Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL INVESTIGATION
PROPOSED HOGEN BALLOON LAUNCHING FACILITY
EGBERT, ONTARIO
FOR
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

PETO MacCALLUM LTD.
19 CHURCHILL DRIVE
BARRIE, ONTARIO
L4N 8Z5
PHONE: (705) 734-3900
FAX: (705) 734-9911
EMAIL: barrie@petomaccallum.com

Distribution:
2 cc: Public Works and Government Services Canada (+email) PML Ref.: 15BF035
1 cc: PML Barrie Report: 1
September 2015

Peto MacCallum Ltd.
CONSULTING ENGINEERS

September 4, 2015 PML Ref.: 15BF035
Report: 1

Mr. Sean Best
Public Works and Government Services Canada
4900 Yonge Street, 11th Floor
Toronto, Ontario
M2N 6A6

Dear Mr. Best

Geotechnical Investigation
Proposed HOGEN Balloon Launching Facility
Egbert, 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 Public Works and Government Services Canada (PWGSC) Contract No. 700330892 dated July 20, 2015.

PWGSC is planning to construct a single storey slab-on-grade balloon launching facility (HOGEN building) which will house a HOGEN Hydrogen Generator at the Centre for Atmospheric Research Experiments in Egbert, Ontario. An operations trailer supported on a concrete slab-on-grade is planned to the west of the proposed building. Slab elevations were not established at the time of this report. Paved access for the HOGEN building is also proposed.

The purpose of this investigation was to determine the subsurface soil and ground water conditions at the site, and based on this information, provide comments and geotechnical engineering recommendations for the foundations for the proposed HOGEN building and operations trailer slab and pavement design for access to the HOGEN building.

A limited chemical testing program was carried out to check the geoenvironmental quality of the soil at selected sampling locations in order to provide comments regarding on-site re-use and/or off-site disposal options of excess excavated soil. In addition, chemical testing on two soil samples was carried out to assess the potential for sulphate attack on buried concrete.

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 assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

INVESTIGATION PROCEDURES

The field work for this investigation was carried out on August 12, 2015 and consisted of Boreholes 101 to 105 advanced to 6.6 m depth. The boreholes were advanced as requested in the RFP, with the locations shown on Drawing 1, appended.

Co-ordination of clearances of underground utilities was provided by PML with the aid of a subcontracted private utility locating company.

The boreholes were advanced using continuous flight solid stem augers, powered by a track mounted CME-75 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 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 boreholes were backfilled in accordance with O.Reg. 903.

The location of the boreholes were established in the field during a site meeting between PML and the Client, based on a plan provided by the Client, and cognizant of underground utilities. The surface elevations of the boreholes were provided by Better Measures Inc., a subcontracted surveying company.

It is noted that Better Measures Inc. also conducted a topography survey of the site and the plan provided for this work has already been submitted to the Client.

All recovered soil samples were returned to our laboratory for moisture content determinations and detailed examination to confirm field classification. Two soil samples of the major soil units from the boreholes were submitted for grain size analysis and the results are presented on Figures 1 and 2, appended.

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.

The stratigraphy encountered in the boreholes consisted of topsoil over shallow fill, underlain by layers/deposits of sand, silty clay and till.

Topsoil

A 100 to 200 mm thick layer of sand topsoil was encountered at the surface of all five boreholes.

Fill

Fill was encountered below the topsoil in all boreholes extending to 0.7 to 1.4 m depth (elevation 243.3 to 247.1). The fill comprised sand with some silt to silty sand, with some gravel. The material was moist with moisture contents typically around 10%, locally 16%.

Till

Underlying the fill in Boreholes 102 to 105, a sand and silt till deposit was encountered to 1.4 to 4.0 m depth (elevation 242.6 to 245.0). Cobbles and boulders were noted. A sample of the material was submitted for grain size analysis and the results are presented on Figure 1, attached. The deposit was typically compact, locally dense or loose, and was moist with moisture contents of 8 to 13%.

Sand

Below the fill and/or till (or locally a silty clay layer in Borehole 105) a silty sand deposit was encountered in all boreholes, extending to 4.8 to 5.5 m depth (elevation 238.5 to 243.0) in Boreholes 101, 104 and 105, and to the 6.6 m depth of investigation in Boreholes 102 and 103. A sample of the material from Borehole 101 was submitted for grain size analysis and the results are presented on Figure 2, attached. The material was generally compact to dense, and was moist to wet with water contents of 5 to 23%.

Silty Clay

A very stiff silty clay unit was encountered under the sand layer in Boreholes 104 and 105 at 4.8 and 5.5 m depth (elevation 241.2 and 238.5) extending to the depth of the borehole. Borehole 101 had a silty clay layer within the sand layer at 5.5 m depth down to 6.4 m depth (elevation 243.0 down to elevation 242.1). Also, a firm to stiff upper silty clay layer was revealed above the sand layer at 1.4 m depth down to 2.5 m depth (elevation 242.6 down to elevation 241.5). The material was drier than the plastic limit with moisture contents of 18 to 25%.

Ground Water

Upon completion of augering, water or wet cave was observed in all boreholes at 1.5 to 3.7 m depth (elevation 241.3 to 245.4) as tabularized below:

BOREHOLE	WET CAVE (m)	ELEVATION	WATER (m)	ELEVATION
101	3.7	244.9	--	--
102	2.1	244.3	1.8	244.6
103	2.4	244.8	1.8	245.4
104	2.4	243.6	1.5	244.5
105	2.7	241.3	1.8	242.2

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

GEOTECHNICAL ENGINEERING CONSIDERATIONS

PWGSC is planning to construct a single storey slab-on-grade balloon launching facility which will house a HOGEN Hydrogen Generator at the Centre for Atmospheric Research Experiments in Egbert, Ontario. An operations trailer supported on a concrete slab-on-grade is planned to the west of the proposed building. Slab elevations were not established at the time of this report. Paved access for the HOGEN building is also proposed.

