 Fax: (705) 734-9911  
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