The boreholes revealed topsoil over fill to 0.7 to 1.4 m depth (elevation 243.3 to 247.1), underlain by a sand and silt till, sand, and/or silty clay units. Upon completion, water and/or wet cave was observed at 1.5 to 3.7 m depth in the boreholes.

Site Grading and Engineered Fill

The existing ground gently slopes down from north to south. Final grades at the site have not yet been established and the HOGEN building location has not yet been finalized. It is assumed that, based on drawings provided by the Client, the HOGEN building will be located at the location of Borehole 104, as shown on Drawing 1, attached. Based on the topography profile, it is assumed that the finished floor of the HOGEN building will be at approximate elevation 246.5, which will require up to some 1 m of fill to achieve.

It is also assumed that the proposed operations trailer concrete slab-on-grade will be at about elevation 249, again requiring up to about 1 m of fill to achieve.

The existing fill encountered in all boreholes is considered unsuitable to support the proposed building foundation and slab-on-grade. In this regard, it is recommended that within the areas of the proposed HOGEN building and the operations trailer, the existing fill be sub-excavated and replaced with engineered fill. The proposed HOGEN building can then be supported on conventional spread footings founded on the engineered fill or native soils with the floor slab-on-

grade supported on engineered fill. The operations trailer slab can also be supported on the engineered fill.

Reference is made to Appendix A, for general guidelines regarding the construction of engineered fill. The following highlights are provided:

- Sub-excavate the existing topsoil, fill and other deleterious materials down to native soil;
- Prior to placement of engineered fill the exposed subgrade should be compacted with a heavy roller to ensure 100% Standard Proctor maximum dry density, under geotechnical review during construction;
- The engineered fill material must be spread in 200 mm thick lifts and uniformly compacted to 100% Standard Proctor maximum dry density;
- The excavated material which will comprise the existing fill, is considered generally suitable for reuse as engineered fill. Reuse of excavated soil is subject to geotechnical review and approval at the time of construction to ensure deleterious content and/or excessively wet soils are not incorporated in the engineered fill. As site grades will be raised, imported material will likely be required for engineered fill. Imported material should comprise inorganic cohesionless soil 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 structure to be supported, then outwards and downwards at no steeper than 45° 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

Footings for the HOGEN building can be founded at normal depth on the native soils or engineered fill constructed as discussed above, where a geotechnical bearing resistance at Serviceability Limit State (SLS) of 100 kPa, and factored bearing resistance at Ultimate Limit State (ULS) of 150 kPa may be assumed for design.

It is noted that higher bearing values may be available depending on the actual footing elevation. In this regard, when the building location and final grades are established, the drawing should be submitted for review by PML to verify the final design bearing capacity.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent.

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.

Footings must be at least 600 mm wide, and have a minimum 600 mm of embedment. Settlement of foundations designed in accordance with the foregoing recommendations is not expected to exceed 25 mm, with differential settlement of 75% of this value.

Seismic Design

Based on the soil profile revealed in the borehole, 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.

Slabs

The concrete floor slabs-on-grade for the HOGEN building and the operations trailer are considered feasible on the 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 slabs. 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.

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

Excavation and Ground Water Control

Excavation for engineered fill will extend up to about 1.5 m below grade and will encounter existing fill, and the upper portion of the native sand or till. The presence of boulders should be expected in the till.

At the time of drilling, water levels in the boreholes were typically below the anticipated excavation depth. As such, in general, ground water is not anticipated to pose significant issues for excavation and conventional sump pumping techniques should control any nuisance seepage.

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. For the anticipated shallow excavations a PTTW is not required.

Concrete Resistance

Reference is made to the Certificates of Analyses for Chemical Testing in Appendix A, for the results of sulphate analysis performed on two soil samples from the subject site.

In accordance with Canadian Standard Association, CSA-A23.1-04, Table 3, the test results indicate a negligible potential degree of sulphate attack on buried concrete on both samples. Accordingly, the use of normal Portland cement is indicated.

Pavement Design and Construction

The location of the driveway is shown on Drawing 1. It is assumed the vertical alignment will follow the general topography of the land. Based on Boreholes 103 and 104, it is anticipated that the driveway subgrade will comprise medium to highly frost susceptible silty sand fill. Based on this, the following pavement structure thicknesses are recommended assuming Light Duty Traffic:

Asphalt (mm)	90
Granular A Base Course (mm)	150
Granular B Subbase Course (mm)	400
Total Thickness (mm)	640

It is not intended to remove all of the existing fill from under the driveway pavement, however, in order to minimize potential settlement issues, it is recommended that following rough grading to the design subgrade level, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy vibratory compactor to minimum 95% Standard Proctor maximum dry density under geotechnical review. Any unstable zones identified during this process should be sub-excavated and replaced with compacted select material.

Imported material for the granular base and subbase should conform to OPSS gradation specifications for Granular A and Granular B, and should be compacted to 100% Standard Proctor maximum dry density. Asphalt should be compacted in accordance with OPSS 310.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the final design drawings be submitted to PML to review of compatibility with site conditions and recommendations of 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.

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.

GEOENVIRONMENTAL CONSIDERATIONS

A limited chemical testing program was carried out to check the geoenvironmental quality of the soil from select samples from the boreholes in order to provide comments regarding the suitability for on-site reuse and/or off-site disposal options.

A Phase One Environmental Site Assessment (ESA) was not within the scope of work for this assignment. Accordingly, soil and ground water impairment that has not been identified by the limited chemical testing program may exist elsewhere at the site. The limited chemical testing program does not constitute an Environmental Site Assessment as defined under the Environmental Protection Act and O. Reg. 153/04, as amended.

Chemical Testing Protocol

Representative soil samples collected during the geotechnical investigation were returned to our laboratory for detailed visual examination. Soil samples were submitted for chemical analysis to AGAT Laboratories Limited (AGAT), a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory in Mississauga, Ontario. The chemical analyses conducted by AGAT were in accordance with the O. Reg. 153/04, as amended Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004, amended as of July 1, 2011.

As part of the geoenvironmental procedural protocol, all recovered soil samples were examined for visual and olfactory evidence of potential contamination, as well as for site coverage. It is noted that none of the recovered samples displayed no visual or olfactory evidence of potential contamination.

The recovered geoenvironmental soil samples were placed in laboratory provided air tight glass containers and stored in an insulated cooler for transportation to the laboratory.

The rationale for sample selection was based on materials exhibiting visual or olfactory evidence of contamination (none displayed), materials most likely to be contaminated (fill material), site coverage and materials most likely to be excavated during construction (fill and upper native soil).

For general environmental quality characterization, soil samples were tested for Metals and Inorganics.

The following soil samples were submitted for testing:

Borehole 101, Sample 2, (fill - 0.8 to 1.4 m)
Borehole 102, Sample 1, (fill - 0.1 to 0.6 m)
Borehole 103, Sample 3, (till – 1.5 to 2.1 m)
Borehole 104, Sample 2, (till - 0.8 to 1.4 m)
Borehole 105, Sample 1, (fill - 0.2 to 0.6 m)

Site Condition Standards

In general, the applicable environmental quality guidelines depend on the site location, land use, soil texture and source of potable water at the site. In this regard, we selected the Generic Criteria of the O. Reg. 153/04, as amended, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act dated April 15, 2011.

Sections 41 and 43 of O.Reg. 153/04, as amended, were used by PML to evaluate the site sensitivity. The site is not considered a sensitive site.

Further, the site was reviewed against the Drinking Water System Vulnerable Areas in Township of Essa, Figure 12-1, dated April 2011, private water wells, and maps for watercourses as part of the protocol to determine the applicable Site Condition Standards (SCS's) for the site. In this regard, the site is not within 30 m of a watercourse, however is located within 250 m of three private drinking water wells.

Based on the above reviews, the criteria of Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for Residential/Parkland/Institutional (RPI) land use, Table 2 RPI SCS's, are considered applicable to the site.

Analytical Findings and Conclusions

On-Site Reuse

The Certificates of Analysis are included in Appendix A.

Based on the results of chemical testing, the measured concentrations of the tested parameters complied with T2 RPI SCS's, which imply that excavated soil is suitable to remain on-site for reuse, subject to geotechnical requirements.

Off-Site Reuse

Based on the limited chemical testing results, the material meets the most stringent standards of Table 1 of O.Reg. 153/04, as amended, suggesting that excess excavated soil can be disposed of at any land site accepting fill, subject to the approval of the receiving site and geotechnical requirements.

Alternatively, excess excavated soil may be transported to a landfill site. However, additional testing for Toxicity Characteristic Leaching Procedure (TCLP) parameters will be required in accordance with O.Reg. 347, Schedule 4, as amended to O.Reg. 558/00, dated March 2001.

When transporting excavated site soil to another site the following are recommended:

- The work must be completed in accordance with local by-laws governing soil movement and/or placement at other sites;
- All analytical results and environmental assessment reports must be fully disclosed to the receiving site owners/authorities and they have agreed to receive the material;
- The applicable SCS's for the receiving site have been determined, as confirmed by the environmental consultant and the SCS's are consistent with the chemical quality of the soil originating at the source site;
- The surplus soil cannot be taken to a property for which a Record of Site Condition (RSC) is being filed as outlined in O. Reg. 153/04, as amended, unless the chemical testing program is completed in accordance with the regulation;
- The surplus soil cannot be taken to a property for which a RSC has been previously filed unless the soil quality meets the SCS's contained in the RSC;
- Transportation and placement of the surplus soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site;
- The receiving site must be arranged and/or approved in advance of excavation in order to avoid delays during construction. As well, it is noted the chemical testing requirements for various receiving sites is site-specific and additional testing may be required, beyond that provided in this limited sampling and testing report;

- The excavation work should be conducted in accordance with a written Soil Management Plan prepared by a qualified professional to ensure that all surplus excavated material is tested and managed appropriately, and that imported fill material is of suitable quality and meets the SCS's applicable to the site. Reuse of surplus excavated soil on site is also subject to acceptance for reuse by the geotechnical consultant at the time of construction based on geotechnical considerations;

- Additional sampling and chemical testing should be carried out during construction to verify the chemical quality of the excess soil to assess the appropriate management/disposal options for the actual soil leaving the site.

- It is recommended that transportation of fill material from the Source Site (s) to the Receiving Site (s) be carried out in accordance with the MOECC document *Management of Excess Soil – A Guide for Best Management Practices* dated January 2014.

Limitations

It should be noted that the soil conditions between and beyond the sampled locations may differ from those encountered during this assignment. PML should be contacted if impacted soil conditions become apparent during future development to further assess and appropriately handle the materials, if any, and evaluate whether modifications to the conclusions documented in this report are necessary.

This assessment is subject to the Statement of Limitations that is included with this report (Appendix B) which must be read in conjunction with the report.

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

Turney Lee-Bun, P.Eng.
President

GRW/TLB:jlb

Enclosure(s):
Figures 1 and 2 – Particle Size Distribution Charts
List of Abbreviations
Log of Borehole Nos. 101 to 105
Drawing No. 1 - Borehole Location Plan
Appendix A – Engineered Fill
Appendix B – Certificates of Analyses for Chemical Testing
Appendix C – Statement of Limitations

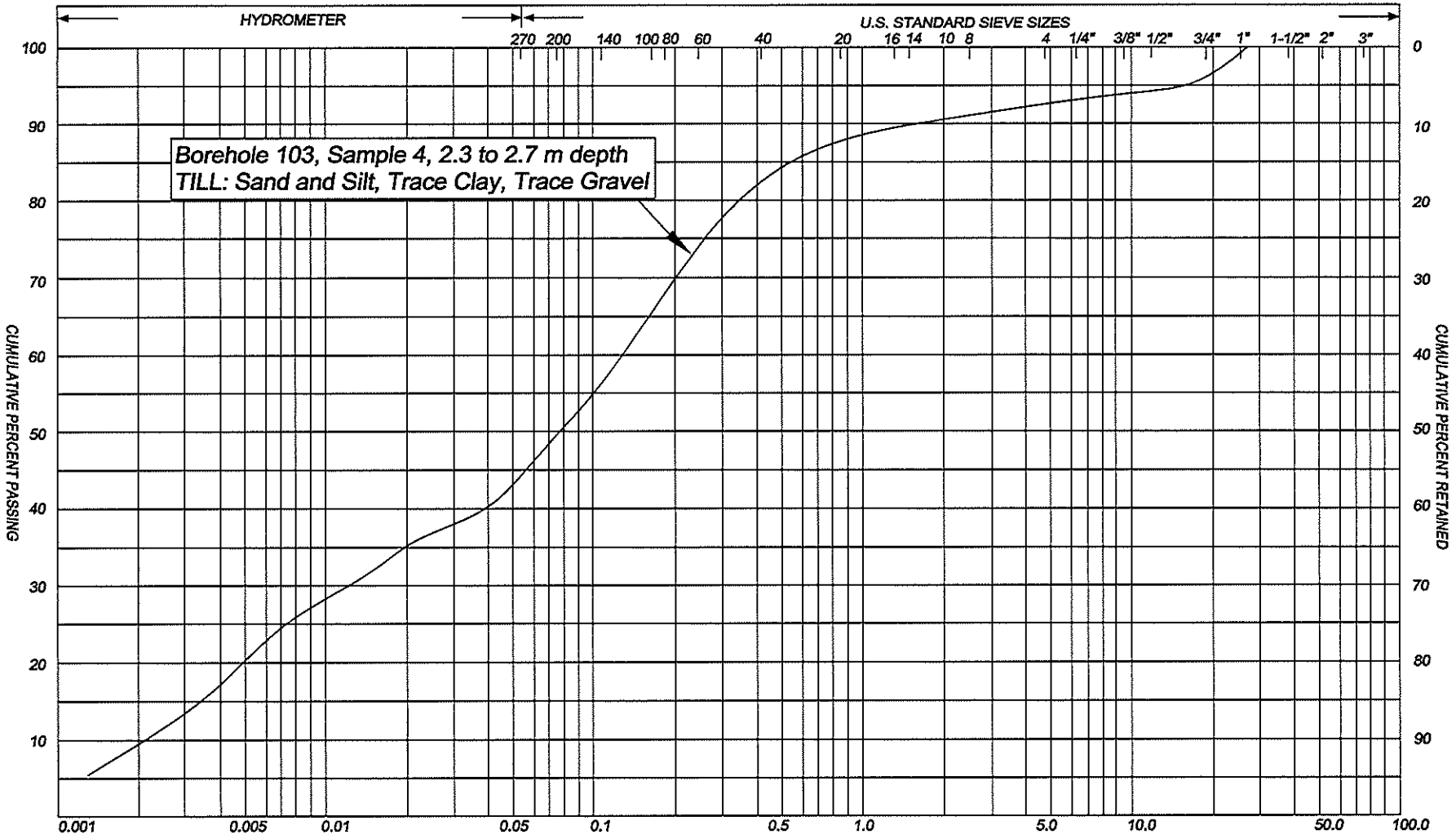
Peto MacCallum Ltd.

CONSULTING ENGINEERS

PARTICLE SIZE DISTRIBUTION CHART

PML Ref.: 15BF035

Figure No.: 1



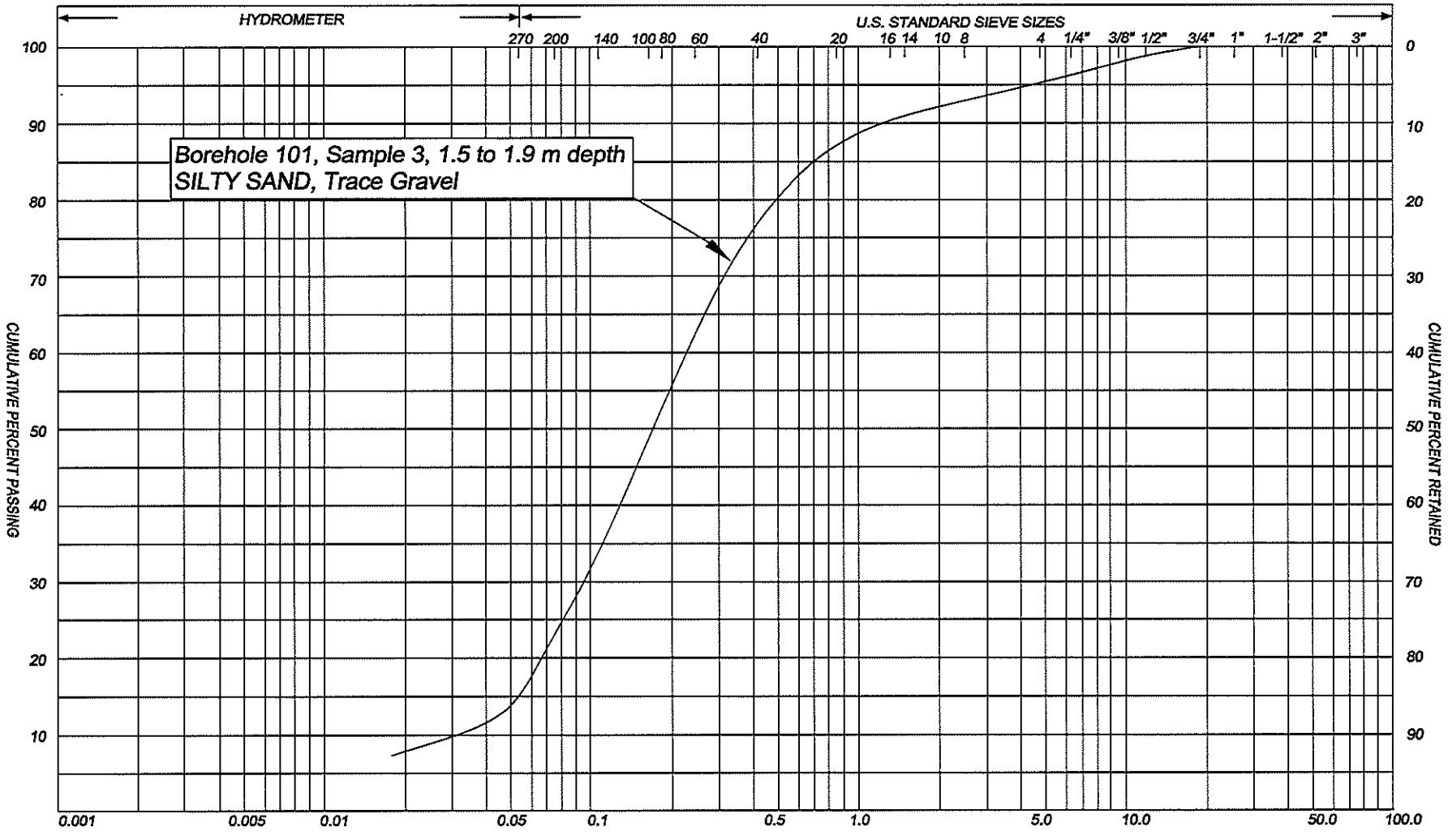
SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL			COBBLES	UNIFIED
				SAND							
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL			COBBLES	M.I.T.
	SILT			SAND							
CLAY	SILT			V. FINE	FINE	MED	COARSE	GRAVEL			U.S. BUREAU
				SAND							

Peto MacCallum Ltd.

CONSULTING ENGINEERS

PARTICLE SIZE DISTRIBUTION CHART

PML Ref.: 15BF035
Figure No.: 2



SILT & CLAY				FINE	MEDIUM	COARSE	GRAVEL		COBBLES	UNIFIED
				SAND						
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
	SILT			SAND						
CLAY	SILT			V. FINE	FINE	MED	COARSE	GRAVEL		U.S. BUREAU
				SAND						

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		

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 101

PROJECT Proposed HOGEN Balloon Launching Facility
17T 0597458E
4898336N
PML REF. 15BF035

LOCATION Egbert, Ontario
BORING DATE August 12, 2015
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 248.55					
0.15 / 248.40	TOPSOIL: Brown, sand, trace silt, moist					
	FILL: Dark brown, silty sand, some gravel, moist		1	SS	10	
			2	SS	15	
1.4 / 247.1	SAND: Compact to dense, brown, silty sand, trace gravel, stratified, moist to wet		3	SS	16	
			4	SS	37	
			5	SS	45	
			6	SS	44	
5.5 / 243.0	SILTY CLAY: Hard, grey, silty clay, DTPL					
6.4 / 242.1			7	SS	43	
6.6 / 241.9	SAND: Dense, grey, silty sand, wet BOREHOLE TERMINATED AT 6.6 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
Wet cave at 3.7 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 102

PROJECT Proposed HOGEN Balloon Launching Facility
17T 0597495E
4898330N
PML REF. 15BF035

LOCATION Egbert, Ontario
BORING DATE August 12, 2015
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 246.40					
0.10 / 246.30	TOPSOIL: Brown, sand, trace silt, moist					
0.70	FILL: Dark brown, sand, some silt to silty, some gravel, moist		1	SS	12	
245.70	TILL: Compact, brown, sand and silt, trace clay, trace gravel, cobbles and boulders, moist		2	SS	15	
1.4 / 245.0	SAND: Compact to dense, brown, silty sand, trace gravel, stratified, moist to wet		3	SS	16	
			4	SS	21	
			5	SS	33	
			6	SS	24	
6.6 / 239.8	BOREHOLE TERMINATED AT 6.6 m		7	SS	41	

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 1.8 m
Cave at 2.1 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 103

PROJECT Proposed HOGEN Balloon Launching Facility
17T 0597504E
4898371N
PML REF. 15BF035

LOCATION Egbert, Ontario
BORING DATE August 12, 2015
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 247.20					
0.10 / 247.10	TOPSOIL: Brown, sand, trace silt, moist					
	FILL: Dark brown, sand, some silt to silty, some gravel, moist		1	SS	13	
0.70 / 246.50	TILL: Compact to dense, brown, sand and silt, trace clay, trace gravel, cobbles and boulders, moist		2	SS	11	
			3	SS	16	
			4	SS	27	
			5	SS	46	
4.0 / 243.2	SAND: Dense to compact, brown, silty sand, trace gravel, stratified, wet		6	SS	38	
			7	SS	18	
6.6 / 240.6	BOREHOLE TERMINATED AT 6.6 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 1.8 m
Cave at 2.4 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 104

PROJECT Proposed HOGEN Balloon Launching Facility
17T 0597519E
4898334N
PML REF. 15BF035

LOCATION Egbert, Ontario
BORING DATE August 12, 2015
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 246.00					
0.0	246.00						
	0.12	TOPSOIL: Brown, silty sand, moist					
	245.88	FILL: Dark brown, sand, some silt to silty, trace gravel, trace organics, moist		1	SS	7	
	0.70						
1.0	245.30	TILL: Compact to loose, brown, sand and silt, trace clay, trace gravel, cobbles and boulders, moist		2	SS	18	245
				3	SS	6	
2.0	2.1						
	243.9	SAND: Compact, brown, silty sand, trace gravel, stratified, moist to wet		4	SS	15	244
3.0				5	SS	19	243
4.0							242
	4.8						
	241.2	SILTY CLAY: Very stiff, grey, silty clay, DTPL		6	SS	24	241
5.0							
6.0							240
	6.6			7	SS	24	
	239.4	BOREHOLE TERMINATED AT 6.6 m					
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

Upon completion of augering
Water at 1.5 m
Cave at 2.4 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 105

PROJECT Proposed HOGEN Balloon Launching Facility
17T 0597542E
4898331N
PML REF. 15BF035
LOCATION Egbert, Ontario
BORING DATE August 12, 2015
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

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 244.00									
0.0	0.20	TOPSOIL: Brown, sand, trace silt, moist									
	243.80	FILL: Dark brown, sand, some silt to silty, some gravel, moist		1	SS	8					
	0.70										
1.0	243.30	TILL: Compact, brown, sand and silt, trace clay, trace gravel, cobbles and boulders, moist		2	SS	18	243				
	1.4										
	242.6	SILTY CLAY: Firm to stiff, grey, silty clay, trace sand, DTPL		3	SS	7					
2.0							242				
	2.5			4	SS	14					
	241.5	SAND: Compact, brown, silty sand, trace gravel, very moist to wet									
3.0				5	SS	12	241				
4.0							240				
				6	SS	19					
5.0							239				
	5.5										
	238.5	SILTY CLAY: Very stiff, grey, silty clay, DTPL									
6.0							238				
	6.6			7	SS	15					
	237.4	BOREHOLE TERMINATED AT 6.6 m									Upon completion of augering Water at 1.8 m Cave at 2.7 m
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

NOTES

PROPOSED OPERATIONS TRAILER

PROPOSED DRIVEWAY

PROPOSED HOGEN BALLOON LAUNCHING FACILITY (HOGEN BUILDING)

BH 101
EL. 248.55

BH 102
EL. 246.40

BH 103
EL. 247.20

BH 104
EL. 246.00

BH 105
EL. 244.00

SCALE 1 : 500

LOT 11 CONCESSION 7

8TH LINE ESSA

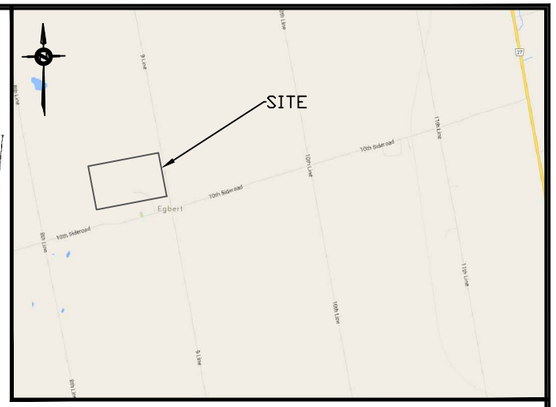
ROAD ALLOWANCE BETWEEN CONCESSION 7 & 8

DATE

DATE

SCOTT BETTS

BETTER MEASURES
Drawn by: Scott Betts
Phone: (519)924-0179
Cell: (519)372-5855
Fax: (519)924-0332
E-Mail : bmbetts@everus.ca



KEY PLAN
GREY COUNTY, ONTARIO

LEGEND:

BH 101 EL. 248.55 — BOREHOLE 101 SURFACE ELEVATION

REFERENCE:

PLAN PRODUCED FROM SURVEYED PLAN PROVIDED BY BETTER MEASURES INC.

NOTE:

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.

0m 10 20 30 40 50
SCALE

BOREHOLE LOCATION PLAN

PROPOSED HOGEN BALLOON LAUNCHING FACILITY
EGBERT, ESSA TOWNSHIP, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GRW	SEP. 2015	AS SHOWN	15BF035	1
APPROVED	GRW				

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.

APPENDIX B

Certificates of Analyses for Chemical Testing

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: PETO MACCALLUM
19 CHURCHILL DRIVE
BARRIE, ON L4N8Z5
(705) 734-3900

ATTENTION TO: Geoff White

PROJECT: 15BF035

AGAT WORK ORDER: 15T007738

SOIL ANALYSIS REVIEWED BY: Anthony Dapaah, PhD (Chem), Inorganic Lab Manager

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Aug 24, 2015

PAGES (INCLUDING COVER): 7

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 15T007738
PROJECT: 15BF035

CLIENT NAME: PETO MACCALLUM
SAMPLING SITE:

ATTENTION TO: Geoff White
SAMPLED BY:A. Turner

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2015-08-14

DATE REPORTED: 2015-08-24

SAMPLE DESCRIPTION:				BH 101 SS2	BH 102 SS1	BH 103 SS3	BH 104 SS2	BH 105 SS1
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				8/12/2015	8/12/2015	8/12/2015	8/12/2015	8/12/2015
Parameter	Unit	G / S	RDL	6867725	6867733	6867736	6867739	6867742
Antimony	µg/g	7.5	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	1	2	<1	1	1
Barium	µg/g	390	2	48	73	29	39	78
Beryllium	µg/g	4	0.5	<0.5	0.5	<0.5	<0.5	<0.5
Boron	µg/g	120	5	<5	<5	<5	<5	<5
Boron (Hot Water Soluble)	µg/g	1.5	0.10	0.13	0.14	<0.10	<0.10	<0.10
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	160	2	14	19	9	10	19
Cobalt	µg/g	22	0.5	4.3	6.4	3.0	3.4	5.1
Copper	µg/g	140	1	9	13	8	8	9
Lead	µg/g	120	1	5	6	2	3	4
Molybdenum	µg/g	6.9	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g	100	1	7	12	5	6	8
Selenium	µg/g	2.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g	23	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	µg/g	86	1	19	28	17	18	23
Zinc	µg/g	340	5	23	34	15	17	23
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.7	0.005	0.302	0.141	0.092	0.082	0.109
Sodium Adsorption Ratio	NA	5	NA	0.229	0.070	0.079	0.072	0.108
pH, 2:1 CaCl2 Extraction	pH Units		NA	10.9	7.62	7.87	7.75	7.58

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S RPI CT
6867725-6867742 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 15T007738
PROJECT: 15BF035

CLIENT NAME: PETO MACCALLUM
SAMPLING SITE:

ATTENTION TO: Geoff White
SAMPLED BY:A. Turner

O. Reg. 153(511) - ORPs (Soil) pH, Sulphate, Chloride

DATE RECEIVED: 2015-08-14

DATE REPORTED: 2015-08-24

		SAMPLE DESCRIPTION:		BH 102 SS3	BH 104 SS3
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		8/12/2015	8/12/2015
Parameter	Unit	G / S	RDL	6867745	6867765
Chloride (2:1)	µg/g	NA	2	3	4
Sulphate (2:1)	µg/g		2	2	<2
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.85	7.86

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S RPI CT

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 15T007738
PROJECT: 15BF035

CLIENT NAME: PETO MACCALLUM
SAMPLING SITE:

ATTENTION TO: Geoff White
SAMPLED BY:A. Turner

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2015-08-14

DATE REPORTED: 2015-08-24

		SAMPLE DESCRIPTION:		BH 101 SS2	BH 102 SS1	BH 103 SS3	BH 104 SS2	BH 105 SS1
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		8/12/2015	8/12/2015	8/12/2015	8/12/2015	8/12/2015
Parameter	Unit	G / S	RDL	6867725	6867733	6867736	6867739	6867742
Benzene	µg/g	0.21	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	µg/g	1.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
F1 (C6 to C10)	µg/g		5	<5	<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	55	5	<5	<5	<5	<5	<5
F2 (C10 to C16)	µg/g	98	10	<10	<10	<10	<10	<10
F3 (C16 to C34)	µg/g	300	50	<50	<50	<50	<50	<50
F4 (C34 to C50)	µg/g	2800	50	<50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g	2800	50	NA	NA	NA	NA	NA
Moisture Content	%		0.1	9.2	9.6	9.6	13.6	14.9
Toluene	µg/g	2.3	0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Xylene Mixture	µg/g	3.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Surrogate	Unit	Acceptable Limits						
Terphenyl	%	60-140		108	116	105	96	100

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S RPI CT

6867725-6867742 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Certified By: NPopnikolof

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: PETO MACCALLUM

PROJECT: 15BF035

SAMPLING SITE:

AGAT WORK ORDER: 15T007738

ATTENTION TO: Geoff White

SAMPLED BY:A. Turner

Soil Analysis

RPT Date: Aug 24, 2015			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	6867733	6867733	<0.8	<0.8	0.0%	< 0.8	104%	70%	130%	96%	80%	120%	95%	70%	130%
Arsenic	6867733	6867733	2	2	0.0%	< 1	108%	70%	130%	86%	80%	120%	90%	70%	130%
Barium	6867733	6867733	73	73	0.0%	< 2	100%	70%	130%	95%	80%	120%	92%	70%	130%
Beryllium	6867733	6867733	0.5	0.5	0.0%	< 0.5	93%	70%	130%	101%	80%	120%	95%	70%	130%
Boron	6867733	6867733	<5	<5	0.0%	< 5	72%	70%	130%	100%	80%	120%	91%	70%	130%
Boron (Hot Water Soluble)	6867725	6867725	0.13	0.14	7.4%	< 0.10	97%	60%	140%	92%	70%	130%	94%	60%	140%
Cadmium	6867733	6867733	<0.5	<0.5	0.0%	< 0.5	103%	70%	130%	102%	80%	120%	97%	70%	130%
Chromium	6867733	6867733	19	20	5.1%	< 2	85%	70%	130%	102%	80%	120%	97%	70%	130%
Cobalt	6867733	6867733	6.4	6.5	1.6%	< 0.5	89%	70%	130%	93%	80%	120%	89%	70%	130%
Copper	6867733	6867733	13	13	0.0%	< 1	93%	70%	130%	99%	80%	120%	91%	70%	130%
Lead	6867733	6867733	6	6	0.0%	< 1	99%	70%	130%	92%	80%	120%	89%	70%	130%
Molybdenum	6867733	6867733	<0.5	<0.5	0.0%	< 0.5	100%	70%	130%	96%	80%	120%	99%	70%	130%
Nickel	6867733	6867733	12	12	0.0%	< 1	91%	70%	130%	92%	80%	120%	88%	70%	130%
Selenium	6867733	6867733	<0.4	<0.4	0.0%	< 0.4	108%	70%	130%	92%	80%	120%	93%	70%	130%
Silver	6867733	6867733	<0.2	<0.2	0.0%	< 0.2	91%	70%	130%	99%	80%	120%	95%	70%	130%
Thallium	6867733	6867733	<0.4	<0.4	0.0%	< 0.4	93%	70%	130%	94%	80%	120%	91%	70%	130%
Uranium	6867733	6867733	<0.5	<0.5	0.0%	< 0.5	97%	70%	130%	93%	80%	120%	92%	70%	130%
Vanadium	6867733	6867733	28	29	3.5%	< 1	86%	70%	130%	92%	80%	120%	94%	70%	130%
Zinc	6867733	6867733	34	34	0.0%	< 5	100%	70%	130%	101%	80%	120%	95%	70%	130%
Chromium VI	6870943		<0.2	<0.2	0.0%	< 0.2	100%	70%	130%	103%	80%	120%	97%	70%	130%
Cyanide	6870481		<0.040	<0.040	0.0%	< 0.040	98%	70%	130%	109%	80%	120%	110%	70%	130%
Mercury	6867733	6867733	<0.10	<0.10	0.0%	< 0.10	109%	70%	130%	83%	80%	120%	85%	70%	130%
Electrical Conductivity	6867725	6867725	0.302	0.304	0.7%	< 0.005	101%	90%	110%	NA			NA		
Sodium Adsorption Ratio	6867725	6867725	0.229	0.228	0.4%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	6875109		7.75	7.90	1.9%	NA	100%	80%	120%	NA			NA		
O. Reg. 153(511) - ORPs (Soil) pH, Sulphate, Chloride															
Chloride (2:1)	6857494		5	5	0.0%	< 2	92%	70%	130%	96%	70%	130%	98%	70%	130%
Sulphate (2:1)	6857494		65	63	3.8%	< 2	94%	70%	130%	92%	70%	130%	94%	70%	130%

Comments: NA signifies Not Applicable.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: PETO MACCALLUM

PROJECT: 15BF035

SAMPLING SITE:

AGAT WORK ORDER: 15T007738

ATTENTION TO: Geoff White

SAMPLED BY:A. Turner

Trace Organics Analysis

RPT Date: Aug 24, 2015			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
Benzene	6875161		< 0.02	< 0.02	0.0%	< 0.02	103%	60%	130%	106%	60%	130%	122%	60%	130%
Ethylbenzene	6875161		< 0.05	< 0.05	0.0%	< 0.05	112%	60%	130%	112%	60%	130%	124%	60%	130%
F1 (C6 to C10)	6875161		< 5	< 5	0.0%	< 5	80%	60%	130%	93%	85%	115%	77%	70%	130%
F2 (C10 to C16)	6867004		< 10	< 10	0.0%	< 10	104%	60%	130%	82%	80%	120%	88%	70%	130%
F3 (C16 to C34)	6867004		< 50	< 50	0.0%	< 50	106%	60%	130%	101%	80%	120%	102%	70%	130%
F4 (C34 to C50)	6867004		< 50	< 50	0.0%	< 50	88%	60%	130%	85%	80%	120%	73%	70%	130%
Toluene	6875161		< 0.08	< 0.08	0.0%	< 0.08	104%	60%	130%	109%	60%	130%	127%	60%	130%
Xylene Mixture	6875161		< 0.05	< 0.05	0.0%	< 0.05	116%	60%	130%	126%	60%	130%	130%	60%	130%

Certified By: N Popowich

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: PETO MACCALLUM

AGAT WORK ORDER: 15T007738

PROJECT: 15BF035

ATTENTION TO: Geoff White

SAMPLING SITE:

SAMPLED BY:A. Turner

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	pH METER
Trace Organics Analysis			
Benzene	VOL-91-5009	EPA SW-846 5035 & 8260	P & T GC/MS
Toluene	VOL-91-5009	EPA SW-846 5035 & 8260	P & T GC/MS
Ethylbenzene	VOL-91-5009	EPA SW-846 5035 & 8260	P & T GC/MS
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
Xylene Mixture	VOL-91-5009	EPA SW-846 5035 & 8260	P & T GC/MS
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	BALANCE
Moisture Content	VOL-91-5009	CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009		GC/FID

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
www.agatlabs.com webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only
Work Order #: 15T007738
Cooler Quantity: Med
Arrival Temperatures: 4.8 4.6 4.4 / 3.5 3.2 2.7
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Report Information:
Company: Peto MacCallum Ltd.
Contact: Geoff White
Address: 19 Churchill Drive, Barrie Ont. L4N 8Z5
Phone: 705-734-3900 Fax: 705-734-9911
Reports to be sent to:
1. Email: rolair@petomaccallum.com
2. Email: aturner@petomaccallum.com.

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☑ Regulation 153/04 Table 1 (Indicate One)
☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use ☐ Sanitary ☐ Storm
Region ____ (Indicate One)

☐ Regulation 558 ☐ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other ____ (Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day
OR Date Required (Rush Surcharges May Apply): ____
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:
Project: 15BF035
Site Location: —
Sampled By: A. Turner
AGAT Quote #: 12-949 PO: ____
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information: Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐B-HWS ☐Cl ☐CN ☐Cr^{+6} ☐EC ☐FOC ☐NO_3/NO_2 ☐Total N ☐Hg ☐pH ☐SAR	Nutrients: ☐TP ☐NH_3 ☐TKN ☐NO_3 ☐NO_2 ☐NO_3/NO_2	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4 +BTEX	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	pH	Sulphate	chloride
BH 101 SS2	Aug 12		3	S		✓							✓									
BH 102 SS1	Aug 12		3	S		✓							✓									
BH 103 SS3	Aug 12		3	S		✓							✓									
BH 104 SS2	Aug 12		3	S		✓							✓									
BH 105 SS1	Aug 12		3	S		✓							✓									
BH 102 SS3	Aug 12		2	S																✓	✓	✓
BH 104 SS3	Aug 12		2	S																✓	✓	✓

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Jennifer Pegg T. Pegg.	Aug 14/15			2015-8-14	9:40
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
	2015-8-14	11:50			

Page 1 of 1
№: T 012357

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

APPENDIX C

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 effect 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.